A manual of psychology.

Contributors

Stout, George Frederick, 1860-1944.
University of Leeds. Library

Publication/Creation

London : University Tutorial Press, 1913.

Persistent URL

https://wellcomecollection.org/works/pan52jm6

Provider

Leeds University Archive

License and attribution

This material has been provided by This material has been provided by The University of Leeds Library. The original may be consulted at The University of Leeds Library. where the originals may be consulted.
Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).

wellcome collection

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

A MANUAL OF PSYCHOLOGY

STOUT

1003 Mon 12/6.

THE
UNIVERSITY LIBRARY
LEEDS

Classmark

STACK PSYCHOLOGY
A-3 STO

STACK PSYCHOLOGY A-3 STO


30106 005041800

Y LEEDS

Fifth Edition, Revised and Enlarged, 1938
Reprinted 1945, 1947, 1949

A MANUAL OF PSYCHOLOGY

BY

G. F. STOUT, M.A., LL.D.

SOMETIME FELLOW OF THE BRITISH ACADEMY; LATE PROFESSOR OF LOGIC AND METAPHYSICS IN THE UNIVERSITY OF ST. ANDREWS

LATE GIFFORD LECTURER IN THE UNIVERSITY OF EDINBURGH; LATE WILDE READER IN MENTAL PHILOSOPHY IN THE UNIVERSITY OF OXFORD

Revised, in collaboration with the Author, by

C. A. MACE, M.A., D.Lit.

PROFESSOR OF PSYCHOLOGY AT BIRKBECK COLLEGE IN THE UNIVERSITY OF LONDON

With an Appendix by

R. H. THOULESS, Ph.D., M.A.

LECTURER IN PSYCHOLOGY IN THE DEPARTMENT OF EDUCATION UNIVERSITY OF CAMBRIDGE

London

UNIVERSITY TUTORIAL PRESS LTD.

Clifton House, Euston Road, N.W. 1

1939 | 150

PREFACE TO THE FIRST EDITION.

THE present work contains an exposition of Psychology from a genetic point of view. A glance at the table of contents will show that the order followed is that of the successive stages of mental development. The earlier stages have been copiously illustrated by reference to the mental life of animals. The phases through which the ideal construction of Self and the world has passed are illustrated by reference to the mental condition of the lower races of mankind.

The shortcoming which I have been most anxious to avoid is sketchiness. I am convinced that the study of Psychology is of no use to the student unless he is able to live himself into psychological problems, so as to acquire a real power of thinking for himself on psychological topics. For this purpose cut and dried statements skimming important questions are of no avail. An effective introduction to Psychology must be clothed in living flesh and blood. The most essential gift to be imparted to the beginner is a real interest in the subject, and a real power of dealing with it even when familiar formulas fail him. He ought to be able to do riders in Psychology as he does riders in Euclid.

It is true that there are students who cannot advance so far from lack of natural endowment. But even for them a treatment full enough to be interesting and so rememberable is better than arid and dogmatic statements. Certainly the teacher who needs Psychology for educational purposes would do better to leave the subject alone altogether than to learn it in a merely external way.

UNIVERSITY LIBRARY LEEDS

AN INTRODUCTION TO THE FOURTH EDITION.

THE progress of Psychology in recent years has been so much a matter of the intrusion of novel 'points of view,' and so little a matter of consistent growth in a single direction that particular interest must attach to the developments in the thought of so distinguished a representative of the central tradition in British Psychology as Professor Stout. Of these developments it has fallen to my lot to be in part the scribe.

Everyone will regret that this revision has not come from the pen of Professor Stout alone; and throughout my part in its preparation I have tried to bear this fact in mind, and in consequence have aimed, above all, at preserving consistency in the general scheme of exposition. In drawing upon the work of other authors I have restricted myself to matters of generally accepted fact or hypotheses which are in fundamental agreement with the psychological doctrines of Professor Stout. But the most important changes and additions relate to amplifications or restatements in respect of these doctrines themselves.

The following are the most important of the changes introduced:—

(1) Professor Stout's general theory of the relation of thought to sentience, with its application to the problems of perception—perhaps one of the most valuable and distinctive features of the previous editions of the *Manual*—has been amplified and very largely restated. This has involved verbal changes throughout the whole work, and a radical revision of the key passages in Book III., Part II. This revision was complete before the appearance of Mr. Joseph's article in *Mind*,[1] but I am not without hope that the newer statement will ease some at least of the difficulties he feels, difficulties which I confess I at one time felt myself no less acutely than he.

[1] Jan. 1929.

The heart of the matter as I see it is this. With regard to any occasion of sensuous apprehension, say for example when I strike a match in the dark, there are two facts of which I am reasonably certain. I am certain *that I have a sensuous experience*, an experience of the kind to which justice has in the main been done in the empirical descriptions of traditional psychology. I am certain, too, *that I have an experience in which it appears 'that something is alight.'*

Now between the sensuous experience and the appearing of something to be alight there is an important relation. I am satisfied that it is not the relation of identity. I am equally satisfied that it is not a merely empirical concomitance or sequence. I am also tolerably sure that the relation is not one merely of causation, and that my awareness 'that something is alight' is not reached by any ordinary kind of inference. The relation is one which Professor Stout endeavours to point out by reference to original meaning. Alternatively he attempts to convey it by saying that the sense-experience is apprehended as an inseparable phase of something other than itself. In the previous edition it was expressed by saying that the sensuous experience was apprehended as 'conditioned.' This phrase, however, appears to have been misleading, and is now withdrawn. Whether the newer formulation will prove more acceptable remains to be discovered.

The difficulty in any case is not of the author's making, it is in the peculiar nature of the facts themselves. It may in fact be the case that the relation is something quite peculiar, and must ultimately just be seen. And I know of no way in which one can be compelled to see.

There is, however, one point on which no restatement was necessary but on which Professor Stout has been fundamentally misunderstood. The psychologist attempts to trace the development of our awareness of objects in space. The experience in which something seems to be alight is part of this awareness. But accounting for the development does not mean accounting for some transition to awareness of this kind from awareness of bare sensation conceived as standing in opposition to the awareness of things in space. In this

there is no transition to be accounted for.—I might have added to my list of certainties the fact that the relation between experiences of the first type and experiences of the second is not any kind of development or transition. Where, then, is the problem?

The problem I imagine is just this. Experiences of the second type develop. If a baby sees me strike the match he too is aware that something is alight, but he is aware of less than I. If a shrimp were in the room it, like the baby and I, might conceivably be aware that something is alight, but the most observant shrimp would see very much less than would the baby. The development of the perception of objects in space, is not the development of something which does not exist into something which does. It is a development of primitive perception of objects in space to a complex perception of objects in space.

It is open, of course, for someone to suggest that this is the development of an hallucination. And to speak of "the worthlessness of the attempts made by psychologists to account for our apprehension of things in space" may merely mean that in pursuing his legitimate studies the psychologist cannot incidentally show that there is not, in the last analysis, a great hallucination of this kind. I would not suggest *a priori* that he can, nor do I see quite how anyone can be sure that he can not. All that one need note is that the psychologist as such is not concerned with the problem.

Suppose it to be an hallucination. To begin with, it would be only a little one. The shrimp would be less deceived than I. Perception certainly develops. It becomes increasingly determinate, increasingly complex, and articulate, and —what is particularly interesting—it becomes increasingly *consistent*. In contrast with the all-pervading deceit, if deceit it be, one would be compelled to say that there are illusions and deceits of, so to speak, a second order—illusions and hallucinations in the ordinary sense of these terms. One can show how these secondary errors arise by reference to the general principles of the primary illusion. This is more than enough for the psychologist; and in any case he need not go out of his way to take account of merely abstractly possible

metaphysical systems. Primarily he works on the basis of common sense and the general presuppositions of the other special sciences. This is taken for granted in the new form of exposition, as it was in the old.

(2) The *Manual* is a Manual of Psychology, but students of philosophy have shown an interest in it on account of the bearing of psychological theory on problems of the 'philosophy of mind'—the status of sense experience, the problems of body and mind, the epistemological problems of perception, and so forth. A number of amplifications have been introduced where previous statements of Professor Stout have not been fully understood. For example, the description of sensa as mental has often been understood to imply that they are endowed in the words of Mr. Russell with 'a certain pervading quality' over and above other ordinarily recognised attributes, or that they have some intrinsic resemblance to subjective states conceived as 'relations to objects.' From the new statements it should be clear, I think, that the differences between Professor Stout and writers of Mr. Russell's school of thought relate not so much to the nature and status of sensa as to the former's rejection of the 'atomistic' conception to which the latter are explicitly committed.

(3) In the thoroughgoing rejection of psychological atomism the views of Professor Stout challenge comparison with those of the exponents of the 'Gestalt' Psychology; and the question is sometimes raised whether the latter have been anticipated in the *Analytic Psychology* and the *Manual*. But to claim 'anticipation' would be ungenerous and inaccurate. It would be truer to say that from the time of his earliest writings Professor Stout was in sympathetic accord with the reaction against the sensationalistic tradition, and in part on the grounds which have led to the more developed form of the Gestalt psychology. But to the latter belongs the credit of carrying the campaign in a systematic way into the experimental field, hitherto the stubbornest of strongholds of sensationalist Psychology.

In part, however, the similarity of their doctrine is based on different and independent grounds, and in some respects Professor Stout goes further than the exponents of this school

would be prepared to follow. But whilst largely independent, the two developments are on many fundamental points in substantial agreement. In the present edition I have drawn freely upon the findings of these workers where this agreement holds.

(4) In the prominence given to conative activity the doctrines of the *Manual* are closely allied with those of Professor McDougall. I believe the latter to be correct in citing Professor Stout as one of the most able and consistent exponents of the doctrine of conation which Professor McDougall himself has done so much to develop. I have found it, however, a little difficult to identify the "wobble" of which Professor Stout "in his later writings" is accused. The general doctrine requires very careful statement and certain qualifications, but these I take it are admitted by Professor McDougall himself.

The dependence of feeling upon conation must not be taken to imply priority in the latter. Something like mutual dependence is suggested by Professor McDougall in the function in mental life which he assigns to feeling. Moreover, dependence upon conation does not involve independence of cognition. Success or failure of conation determines feeling so far as the success or failure is *known*, and it is only defined in the phases of cognition. So far feeling is conditioned by cognition.

On this topic and its applications I have found it possible without inconsistency to draw upon Professor McDougall's writings in amplification of the views of Professor Stout, and I should add here that my indebtedness in this respect applies to several passages in which the name of Professor McDougall is not explicitly mentioned.

(5) I have referred to these distinguished authors in the preface in order to avoid more than is absolutely necessary the discussion of controversial issues in the text. The *Manual* is primarily a manual of instruction, and a majority of the alterations introduced are for the assistance of the student. In making these changes I have been guided by actual difficulties of students which have been brought to my notice.

For the convenience of the student I have also transposed a number of passages. The general tendency of these transpositions has been to enable essential points to be introduced as early as possible in the course of exposition, and to bring closely connected topics into a single chapter. But nowhere so much as in Psychology does one feel the need of trying to say everything at once, nowhere else do apparently separate topics call so insistently for parallel development. Consequently it needs perhaps to be pointed out that the clear comprehension of many concepts introduced at the beginning is only to be attained in the light of subsequent exposition.

Among the things which I have not attempted to change is the terminology employed by Professor Stout in his treatment of space, time, and the material world as "ideal constructions." It has been brought to my notice that the language employed in this connection, and especially in Book IV., may mislead some less attentive readers into supposing that the doctrines here expounded involve some form of ontological idealism, and that Professor Stout is here committed to the view that the world, space, and time are either themselves mental in nature or dependent for their existence upon some mind's awareness of them.

To have attempted in detail to remove the danger of this particular misinterpretation would have involved an enormous amount of re-writing merely for the purpose of expressing the meaning of these passages in another way. This would hardly seem to be justified, since the mistake in question could be made only by readers who have forgotten that the *Manual* is a manual of Psychology and that Book IV. is the sequel to Book III. In any case, it should be sufficient to notice here that the problem with which Professor Stout is concerned is not that of the nature of space, time, and the material world, but that of our knowledge of these things. It is, in fact, only in connection with *cognitive process* that such terms as 'development' and 'construction' are here to be understood.

Briefly, Professor Stout's view is that we directly apprehend only fragments of the material world, and fragments of space and time. Our knowledge of what we do not directly appre-

hend is reached through "trains of ideas" and through a process of "ideal construction." Similarly, of course, the self is an ideal construction only in the sense that our 'idea of the self'—an idea which embraces past and future states—is not immediately given, but is reached through ideational activity.

It remains only for me to express my indebtedness to Professor Stout himself, without whose assistance and encouragment I could hardly have attempted this revision. Certain passages have been written by him especially for this edition. For many others I am indebted to him for the generous way in which he has placed unpublished manuscripts at my disposal. At every point I am indebted to him for invaluable suggestions. I do not think that I have proposed any changes of importance which he has not improved. This, however, does not commit him to any responsibility for the blemishes that remain in what I have contributed.

I should like, too, to express here my gratitude to my colleague, Mr. A. R. Knight, for the assistance he has given me in the preparation of this edition for the press.

C. A. MACE.

INTRODUCTORY NOTE TO THE FIFTH EDITION.

THE only alteration made in the present edition is the addition of an Appendix on "Gestalt Psychology" by Dr. R. H. Thouless with an added Note by Professor Stout himself clarifying his own position on the issues raised by the Gestalt psychologists. Since a very large part of modern experimental work in the field of Perception, with which field Professor Stout is particularly associated, has been inspired by the Gestalt psychology, it was felt that there should be a fuller treatment of the work of this school than has appeared in the earlier editions. It is hoped that both the Appendix and the Note will increase the usefulness of the *Manual*.

CONTENTS.

INTRODUCTION.

CHAPTER I.

THE SCOPE OF PSYCHOLOGY.

PAGE

1. The Problem of Definition. 2. The Psychological Point of View. 3. Individual Experience. 4. The Subjective Side of Individual Experience. 5. Objects which are Actually Experienced. 6. Immediate Experience and Immediate Knowledge. 7. The Privacy of Immediate Experience. 8. The Unity of Experience. 9. Consciousness. 10. The Mind and the Self. 11. Mental Dispositions. 12. Unconscious Mental States ... 1

CHAPTER II.

THE DATA AND METHODS OF PSYCHOLOGY.

1. The Problems of Psychology. 2. General Presuppositions. 3. The Data and Methods of Scientific Psychology. 4. Objects as Data. 5. Introspection. 6. Difficulties of the Introspective Method. 7. Manifestations of Mental Process in Others. 8. Experiment. 9. Quantitative Methods... 30

CHAPTER III.

BODY AND MIND.

1. The Physical Conditions and Expressions of Mental Life. 2. The Organism in General. 3. The Nervous System. 4. The Reflex Arc. 5. The Central Nervous System. 6. The Problem of Body and Mind. 7. General Hypothesis concerning the Relations of Body and Mind. 8. Parallelism. 9. Interaction. 10. The Bearing of the Two Hypotheses on Psychological Procedure 62

BOOK I.

GENERAL ANALYSIS.

CHAPTER I.

ULTIMATE MODES OF THE RELATION OF THE CONSCIOUS SUBJECT TO ITS OBJECTS.

PAGE

1. Problems of Analysis 2. Thought. 3. The Cognitive Attitude. 4. The Affective Attitude. 5. The Conative Attitude. 6. Interrelations of Cognition, Feeling, and Conation 97

CHAPTER II.

SENSATIONS AND IMAGES.

1. Thought and Sentience. 2. The General Nature of Sensation. 3. The Attributes of Sensation. 4. The Perception of Form. 5. Mental Imagery. 6. Characteristic Differences of Impression and Image. 7. Relative Independence of Impression and Image. 8. Imageless Thought 120

CHAPTER III.

ATTENTION.

1. Mental Process in General. 2. The General Nature of Attention. 3. Attention and Inattention. 4. The Conditions of Attention. 5. Attention to Displeasing Objects. 6. The Unity and Continuity of Attention. 7. The Effects of Attention 157

CHAPTER IV.

RETENTIVENESS.

1. Retentiveness. 2. The Facts of Retention. 3. Facilitation and Inhibition. 4. The Acquirement of Meaning. 5. Association and Reproduction. 6. Complication. 7. Explicit Ideas which are not Free. 8. Free Trains of Ideas 187

CHAPTER V.

PRACTICAL CONATIVE ACTIVITY.

1. The Practical Aspect of Conative Activity. 2. Movements of Fixation. 3. Attention and Motor Activity. 4. Ascending Levels of Conative Development. 5. Specific Forms of Conative Activity at the Perceptual Level. 6. Motor Association. 7. Habit and Automatism. 8. The Modification of Specific Tendencies. 9. The Unity of the Presented Field and the Unity of Response. 10. Primary and Secondary Tendencies 212

BOOK II.

SENSATION.

CHAPTER I.

DIFFERENTIATION OF SENSE-EXPERIENCE AND ITS PSYCHICAL SIGNIFICANCE.

PAGE

1. Sensation and Reflex Action. 2. Stimulus and Sensation. 3. Perceptual Value of Sense-Experience. 4. Sense Differentiation. 5. Differentiation of Sense-Organs 233

CHAPTER II.

ORGANIC, CUTANEOUS, AND MOTOR SENSATIONS.

1. Organic Sensations. 2. Cutaneous Sensations. 3. Motor Sensations 242

CHAPTER III.

TASTE AND SMELL.

1, Taste. 2. Smell 264

CHAPTER IV.

LIGHT-SENSATION.

1. Nature of the Stimulus. 2. Structure of the Eye. 3. Analysis of Light-Sensations. 4. Total Colour-Blindness and Dark-Adaptation. 5. Partial Colour-Blindness. 6. Mixture of Lights of Different Wave-Lengths. 7. The Effects of Contrast. 8. After Images. 9. The Sensation of Blackness. 10. Physiological Theories of Light-Sensation 268

CHAPTER V.

SOUND-SENSATION.

1. Nature of the Stimulus. 2. The Organ of Hearing. 3. Noises and Musical Sounds. 4. Pitch. 5. Harmonic Intervals. 6. Combination of Musical Sounds from Different Sources. 7. Beats and Dissonance. 8. Timbre. 9. General Theory of Sound-Sensation 289

CHAPTER VI.

THE WEBER-FECHNER LAW.

1. The Experimental Facts. 2. Interpretation. 3. Further Questions. 4. Limitations of Weber's Law 298

BOOK III.

PERCEPTION.

PART I.

CONATIVE ACTIVITY AT THE PERCEPTUAL LEVEL.

CHAPTER I.

PERCEPTUAL PROCESS AND LEARNING BY EXPERIENCE AT THE PERCEPTUAL LEVEL.

PAGE

1. General Characteristics of Perceptual Process. 2. Primary Retentiveness at the Perceptual Level. 3. Learning by Experience of Results. 4. Reproduction in Perceptual Process. 5. Explicit Ideas accompanying Perceptual Process. 6. Impulsive Character of Perceptual Process 306

CHAPTER II.

INSTINCT.

1. Introductory. 2. The Purely Biological View of Instinct. 3. The Psychological Factor as Indispensable to Instinct. 4. The Blindness of Instinct. 5. Instinct as a Psychical Fact. 6. Instinct in Human Beings 328

CHAPTER III.

IMITATION.

1. Introductory. 2. The Imitative Impulse. 3. Learning by Imitation 355

CHAPTER IV.

EMOTIONS.

1. General Characteristics. 2. The Theory of William James. 3. Ultimate Qualitative Differences. 4. The Interconnections of the Emotions. 5. Sentiments and Emotional Dispositions ... 362

CHAPTER V.

AFFECTIVE TONE AND PERCEPTUAL PROCESS.

1. Introductory. 2. Affective Tone and Common Sensibility. 3. Affective Tone and the Special Sensations. 4. Surplus Excitation. 5. Affective Tone and Organic Welfare. 6. Affective Tone and Conative Tendency. 7. General Theory. 8. Affective Tone

PAGE

of Perceptual Process. 9. Affective Tone of Attention. 10. Success and Defeat in Determining Pleasure and Pain. 11. Affective Tone due to Preformed Associations. 12. Pleasure, Pain and Emotion 377

PART II.

GROWTH OF THE PERCEPTION OF THE EXTERNAL WORLD.

CHAPTER I.

NATURE OF THE PROBLEM AND ITS PRESUPPOSITIONS.

1. The Meaning of the 'Physical,' 'Material,' and 'External' World. 2. The Psychological Problem. 3. The Activity-Factor and the Sense-Factor. 4. Original and Acquired Meaning. 5. Spatial Unity. 6. Temporal Unity. 7. Unity of Attributes in the Same Subject. 8. Causal Unity. 404

CHAPTER II.

SPECIAL PROBLEMS OF PERCEPTION.

1. Introductory. 2. The Singling out of Separate Things. 3. Awareness of the Body. 4. Distinction between the Real and the Merely Apparent Properties of Things. 5. Correlation of Different Sensible Qualities as belonging to the Same Thing. 6. Hallucinations 427

CHAPTER III.

SPATIAL PERCEPTION: (1) TACTUAL.

1. Nature and Conditions of the Problem. 2. Spatial Perception of the Blind. 3. Localisation and Projection. 4. Projection. 5. Localisation. 6. Influence of Localisation on Projection. 7. Congenital Dispositions for Spatial Perception 451

CHAPTER IV.

SPATIAL PERCEPTION: (2) VISUAL.

1. General. 2. Advantages and Disadvantages of Sight as compared with Touch. 3. Distinction of Up and Down and of Right and Left. 4. Secondary Means of Spatial Perception by the Eye. 5. Primary Monocular Perception of Shape and Distance in the Third Dimension. 6. Binocular Perception. 477

CHAPTER V.

TEMPORAL PERCEPTION.

PAGE

1. Introductory. 2. Immediate Experience of Time-Transience. 3. Present, Past, and Future. 4. Perception of Lapse of Time ... 496

BOOK IV.

IDEATIONAL AND CONCEPTUAL PROCESS.

CHAPTER I.

TRAINS OF IDEAS.

1. The Twofold Aspect of Ideational Process. 2. Association of Ideas. 3. Different Forms of the Association of Ideas: (*a*) Contiguity (Continuity of Attention), (*b*) Reproduction of Similars. 4. Competition of Divergent Associations. 5. Ideal Construction. 6. Obstructions in the Flow of Ideal Activity 503

CHAPTER II.

MEMORY.

1. Definition of Memory. 2. Good and Bad Memory. 3. Decay of Memory with Lapse of Time. 4. Variety of Memories. 5. Improvement of Memory by Practice. 6. Memory and Past Time 521

CHAPTER III.

IDEATION, COMPARISON, AND CONCEPTION.

1. Ideal Pre-arrangement Distinguished from Perceptual Pre-adjustment. 2. Conceptual Analysis and Synthesis. 3. Comparison 529

CHAPTER IV.

LANGUAGE AND CONCEPTION.

1. Language as an Instrument of Conceptual Analysis and Synthesis. 2. The Motor Element in Ideal Revival. 3. Tendency of Motor Reproduction to Pass into Actual Movement. 4. Natural Signs. 5. Natural Signs as Instruments of Conceptual Thinking. 6. Conventional Element in Gesture-Language. 7. Origin of Conventional Language. 8. Certain other Theories of the Origin of Speech. 9. Advantages of Conventional Language 537

CHAPTER V.

THE EXTERNAL WORLD AS IDEAL CONSTRUCTION.

PAGE

1. Unification of Perceptual Data. 2. Verification and Re-interpretation. 3. Space as Ideal Construction. 4. Time as Ideal Construction. 5. Causality as Ideal Construction. 6. Thinghood as Ideal Construction. 7. Ideal Construction as a Co-operative Process 561

CHAPTER VI.

THE SELF AS IDEALLY APPREHENDED.

1. General Nature of the Self as Ideally Apprehended. 2. The Social Factor in the Development of Self-Consciousness. 3. The One Self and the Many Selves. 4. Pathology of Self-Consciousness. 5. The External and the Internal Self 581

CHAPTER VII.

BELIEF AND FREE IMAGINATION.

1. General Distinction of Belief and Free Imagination. 2. Distinction between the Conditions of Belief and Imagination. 3. General Conditions of Belief. 4. Variation in the Relative Importance of the Subjective and Objective Factors of Belief. 5. Influence of the Social Factor. 6. Some Features of Primitive Belief 600

CHAPTER VIII.

THE AFFECTIVE TONE OF IDEAS.

1. Introductory. 2. Revived Conditions of Affective Tone. 3. Affective Tone of Belief. 4. Affective Tone of Imagination. 5. Sentiment and Emotion 615

CHAPTER IX.

VOLUNTARY DECISION.

1. Conative Aspect of the Conception of the Self. 2. Deliberation. 3. Voluntary Decision. 4. The Forming of a Decision. 5. Fixity of Voluntary Decision. 6. "Action in the Line of Greatest Resistance." 7. Volition and Bodily Activity. 8. Involuntary Action. Fixed Ideas. 9. Self-Control. 10. Voluntary Attention. 11. True Freedom 629

APPENDIX—THE GESTALT THEORY 655

SUPPLEMENTARY NOTE 673

INDEX 683

MANUAL OF PSYCHOLOGY.

INTRODUCTION.

CHAPTER I.

THE SCOPE OF PSYCHOLOGY.

1. The Problem of Definition. — Psychology may provisionally be defined as the study of mental facts or as the study of mental life. These definitions suggest quite well the nature of the topics with which the psychologist deals. But difficulties arise when a more precise account of the nature of the science is required. It is not easy to frame a definition to which all psychologists would agree and which indicates quite clearly the place of this special study within the system of the sciences as a whole.

We naturally turn to the models afforded by the more developed sciences which have proved less difficult to define. We find in the world all sorts of material things and many kinds of events in which these things participate. The natural sciences attempt to determine the nature of these things and to formulate the laws in accordance with which events of different kinds occur.

Zoology deals with animals, Botany with plants, Petrology with rocks; and theoretically a classification of material things would closely correspond with the classification usually adopted for the special sciences. Sometimes the science which deals with a special sort of object is distinguished from the events which take place in these objects. In this way Anatomy, the study of the structure and disposition of bodily organs was once separated from Physiology, the science of

the function which these organs subserve. But a division of sciences in this way is at best only provisional, and becomes untenable as knowledge advances. The things themselves and the connected events are embraced within a single field of inquiry.

In this system of sciences, however, Psychology would seem to find no place. It does not deal with material things as these things are conceived in the natural sciences, nor do the events which make up a mental life appear to enter into relations with purely physical events in the way in which the latter enter into relations with one another. It has in consequence been very widely supposed that the world must be conceived as consisting of two entirely different kinds of things: material bodies and minds. The science of Psychology is then defined as the science concerned with minds or events which take place in minds. But this view involves an extremely dubious assumption. It is undesirable for the psychologist to start from the supposition that reality consists of two contrasted and independent kinds of things, and that his subject-matter can be wholly separated from that of the natural sciences. There are, in fact, two important ways in which objects studied by other sciences also fall into the domain of Psychology.

First of all, there is the bodily self. We cannot, of course, assume at the outset that the self or mind of which we are aware as possessing a mental life is identical with the body; but, on the other hand, we are no more justified in assuming that it is an entirely independent existent. Even if eventually it should be possible to distinguish a ' pure ' and potentially disembodied ' ego ' from the bodily self of which we are primarily aware, the latter would still remain as a subject of psychological inquiry.

Again, it has been universally agreed that the ways in which things appear to us under varying conditions, and at various stages in our mental development are matters for psychological investigation. The psychologist is concerned with trees and lamp-posts and other material objects not only as they appear in dreams, illusions and hallucinations, but also as they appear in normal waking life. The study of the various

forms of cognition cannot be carried on without any kind of reference to the objects cognised.

This being granted it would follow that Psychology is concerned with objects of every kind notwithstanding the fact that they may also form part of the subject-matter of some other science. Hence it has been said that the important difference between Psychology and other sciences is not so much a difference of subject-matter as one of point of view.

2. The Psychological Point of View.—Suppose that a man is wholly absorbed in watching the waves as they rush in upon the sea shore, and in listening to the sound they make. In this total situation we distinguish three constituents: (1) the man who is watching and listening: this factor of the total situation is the Subject. (2) The movement and sound of the waves to which he is attending: this is the Object with which the subject is occupied at the moment. (3) The watching and listening, which are activities of the subject in relation to its object.

Now, so far as the man is wholly absorbed in attending to the movement and sound of the waves, he is not attending to himself or to his own acts of watching and listening. He is preoccupied in attending to his object, and has therefore no attention to spare for himself and his own states and activities. In other words, his point of view is 'objective.' We, on the contrary, who are concerned with the total situation, are taking account of all the three factors which it involves: subject, object, and the relation of the subject to his object.

Unlike the man himself we are not thinking only of the movement and sound of the waves. We are thinking also of the subject who is attending to the waves and of the act of attention. In other words, our point of view, as distinguished from the man's own point of view, is 'subjective.' Now it is the subjective point of view which is distinctly characteristic of Psychology as contrasted with other branches of human knowledge. The subjective attitude is not, of course, confined to outsiders who are looking on at what others are doing. In our illustration the man himself may pass at any moment from the purely objective to the psychological point of view.

If, for instance, someone breaks in upon his contemplation with the question, "What are you doing?" and if he turns round with a start and answers "I am watching the waves," he is no longer attending only to the waves, but also to himself, and his own states and actions. When a subject thus attends to himself and his own states and actions, he is said to be introspective; he does not merely look outward, so to speak, at things, but turns inward upon himself.

From this explanation of what is meant by the psychological or subjective point of view, it should be clear why it must essentially take account of objects. This is because subjective states and activities cannot be conceived or described without reference to their objects. A subject is a mind, and a mind only exhibits its distinctive nature in *minding* things. It is impossible to name a thought without naming it as the thought of something. Thus Psychology must constantly refer to objects. What is really distinctive of its procedure is that it takes account of objects only in their relation to a subject; it is concerned with objects only in so far as they are objects for some conscious individual—only in so far as some mind *minds* them.

Other sciences are concerned with objects as they are in themselves, independently of the way they may present themselves to this or that individual who may be perceiving or remembering them. Psychology is concerned with them as presentations, that is as percepts or ideas. It deals with objects so far as they enter as essential factors in the experience of an experiencing individual. In this last phrase we have introduced a conception which requires further explanation in order to bring out fully the nature of the psychological problem—the conception of individual experience.

3. Individual Experience.—So far as the man in our previous illustration is engaged in watching the waves, he is not adopting the psychological point of view, but when he notices that he or some one else is watching the waves his standpoint is psychological. But here an important issue arises. Clearly it is possible for attention to pass from one object to another without involving any change in standpoint. The observer

may turn his attention from the waves to the birds above, and thence to the movements of his fellow men, whilst his standpoint remains objective. But so far so this is the case he is restricted in what he can observe. In noticing that someone else is watching the waves all that he is aware of from the strictly objective point of view is certain movements and postures. He does not perceive the observer actually seeing the waves, nor the interest he may feel.

But it is precisely with these experiences that the psychologist is concerned. He is concerned with the experiences which make up the life-history of an individual mind. Of his own experience he has knowledge which is immediate and direct, but for information concerning the experiences of other men he is dependent upon language or knowledge of bodily movements gained by external observation. But the knowledge of bodily processes gained in this way affords the psychologist only with intermediate data which, having served their purpose, find no place in the completed formulations of his science.[1]

An individual experience, mine or yours or the dog Jacko's, is also an indivisible experience. It is an indivisible unity in the sense that it does not consist of independent parts. My thoughts, feelings, etc., cannot have an independent existence of their own as bricks may exist before they are put together to form a wall. But though not in this sense composite, an individual experience is very complex. It includes within its individual or indivisible unity a variety of diverse factors which may enter into it in fundamentally different ways. We may thus speak of different ways of experiencing and of different kinds of experience. But in applying the common

[1] These considerations might seem too obvious to mention but for the fact that it is not infrequently suggested that Psychology is exclusively concerned with bodily processes. For one of the more recent forms of this doctrine see *Psychology from the Standpoint of a Behaviourist*, by J. B. Watson. It is unfortunate that the term behaviour has become so closely associated with this doctrine, for it is required to express much more than bodily processes as externally observed. It has to be remembered in this connection that even bodily behaviour is apprehended by internal as well as by external perception. Cf. below, Bk. III., Pt. II., Chap. II.

name 'experience' to them, we do not imply that they have any common character except that of being essential to the constitution of individual experience as a whole in its complex unity.

4. The Subjective Side of Individual Experience.—Experiences in general involve the presence of objects to the mind. We cannot perceive without perceiving something, we cannot suppose without supposing something to be the case, and even the apparently objectless emotions are found on analysis to be directed upon something before the mind. But experience cannot be described in terms of objects alone.

Compare the two statements: "I am glad that it is going to rain"; "I am sorry that it is going to rain." The first of these statements expresses a certain relation of the mind to an object; the second expresses a different relation of the mind to the same object. The common object is the meaning which the speaker attaches to the words "that it is going to rain." Whether it actually will rain or not, what is signified by the words "that it will rain" is something which the speaker thinks of—something which he means or intends to refer to, something which is before his mind. It is, therefore, from the psychological point of view, an object. But this object is not itself mental; for what the speaker means or intends when he speaks of rain or uses the words "that it is going to rain" is a kind of occurrence which can only take place in the material world, not in his own mind or the mind of anyone else. It is something of which he thinks: but it is not something which he directly experiences.

On the other hand, if we consider the diverse relations of the mind to its object we find that these cannot be reduced simply to differences in the nature of the object itself. The difference between my being glad that it is going to rain and my being sorry that it is going to rain consists in a qualitative difference in the feelings which I feel with reference to the same object. Of course, in feeling glad or sorry I may also have cognisance of the fact that I feel glad or sorry. It may be that I always do have some cognisance of the fact, however dimly and vaguely. But the fact itself consists in the feeling being felt, and not in my knowing about it.

We may express this by saying that it is not merely known or thought of but is actually or immediately experienced. And when in fact I not only immediately experience sorrow but also know that I am sorry, the distinction between what is subjective and what is objective remains precisely the same. The feeling of sorrow is a subjective factor in experience, even if in addition it is the object of concurrent attention. This is shown by the fact that it is expressed as a predicate of the self or 'I' experiencing. I say that I am glad or sorry, but I do not say that I am the tree I perceive or that I am green because it seems to me to be green.

5. Objects which are actually Experienced.—In the preceding paragraph we had in view only those modes of feeling which give specific character to the various ways in which the subject is related to objects which are not themselves actually experienced. But it is by no means true that all which enters into our actual experience is subjective, or that all objects fall outside actual experience. On the contrary there is a most important class of immediate experiences which are themselves primarily objects rather than ways of feeling in reference to objects.

Under this head come what are called 'sensations.' Sensations consist in the immediate experiences which arise in connection with brain changes excited by processes in the sense-organs, primarily initiated by stimuli from outside the body and also by processes within the body taking place independently of external stimulation. If the eye is stimulated, we immediately experience colour-sensation; when the ear is stimulated we experience sensations of sound. Similarly sensations of taste, smell, warmth or cold arise in connection with other stimuli acting at or near the surface of the body, while sensations such as nausea, cramp, fatigue, and hunger arise in connection with stimuli acting upon the internal organs.

Sensations are not the only immediate experiences which are psychologically objective. We have to bring under the same head those revivals or copies of sensuous experience which are called mental images. At this moment I can call up the mental picture of a horse although no horse is present

to my senses so as to be actually seen. In like manner I can command experiences resembling previous sensations of sound or touch without actually hearing or touching. Such revivals of sensation are immediately experienced in the same way as the original sensations themselves, and they have the same title to be regarded as objective. They are not subjective states of attending, liking or disliking, etc., but objects attended to, liked or disliked. Like sensations, they are objects which are immediately experienced.

We shall see in the sequel strong reason for affirming that there are other objects of this kind besides sensations and those which are ordinarily called images.[1] We may refer here to certain ambiguities in the terms 'objective' and 'subjective.' 'Object' and 'objectively' are terms commonly used to indicate what really is, or is true, in contrast with what appears to this or that individual. To the drunkard, pink rats may appear to be present though 'objectively' they are not present. In this sense of the term sensations are not objective but subjective, since the psychologist is concerned with them as appearances to this or that individual. He is not primarily concerned with physical things as they may exist independently. For this reason this use of the term objective and subjective is inconvenient.

On the other hand, the words 'subjective' and 'objective' are much needed in Psychology to express another distinction, the distinction between the states, acts, or functions of attending, desiring, liking, willing, believing, etc., and that which is attended to, desired, liked, willed, believed, etc. Whatever is meant, intended, or thought of by the mind, inasmuch as it is meant, intended, or thought of, is the mind's object, whether it be fact or fiction, a mountain or a headache or a geometrical problem. On the other hand, the various relations which the mind has to its objects in minding them and the various immediate experiences involved in these relations are primarily subjective. When I desire to catch a fish, annoy an enemy, or feel warm, then what is meant by the words 'catching a fish,' 'annoying an

[1] Cf. Bk. I., Chap. II., § 8.

enemy,' or 'feeling warm' is in each case the object before my mind; and my subjective relation to it consists (*a*) in my apprehending it or having cognisance of it or thinking of it, (*b*) in my desiring it.

Now, in this application of the terms 'subjective' and 'objective,' sensations are objective. They are not immediate experiences which enter into the constitution of such subjective states as attending, desiring, liking, or disliking, etc.; on the contrary, they are immediate experiences which enter into the constitution of objects apprehended, attended to, desired, liked, or disliked. That this is so becomes clear when we consider the part played by sense-experience in the knowledge of the material world.

The precise way in which the apprehension of sense-experiences conditions the apprehension of material things is a topic which will be discussed at a later stage, so far as it properly comes within the province of Psychology. But apart from any special investigation, it is clear from the outset that material things are primarily known as having sensible qualities, and that the cognisance of sensible qualities presupposes that sensations and their various relations and combinations are attended to so as to be identified and distinguished. In other words, it presupposes that sensations are, in the psychological sense, primarily objective, as being part of the total object which is before the mind in perceiving material things by the eye or ear or other sense-organ—as being that part of the total object which exists as an immediate experience directly traceable to the change set up in the sense-organ by the agency of the external object and thence transmitted to the brain.

The two meanings of the term 'object' (1) as what appears to someone, and (2) as what exists and has a nature of its own independently of its appearance may seem, at first sight, to be mutually exclusive. But they are in fact essentially connected. What appears to this or that individual may be inadequately apprehended; it may seem in various ways and degrees other than it really is. But the phrase "other than it really is" implies that what thus appears has a being and a nature of its own independent of the fact of its appearance.

In all appearance something real appears. Fiction consists in thinking of what really is as in some way modified or transformed. To make a mistake is to believe something real to be in some way different from what it really is. But unless we are cognisant of the real being concerning which the mistake is made we cannot believe it to be what it is not: we cannot think of it wrongly if we do not think of it at all.[1]

6. Immediate Experience and Immediate Knowledge.—Objects immediately experienced stand in contrast with objects which are merely objects of thought. I immediately experience a toothache in a way in which I can never immediately experience the tooth. The tooth is a physical object, and is thus not the sort of thing which can be actually experienced at all.[2] I cannot actually experience another man's sensations, though these too may be present to mind. My own sensations are present to mind without being actually experienced when I think of them in memory or in anticipation.

Immediacy of experience is therefore to be distinguished from immediacy of knowledge. Knowledge is immediate when it is not inferred or otherwise derivative from prior knowledge. Knowledge of what is strictly remembered is immediate. The knowledge that $1 + 1 = 2$ is immediate, whilst the knowledge of the total of a column of figures is only mediate. What is actually or immediately experienced is also the object of immediate knowledge when we attend to its nature. But immediate knowledge, though conditioned directly or indirectly by immediate experience, is not restricted

[1] In order to emphasise its objective character the term 'sensum' or 'sense datum' is sometimes employed for what has been referred to in the text by the term 'sensation.' This usage is convenient in certain contexts, but it is almost exclusively restricted to epistemological discussion. In Psychology the term 'sensation' is much too firmly established to be changed. The alternative term, moreover, is closely associated with the special doctrine that the sensum is the object of a distinctive 'act of sensing,' which in contrast with the sensum is to be described as 'mental.'

[2] This is true whatever view be taken of physical objects. If physical objects were composed entirely of actual and possible sensations, I should not be able actually to experience all the possible sensations to which in thought I should refer in thinking of any given object.

to it. The immediate experience which yields knowledge of our selves and our own minds also yields immediate knowledge of other things. For this reason it is possible to have immediate knowledge of physical things.

7. The Privacy of Immediate Experience.—It is characteristic of immediate experiences that they are not in a literal sense shared in common by different minds. Two men, A and B, may both be cognisant of the same fact, *e.g.* the death of a friend of both, C. But each feels his own grief. If they are said to share in a common sorrow this does not mean that A's feeling of sorrow is numerically identical with B's feeling of sorrow. It means rather that the feeling immediately experienced by A and the feeling immediately experienced by B both refer to the same object, the death of C. But A's immediate experience is owned by A only and not by B or any other man; and B's immediate experience is owned by B only and not by any other man.

The same is true of immediate experiences of the kind which we have described as objective. The privacy of sensations is most obvious in the case of hallucinations and dreams. Here the sensations which are ordinarily experienced in perceiving certain bodies are experienced in the absence of these bodies. When a drunkard suffering from *delirium tremens* is said to 'see rats,' he does not, of course, really see rats: for there are none to see. But he really experiences sight-sensations such as are experienced when rats are actually seen.

Such visual experiences are obviously private. Ordinarily, however, sensations are so bound up with our apprehension of material things and their qualities that difficulty may be experienced in distinguishing the sensation from the physical and 'public' object perceived. It is chiefly the discrepancies between what the object appears to be and what we know it really to be that enable us to become aware of the sensory data as such. It is then clear that these, like other immediate experiences, are not shared in common by different minds, even when they are perceiving a common object. Each individual experiences his own sensations, not those of others.

Two men, A and B, may both perceive the same fire; the fire is their common object, inasmuch as it is what both *mean*. If A says, "This fire is too big," and if B replies, "It isn't," they really contradict each other, because they are referring to the same thing. But though they perceive the same object, each of them in perceiving it experiences his own separate sensation connected with separate processes in his own sense-organs and brains. If A says, "I feel warm," and if B replies, "I do not," they do not really contradict each other. For what A affirms is that he is experiencing a certain sensation; and what B denies is not that A has this experience, but that he himself has another experience similar to it. Similarly if A says that the fire looks red to him, and B denies that it looks red to *him*, they do not contradict each other. For what A asserts is that in seeing the fire he experiences colour-sensations like those which are usually experienced by normal persons under normal conditions when they see red things; and what B denies is not that A has these sensations, but only that he himself has sensations of the same kind.

Another fact which enables us to distinguish the sensation from the physical thing is that the existence of the sensation is capable of being continued independently of what may happen to the things. The sensations have, so to speak, a separate history of their own. After seeing a candle I can retain the sense-experience in the form of a mental picture, though the flame itself has been blown out. The existence of the sense-experience is continued in the mental picture when the flame itself has ceased to exist.

8. The Unity of Experience.—Sensations, feelings, desires, etc., are not found in isolation, but only as parts or phases of a complex whole, possessing a peculiar kind of unity within itself and a peculiar distinctness from all else, a unity and distinctness to which there is nothing analogous in the material world. The unity of different modes of consciousness with each other is expressed by saying that they are phases in the life history of the same conscious individual—the same self or 'I.'

If I believe that a certain ship has been lost with all on board, and if I also believe that X was on board, the two

beliefs are connected as modes of my consciousness, and it is possible for me to proceed from them to the further belief that X must have been drowned. On the other hand, if I believe only that the ship has been lost, and if someone else believes only that X was on board, the two beliefs are not connected as modes of the same individual consciousness; there is no possibility of either of us making the inference that X must have been drowned.

The unity of consciousness is clearly implied in such pairs of correlative terms as expectation and disappointment, trial and failure, desire and satisfaction, purpose and fulfilment. An expectation can be disappointed only on condition that both expectation and disappointment fall within the unity of the same consciousness: the disappointment can be experienced only by the individual who formed the expectation. Similarly with the other pairs of correlatives.

All recognition ultimately involves unity of consciousness. A man is seen on one day and again seen on the next day. If it is one person A who sees him on Monday and another person B who sees him on Tuesday, this does not of itself yield the possibility of B identifying the man seen on Monday with the man seen on Tuesday. For this it is necessary that the same individual B who saw him on the first day should see him again on the second. The two perceptions must be owned by the same self; they must fall within the unity of the same individual consciousness.

The unity of consciousness is radically different in its nature from any unity which can belong to a material thing. Every material thing is extended in space and therefore consists of parts spatially external to each other and spatially separable from each other. It is divisible into component portions, each of which exists independently as a material thing or parcel of matter in the same way as the whole which is constituted by their union. The cup, for instance, which I hold in my hand is apprehended by me as one thing; but the separate subsistence of its parts as distinct bodies is forcibly brought home to me, if it falls on the floor and is broken in fragments.

On the contrary, the unity and distinctness of an individual consciousness is not thus composed of parts, each possessing

independently a separable unity and distinctness of the same kind. It cannot be broken into fragmentary thoughts, feelings, and volitions, or fragments of thought, feeling, and volition, each persisting, like the pieces of the cup, when I have ceased to think, feel, and will. A material thing is composed of material things; but a conscious self is not composed of conscious selves.[1]

Even if we restrict attention to sensory experience we find here, too, a distinctive unity. If sensations occurred in isolation this, from the nature of the case, would not be known. But as part of our experience they occur within a systematic whole, and by their relations within this whole their characteristics are in part determined. And wherever there is reason to believe in the existence of sensations elsewhere the reasons are such as lead us to believe in the existence of other minds. For the conditioning context of particular sensations does not consist merely in other sensations. When we come to trace in detail the development of experience, we find that it proceeds not by mere association of separate and independent units, but by certain progressive changes in an initially unified field. These changes are to a great extent determined by subjective activity. There are reasons to suppose that apart from *interest*, sensations as we now experience them would not, in fact, have arisen. Nor, of course, could there be interest or attention apart from something of the nature of sensations. Such mutual dependence is one of the more important implications of the unity of experience.

9. Consciousness.—There are certain phrases in which the term 'consciousness' may be used instead of 'experience,' and convey virtually the same meaning. Thus we may speak indifferently of an experiencing individual and of a conscious

[1] That is not to say that a number of selves may not constitute a unity of a more complex type. The facts relating to 'multiple personalities' suggest that even a normal mind may involve an organisation of selves. But even if this were true such systems are unlikely to be infinitely divisible, and ultimate selves would have to be postulated, of which the statements in the text would be true.

individual, of individual consciousness and of individual experience. But the terms are interchangeable only when 'consciousness' is contrasted with the total unconsciousness which we ascribe to a log of wood or a stone. When we say that a stone is unconscious we mean that it has no kind or degree of experience, not even the dimmer and vaguer feelings or sentience.

In other applications the two terms cannot be used indiscriminately without serious risk of confusion and error. Whatever enters in any way into the experience of an experiencing individual belongs to the distinctive subject-matter of Psychology; it may, so regarded, be itself called an experience without doing violence to ordinary language. A traveller telling of his adventures and the sights he has seen may be said to be describing his experiences. But we cannot say that he is describing states of his own consciousness.[1] This would rightly be taken to mean that he was describing, not what he saw or heard or did or endured, but rather his subjective experiences of hoping, fearing, desiring, etc.

It is just because the term consciousness refers distinctively to the subjective side of our mental life and not to the presentative or objective side that it cannot serve as a synonym for experience which may refer to either or to both in one. It should be added that when we simply speak of being conscious of this or that, *e.g.* of the presence of some one or of his value, we mean only that we are cognitively aware of it. Reference to other aspects of subjective experience requires to be specially indicated. We may say, for instance, that we are agreeably or disagreeably, attentively or inattentively conscious of something.

10. The Mind and the Self.—Psychology is concerned with modes of consciousness as connected within the unity of consciousness. But we have been unable to speak of modes of consciousness and their unity without reference to a conscious individual, a mind or self which owns them, and which

[1] 'States' or 'modes of consciousness' are necessary substitutes for the impossible word 'consciousnesses.'

we name whenever we use the personal pronoun 'I.' Here we are confronted by the question: What is this mind which owns consciousness in distinction from the consciousness which it owns?

Now this inquiry may be interpreted in two ways. It may mean: Has the mind other attributes besides those involved in saying that it is conscious or that it has experiences, and if so, what are they? In this sense the question is perfectly legitimate, and we shall presently deal with it so far as is required for psychological purposes.

But this legitimate inquiry is sometimes confused with a metaphysical problem which the psychologist is in no way bound to consider—the problem of the distinction and relation between that which possesses constituents, attributes, and states, and the constituents, attributes, and states which it possesses. The problem is that which arose for Locke when he inquired what a substance is as distinguished from its qualities.

"If anyone," says Locke, "should be asked, what is the subject wherein colour or weight inheres, he would have nothing to say, but the solid extended parts: and if he were demanded, what is it that solidity and extension inhere in, he would not be in a much better case than the Indian . . . who, saying that the world was supported by a great elephant, was asked what the elephant rested on; to which his answer was a great tortoise. But being again pressed to know what gave support to the broad-backed tortoise, he replied, something, he knew not what."

Similarly, whenever we are called on to say what a thing is apart from its states, activities, relations, capacities, and other attributes, we are reduced to the position of Locke's Indian. This must be so, because we are required to describe the nature of a thing, and are at the same time forbidden to refer to what alone constitutes its nature.

Are we then to give up using the distinction between attributes and that which possesses them? This is plainly impossible; for we must use the distinction in order to be able to think at all. All ordinary thought and conduct involve it; common sense and science cannot stir a step

without it. Hence whatever account we ultimately give of it must explain and not overthrow its validity and value.

If, for instance, we say that the being to which attributes belong is nothing but the totality of the attributes themselves, we must hasten to add that the way in which the attributes are connected with each other is unique; and if we are called on to assign the distinctive nature of the unity which they form with each other, we can discover no possible way of adequately describing it except by saying that they are all attributes of the same thing. Thus, this explanation,[1] which is probably correct, leaves the ordinary working distinction between the thing and its attributes untouched. It permits and demands that common sense and science shall for their special purposes go on using it as they did before critical reflection about it. If this were not so the result of critical reflection would be self-condemned.

The relation of the mind to its experiences is a special case of the general problem. Hence it is wrong to say, as some writers do, that Psychology is *not* the science of mind, but only of mental processes or states. This suggests that we can deal with mental processes or states without reference to their being the processes or states of some conscious individual, some 'I' or self. But no one has succeeded or can succeed in doing this, and if anyone did so he would only falsify the facts.

It may be suggested that the subject of consciousness is really the brain, and that in Psychology we ought to proceed on this assumption. Now we need not here discuss the truth of this position. It will be sufficient if we inquire what it must be taken to mean if it is to be rendered intelligible.

Approaching the question from this point of view we discover that what is meant cannot be that there is not a mind. It can only be meant that the same thing which is a mind is also a brain; that on account of its possession of certain attributes we name it a material thing, and that on account of its possession of certain other attributes we

[1] The special view here indicated must be taken in connection with Professor Stout's theory of Universals. Cf. his Henrietta Hertz lectures. *Proceedings of the British Academy*, Vol. X. [C.A.M.]

name it a mind. But the bodily aspect of its nature remains radically distinct from the mental. Thought and feeling must be recognised, on any view, as fundamentally different from any material process, and the motion of the atoms and molecules of the brain as fundamentally different from thoughts and feelings.

The difference is so radical that no knowledge of the constitution of the human body, however precise and exhaustive, could, of itself, yield any clue whatever to the existence of modes of consciousness connected with it. Even if the brain of a man "could be so enlarged that all the members of an International Congress of Physiologists could walk about inside his nerve fibres and hold a conference in one of his 'ganglion cells,' their united knowledge and the resources of all their laboratories would not suffice"[1] to enable them to discover a feeling or sensation or perception or idea or belief or anything which can properly be called a mode of consciousness.

On the other hand, it is equally clear that no scrutiny of modes of consciousness can reveal the anatomical constitution of the brain or the processes which take place in it. Information on this point is first acquired when the skull is opened so that the pulpy mass within it can be seen and felt. Apart from this, conscious individuals might have thought, felt, and willed and known about themselves and each other without ever suspecting that they had brains at all.

It thus appears that even if the being which is a mind is also supposed to be a body, yet the mental aspect of its nature is so distinct from its bodily aspect that each requires separate and independent investigation. Knowledge concerning the mind does not of itself include or conduct to knowledge concerning the body as such. Knowledge concerning the body does not of itself involve or conduct to knowledge concerning the mind as such. Hence Physiology and Psychology are radically distinct sciences, each dealing with its own proper subject-matter. As each advances independently, it becomes

[1] This illustrative hypothesis is borrowed from McDougall, *Body and Mind*, p. 352.

increasingly possible to compare their results, so as to determine how purely physiological facts and purely psychological facts are related to each other. There thus arises a borderland science, which is called Physiological Psychology. In this science Physiology and Psychology co-operate, and both receive from it light and guidance in their own special domains.

The point from which the psychologist must start is the unity of experience itself. It is that which primarily constitutes the mind. There is a distinctive unity of all that is simultaneously embraced within the experience of an individual at any given moment, but this is only a phase in a larger unity, the 'life-history of an individual mind.' It is in virtue of forming part of this peculiar unity that its components are called mental, not on account of any pervading quality they possess. But within this unity we find something which is central and invariably present whatever other things may come and go. This we may call the self in the narrower sense of the term.

The distinction between the self and the not-self, therefore, does not coincide with that between the bare subject of experience and the experience it has. Nor does it correspond to that between what falls within and that which falls outside experience. It is a distinction within experience itself.

The self is apprehended as clearly and positively characterised. Prominent among its features are those revealed by bodily sensations. But if we say the self is the body we must add that it is the body as immediately apprehended by internal perception, not as it is apprehended by physiological research. Further, we must reject the view that the self is only revealed by a special group of sensations. Most sensations contribute both to our knowledge of the bodily self and to our knowledge of external things; though some are more frequently employed in attention to external things and some for the apprehension of the self.

A further important distinction between the self as internally perceived and the body as apprehended by external perception arises from the fact that the former is immediately apprehended as united in the most intimate way with the subjective

phases of mental life. As internally perceived the self is thus an 'embodied mind,' essentially capable of knowing and feeling, and active in the pursuit of ends.

There is thus a double sense in which immediate experiences in general, and those which are objective in particular, may be said to 'exist within' or 'depend upon' the mind. Sensations, hopes, fears, desires, etc., exist within or as part of that unity of experience which constitutes the life history of an individual mind. Upon their relations within this unity their special features are in part dependent. But while some arise only within the narrower unity of the bodily self, others stand opposed as manifestations of external things.

The latter, nevertheless, though external to the self, are not independent. Appearances of external things are in various ways dependent upon the self. It is, in fact, in this way that they may come to be regarded as appearances, prior to physiological evidence of this fact. The latter merely provides external corroboration.

11. Mental Dispositions.—We now pass to a very important question. Does everything which falls within the scope of Psychology merely consist in what actually forms part of experience? Or does it include unconscious factors, states, or processes which may also be described as mental? In considering this question we may recall that it is the function of psychology to systematise the facts of experience just as it is the function of the physical sciences to systematise our knowledge concerning occurrences in the material world. Psychology proceeds in the same way and with the same general presuppositions as are involved in other sciences. Observed events of one kind are 'explained' wherever possible by reference to other kinds of events, the existence of which is also capable of being established by further observation. But there are cases in which the occurrence of certain experiences can only be understood by reference to certain subjective factors which are not themselves experienced, but are known only through their effects. Such conditions must fall within the scope of psychological inquiry, and in a derivative sense may be described as 'mental.'

Consider the case in which a previous experience contributes to determine the nature of a present experience. I meet a man to-day; I do not think of him until I meet him again after the lapse of a week or a month. But when I meet him again my consciousness in relation to him is different from what it would be if I were then seeing him for the first time. In particular, it differs inasmuch as I recognise the man as being someone whom I have seen before. This is due to my having in fact seen him before. But my seeing him before is a transient mode of consciousness which ceased to exist, as such, a week or a month ago. How then can it exert any modifying influence on my present consciousness when I see him again?

Plainly, if my previous perception of the man, when it had ceased to exist as an event in my conscious history, had also ceased to exist altogether so as to leave no trace or vestige of itself behind, my present consciousness, when I see the man, would be just the same as if I were seeing him for the first time. We must, therefore, assume that in ceasing to exist as an actual mode of consciousness it has continued existence as a persistent condition of possible consciousness, or as a persistent possibility of consciousness which may come into operation to determine the actual course of my experience whenever a suitable occasion arises.

The occasion need not, of course, be a fresh perception of the man. If he has been introduced to me by name, then when I hear the name a week after, in the absence of the man, the idea of him may thereby be recalled, including, perhaps, a mental picture of him. The mere sound of the name will not of itself account for this. It is necessary also to take into account the abiding after-effect of the previous experience in which I was introduced to the man. The general name for such unconscious factors is 'mental dispositions.'

By far the greater part of our mental acquisitions are owned by us as mental traces or dispositions and are not present in the form of actual consciousness. When a person is said to know mathematics or to retain in his memory the events which happened a year ago, it is not meant that all the mathematical propositions which he knows or all the events which he is said to retain in his memory are actually

present to his consciousness. He need not be supposed to be actually thinking of mathematics or the events of the past year at all. What is meant is rather that he is capable of recalling to mind the mathematical propositions or the past events when occasion arises, and also that these previous mental acquisitions contribute as occasion arises to influence in other ways the subsequent course of his conscious life history.

We may regard mental dispositions as constituting a sort of mental structure which is constantly being formed and modified by conscious process and is in its turn constantly contributing to determine and modify subsequent conscious process. "We are able to discover a number of general laws of this structure and (its) operation, and to describe how it gradually grows, every moment of conscious life leaving it altered in such a way that its influence upon later coming parts of the stream of consciousness is modified until its structure and its influence upon conscious life becomes exceedingly complex. But as compared with consciousness itself this conditioning factor . . . is relatively stable and unchanging."[1]

The onward flow of thought and experience depends in every moment of its course on the co-operation of an organised system of conditions which have indeed been formed in and through bygone conscious experience, but which are not themselves present in or for consciousness.

Consider, for instance, the process of recollecting a name. The endeavour to recollect is a conscious process, but its success or failure depends on other factors. It depends, for instance, on the trace or disposition formed in the course of previous conscious experiences in which the name has occurred. Conditions connected with this trace or disposition determine whether the name will be recalled at once, or after prolonged effort, or not at all. It may happen that we fail to remember the name while we are trying to do so, and that it suddenly emerges into consciousness after an interval during which we have been occupied with other matters or

[1] McDougall, *op. cit.*, p. 165.

have been asleep. This implies that out conscious effort to remember has set going an unconscious process which continues after the conscious effort has ceased and terminates in the actual emergence of the name into consciousness.

Now, what holds good in this instance of recollecting a name holds good generally throughout our mental life. Whether my thoughts come to me quickly or slowly, easily or with difficulty, they come to me only through the co-operation of conditions which are not discoverable by any analysis of my consciousness. My conscious activity is never the sole factor involved. It always appeals, so to speak, to something else and awaits the result, which may or may not be such as it requires.

It may help us to understand better the nature of dispositions if we consider an analogous case drawn from the scientific view of the material world. For the student of physical science matter is primarily what has extension, position, and motion in space. In particular, material process primarily consists in motion. But the student of physical science is constantly compelled to recognise other attributes, besides these, as belonging to the nature of matter.

He has, for instance, constantly to recognise the existence of mass and energy. Under certain conditions a ball of gold is set in motion, and its motion has a certain velocity: under otherwise precisely similar conditions a ball of iron of the same size is set in motion; the ball of iron then moves more quickly than the ball of gold of exactly equal bulk. Its velocity is two and a half times as great. What makes the difference? The student of physical science can only say that it is somehow due to a difference in the nature of the two bodies, the ball of gold and the ball of iron. This difference he names a difference in their 'mass,' and he says that the mass of the ball of gold is two and a half times as great as the mass of the ball of iron.

Now the point to be noticed is that mass for the physicist is not anything positively and directly observable and describable like the actual motion of a body. It is only inferred from its effects, and it is conceivable only in relation to its effects. It is conceivable only as being that which makes a

certain traceable and definable difference in the behaviour of bodies under otherwise similar conditions.

What the physicist calls 'energy' is an entity of a similar type. A man carries a stone to the top of a hill. It has thereby acquired a capacity of doing work equivalent to that which was done on it in carrying it there. If it is allowed to drop down the hill again it may break a man's head on the way and make a dint in the earth when it reaches the bottom; besides this, it also generates heat in colliding with or rubbing against the objects which it encounters on its way. This capacity for doing work is attributed to the stone even while it is lying idly at the top of the hill. It is then called potential energy, or energy of position. What then is this potential energy?

It is not anything positively observable or imaginable like shape, position, and motion. It is conceived only either as the mere possibility of a body or system of bodies doing work, or as being something, otherwise indefinable, on which this possibility depends. We need not here stay to discuss which of these alternatives is the right one. But it is important for our purpose to note that whether or no energy is a mere possibility, the student of physical science is continually compelled to speak of it and think of it as if it were something actual. It is for him something which is continually being communicated from one body or system of bodies to others almost as if it were a fluid poured from one vessel into another. Further, on being thus transferred it is also transformed in its nature. It may assume the form of mechanical energy, electrical energy, radiant energy, magnetic energy, energy of molecular condition, or energy of heat. Further, in all its redistributions and transformations, it is regarded as constant in quantity. In all its redistributions and transformations it undergoes neither increase nor diminution.

Similarly, in Psychology we cannot proceed without constantly recognising the existence of unconscious factors connected with consciousness in a way comparable to the way in which mass and energy are connected with motion.

We may now briefly reply to three questions: How do we know that mental dispositions exist? What are they?

Why do we regard them as mental facts? We know of their existence through their effects, through their indispensable function as factors conditioning the flow of conscious life. In like manner mass and energy are known to the physicist only as being indispensable factors conditioning the motion of bodies in space.

To the question, What are they? it is sufficient to reply that their nature is defined for us by their function and their origin, by the way in which they condition the flow of our conscious life, and by the way in which they are themselves produced and modified by conscious processes. The physicist can give only the same type of answer to the question, What are mass and energy? These are for him only entities which condition in certain definite ways the course of material process consisting in the motion of bodies in space. In metaphysics such answers might be regarded as unsatisfactory, for metaphysics aims at ultimate and complete truth. But Psychology does not attempt to solve metaphysical problems. Its special province is merely to give a systematic account of the laws and conditions of the life history of individual minds.

As for our reason for classing dispositions as mental facts we may again refer to the analogous case of mass and energy. For the student of physics mass and energy are physical facts because for him their whole meaning and significance lies in their relation to material occurrences, the motion of bodies in space. Similarly, for the student of Psychology, dispositions are mental facts, because for him their whole meaning and significance lies in their relation to consciousness and its various modifications. If the physicist were assured that energy is really something psychical, as it possibly may be, this piece of information would be irrelevant for him as a physicist. He would still, for the purposes of physical science, be bound primarily to regard it in its relation to material process, and therefore as itself material. It would not cease to be a material fact for him merely because he had reason to regard it as also a psychical fact. In like manner even though it were admitted that mental dispositions are also physical facts, they do not cease for the psychologist to be mental facts.

It is from this point of view that we must approach the doctrine that mental dispositions are in reality physiological dispositions. It is true that there are physiological dispositions. Processes taking place in the brain leave behind them modifications of the brain substance which contribute to determine the nature and occurrence of subsequent brain processes. Such physiological dispositions are, of course, physical existences. They are so because they are conceived merely as resulting from material processes and as factors determining further material processes.

Now it has been held by many authorities that what we have called mental dispositions are really identical with physiological dispositions. The question here raised is logically the same as that with which we have already dealt in examining the view that the mind is really identical with the body. Even supposing that that which is a physiological disposition is also a mental disposition, yet these two aspects of its nature are so distinct that they can be examined separately and must be examined separately before we can proceed to investigate the relation between them.

In defining dispositions in psychological terms we are not defining them as being in themselves any kind of consciousness or experience, any more than the physicist in defining potential energy by reference to motion is defining it as an actual mode of motion. On the contrary the nature of the disposition in itself is wholly undetermined except in so far as this can be inferred from its conditions and its effects. Such inferences will depend upon our general views about causation and upon the special doctrine held with regard to the relation of body and mind.

It is important to distinguish between two kinds of dispositional facts. There are firstly dispositions of the kind which are formed under conditions requiring actual experience. The fact, for example, that I am able at any time to 'call up a mental picture' of St. Paul's Cathedral depends upon a disposition left by some actual experience in which I saw the cathedral or some representation of it.

In contrast with dispositions of this kind there are *pre*-dispositions, dispositions which do not depend upon actual

experience in the life of the individual whose mental process they determine. Under this head fall innate aptitudes and propensities. Some men, for instance, are born with a native bent for music, others for mathematics. Such innate endowments consist partly in an original capacity for feeling interested in certain directions, partly in original power of rapidly learning and firmly retaining what has been learned.

Differences of congenital equipment are very evident when we compare with each other animals belonging to different species. The special interest which a kitten, without previous relevant experience, shows in a dangling ball of worsted is totally absent in the case of a rabbit. The propensity and ability of a starling to imitate sounds is not found in the canary. "The twilight which sends the hens to roost sets the fox to prowl, and the lions' roar which gathers the jackals scatters the sheep . . . Out of all the manifold changes which a given individual experiences only a few are the occasions of such decided feeling as to become possible objects of appetite and aversion."[1]

What special experiences have this exciting effect depends primarily on congenital predispositions.

12. Unconscious Mental States.—Closely connected with the question of mental dispositions is the problem of actual unconscious experiences. To assert the existence of such experiences might seem to be equivalent to the absurdity of asserting unconscious consciousness; but the intended meaning of the assertion is not self-contradictory, and it is important.

In an older sense of the term, 'consciousness' was equivalent to what we now express by 'self-consciousness'—the awareness of our own experiences. In general, when we have an experience we also know that we have it. It would seem almost impossible to experience a toothache, to feel excited or to see a ghost without also being fully aware that we are having these experiences. And even when we are not attending at all to our experiences and are therefore having them unconsciously, it is in general possible to become fully aware of them by a movement of attention.

[1] Ward, *Psychological Principles*, pp. 50-1.

Now the question of unconscious mental states relates to the possibility of there being experiences which may be said to be ours, but of which we cannot become aware in this simple and direct way. There is evidence, it is suggested, of our having thoughts, feelings, sensations, and desires which do not enter into the stream of our normal mental life so as to be open to direct observation at the time at which they occur. From the nature of the case the suggestion is one which cannot be tested by the normal and the most conclusive test of the existence of mental states—the test of introspection. If we come to know of them at all we can only do so in the way in which we come to know of mental dispositions or as we come to know of mental states in the lower animals.[1]

There are many circumstances in which from bodily behaviour we can infer a certain mental state. If a man persistently behaves in a distinctly aggressive manner towards us we infer that he *feels* hostility. Frequently confirmation of the inference might be obtained from the aggressor's introspection. Sometimes, however, he will deny in all sincerity the existence of any such feeling. It is then suggested by the exponents of the doctrine of unconscious mental states that the feeling is unconscious.

Again, restricting ourselves to our own experience, we find in general that when we strongly desire a certain thing this desire not only intrudes with frequency into our thoughts, but also that it influences in many ways the sequence of ideas. We tend to imagine ourselves in all sorts of situations which would satisfy our desire, and objects otherwise indifferent tend to be thought of in relation to this conscious end. Now when we find our imagination active in this way, *as if* we desired a certain thing, but without there being any such desire open to introspection we are again confronted with the suggestion of an 'unconscious wish.'

[1] The method by which we know of the mental states of other men does not avail us here. Certain conditions of normality must be presupposed in accepting a reported introspection. In the cases of multiple personality, where there seems to be a secondary self who performs the requisite introspection, the evidence must be inconclusive; since it is the existence, or rather the identity, of the witness which is the issue in dispute.

We cannot, however, assert that whenever a process of thought or behaviour occurs *as if* in accordance with a wish such a wish is certainly present. It may be the case that the process arises in various ways. When a man eats his dinner he behaves as if he wanted to go on living. He may, in fact, be fully determined to put an end to his life. He behaves as if he wanted to go on living only because he wants his dinner, and the natural consequence of eating is the prolongation of life. It might even be the case that he was acting from force of habit without wanting anything at all.

The difficulty in general is that there is no quite conclusive external criterion of a mental process. The criteria we have yield overwhelming probability under normal conditions, but in cases most favourable to the hypothesis of unconscious mental states the general conditions of normality are seriously disturbed.

The strongest evidence arises from the existence of dispositions of the kind that presuppose a specific experience when there is reason to suppose that this experience, if it occurred at all, found no place in the normal stream of mental life. A man who has lost a valuable article may dream that he sees it in a certain place where later it actually proves to be. The presumption is that the dream is based on a disposition left by an actual perception. But had he consciously observed the object in this place he would have been sufficiently interested to have removed it to safety. If he had seen it there at all, he must have done so 'unconsciously.'

Such cases, of course, are rare in normal mental life, though analogous facts are frequent in the sphere of mental pathology to which the problem chiefly belongs.[1] It is sufficient to note here that the facts admit of varied interpretation, but that in any case the hypothesis of the 'unconscious' falls within the scope of psychological inquiry.

[1] This and kindred topics are treated most fully and in a form most suitable for the student of general psychology by McDougall in his *Outline of Abnormal Psychology*. For a more detailed analysis of the meanings of the term 'unconscious' see Broad, *The Mind and its Place in Nature*.

CHAPTER II.

THE DATA AND METHODS OF PSYCHOLOGY.

1. The Problems of Psychology.—All the special sciences grow out of the common matrix which is supplied by that ordinary prescientific knowledge of the world which we call common sense—the knowledge possessed by the 'plain man' or 'the man in the street.' They are special developments of that practical acquaintance with things and their behaviour which is acquired by all of us in the course of daily life. Psychology is no exception. It has for its primary basis the pre-scientific knowledge which we all of us possess of what passes in our own minds, together with that knowledge of what passes in the minds of our fellow-men on which the possibility of social intercourse and social co-operation depends.

As members of society, we are constantly gathering and seeking to gather from the outward behaviour of other members of society, from their gestures, attitudes, words, and actions, a knowledge both of their transient mental states and processes and of their more permanent mental dispositions—of their passing emotions, desires, thoughts, and volitions, and of their abiding and habitual ways of thinking, feeling, and willing. In this manner each of us acquires in ordinary social intercourse a knowledge of mental facts and laws sufficient for the practical purposes of our daily lives.

But this knowledge is incomplete, vague, and unsystematic. In studying Psychology, we are attempting to extend it, to make it precise, and to reduce it to systematic form. We have, first of all, to subject our experience to analysis, to describe and classify its forms. Simple must be distinguished from complex mental states, and the latter must be shown to

be in some way derivative from the former. These are the problems of *analytic* Psychology.

We have further to formulate the laws of mental process. Experiences do not occur in a wholly haphazard manner, but conform to certain laws. Absolute uniformities are not easily established, but we must assume that as with physical occurrences so in the sphere of mind events occur in an orderly way.

In referring a particular instance to a general rule, or in subsuming a narrower under a wider generalisation, we are passing from description to what in the empirical sciences is meant by explanation. The 'laws of human nature' are generalisations about the human mind, about mental process, its conditions and expressions. These laws may prove to be comprehended within wider generalisations concerning the mental processes of living things in general. There will also be narrower laws relating to racial, national, or individual differences.

The fact that, like the body, the mind is subject to growth and evolution, leads to a genetic treatment of psychological problems. We may attempt to trace the course of mental growth in the individual life or in the history of the race. In this latter inquiry two methods may be employed. In the comparative method the manifestations of mental process are compared at different levels of animal life. The merit of this procedure is that it greatly extends the range of available data. Its great defect lies in the difficulty of interpreting the behaviour of the lower animals in terms of mental process. Recourse is sometimes taken to the desperate expedient of denying the legitimacy of this kind of interpretation altogether. On this view, Psychology would be restricted to the study of external behaviour.[1]

[1] The exponents of this view are the 'Behaviourists' previously referred to (footnote, p. 5). Within this school we may distinguish the Metaphysical Behaviourists, who hold that consciousness does not exist at all or that what is called consciousness can be analysed in terms of behaviour, and the Methodological Behaviourists who merely advocate as a principle of method the restriction of observation to external behaviour.

2. General Presuppositions.—The presuppositions upon which prescientific and scientific psychology depend are fundamentally the same. The data are ultimately of the same kind, and they are used in fundamentally the same way. The difference is only the difference between common-sense knowledge and scientific knowledge. Scientific knowledge is a development of common-sense knowledge, distinguished by a more purely theoretical interest and by its systematic thoroughness and precision.

(*a*) *Uniformity in Mental Process.*—One necessary postulate plainly is that mental states and processes as they occur in individual minds exhibit a systematic order in conformity with rules of more or less generality, and that this order is uniform in different minds, varying only in its expression according to the varying conditions of special cases. We all in daily life expect that a person whom we have frequently and recently met will be able to recognise us when he sees us again. We anticipate that, in general, a man will be disagreeably affected if someone treads heavily on his toe or if he suddenly loses all his money. We assume that the persons around us are pursuing definite ends and in consequence are endeavouring to possess themselves of the means to those ends and to utilise such means. On every hand we find more or less permanent institutions which presuppose uniform and predictable behaviour on the part of large groups of human beings, *e.g.* the railway system, ships, post offices, colleges, churches, and business establishments of all kinds. Our whole social system presupposes that there is a systematic order more or less uniform in different individual minds.

This is not to deny the existence of individual differences. In fact this postulate is equally presupposed in the assertion of individual peculiarities. To say that A is irritable or that B has an unrivalled capacity for remembering dates is to generalise about the experiences of irritation in A and about the memory of B. In pre-scientific thought all such generalisations are vague and ill-defined, but they admit of progressive refinement by statistical formulation which ultimately presupposes certain invariable laws.

(*b*) *Psycho-physical Uniformity.*—In the second place, it is an essential postulate of pre-scientific Psychology that the mental states and processes of human beings are connected in a more or less regular way with their bodily behaviour. Thus, if we see a man going through the act of throwing a stone in a certain way into the water, we assume that he wants to make 'ducks and drakes.' If a person without any kind of compulsion, regularly attends a course of lectures we assume that he is interested. Our only means of gaining insight into the mental life of others is through interpretation of their bodily actions, attitudes, and words. The logical presuppositions on which this procedure is based is that bodily behaviour is connected in a more or less uniform way with mental facts.

Here, too, the degree of uniformity will be more or less exact according to the precision with which the facts are defined and according to the way in which they are arranged. If we limit attention to the isolated fact of regular attendance our inference to the student's interest will be insecure, but if we take into account his conduct at the lecture the presence of interest may be more surely known. Where all grosser indications fail, experimental evidence and the observation of bodily process by means of appropriate instruments will render the inference more secure. In other words, we assume that a certain parallelism prevails between the facts of body and of mind.

(*c*) *Teleological Determination.*—The two postulates so far considered are similar in nature to those which underlie our knowledge of the material world. They merely require that the general principle of the uniformity of nature shall be applicable within the domain of psychical existence. But when we consider the special nature of the order which we seek to discover in the domain of mind, it becomes evident that this differs essentially from the order of the material world as traditionally conceived. The latter is represented as fundamentally mechanical; the order which pervades and unifies the life history of individual minds is fundamentally teleological.

The material world is a world in space, and physical occurrences are through and through determined by spatial

relations, and themselves consist in changes of relative position in space. But conscious individuals, as such, and the varying modes of their consciousness are not in space. The controlling concept by which we apprehend the unity of their life history cannot be that of space and spatial relations. It is rather that of the direction of mental processes towards *ends*. When we inquire why a person does this or that we are satisfied when we discover that he does it because he wants something either as an end in itself, or as a means to some further end.

3. The Data and Methods of Scientific Psychology.—The data of scientific psychology are essentially of the same nature as those of pre-scientific Psychology. They are obtained through the individual's reflective apprehension of what passes in his own mind and also through observing and interpreting the behaviour of others and in general their bodily as indicating their conscious life. What distinguishes Psychology as a science is that it carries out its researches in a far more precise, systematic, and thoroughgoing way than is needed for the purposes of daily life. In daily life knowledge is mainly pursued in order to meet practical needs. But it is the distinctive aim of science to elicit from its data principles of the highest possible generality and to exhibit these principles as connected with each other in a systematic unity.

We have to consider separately the two ways of acquiring psychological data: (1) by self-examination, and (2) by observation of others; we have also to say something about the nature and use of scientific experiment and of quantitative methods in Psychology. But before proceeding to these topics it will be an advantage to draw attention to a point of great significance for our whole view of the nature of psychological data, the fact that these data include not only subjective states but also, as inseparable from these, their objects, *as such*.

4. Objects as Data.—However we may come to know of them—whether by introspection or in other ways—objects are psychological data; objects, that is to say, in the psycho-

logical sense of the term. Whatever any conscious individual means or intends to refer to is an object for that individual at the moment at which he means or intends to refer to it. This is so, independently of the question whether the object really exists or what kind of reality belongs to it. An object, in order to be a datum for Psychology, need have no actual existence in the real world. The solid figure seen in the stereoscope is not physically existent. It is nevertheless an object present to the mind. Its absence physically is important for Pyschology only because it involves the absence of certain conditions which might otherwise be supposed to be essential to the presentation of solidity.

Similarly a man dreams that he sees a blue horse. There is no blue horse really there; and it follows that he cannot really see one. Nevertheless, the sensations and other conditions of his dream irresistibly impel him to think of a horse being actually present; and the presence of the horse, so far as he thinks of it, is an object for him, in the psychological sense. If he does not know that he is dreaming, he will in all probability not only think of the horse being actually present, but will also believe that it is so. It is an object not only of thought but of belief. If he becomes aware that his dream is only a dream while it is still going on, then, although the presence of the horse continues to be strongly and vividly suggested by his dream-imagery, he no longer believes but rather disbelieves in it. It is an object of thought and of disbelief.

Now objects in this sense form always an essential part of the data of Psychology. In describing a mind at any stage of its development, it is not enough to say that it has perceptions, conceptions, beliefs, hopes, fears, desires, and other immediate experiences; we have also at the same time to specify the objects which in these various ways it is occupied with; we have to specify what it is that is present to its consciousness when it perceives, conceives, hopes, fears, believes, and so on.

"I don't know" says J. M. Barrie, "whether you have seen a map of a person's mind." He then proceeds to indicate what a map of a child's mind would be like; and in doing so

he gives nothing but a list of objects in the psychological sense: "there are astonishing splashes of colour here and there, and coral reefs and rakish-looking craft in the offing, and savages and lonely glens, and gnomes who are mostly tailors, and caves through which a river runs, and princes with six elder brothers, and a hut fast going to decay, and one very small old lady with a hooked nose. It would be a very easy map if this were all; but there is also first day at school, religion, fathers, the round pond, murders, hangings, verbs that take the dative, chocolate pudding day, getting into braces, threepence for pulling out your tooth, and so on."[1]

Now this inventory, supposing it is correct, is a collection of data for Psychology; they are data for the solution of such problems as: what things does a child think about, and how does he think about them, at various stages of his development? At what stage in his development do such and such things come to be objects for him? How do these objects come to be in his mind?

Of course, objects are never psychological data when considered in total separation from the cognitive, affective and conative life of the mind. The psychologist is interested in objects as objects of belief, supposition, hope, or desire, etc. It is important to know that fairies are objects to the primitive mind, but we also want to know whether they are more particularly objects of belief or only of fancy. Objects in isolation would be of no more psychological interest than would beliefs or perceptions in abstraction from what is believed or perceived. The consideration of objects is primarily of importance in the study of the psychical processes and conditions through which such objects become present to consciousness. Hence it is important to be able to compare different stages or phases in the development of the objective content of mind in the race and in the individual.

[1] *Peter and Wendy*, p. 9. Inventories of this kind have been compiled in a systematic way, *e.g.* by Stanley Hall and his pupils. See *Aspects of Child Life and Education*, London and New York, 1921. Many investigations into the association of ideas are also of this character, as for example, the experimental studies summarised in Ch. IX. of Whipple's *Manual of Mental and Physical Tests*.

In this way Philology and Anthropology supply useful data to the science of mind. The products of thought are embodied in language, so that the comparison of the vocabulary and of the syntactic structure of different languages is a means of comparing different stages of mental evolution. The comparative study of the religious and other beliefs of primitive races has the same kind of psychological value, and the same holds good as regards their technical and artistic productions.

Again, apart from any reference to historical order, we may compare the same object as it is presented to different minds, or to the same mind under different conditions. This course yields important results when we can assign definite circumstances on which the variation depends. Thus, by comparing space as it exists for persons possessed both of sight and touch with space as it exists for the blind, we may obtain valuable data for determining the part played by visual experience in the development of this perception. A flood of light is thrown on the conditions of mental development in general by examination of the cases of such abnormal individuals as Laura Bridgman or Helen Keller. Under the same head come the data supplied by mental pathology, including cases of aphasia, psychic blindness, and so forth.[1]

5. Introspection.—Primarily, to introspect is to attend to one's own experience, but it is important to distinguish introspection as a psychological method both from attention to mental process in prescientific thought and from the observation of the contents of actual experience which is involved in perceiving physical things.

A person who broods upon the condition of his mind or who 'luxuriates in his emotions' is said to be introspective. This form of self-observation may perhaps provide valuable psychological data, but it is not the kind of introspection upon which Psychology depends.

Introspection cannot be distinguished from external observation on the ground that each deals with separate and independent objects, respectively matter and mind. When we attempt to localise some vague discomfort to assist the

[1] Stout, *Analytic Psychology*, Vol. I., pp. 9-11.

UNIVERSITY LIBRARY LEEDS

doctor in his diagnosis, we attend to our immediate experience much as a psychologist would in trying to decide whether organic sensations possess the attributes of extensity and localisation. But only the latter case is one of introspection.

Again, a physicist engaged in photometry may compare two shades of grey and pass a judgment upon their similarity. The same observation, when the purpose is to determine the nature of visual perception or the limits of visual discrimination is described as introspection.

Similarly, when a person calls up an image of his breakfast table in order to remember what he had for breakfast, he would not be said to be engaged in introspection. When we perform the same act of visualisation to determine the nature of our images, the task has an introspective character.

The cases are distinguished by the direction of thought reference. In introspection we attend to the contents of experience as such, and as forming part of the life history of an individual mind. We are concerned with the nature of experience itself and with the laws of mental process. When we attend to sensations with reference to the nature of physical things it is no longer introspection, as the term is usually and naturally employed.

Introspection is a special development of explicit self-consciousness. In this we may distinguish three stages—

(1) The mere transition from the objective to the subjective point of view, as when a man, previously engrossed in watching the waves beating on the shore, begins to notice that he is watching them. This is the most rudimentary stage of *explicit* self-consciousness. But even while the subject was wholly pre-occupied with an external object, we cannot affirm that he was without any kind of self-awareness. What we ought rather to say is that this self-consciousness was implicit. Himself watching the waves formed part of the whole of which he was cognisant before he expressly discerned it as a distinct constituent of the whole. It is this separate discernment of the self which constitutes explicit self-consciousness. When it occurs after a previous state of absorption in other objects, the self discerned does not appear as something quite novel which was in no way present to the

mind before, as when something previously unseen enters into the field of vision, or a sound previously unheard reaches the ears. In general, explicit awareness of self seems to be pre-conditioned by implicit awareness.

(2) The second stage of explicit self-consciousness involved is reflective, but not scientific. In it questions are raised by the subject concerning the workings of his own mind, but without reference to any scientific interest. Such questions may take shape as follows: Am I really convinced or have I a lingering doubt? Am I feeling only moral indignation or personal resentment also? Is my mind really made up to do this or will I hesitate when the moment for action arises? Am I feeling better? What put this idea into my head? Am I really enjoying this picture or only pretending to myself that I enjoy it, because it is generally praised?

(3) The third stage is introspection as a scientific method, directed towards the answering of questions of theoretical importance for the advancement of our systematic knowledge of the laws and conditions of mental process. *E.g.* Can I will to do what I am fully convinced is impossible? Can I by an exertion of will bring myself to believe this or that, when otherwise the evidence would not convince me? Can I at the same time be in a mixed state of pain and pleasure? Can I attend to two disconnected objects at once? Do ideas ever arise in my mind without being suggested by other ideas? What kind of mental imagery do I use in thinking?

6. **Difficulties of the Introspective Method.**—The validity and utility of introspection has been challenged on various grounds. It is asserted that the privacy of experience involves the impossibility of testing the introspective judgment, that the futility of the introspective method is shown by the conflicting deliverances of different observers, and that such observation is vitiated by bias and pre-conception.

(*a*) *Introspection and the Privacy of Experience.*—It may be admitted at the outset that a physical object or process, unlike a conscious process, may be simultaneously attended to by independent observers. This, however, does not involve that introspection is less reliable than external observation, or that

it cannot be confirmed. In the natural sciences the corroboration of testimony does not depend upon two observers attending to an object which is numerically identical for both. A physiologist may in the privacy of his laboratory investigate the nervous system of a starfish, and from the nature of his researches the object is likely to be destroyed. His observation can be repeated only upon another specimen. The case is the same with introspection. Two men cannot observe the same sensation or mental image, nor is there any reason why they should. It is sufficient for them to observe the sensations which arise under similar conditions. It is true that what they observe may differ not only numerically but in qualitative ways. But this is true of the observation of the starfish. In this way we come to know that both physical objects and experiences are liable to individual differences.

No mere multiplication of observers is sufficient to secure the confirmation of a given observation. Even the size of a physical object would not be adequately established by taking the average estimate of a number of independent observers. Confirmation is largely inferential, and is based upon the coherence of the isolated datum with other facts.

(*b*) *Conflicting Introspective Judgments.*—It may be further admitted that on many questions the introspective deliverances of separate observers conflict to such a degree and to such a manner that the differences cannot be attributed either to the ordinary errors of observation or to differences in individual constitution. Frequently it is not easy to decide between the judgments by inferential tests. The question of 'imageless thought' provides an obvious example. Some observers declare that they can think of an object which is not present to their senses without experiencing any kind of mental image or using any kind of symbols such as words. By others this is categorically denied. *Prima facie*, the issue is one which introspection might be expected to decide, but the evidence from this source is admittedly inconclusive.

Clearly, however, the existence of such disputed points would at most enable us to say that there are cases of a certain sort on which introspection is inconclusive. They

justify no generalisation about the reliability of introspection as a whole. It is clear at any rate that there is no essential obscurity, fallacy, or difficulty when the question is broad and simple. There is no fallacy, obscurity, or ambiguity in the statement that when I have toothache I dislike it very much, or that I was afraid when I saw a white figure in a churchyard. There is no fallacy or ambiguity in the statement that feeling pleased is different from feeling displeased, or that when we are fully convinced that an action is totally impossible we cannot voluntarily determine to perform it. Facts of this kind can be observed with ease and certainty by everyone.

Now if introspection could only supply us with such simple and obvious data, it would none the less be of essential value. It would supply us with the general terms in which to describe mental process. The more precise determination of such process in details might be hypothetical, and dependent on other data as the ultimate test of its correctness. To a large extent this is the case. In this respect Psychology is on a footing with other sciences. There is much in the natural sciences which direct external observation is powerless to decide.

It is difficult to formulate the general principles in accordance with which some matters may be asserted to fall within and others outside the sphere in which the introspective method is appropriate. Certain degrees of difference fall below the threshold of discrimination, certain facts are inherently obscure, certain conditions, such as conditions of rapid change, are unfavourable both to external observation and to introspection. One important consideration is that every reported observation must in a certain sense 'go beyond the facts' which are actually observed. It must be formulated in terms of certain categories of thought, categories implied even in the question raised. Where these categories are inappropriate or themselves the subject of dispute, the issue cannot be settled simply by introspection.

Many of the alleged difficulties of introspection are really due to this. It is not so much that introspection is more fallible than external observation as that in Psychology the underlying categories are not so clearly determined as are

those employed in the description of physical facts. Where this is the source of dispute it is common to attribute the disagreement to the existence of prejudice. This leads us to the third of the commonly alleged difficulties in introspection.

(*c*) *The Influence of Preconceptions.*—The objection frequently takes the form of a dilemma. On a question submitted to introspection we must either accept the finding of the unsophisticated observer, the tyro or the 'plain man,' or we must refer to the trained and practised expert, the professional psychologist. The former will be unreliable from his very inexpertness, the latter will be influenced by his theories, and by what he wishes to prove.

Clearly as the argument stands it proves too much. The considerations raised are not peculiar to the case of introspection. If the argument were valid it would be destructive of observation in general. Further, it involves a definite error of fact. Cases are not infrequent in which the observer merely wants to get at the facts and would sacrifice many theories to have a disputed question settled. The fact would seem to be that the difficulty is not one of prejudice but arises from 'preconceptions' of the subtler kind to which we have referred, the categories implied in the statement of the fact. There would seem to be, in short, no possibility of a purely observational psychology, apart from the analysis of fundamental conceptions. The difficulty is less acute in the natural sciences because this part of the task has been previously performed or at least may be presupposed.[1]

A certain special difficulty calls for consideration. The necessity for distributing attention over a complex field arises in purely external observation, but there is a special complication when this is demanded in introspection.

The mind in watching its own workings must necessarily have its attention divided between two objects,—on the one hand, the mental operation itself which is to be observed, and on the other, the object to which this mental operation is directed. If I observe the process of seeing, I must attend at once to what is seen, and to the seeing of it. If I notice what

[1] Similar difficulties, however, do arise in the natural sciences when a revision of descriptive concepts is proposed.

takes place in attending, I must both attend to something and also to the fact that I am attending to it. Thus if the introspective effort is sustained and strenuous, it is apt to destroy the very object which it is examining. For, by concentrating attention on the subjective process, we withdraw it from the object of that process, and so arrest the process itself. Thus, introspection, when it is directly concerned with a mental operation that is in itself more or less absorbing, can proceed only by taking a series of transient side-glimpses.

This difficulty is, however, not so serious as it appears; for, in the first place, retrospection is to a large extent free from it. By calling up a process in memory immediately after it is over we are often able to notice much that escaped us when it was actually going on. In like manner the astronomer can call up in memory the image of a star which has just passed before his vision; and can then notice details which had escaped him at the moment of its actual appearance.

In the next place, we must bear in mind that it is not the isolated observation which is of importance in introspective psychology, but rather the accumulation of a vast number of observations, each helping the others. Thus, what is important is to acquire a general habit of alertness, a perpetual readiness to attend to the workings of our own minds whenever opportunities present themselves; and it must be noted that opportunities are constantly presenting themselves; the subject-matter which we have to observe is perpetually with us. This may be set down as a grand advantage of introspection, compensating in a high degree for its drawbacks.

Finally, introspection, to be effective for the advancement of science, must, like other modes of observation, be carried on by a number of experts in co-operation. Each must communicate to the rest his own results, for confirmation or rejection. Thus, it is an essential part of his business to state his results in such a form that they can be tested by others. He must be able to point out to others exactly where and how to look for what he himself has observed. This is most easy when the method of experiment, as distinguished from mere

observation, is followed, and constitutes one of the main advantages of that method.

The peculiar difficulties of introspection, it should be noted, are mainly confined to the case in which what we attempt to observe is a subjective state or process, such as attending, willing, desiring, or believing. The scrutiny of the nature and behaviour of sensations is not beset with the same difficulties. The reason, of course, is that sensations are themselves primarily objects. Besides, their dependence on appropriate stimuli makes it possible to fix and detain them or to repeat them at will by controlling their physical conditions.

Hence the examination of sense-experience is comparatively easy, and readily yields definite and trustworthy results. On this account there is a tendency in some psychologists to ignore or overlook the more evasive subjective states and to recognise only sensations and images as mental facts. This sensationalist bias is natural; but it results in a fundamentally false view of mental life.

We may summarise the results of this discussion by saying that the reliability of introspection is within a wide range equal to that of external observation. There are, however, psychological problems to the solution of which it is inappropriate. Within the sphere to which it is legitimately applied, it admits of considerable refinement. Its utility is extended by systematic training and by the improvement of technique.[1]

7. Manifestations of Mental Process in Others.—Prescientific psychology is not primarily introspective in its general tendency. The conscious individual does indeed to some extent take note of what passes in his own mind. But as his controlling interest is social, he is primarily concerned with the minds of others, and with himself only in relation to others. For all of us, the awareness which we ordinarily have of ourselves is inseparably connected with the thought

[1] For example, by Ach's method of 'systematic experimental introspection.' See Titchener, *Experimental Psychology of the Thought Processes*.

of other selves as variously related to us in the way of social intercourse. As the social situation varies, there is corresponding variation in the self-consciousness of the individual. The schoolboy's view of himself differs according as he is in the company of his schoolmaster, or his play-fellows, or his mother, or his little sister. In general, as we see our own faces only as revealed in reflecting surfaces, so we think of ourselves, for the most part, as mirrored in other minds, and it is, primarily, the mental life of others rather than our own which engages our interest and attention. Deliberate introspection undertaken for its own sake is in general a comparatively late development.

On the other hand, no one can directly observe what is passing in the mind of another. He can only interpret external signs on the analogy of his own experience. These external signs always consist in some kind of bodily action or attitude. Thus, when a man clenches his fist, stamps, etc., we infer that he is angry. When a dog wags its tail, we infer that it is pleased.

There is thus an apparent difficulty to be noted. We have to reconcile two positions which may at first sight appear to conflict with each other: (1) That initially our knowledge of others develops in advance of our knowledge of ourselves. (2) That we can construe the outward behaviour of others as expressing their conscious life only on condition that we have ourselves lived through or are living through similar or related experiences.

In the solution of this problem three facts have to be borne in mind. In the first place, while our earliest knowledge of other minds is not based on introspection it is nevertheless more than knowledge of bodily behaviour. It is prescientific Psychology, not prescientific Physiology. It is knowledge of behaviour conceived in psychological terms. We recognise an animal as frightened or hungry without being able to describe in purely objective terms the bodily processes by which these psychical states are expressed.[1] Secondly, we

[1] This point has been abundantly and rightly emphasised by the exponents of the 'Gestalt' Psychology. Cf. the whole treatment in Köhler's *Mentality of Apes*.

may note that though knowledge of mental process in others is dependent upon our having more or less similar experiences ourselves, it is not necessary that our own experiences should have been the subject of introspective analysis.

The solution of our problem depends on a distinction already referred to, the distinction between having an immediate experience and knowing or thinking about it. It is one thing to live our conscious life, it is another to take express notice of our modes of consciousness so as to recognise their nature, classify them, describe them, raise questions about them, or make judgments about them—even the judgment that they exist or occur. As I have already pointed out, when a man's attention is completely engrossed by its object, he does not attend to his own attention as he attends to the object. Similarly, to desire something is distinct and separable from reflection on the state of desiring. The same holds for all properly subjective modes of consciousness.

It might be supposed that this is otherwise with sensations, inasmuch as these are primarily objective. But it must be remembered that there are two ways of attending to sensations. We may attend to them as a necessary part of the process of attending to external objects and their qualities and relations, or we may attend to them as being immediate experiences of the individual in contrast to what exists or occurs in the material world.

Now initially our attention is given to sensations in the first way rather than the second. We are mainly interested in them, not as being modes of our own private experience, but as conveying information concerning the existence and nature of material things. And this remains our prevailing attitude to the end. When I see a horse or a tree I experience visual sensations, but I take note of them only in the act of attending to the horse or the tree. I do not usually reflect on my own sensations as immediate experiences. This is more likely to occur when I am observing the behaviour of another person. When, for instance, I see another man shivering while I am warm and comfortable, I contrast his feeling of cold and discomfort with my feeling of warmth and comfort under similar external conditions.

In order that we may be able to enter into the experience of others, it is indeed ncesssary that we have similar or related experiences of our own. But it is not necessary that there should be a prior stage in which we reflect on these experiences, take note of them, name, describe, or analyse them.

Take, for example, an excited spectator of a game at football. His sympathetic excitement finds vent in movements of his own, imitative of those of the players. There exists in his mind an experience of activity corresponding to theirs and more or less like theirs. Through this experience he enters into theirs; he brings home to himself how they are feeling. But he is not at all attending to his own mental states, as such, to his own immediate experiences. By means of these experiences he apprehends what is going on in the minds of the players. But he is not taking notice of what is going on in his own mind. Probably he is not even aware of his own imitative gestures.

This case may be taken as typical of what is primarily our normal procedure in taking cognisance of the mental processes of others. You see a man fall. You know more or less what he feels like in falling, because the sight suggests corresponding experiences of your own. But you do not go through the process of saying: "I feel in a certain way when I fall; this man is falling; therefore, he has corresponding experiences. He is a tall and heavy man; therefore these are more intense and in some respects different."

A third fact which calls for recognition in this connection is that our knowledge of other minds is not merely inferential, nor is it wholly derived from the observation of the bodily 'expressions' of mental states. Clearly no inference is involved in a child's 'understanding' of a friendly or a hostile face. This understanding is sometimes said to be instinctive, and the expression may be allowed if all that is meant is that this understanding is in part dependent upon specific predispositions.

But they are not wholly dependent on the perception of expressions and on the dispositions so aroused, nor are they dependent upon the correlation of our own experiences with our own expressions. It is not in any of these ways that we

know that a dog is happy when he wags his tail. We become aware of the mental states of others as much from the perception of causes as from the perception of effects. When a man is presented in a certain situation you presume until reasons appear to the contrary that he feels as you would feel in a similar situation, and in the main his behaviour corroborates the presumption. The situation need not be one which you have actually experienced.

In reading a play or a novel you sympathetically follow the thoughts and feelings of imaginary personages; this you are able to do ultimately because you have had kindred experiences of your own or are capable of having them; but it is not essential that you should previously have reflected on these experiences of your own, still less that you should expressly recall them and think about them at the time when you read the novel or see the play.

Logically, the transition in prescientific thought to beliefs about other minds is both redundant and deficient. It is redundant in the sense that the facts of experience which warrant the belief that living organisms have a mental life are more numerous and varied than is necessary for rational assent. It is deficient in the sense that in the presumption of certain mental states generalisation tends far to outrun the facts. The savage endows everything with mind, and with mind of an anthropomorphic type. But the fact that our primitive beliefs are often false, and that in certain respects knowledge of other minds is difficult to obtain, does not warrant scepticism. In correcting the extravagance of primitive animism we are not forced to restrict our belief in mind to the single case in which a mental life is directly experienced. It is, in fact, the function of scientific psychology to formulate the principles in accordance with which various forms of mental life may be inferred.

In general, the reliability of our inferences is proportionate to the degree in which the organism with which we are concerned is similar in nature and behaviour to ourselves; but we are not wholly ignorant of the mental life of even the most lowly organism. Where there is genetic continuity of neural structure, there is a presumption of continuity in mental process also.

In the detailed application of the hypothesis of parallelism special importance attaches to the forms of bodily activity which we describe as 'expressions.' Certain actions connected with mental states arise as specific adaptations to a given situation, others essentially presuppose a social milieu. The latter alone are strictly to be described as expressions. A man suffering from a corn walks with a characteristic limp. He would do so quite apart from social considerations; it is the natural response to a certain kind of painful stimulation, but it is not an expression of his pain. The song of a bird or a cry of distress, on the other hand, cannot be completely described in this way. These actions presuppose the possibility and need for communication. It is precisely their function to express and thereby communicate mental states; and by the development of expressions the original parallelism between mental and neural process is supplemented by an artificial parallelism between mental process and overt bodily behaviour.

At the higher levels of mental life language is the most important of these overt expressions and provides the chief means of communication through which we devise knowledge of other minds. The primary function of an utterance is to express an experience. A sentence may express a fact, but the utterance of it expresses our apprehension of the fact. More generally, it expresses our knowledge, our beliefs, our feelings, etc. We must therefore distinguish two ways in which verbal expressions afford data for Psychology. A mental state is described only in a recorded introspection, it is expressed whenever we speak at all. When someone shouts at us in a certain way he is expressing his anger—no matter what his remarks may be about. When, on the other hand, he tells us he is angry, he is not expressing this emotion, but is expressing a belief about it. He is conveying to us the result of his own introspection.

This latter source of information is in no way peculiar to psychology. It does not differ from any other communication of observed facts by means of words. What we here especially refer to is the interpretation of signs which may or may not be noticed or understood by the subject who displays them. It may happen that the inference from the direct expression

of the mental state may contradict the subject's own assertion about it. He may show most unambiguous symptoms of anger, and at the same time declare vehemently that he is not angry. His descriptions or assertions may be erroneous for the reasons that any description or assertion may be. An expression, on the other hand, cannot be erroneous. It may be ambiguous or misleading, but it only expresses what actually occurs. We do not groan by mistake or give vent to anger by a slip of the tongue. The same applies to subtler cases. Different degrees of belief and doubt have their characteristic expressions.[1]

In the case of the lower animals and young children, it is impossible, and in the case of savages it is difficult, to obtain verbal descriptions of their own mental states and processes. This is partly because they either do not use language, or use a language inadequate for the purpose, and partly because they are not introspective. Under such conditions our only course is to rely on the interpretation of the appropriate external manifestations of their mental life. Interpretation becomes more difficult in proportion to the difference between the mind of the psychologist and the mind which he is investigating. The interpretation must rest on some analogy between the two. But if the analogy is only partial and accompanied by great diversity, a constructive process is necessary, requiring critical reflection on the nature of the problem and the data. It is in his own mind alone that the psychologist has the constituent elements from which an interpretation can be framed. "All depends on accurate resolution of his own complex consciousness into its constituents, and on recompounding these in such a way and in such proportions as to explain the nature and order of the signs which indicate to him the mental processes of others."[2]

For instance, he finds among savages a wide-spread belief in the power of all kinds of irrelevant occurrences to influence

[1] In written symbols much of the expressive function of language is lost. From the manner of speech as distinct from its content it is often possible to distinguish a genuine utterance of belief from acting or conscious lying. But in the written expression this is, of course, impossible.

[2] Stout, *op. cit.* p. 15.

the fortunes of the person to whom they occur. This is a prevailing tendency of savage thought; if the psychologist looks for analogies in his own mental life, he will find them few and far between. But they are not likely to be wholly absent. There are moments in which he either has been influenced or has felt strongly inclined to be influenced by considerations in themselves as meaningless as those on which the savage relies. The fall of a picture, or the spilling of salt, or the presence of thirteen at table, may make him uneasy in spite of reason. If he has ever been carried away by the gambling impulse, he must have been almost irresistibly prompted to regard quite irrelevant details as having an essential bearing on his winning or losing. In order to construct the mental state of a savage, he must carefully observe and analyse these transient and occasional mental attitudes in which he approximates to savagery. He must then attempt to represent a mind in which tendencies that, in him, are so overborne by other conditions as to be transient and occasional, are unchecked by opposing forces, and for that reason prominent and permanent.

It sometimes happens that a man is so destitute of a certain kind of mental tendency himself that he is unable to understand its presence in others. Thus, Charles Lamb tells us that his friend George Dyer could never be brought to say anything in condemnation of the most atrocious crimes, except that the criminal must have been very eccentric.

The besetting snare of the psychologist is the tendency to assume that an act or attitude which in himself would be the natural manifestation of a certain mental process must therefore have the same meaning in the case of another. The fallacy lies in taking this or that isolated action apart from the totality of the conditions under which it appears. It is particularly seductive when the animal mind is the object of inquiry. The economy of a beehive displays such adaptation of means to ends as to suggest far-reaching prevision and political faculty of a human kind in the bees. But to avoid this error it is not necessary to abstain from psychological interpretation altogether. If we analyse both the behaviour and the presumed mental processes more carefully we find

important differences wholly destructive of the superficial analogy between human and animal behaviour.

There is a caterpillar which makes itself, by a succession of processes, a very complicated hammock. Superficially this appears to resemble an intelligent action. But a careful observer[1] noticed "that if he took a caterpillar which had completed its hammock up to, say, the sixth stage of construction, and put it into a hammock completed up only to the third stage, the caterpillar did not seem puzzled, but repeated the fourth, fifth, and sixth stages of construction. If, however, a caterpillar was taken out of a hammock, made up, for instance, to the third stage, and put into one finished up to the ninth stage, so that much of its work was done for it, far from feeling the benefit of this, it was much embarrassed; and even forced to go over the already finished work, starting from the third stage from which it had left off before it could complete its hammock. The case now looks less like an intelligent working out of a problem, and more like the mechanical performance of a complex habitual process. Accordingly, there is a presumption that the mental concomitants resemble those of the latter rather than those of the former.

The two chief methods of securing psychological data thus have in isolation characteristic merits and characteristic defects. The chief merit of introspection is that it yields first hand apprehension of the facts with which Psychology is concerned. Its principal defect is that it is difficult to separate purely introspective issues from questions of an entirely different kind—the analysis of psychological concepts. The facts revealed by the observation of external behaviour and of the physical conditions of mental life are in general easy to define in terms admitting of common acceptance, but they are not in themselves psychological facts; and the inference to states of mind is difficult and precarious. A special importance therefore attaches to the use of these two methods in conjunction. This is the characteristic function of the psychological experiment.

[1] Huber. The quotation is from Romanes, *Evolution of Animals.*

8. Experiment.—To experiment is to observe under conditions which we have ourselves pre-arranged. The pre-arrangement is intended to simplify the issue that is to be decided, by excluding irrelevant conditions, and by variously modifying and combining those which are relevant. More especially by experimental methods we are able to approximate to the ideal conditions of observation where only one of the relevant factors varies at a time. If we suspect that a certain kind of experience depends upon the factors *a*, *b*, *c*, we try to vary these one by one in order to determine, from the corresponding variations in the experience, the precise form of dependence involved. We know, for example, that in general the vividness with which an impression is retained in the memory depends in part upon the number of times the impression has been received. We may therefore vary the number of impressions, taking care to keep constant all the other factors such as attention and interest, and so formulate more exactly the law concerning the dependence of retained experience upon frequency of impression.

But the sequences in experience are closely connected with the sequences in physical and physiological process, and the pre-arrangement of experience is chiefly effected through the pre-arrangement of the physical setting. Hence the typical psychological experiment tends to be psycho-physical in nature, and involves the co-operation of two observers, the experimenter proper and his 'subject.' The former arranges the physical conditions, issues instructions which further determine the course of the subject's experience, and records all that is to be observed from the external point of view. The latter surrenders himself more or less passively to the prescribed conditions and observes the resulting experience from 'within.' The attitude of the experimenter in the course of the experiment is thus in a sense 'behaviouristic,' while that of the subject is essentially introspective. The subject observes his own mental process; the experimenter its manifestations.

To illustrate the nature of the problems studied by the experimental method, we may restrict ourselves first of all to the case in which external modes of stimulation provide the

essential condition of a specific kind of response, and where the process is accompanied by psychical events. We then have—

I. A specific collocation of physical events.
II. A group of processes in the system of receptive organs.
III. Conductive processes, afferent, central, and efferent.
IV. Movements of response (or glandular processes).
V. Resultant physical phenomena, events or persistent products in the environment.

With this sequence, and with this alone, the attention of the experimenter is primarily occupied. The initial and terminal phases are largely open to direct observation or by the use of suitable appliances may be fully recorded. The intermediate events must be inferred or hypothetically reconstructed in the light of general physiological theory. But concomitant with some of the phases of the cycle there is another series of events. There are complex changes in perceptual experience, fluctuation in feeling, and conative activity which may be variously directed. In the form in which this series is observable by the subject, it is inaccessible from the external point of view. Hence the need of this co-operative procedure.

It is possible, of course, to restrict inquiry to the inter-relations between the members of the physical series of events. One could, for instance, attempt to correlate various modes of stimulation with various modes of response. But the relations so revealed would hardly admit of extensive generalisation. It is at least necessary to extend the field of observation to the total cycle. This in fact is an important branch of physiological research. What is distinctively psychological is the investigation of the empirical relations between experiences *inter se*, or between experiences and their physical concomitants. It is not possible actually to observe anything of the nature of interaction as separate observers are required for noting the two kinds of occurrences which might be supposed to interact. But between them the two observers may establish correlation between modifications in experience and the phases of the physical process. The topics investigated fall broadly into two main fields.

(1) *The Study of Variations in Experience following Change in Physical and Physiological Process.*—Commencing with cognitive experience we may note that variation in what is presented depends only upon what is antecedent to the central phases of the physiological cycle together with certain of those central phases themselves. There is thus an important group of problems which may be described as the psycho-physics of reception.

Under this head would fall questions such as the following: What are the conditions under which we apprehend the various sensible qualities of physical objects? What is involved in the perception of spatial and other relations, and in the apprehension of form? What are the minimal appreciable changes in the characters of a presented object? How acute are the normal subject's powers of discrimination, and what are the conditions of variation in various forms of sensory acuity?

A similar series of questions may be raised with regard to feelings and other kinds of experience. Colours and sounds, for example, condition changes in feeling according to their intensity, duration, arrangement, etc. The laws of such inter-connection may be empirically determined.

(2) *Physiological and Physical Changes following Variations in Experience.*—The psycho-physics of reception is closely paralleled by a psycho-physics of expression. Behaviour, though it be physiologically determined, is the *expression* of mental life. Variation in behaviour corresponds to variations in the experiences introspectively observed.

Bodily activity broadly assumes two distinctive forms; the one expressive of feeling, the other expressive of conation. Feeling is expressed in diffuse mobility, in change of pulse rate, in alterations in respiration, in modification of the electrical properties of the body, and in a variety of widespread changes of this kind. Conation, on the other hand, tends to find expression in more specific and restricted bodily movements, in co-ordinated movements directed to specific ends, and resulting frequently in the creation of persistent physical products, to some extent pre-conceived. All of these forms of expression admit of precise determination by experimental

means, and may be studied for the light they throw on the related experiences. They are in fact significant only in relation to these experiences.

Suppose, for example, a subject is trying to strike the bull's eye in each of a series of presented targets. E_1 E_2 ... E_n, then stand not for a set of independent movements but for a specific responsive " pattern " which as such will possess certain distinctive characters such as rhythm, accuracy, and speed. Each of these characters will vary with the quality, intensity, and content of the conative experience of the subject in question. It is true that since the activity is perceptually guided, certain variation in the stimulus will involve corresponding variations in response. If the target were invisible or exposed to a flickering light, the behaviour would be different in many ways. But explicit reference is in addition required to the subject's overt intention. One must at least presuppose that he really ' wants ' to hit the target, and this raises further questions as to the intensity and other characteristics of the controlling desire.

But correlations between the simpler constituents of the psycho-physical process yield only a partial understanding of behaviour. Such specific uniformities are generally connected with the existence of complex dispositions. Changes in respiration, for example, occur not as expressive of isolated feelings, but as part of a total reaction such as that of fear. The observation of behaviour has made it possible to formulate many of the components in these complex systems. The perception of a specific kind of situation is followed by a characteristic emotional response and a determinate cycle of behaviour. For such systems the term instinct is now commonly employed. To a great extent they admit of detailed investigation by experimental means.[1]

Of course, very few experimental inquiries can be restricted to the simple situation in which all the relevant factors are

[1] See, for example, " Experimental Studies on the Growth of the Emotions," by J. B. Watson, in *Psychologies of 1925*, Clark University, 1926. Some of the best of these investigations have been conducted by Behaviourists, with the result that the psychical factors in the process still remain to be more precisely defined.

comprised within the short period elapsing in the response to a perceptual situation. In experiments on memory and learning, for example, three periods of variable duration have to be taken into account, that in which impressions are received, that through which they are conserved, and that in which revival operates. In each of these phases there are many factors which condition the ultimate manifestation of retention, and each of these factors requires to be controlled.

Still more complex are the cases in which the experimental method is employed to distinguish the effects of heredity from those of environment. Here the conditions to be controlled will operate over several generations.[1]

The experimental method has its own peculiar limitations. The simplification of conditions which experimentation essentially requires will tend often to interfere with the phenomena we set out to investigate, some of which occur only under the normal conditions of mental life. For example, traditional experiments on the association of ideas labour under this defect. The question which interests us is how the succession of ideas is determined in ordinary thinking. But experiment subjects the mind to conditions which are quite remote from those of the normal flow of thought. In experiment, isolated words or other objects are successively presented to a person, and he is called on to name the first idea which each of them suggests to him. Thus, continuity of interest, which is all-important in ordinary thinking, is excluded.

Another question in which the experimental method is seriously defective is that relating to the mental imagery accompanying the use of words. When we deliberately select a word, and ask ourselves what imagery it calls up in our minds, we are by the very process of our inquiry interfering with the result. We are looking for mental imagery, and we have no right to affirm that the imagery which we find would be present if we had not been looking for it. The only safe course in such a case as this is to cultivate the habit of watchfulness, so that we may frequently catch ourselves in the act

[1] For an example of this kind of inquiry see McDougall, "An Experiment for the Testing of the Hypothesis of Lamarck," *British Journal of Psychology*, Vol. XVII., No. 4.

of using words in a natural manner in the ordinary course of thought. This perpetual readiness to notice what is taking place in our own minds, without deliberately resolving to do so, on this or that special occasion, is at once a most difficult and a most necessary equipment of the introspective psychologist.

9. Quantitative Methods.—One way in which a science becomes more exact is by the introduction of measurement. This, in fact, is usually involved in the use of experimental methods. The attempt to quantify the science of Psychology takes two distinctive forms. To a large extent the measurements made are precisely those of other sciences, the exact determination of intervals of time, the measurement of physical stimuli, and the statistical treatment of behaviour, or of the physical products of mental work. A number of special problems arise, however, in relation to the attempt to measure certain characters in the phenomena of experience itself, such as the intensities of sensation, feeling, or desire. The problems here are of a kind not peculiar to Psychology, but in Psychology they hold an unusually important place.

The determination of intervals of time, when extreme refinement in measurement is required, may be illustrated by reference to the study of 'reactions.' A reaction-time is the interval between the application of a stimulus and the occurrence of a prearranged response. This is generally measured by a chronoscope,[1] a clock which records in units of a thousandth part of a second. The application of the stimulus simultaneously makes an electric contact, thereby putting the clock in action, the response such as the movement of a finger or the utterance of a sound breaks another contact and immediately stops the clock.

Reactions take various forms. In what is called the 'simple' reaction the response is made by the subject immediately upon the apprehension of the stimulus. In the 'compound'

[1] For details of the Hipp Chronoscope see Myers, *Textbook of Experimental Psychology*. An improved type of instrument constructed on a somewhat different principle is described in the *Journal of Scientific Instruments*, Vol. I., No. 6.

reaction complications are introduced. The response has here to be delayed until certain processes of recognition, discrimination, choice, or association have been completed. Thus the subject may be informed that he will be shown either a circle or a square, and if the square is presented he must react with the right hand, and if the circle appears he must react with the left. In general, the more complex the process the longer the reaction time will be, and conversely the longer the reaction time the more complex the psycho-physical process may be presumed to be. Special importance attaches to 'association times'—where the reaction involves association, a word or an idea with some other word or idea presented by the stimulus. It has been found, for example, when the presented word evokes an emotive response the time elapsing before response tends to be prolonged. Under certain conditions, therefore, association times have been employed for disclosing emotional 'complexes,' and even for the detection of crimes.[1]

Measurement is involved in the psycho-physical problems previously discussed; for example, in the attempt to determine precisely the conditions of sensation. In any continuous range of sensory experience such as that of audible sounds, three measurements in particular are of primary importance. We want to know the lower and upper thresholds of discrimination, *i.e.* the lowest and highest pitches distinguishable as such, and the threshold for the perception of difference, *i.e.* the smallest difference between two stimuli which admits of discrimination. Here, also, it is to be noted that what we are measuring are the stimuli, not the sensations they condition. Anything of the nature of literal mental measurement is derivative from this. Similar thresholds can, of course, be determined in every department of sense, and with regard to every sensory attribute which depends upon a measurable stimulus.

Similar considerations apply to what we have called the psycho-physics of expression. Mental activity can be measured only in terms of movement or its physical 'pro-

[1] For example, see Jung, *Studies in Word Association*.

ducts.' Fluctuation in interest in a task will be revealed by variation in 'output.' Such measurements have acquired particular importance in the form of 'mental tests.' We are said to measure the 'memory' or 'intelligence' of a subject when we measure certain forms of work presumed to depend upon these capacities, *e.g.* the number of items reproduced after a standard lapse of time, or the number of standardised problems solved.[1]

The measurement of the qualitative or intensive attributes of sensation or feeling is attended by peculiar difficulties, due to the intrinsic nature of what is measured. The degree of loudness of a sound cannot be broken up into fractional parts which can be marked off from each other. We cannot say by direct comparison of two sounds that one is half, or a quarter, or a third, or twice as loud as the other. The two sounds cannot be superposed so as to make the fainter coincide with part of the louder, leaving a remainder which can be regarded as the quantitative difference between them. In this respect intensive differs from extensive quantity. The difference between two extensive quantities is itself an extensive quantity. The difference between two lines, one a foot long and the other ten inches long, is itself a line two inches long. But the difference between the loudness of two sounds is not itself a sound having a certain assignable loudness. "The difference between two intensive quantities, in fact, differs from each as much as the difference between two horses differs from a horse."[2]

Nevertheless, the attempt to measure intensive magnitude is not so desperate as it may appear. Clearly we cannot take one intensive quantity as the unit of measurement of others; but we may take as unit of measurement the difference or

[1] This statement requires various qualifications. It is not necessary, for example, that the performance of an intelligence test should require the exercise of intelligence. It is sufficient if the operations involved are closely correlated with those which directly involve the capacity we are trying to measure. But whatever form the test takes, only external expression or effects are *directly* measured.

[2] B. Russell, "On the Relations of Number and Quantity," *Mind*, N. S. VI., p. 334.

interval between *two* intensities. Suppose that we are considering, instead of two sounds, two pairs of sounds. Symbolise the one pair by A and B, the other by α and β. We find that we are able to judge whether the difference in loudness between A and B is or is not equal to the difference in loudness between α and β. Thus, if we have a scale of increasing gradations of intensity, we may take as our point of departure any given intensity in the scale. We can then arrange other intensities in relation to this, proceeding by intervals which we judge to be equal. By counting these equal intervals we can assign a numerical value to any intensity in the scale. The unit which is of most use is the least perceptible difference, viz. that difference between two intensities which makes it just possible for us to be aware that there is a difference at all. All least perceptible differences in the same class of intensities are regarded as equal to each other, because they appear equal when compared.

Theoretically, the same principles might be employed in the measurement of the purely subjective phases of mental process; for example, in the measurement of feelings, desires, and degrees of conviction.

CHAPTER III.

BODY AND MIND.

1. The Physical Conditions and Expressions of Mental Life.—Conscious life appears, normally, to be inseparably connected with processes within the living organism. It is conditioned, directly or indirectly, by external stimulation, and it is expressed in bodily behaviour. These physical and physiological conditions do not directly concern the psychologist. They fall outside the scope of Psychology in the sense that they would have no place in the completed science.

Nevertheless they provide important clues in the course of psychological inquiry. The physiologist in studying the functions of bodily organs finds it helpful to refer to experiences which arise in connection with their activity. In the same way in studying these experiences themselves it is of value sometimes to take account of processes in the bodily organs. The differences in the two cases is primarily one of the ends in view. To the physiologist the facts of experience are merely incidental data employed for the light they throw upon the function of bodily organs. The psychologist is interested in the nature of experience itself, and for him the facts of physiology are of importance only so far as they throw light upon mental process. The impartial treatment of both groups of data belongs to the special branch of science called Physiological Psychology.

2. The Organism in General.—In all but the most primitive forms of life, what we call a living organism is in reality a society or community of living beings. The whole animal is ultimately composed of certain units called cells; a cell is the simplest particle of living substance which is permanently capable of independent life. Every cell is bathed in the fluids

of the organism, the blood and lymph; these fluids form the environment which conditions its vital processes. It is continually taking up substances from this environment, submitting them to chemical transformation in its interior, and giving out other substances.

The chemical processes involved are called processes of 'metabolism'; and comprise 'anabolism'—the building up of complex substances from simpler constituents—and 'katabolism' the breaking down of compounds into simpler components. What is distinctive of the living organism is that these processes are so adjusted, in nature and degree, as to conduce to self-conservation for considerable periods. Of this general tendency the special 'vital functions' of growth and reproduction may be regarded as special cases.

Many primitive organisms are composed of a loosely-organised colony of relatively undifferentiated cells which cohere as a single mass. In the course of evolution the cells undergo differentiation, various cells or groups of cells specialising, so to speak, upon particular vital functions. Some become contractile, others are specialised for the conduction of impulses, and others become specially adapted for other processes requisite for the maintenance and development of the organism. Consequently when we turn to the higher organisms we find self-conservation effected in a different way. The organism responds to its environment by means of specialised organs adapted to special kinds of stimulation. It responds by complicated movements involving the co-ordinated use of a number of different limbs. It does not wait for the raw material required for restoring its wasted tissue to come its way, but proceeds by various modes of locomotion to procure it. The acts which directly or indirectly subserve the quest for food are infinitely varied. Similarly it engages in many forms of defensive action to resist dangers from the elements and from other organisms which would secure their own self-conservation at its cost.

At this level we know that the processes involved have conscious concomitants. Stimulation is accompanied by perception; self-conserving action is accompanied by a consciousness of striving towards anticipated ends. These

are the facts with which we are acquainted from the psychological point of view. Our problem is to determine how precisely conscious life is related to physiological process, to place it in its physical setting.

Differentiation, or functional specialisation, has led to the formation of different kinds of cells which, with the help of intercellular material, unite to compose the bodily organs. For simplicity, we may regard the developed organism as a peculiar kind of machine[1] which responds to stimulation, so far as its constitution allows, in ways which conduce to self-perpetuation and growth. At the level of vertebrate life there are four components in organic structure primarily to be considered in the study of behaviour. There is firstly an articulated frame—the skeleton—which, in addition to supporting other organs, provides a set of mobile limbs. Secondly, there is a system of organs composed of contractile tissue by means of which these members may be moved. This is the muscular system. Thirdly, there are areas sensitive to various forms of stimulation—the system of receptors or sense organs; and lastly, there is conductive tissue, by which these sensitive organs are connected by more or less roundabout routes, with the responding organs. This conductive tissue is the nervous system.

3. The Nervous System.—Nervous tissue is constituted by the union of thousands of millions of specially differentiated cells called 'neurons.' A neuron consists of a cell-body and of branching processes which issue from it. These branching prolongations of the cell-body are of two kinds, dendrons and axons. The dendrons terminate in the immediate neighbourhood of the cell-body, and there divide and subdivide into minute twigs, forming what is called an arborescence. Axons are the essential part of nerve-fibres; they pass for a longer or shorter distance from the cell-body; in their course they send out here and there offshoots which are called collaterals. The main axon and each of its collateral offshoots severally

[1] The term 'machine' must be used in this connection with reserve. It is because it is so peculiar a kind of 'machine' that it is assigned the distinctive name of 'organism.'

terminate in immediate contact either with a sense-organ or a muscle or a gland or another nerve cell with its dendron. When they thus terminate, and not till then, they break up into an arborescence of fine twigs.

The propagation of nervous impulses from neuron to neuron is made possible by this final arborescence of the axon or some collateral of the axon mingling with the arborescence of another neuron. The place where this takes place is called a synapse, or " clasping." It is the place where two neurons enclasp each other. The connection is here intimate and complex. But it consists only in contact. The two neurons meet and embrace; but the substance of the one is not continued into the substance of the other. " The arborisations interlace and intermingle, and nerve impulses are transmitted from one nerve-unit to another, through contiguous, but not through continuous structures."[1]

In this way every part of the whole nervous system or community of neurons is directly connected with every other. The unit of this organisation, however, is not so much the single neuron as the ' reflex arc,' the structural foundation of the ' reflex act.'

4. The Reflex Arc.—The term ' reflex action ' is restricted to responses to stimulation which arise in virtue of a specific neural organisation involving three separate structures, an initiating organ in what we have called a ' sensitive area,' a conductive nervous path and responsive organ; either a muscle or gland. To these three components the names ' receptor,' ' conductor,' and ' effector ' have been applied.[2] The total chain constitutes the ' reflex arc.' The neural link in this circuit embraces at least two neurons, the afferent neuron which conducts the impulse from the receptor, and the efferent neuron, conducting it outward to the effector. The two are united only by a synaptic point of junction.

The simple reflex, however, is only a convenient abstraction. In the developed organism we do not find a single receptor linked with only one effector. The afferent neuron, when it

[1] Halliburton, *Handbook of Physiology*, p. 192.
[2] Sherrington, *The Integrative Action of the Nervous System.*

reaches the spinal cord, sends off a number of branches, each of which is in synaptic connection with the dendrites of an efferent neuron, and so gains communication with a number of different muscles. Moreover, central neurons may be interposed between the afferent and the efferent paths. These serve further to distribute and co-ordinate the impulses. Such neuronic relays also serve to conduct the impulses to those higher centres of the brain with which conscious life appears to be most intimately associated. In the same way a variety of receptors gain communication with the same effector so that different modes of stimulation may produce in part at least an identical response. Neural organisation thus comprises a network of converging and diverging arcs. Paths from a single receptor radiate to a plurality of effectors and impulses from a number of receptors may similarly converge through a common final path to the same effector.

This kind of organisation provides the structural basis for considerable complexity in action which is none the less purely reflex. It provides for the co-ordination of simultaneous movements, that is to say for actions involving a group of muscles which work together co-operatively to produce a joint effect. This co-ordination at the reflex level is strikingly illustrated in the 'decerebrate frog,' *i.e.* one in which the cerebral hemispheres have been removed. Under such conditions we see reflex action in its purest form. The frog then exhibits no spontaneous movements, but by the application of appropriate stimuli can be induced to perform all or nearly all the movements which an entire frog is capable of executing.

"It can be made to swim, to leap, and to crawl. Left to itself, it assumes what may be called the natural posture of a frog, with the fore limbs erect, and the hind limbs flexed, so that the line of the body makes an angle with the surface on which it is resting. When placed on its back, it immediately regains this natural posture. When placed on a board, it does not fall from the board when the latter is tilted up so as to displace the animal's centre of gravity; it crawls up the board until it gains a new position in which its centre of gravity is restored to its proper place. Its movements are exactly those

of an entire frog, except that they need an external stimulus to call them forth. They differ, moreover, fundamentally from those of an entire frog in the following important feature: they inevitably follow when the stimulus is applied; they come to an end when the stimulus ceases to act. By continually varying the inclination of a board on which it is placed, the frog may be made to continue crawling almost indefinitely; but directly the board is made to assume such a position that the body of the frog is in equilibrium, the crawling ceases; and if the position be not disturbed the animal will remain impassive and quiet for an almost indefinite time. When thrown into water, the creature begins at once to swim about in the most regular manner, and will continue to swim until it is exhausted, if there be nothing present on which it can come to rest. If a small piece of wood be placed on the water the frog will, when it comes in contact with the wood, crawl upon it, and so come to rest. If disturbed from its natural posture, as by being placed on its back, it immediately struggles to regain that posture; only by the application of continued force can it be kept lying on its back. Such a frog, if its flanks be gently stroked, will croak; and the croaks follow so regularly and surely upon the strokes that the animal may almost be played upon like a musical, or at least an acoustic instrument."[1]

A second way in which reflexes may be organised is in chains of greater or less complexity. One reflex may follow another in virtue of the fact that the response to one stimulus inevitably brings about the situation which evokes a second, the response to which provokes a third, and so on, until a specific cycle is completed. These chains, from the nature of the case, are only likely to be found when the stimuli to the later component acts arise within the body or in some environmental factor which is always at hand. An example of such a chain is provided by the 'dart reflex'[2] of the frog. The presence of a fly before the eyes reflexly evokes the act of protruding the tongue. If the fly is caught the mouth is

[1] Foster, *Textbook of Physiology*. Sixth Edition. Part III., "The Central Nervous System," pp. 1000, 1001.

[2] Sherrington, *op. cit.*, p. 181.

closed in a similar reflex way. This in turn automatically leads to swallowing, and swallowing itself involves a series of reflex actions organised in a chain.

5. The Central Nervous System.—Within the whole nervous system we have to distinguish a peripheral part and a central part. The central part consists of the spinal cord and brain. The spinal cord lies within the spinal column or back-bone; at its upper end it passes into the head, where it broadens out into what is known as the *medulla oblongata* or 'bulb.' The other parts of the nervous system situated within the cranium are (1) the hind brain or cerebellum, consisting like the cerebrum of two hemispheres, and especially subserving the maintenance of equilibrium of the body as a whole in rest and in motion; (2) the mid brain, which includes the optic thalami and the *corpora striata*; this lies at the base of the cerebrum and is most intimately connected with it; (3) the cerebrum itself.

The peripheral part of the nervous system is that which connects the central part with other organs of the body, such as muscles, sense-organs, and glands. It thus corresponds to the afferent and efferent as distinct from the central phases of the arcs previously discussed.

Let us now turn to the central nervous system and consider in rough outline the way in which its parts co-operate in determining bodily behaviour.

What we are mainly concerned with is the relation of the cerebrum to the other groups and systems of neurons. Here it is above all important to notice that the cerebrum does not directly receive impressions from sense-organs through afferent nerves, and that it does not directly send out motor impulses to the muscular apparatus. It operates and is operated on through the other parts of the nervous system. It uses lower groups of neurons as its instruments. Its place and office within the whole nervous system is analogous to that of the system as a whole in relation to the body. As the nervous system initiates, combines, and co-ordinates the movements of the body, so the cerebrum initiates or arrests, combines or separates processes occurring in the spinal cord, the bulb, the cerebellum, and other groups of neurons.

One way in which this cerebral control may be manifested is in the partial or total arrest of reflex action which would otherwise take place owing to the independent action of lower nervous centres. This happens when we stop an inconvenient sneeze or cough or yawn. A good example is that of Cranmer holding his hand in the flames until it was consumed. Left to itself the spinal cord would have withdrawn the hand at once. This reflex was checked by nervous impulses arising from the cerebral cortex.

The cerebrum also controls lower centres in other extremely important ways. It may, for instance, isolate a movement which originally forms part of an inherited reflex action so as to carry out this movement by itself. "The motor co-ordination ancestrally provided for the ring finger gives an extending of it only in company with extension of the fingers on either side of it. The isolated lifting of the ring finger can, however, soon be acquired by training."[1] The isolated lifting then involves nervous impulses from the cerebral cortex controlling the action of the lower groups of neurons on which the reflex action depends.

Besides this separating or analytic function the cortex also constantly exercises a synthetic function. It combines and adapts, arranges and co-ordinates the relatively simple movements provided for by the reflex nervous mechanisms, so as to produce more complex modes of bodily behaviour. This takes place in the acquirement of such skilled actions as swimming, bicycling, skating, and the like. The combination of the movements of the legs and arms in swimming has to be learned; and the learning involves the formation of a neural habit, of a new habitual grouping of processes within the cortex. Similarly, the complex combination and coadjustment of the movements required for speaking a word depends on nervous impulse from a certain definite part of the cerebrum; but the simple movements combined and coadjusted in articulating the word are ultimately dependent on the reflex apparatus of lower centres.

This may be expressed by saying that other groups and systems of neurons are subsidiary to the cortex for all move-

[1] Sherrington.

ments which are not reflex. Similarly, even for reflex actions of a comparatively complex nature, relatively lower centres are, in general, subsidiary to higher, for example, the spinal cord to the bulb.

The interrelation between higher and lower centres is well illustrated in the following parallel. "Imagine a commercial house or an agency containing a central office in which some of the employees are engaged in receiving telephone messages, each in communication with a single exterior station, others in transmitting orders, each also in communication with a single executive station; and further, a number of persons appointed to carry out the orders, each in touch with several receivers and several employees who are transmitters only. Here we have an outline of the elementary form of nervous centralisation.

"The service develops and complications arise; to give orders it is sometimes necessary to consult the records, to take a large number of facts into account, and to delay or accelerate the execution of other orders. In some cases a very urgent response is necessary, a response which is always the same, and which requires no preliminary deliberation. The original office is retained, but higher floors are added, containing more receiving employees, transmitting employees, individuals charged with the elaboration of orders, and finally a particularly large number of employees to act as connecting agents. These put the chiefs into communication with one another, and, above all, see to it that each is in possession of any information likely to be of use to him, and make it their particular business to communicate as required the whole of the data collected by the receiving agents. Finally, they consult the records.

"Let us assume that there are four or five floors, the most complete organisation is on the top, the intermediate floors being more or less analogous to the original office.

"When information arrives, it is received by an agent in the office below, who transmits it to a connecting agent of his office, and also to the receiving agent in the office above, who likewise sends it on until it reaches the highest floor.

"Certain messages require a simple immediate response, indicated by the connecting agent below to his transmitting

employees, but others necessitate a more complex elaboration. When they reach the connecting agent, who responds automatically and without reflecting, this agent, in consequence of precautions taken by the transmitting agents on the upper floors, is prevented from communicating with his own transmitting agents. The inhibition may bear upon his apparatus of communication or upon the apparatus of the transmitting agents, or again, it may affect the path of communication, and this may be practically broken.

"The news is transmitted upwards from floor to floor; if the connecting elements of the intermediate floors are equally inhibited, the order required by this information will receive considerable elaboration in the light of information already received, at the same time or later, by various receptive agents at the first station, and likewise communicated from floor to floor; and this order will then be communicated, directly this time and without delay at the intermediate floors, to the transmitting agents below, who alone are in communication with the outside world."[1]

6. The Problem of Body and Mind.—Modifications of consciousness would seem, *prima facie*, to depend upon changes in the physical environment, and some physical changes in the environment upon the changing phases of mental life, the interconnection being mediated by the neural processes previously considered. This apparent interaction is well illustrated in the course of conversation.

Consider, for example, the series of events occurring when I hear a spoken question and after deliberation utter a suitable reply. Sounds are produced by movements of the vocal organs of the speaker. These movements we may call the 'originative'[2] condition of the experience which ensues. The waves of sound proceeding from the speaker's mouth constitute an 'external transmissive' condition. The changes in the organ of hearing we may call the 'peripheral receptive' condition, the

[1] Piéron, *Thought and the Brain*. Eng. Trans., London, 1927, pp. 7, ff.

[2] Adopting, with some modification in what follows, the terminology of Broad, *Scientific Thought*, p. 490.

afferent neural impulses the 'internal transmissive' condition, and the excitation in the cerebral hemisphere the 'central receptive' condition. With the completion of these phases of the total process there arises the experience of 'hearing the sound,' and fused with or immediately ensuing upon this the complex psychical processes involved in recognising the sounds as those of X's voice, and the words as framing a question. Then follows the process of thought in which an answer is sought. Upon decision, a further cerebral process occurs which may be called the 'central responsive' effect, involving some of the motor areas of the cortex. Thence proceed outgoing nervous impulses to the vocal organs, an 'internal transmissive' response. These in turn are followed by a peripheral response—the articulation of the reply—and further external transmissive processes with consequent changes of a transitory or permanent nature in the physical environment.

Our problem concerns the relation of this circuit of processes, particularly the phases occurring in the nervous system, to the mind which experiences sensations, appreciates their meaning, and determines bodily conduct in accordance with its own interests and purposes, its continual striving after ends. How, we ask, is the purposive direction and guidance of bodily behaviour connected with its material conditions? This is the problem of the relation of body and mind.

We may notice at the outset that if the circuit be interrupted, say by a section of the nerves, at any point before the impulse reaches the cerebral hemispheres, the conscious process fails to arise. On the other hand, if the interruption occurs on the outward path it will have no effects in conscious life, except, of course, those resulting from the absence of the further afferent impulses which the performance of the movements would otherwise initiate. It is thus natural to suppose that normal consciousness is only directly connected with the central phases of the process. On a varity of grounds we are justified in thinking that nothing which takes place in other parts of the nervous system is found to make any difference to consciousness except in so far as it gives rise to changes in the cerebral cortex and its annex the mid-brain;

on the other hand, the suspension or alteration of certain cerebral processes appears uniformly to be accompanied by suspension or alteration of conscious process. Hence we may conclude generally that in the cerebral cortex alone, the mental life of which we are normally conscious is directly conditioned by neural occurrences.

This general doctrine is further defined and confirmed by the results of investigation into the localisation of cerebral functions. It has been discovered that a large part of the cortex can be mapped out into distinct districts, which fall into two classes. On the one hand, there are motor areas; each specially and distinctively the seat of nervous impulses which, passing directly to lower centres, finally reach certain definite groups of muscles, and consequently produce movements of a certain part of the body. On the other hand, there are sensory areas; these are only indirectly concerned in production of movement in so far as nervous impulses are propagated from them to motor areas. But each sensory region is distinctively connected with a special kind of sensation.

Let us consider first the sensory areas. The general principle which determines their localisation is this: The sensory area corresponding to a certain class of sensations is found in that region of the cortex where nervous impulses reach it from the appropriate sense-organ. The local separation of the parts of the cerebrum connected with different sense-experiences is founded on the "separateness of the incoming channels from the organs of sense."[1] Thus nervous impulses originating in the retina of the eye mainly reach the cerebrum in a certain part of the occipital lobe of the cortex: and it is here that the nervous arrangements are situated on which visual experiences depend. This area admits of subdivision, and it has been possible to correlate small parts of the retina, and consequently corresponding parts of the visual field, point to point with specific areas in this region of the cortex.

There is good evidence that more or less definitely circumscribed areas of the cortex are connected respectively with

[1] Sherrington, *Encyclopaedia Britannica* Vol. 14, p. 411.

sense experiences of smell and of sound. There is also reason for assuming that tactile and other skin sensations, together with other allied sensations which are due to the stimulation of afferent nerves coming from muscles, joints, and tendons, are specially connected with a region of the cortex situated immediately behind the motor areas and to some extent continued into these.

The motor areas have also been in part definitely ascertained. In general they are grouped together in what is known as the pre-central or ascending frontal convolution. From above downwards they are arranged in an order which in its main plan inverts the order of the corresponding parts of the body. First comes the area concerned with movements of the toes, then follow consecutively those for movements of the ankle, the knee, the hip, the shoulder, the elbow, the wrist, the fingers and thumb, the eyes, the ear, the eyelids, the nose, closure of jaw, opening of jaw, vocal chords and mastication. The relative size of the several areas is conditioned by the variety, delicacy, and complexity of the movements they are concerned in producing, not by the size of the bodily organ with which they are connected. Thus the cortical area for the hand is larger than those for the whole abdomen and neck combined; that for the thumb is larger than that for the neck.

The part played by motor areas seems to be limited to the production and coordination of movements. It would seem that they are not directly connected with sensations or sensory images or with anything which is properly mental. It was once supposed that the outward discharge of nervous impulses from the cortex to the muscles was immediately connected with a peculiar kind of sensation, called 'sense of effort' or 'sense of innervation.' But this view has been generally discarded.

A striking confirmation of the position that the motor areas are not immediately connected with any sensation has been supplied by an experiment carried out by Cushing, of Baltimore. Cushing had two patients in whom both the motor region and the tactile region of the cerebral cortex were exposed. He found that by directly stimulating the several

motor areas he could evoke corresponding movements of the body. But no sensations were felt except "those which accompany forced changes of position in the parts moved"[1] such as would occur when another person took them in his hand and moved them. "On the other hand, stimulation of the tactual areas produced no movements, but gave definite sensory impressions which were likened by one patient to a sensation of numbness, and by the other to definite tactual impressions."[1]

This experiment also disposes of the view that the motor areas are directly connected with the will. For enforced changes in the position of a limb, and the sensations which arise in consequence of such changes, certainly do not constitute a volition. A volition is the intention or determination to act, not the mere production of movement; otherwise all reflex action would be volition and we might regard the muscles themselves as the seats of will.

Only part of the cortex has been mapped out into sensory and motor areas with definitely localised functions. Of the rest we can only say that it consists of neurons and groups of neurons which supply, in immensely complex ways, lines of communication with each other and with the sensory and motor areas. Such portons of the cortex have been called 'association centres.' Their precise relation to conscious life is very obscure. There is a strong presumption that they play an essential part in the neural processes concomitant with the complex psychical events intervening between perception and motor response, but there is no justification for the attempt to treat them as the seats of special intellectual powers. Thought, memory, and intelligence almost certainly depend upon processes in the neural apparatus as a whole, not upon special areas of the brain.

There is thus a general parallelism between the phases of mental life and the physico-physiological cycle which commences with stimulation and ends in bodily behaviour.

In general, too, the parallelism appears to be more exact as we pass from the initial or terminal to the central phase of the

[1] Halliburton, *op. cit.*, p. 729.

cycle. In the first place there is a crude parallelism between objective changes in the source of stimulation and the apparent properties it has in perceptual experience. The size, shape, colour, etc., which an object appears to have vary with its real size, shape, distance, and the intrinsic constitution which determines the absorption and reflection of light. Nevertheless an object may change in each of these respects without involving change in its appearance, or it may change in appearance without any actual change in its nature taking place. Restricting ourselves to the comparison of changes in the receptive organs with those in perceptual experience, the concomitance is very much more exact. If, for example, a double image is produced upon the retina, the object appears to be doubled independently of any duplication in the presented physical object.

Even here, however, the correlation is not perfect. But this is in turn explained by the nature of the internal conductive process, and by reference to internally initiated changes in the region of the cortex to which the afferent neurons lead. Direct evidence concerning the central processes involved is exceedingly meagre, but it is natural to suppose that they would show a much more detailed correspondence with the concomitant experiences.

Similar considerations apply to the efferent discharge and its physical products. There is a rough correspondence between variable mental states and the products of work. Variation in quality and speed are connected with fluctuations in interest and movements of attention. But bodily movements are only incompletely under cerebral control. Various factors tend to impair the correspondence which would otherwise hold between performance and intention. It is reasonable to suppose that a closer correspondence holds between variation in volitional experience and the central processes which immediately precede an efferent discharge. This general parallelism, in its main outlines, is not affected by the views we may adopt on the more controversial issues which now arise: Is the parallelism between neural and mental process absolutely exact? and what are the causal relations between the neural and mental phases of the cycle?

7. General Hypothesis Concerning the Relations of Body and Mind.—In answer to the foregoing questions two main hypotheses are current, the hypothesis of psycho-physical parallelism and that of interaction. Parallelism in its extremer form asserts a strict, point to point, correspondence between mental processes and a certain group of physical processes, but denies interaction between the two series. The doctrine of interaction couples the assertion of causal interaction with the denial of the parallelism. It is contended by the interactionist either that certain mental occurrences have no bodily correlative or that certain characteristic features in conscious life have no parallel in the bodily process. Each of these doctrines take various forms, but the principal issue throughout is the problem of causation. It is worth while, however, first to consider the question of correspondence without regard to that of interaction.

8. Parallelism.—The progressive correspondence between conscious states and bodily events as we pass from the peripheral to the central phases of neural process encourages the expectation that complete knowledge of these central phases would show the correspondence at this point to be perfect. But a more detailed examination of the implications of this view greatly weakens its plausibility. If the theory is that every difference and resemblance between psychical states and events is regularly paired off with a corresponding difference and resemblance in contemporaneous cerebral states and events, and if this be taken to mean that there is intrinsic analogy or likeness of nature between psychical fact and correlated physiological fact, parallelism cannot be maintained for a moment even as a suggested possibility. It also breaks down utterly if it is taken to mean that important differences on the psychical side are matched by proportionately important differences on the physiological side.

Even if mental life were composed of sensations alone the doctrine would be impossible to defend. On this view, a change in the apparent position of the sensation might be said, for example, to correspond with a change of locus in the receptor neural process. A change in apparent extension

would correspond to a change in the number of neurons affected. Sensory intensity might be paired off with intensity or density of neural process. Some other character of neural process would then be required to correspond with changes in quality.[1] But here serious difficulties arise. The qualitative difference between one colour-sensation and another cannot be matched by a difference between physico-chemical processes going on in the brain either similar in nature to the difference in the sense-experience or answering to it in the degree of its importance from the purely physiological point of view. The fundamental differences in kind are represented on the physiological side only by differences of degree.

A general objection against all doctrines of this kind is that the range of irreducible attributes postulated in neural process are greatly outnumbered by the range of irreducible attributes and relations which enter into the conscious correlates. We are therefore compelled to conclude either that some of the constituents of experience are devoid of a neural correlate or that the same kind of neural character has to correspond to radically different factors in mental life. Both alternatives are seriously detrimental to the doctrine of parallelism in its more obvious form.[2]

The brutally empirical nature of the connection is most evident when we compare the unity of the individual consciousness and the relation of the knowing and willing subject to objects known as willed, with any possible relations within the nervous system. It is difficult to see what can be the physiological counterpart of the unity and identity of the conscious self and of its own awareness of itself as one and

[1] A doctrine of this type has been formulated by H. J. Watt. See *The Sensory Basis and Structure of Knowledge.* London, 1925.

[2] This objection has been formulated in detail by Johnson (*Logic*, Part III., pp. 113, ff.). Broad's later criticism of the objection (*Mind and its Place in Nature*, pp. 126, ff.) is made from the standpoint of a parallelist accepting the latter alternative. Strict parallelism, however, would imply not only that every character in the psychical series is paralleled by a neural character, but that this neural character when relevant to psychical process at all is parallelled by the psychical character.

identical.[1] Nothing like it is conceivable in the brain or in any part of the material world as ordinarily conceived. Matter is infinitely divisible, and every portion into which it can be divided is just as much a distinct and independent material substance, just as much a separate parcel of matter, as any other. But the conscious self is not divisible into conscious selves. It is in the strictest sense individual or indivisible.

When I compare a sensation of purple with a sensation of blue and apprehend their likeness and difference, the sensations are distinct, but my apprehension of them in their relation to each other is a single act, having a unique sort of unity to which there can be nothing at all similar in the material world. The utmost parallelism can maintain is that the unity of consciousness always accompanies a specially systematic and intimate connection between certain groups of neurons. But this connection cannot, from the nature of the case, be fundamentally different in kind from all other material connections, as the unity of consciousness is fundamentally different from all other forms of unity. It cannot indeed be fundamentally different from other connections within the nervous system which have no conscious correlate. For, in the last resort, such connection consists merely in the propagation of a physico-chemical process from one neuron to another.

It is equally clear that the relation of the knowing or willing subject to its object cannot be paralleled by any possible relation between material things. I think of the civil war in China, or of the interpretation of $\sqrt{-1}$, or of the other side of the moon, or of my having voted yesterday in the town council election. These are the objects which I mean, to

[1] Difficult, that is to say, on the traditional scientific conception of the material world. If, as is sometimes suggested, forms of unity similar to those found in individual conscious experience also require recognition for the interpretation of physical facts, the difficulty would be lessened. But with any reconstruction of the purely physical conception of nature, the problem would take a different form. The traditional problem of body and mind arises from traditional Psychology and traditional Physics.

which I intend to refer. But when I thus mentally refer to $\sqrt{-1}$ as having an interpretation, obviously there can be no analogous relation of my body or the neurons of my brain to the root of -1. Material things may be near each other in space; they may causally interact with each other; but they cannot do anything like *meaning* or *intending* each other. The parallelist must content himself with saying that when I think of A, the process going on in my brain must be in *some* way different from what it is when I think of B.

Parallelism then, if it exists, must have a brutally empirical character. There is very little scope for the application of any intelligible principle which shall enable us to determine what the nature of the nervous processes ought to be to which a given psychical process should correspond. This does not, of course, of itself destroy the conception of parallelism. But it may fairly be urged that its claim to rank as a probable hypothesis is somewhat damaged by such considerations. For the arbitrary character of the connection strongly suggests that the concomitant variation of mental and cerebral facts is not an ultimate law of nature, but an empirical rule which requires to be explained by taking account of some other factor; and this other factor is just what the theory of interaction seems to supply by positing a conscious individual distinct from the body who is constantly influencing and being influenced by bodily occurrences.

In fact, parallelism owes its plausibility very largely to the assumption that in one respect at least there is a real and thorough-going analogy between mental and cerebral process, which enables us to regard their concomitance as the expression of an intelligible principle. It assumes that there is a real analogy and a systematic correspondence between neural habit and mental association—what in ordinary language we call association of ideas. As the sight or the idea of smoke calls up the idea of fire, through the conjunction of smoke and fire in past experience, so, it is held, the excitement of the group of neurons corresponding to the idea of smoke evokes the excitement of the group which corresponds to the idea of fire, owing to a nervous impulse having frequently passed between them in the previous history of the brain. This view

looks plausible at the first blush. But as soon as we come to apply it in detail we encounter difficulties which threaten to bring us to a standstill. These are found (1) in the nature of mental associations, and (2) in the way in which motor habits are formed.

As regards the first point, the problem for parallelism would be comparatively simple if all mental association could be directly reduced to an association between sensations or mental images, as in the case of smoke and fire. Here the sight of smoke has frequently been conjoined either simultaneously or in close succession with the sight of fire. Hence we may say that the two corresponding groups of neurons having been frequently excited together, the resistance at their synapses has been lowered so that a nervous impulse in the one readily and rapidly spreads to the other. But by far the greater part of our associations do not exhibit this character. The only general principle which determines their acquisition is that they enable us to retain and call to mind, as occasion requires, such objective connections as have aroused our interest and attention.

It is relations of meaning, not mere conjunctions of sensations and sensuous images, which are all-important. These relations may be logical, mathematical, aesthetic, ethical; they may be abstract or concrete. The function of association in all cases is to enable us to retain the result of the mental work which we have previously gone through in discerning them, so that this work does not need to be done over again. When A suggests B through association, it is because A has been previously attended to as related in a certain way to B, and B is suggested only in so far as it is a term in this relation.

Now the crucial problem for parallelism is to show neural correlates for the boundless variety of special relations on which association depends. For example, I find in a Latin grammar the line *Tum pius Aeneas umeris abscindere vestem;* I immediately think of a notice which I had seen in St. John's College, Cambridge, "Smoking is not allowed in the courts and grounds of the College." Now it is true that I had already recognised this notice as forming an English hexameter. But why should it be recalled by me at that

precise moment? Because the two lines correspond as exactly in metrical construction as the hexameter of stress can correspond to that of quantity. But the relation between the two lines exists only in one highly abstract aspect, their likeness in metrical form. What counterpart can this have in a neural habit connecting the excitement of one group of neurons with the excitement of another group, each having for its psychical correlate certain groups of sensations and sensuous images?

Or take as another example the lines—

> Music that gentlier on the spirit lies
> Than tir'd eyelids upon tir'd eyes.[1]

What on the side of neural habit can correspond to the associative connection here, which consists in a subtle analogy between the relation of a certain kind of music to a tired spirit and the closing of tired eyelids upon tired eyes?

Now it is true that our ignorance of what takes place in the brain is immense, so that after all it may not be impossible that some parallel in the neural connections may exist corresponding to such associations of ideas. But this appeal to ignorance is the only resource open to the parallelist. Otherwise he is helpless. In any case, the mere law of neural habit is, by itself, utterly insufficient to account for the facts. We have next to examine this law of neural habit itself. The question is whether, apart from other assumptions, and in particular apart from the independent co-operation of conscious process, it can be made to account for the facts.

The law is that the "passage of a nervous impulse through a chain of neurons leaves that chain more or less permanently altered, in such a way that its resistance to the passage of the impulse is in some degree diminished."

Now, if this is put forward as a complete account of the way in which neural habits are acquired, it is obvious that there is a vicious circle. For it presupposes that nervous impulses are already restricted to definite pathways. When once it is assumed that a neural process pursues a definite

[1] Tennyson, *Lotus Eaters*. The illustration is used by McDougall, *Body and Mind*, p. 173.

course from *a* to *b*, then, according to the law of neural habit, fresh nervous impulses, starting from *a* under similar conditions, will tend to pursue a similar course; and the more frequently they have traversed this line before, the stronger is the tendency to traverse it again.

But the law does not account for the original restriction. To explain this we must have recourse to some other principle. The question is whether the physiology of the nervous system can, by itself, supply such a principle. The only suggestion which has been made from this point of view is that when two groups of neurons have been excited simultaneously or in close succession, the discharge of nervous impulse from the one to the other meets with less resistance. But, in the first place, it is by no means clear why this should be so, and, in the second place, it does not cover the actual facts of the formation of neural habits.

The clearest and most typical cases are supplied by the acquisition of bodily aptitudes for such actions as walking, speaking, swimming, dancing, and so forth. Now these are not learned merely by passive repetition of movements which we have chanced to make in the past. They involve throughout a selective activity by which unsuitable modes of behaviour are weeded out and suitable modes of behaviour are stamped in. The interest, aim, or purpose of the subject is, at every step, a controlling factor which excludes what does not satisfy it and retains and repeats what does satisfy it.

When a child is learning to walk, its achievement at first falls far short of its endeavour. Only a certain series of muscular contractions, in proper combination, order, and proportion, is capable of realising the end aimed at, with the maximum of rapidity, certainty, and facility. At the outset, muscles are contracted which are superfluous, and this operates as a disturbing condition. Others are not contracted in the right combination, at the right moment, or in the right measure, so that action is deranged. Obviously, if these relatively unsuccessful modes of behaviour were retained and repeated in the same way as the successful ones, the child would never learn to walk at all. He would go on stumbling and falling all his life, as he stumbled and fell to begin with;

and the same holds good for such later acquisitions as swimming or golf playing. Now, plainly, no principle which confines itself to the assertion that conjunctions of nervous processes tend to recur again merely because they have occurred before will account for this selection of successful modes of behaviour and gradual elimination of unsuccessful modes of behaviour.

We must also recognise as an essential factor the controlling influence of subjective interest, the direction of conscious life towards ends. The question for parallelism is whether any likely physiological correlate can be found for this teleological control. The psychical factor is plainly revealed to us in every moment of our lives; it is a *vera causa*, one which is independently known to exist. If it has such a nervous counterpart as must be assumed by a consistent parallelist, this nervous counterpart is certainly not independently known. It is merely conjectured on the basis of the general hypothesis of parallelism. Can this conjecture be put into a likely form? In the present state of physiological knowledge, no positive and distinct hypothesis is to be found which has any plausible claim to cover the facts. Here again, parallelism must appeal to our immense ignorance of what takes place in the brain. But this appeal to ignorance is not a positive argument. If we take the facts as they stand, it seems to be a natural hypothesis that the selective and controlling influence of subjective interest is a distinct factor which independently co-operates with physiological conditions in the formation of nervous habits.

This view is reinforced by another consideration. It is an intensely significant fact that interest and attention are present only in the process of forming neural habits, and tend to disappear in proportion as the nervous pathways become fully fixed and organised, approximating in character to those on which reflex action depends. "It is a familiar truth that the first acquisition of a habit or an association requires attentive effort and clear consciousness of the several steps of the process, and that with repetition the process goes on more 'automatically,' more smoothly and easily, and with less clear consciousness of the end, or of the steps, or of the

impressions by which it is guided; and finally, after sufficient repetition, it seems to go on without any effort or attention, and without our being conscious of it, save possibly in an extremely obscure fashion."[1] Interest and attention, then, are found only " where a new path has to be forced through the untrodden jungle of nerve cells."[2]

What can be the reason for this limitation? The most obvious interpretation is that interest and attention are present where they are needed for the special work of teleological direction, and that where the nervous processes have become so educated by the previous co-operation of conscious attention and interest, that they can pursue a definite and useful course by themselves, they are then left to themselves. A machine, such as a watch or a steam engine, when once it has been constructed and adjusted and set in action in accordance with conscious thought and purpose, may go on working by itself in fulfilment of conscious design; in the same way cerebral processes, when once they have been fully organised under the control of the " spirit's plastic stress," may proceed of themselves without the co-operation of consciousness.

Nevertheless, the difficulties in the detailed working out of the conception of parallelism do not warrant a total rejection of the hypothesis. The importance of the doctrine lies not so much in the theory of one-to-one correspondence which the term suggests as in the denial of interaction.

9. Interaction.—According to the hypothesis of interaction, conscious life is itself an independent factor which controls and modifies the course of nervous impulses so as to produce effects inexplicable by reference to merely material conditions. On this view, when my desire to light a cigarette is followed by the bodily movement of striking a match, this is not due merely to the brain processes which accompany the occurrence of the desire. It involves also the operation of the desire itself, controlling and modifying nervous occurrences, so that they follow a course which they would not have followed if

[1] McDougall, *op. cit.*, p. 276. [2] *Ibid.*, p. 277.

left to themselves. The flow of events within the cortex and the consequences which follow from it are, according to the hypothesis of interaction, guided and directed by conscious interest and purposes so as to lead to the satisfaction of conscious interest and purpose.

This view accords well with common opinion and the broad facts of science can be given a not unplausible interpretation in conformity with it.

Consider first of all the broad fact that conscious life proceeds only in immediate connection with certain processes in the cerebral cortex, so that when these processes are abolished, say by inhaling chloroform, conscious life ceases. This would be interpreted by the interactionist as follows. Nervous processes, it would be admitted, are indeed indispensable conditions of consciousness, but not the only indispensable conditions. A proper supply of blood containing oxygen is necessary to the nervous processes themselves; without such a blood supply the metabolism in the cells of the nervous system cannot go on. But it would be absurd to argue that the blood supply is the sole condition of nervous metabolism and that the neurons themselves and their peculiar constitution have nothing to do with it, or that they themselves in their turn have no effect on the blood supply. Similarly, there may be a soul distinct from the body and interacting with it, although the conscious life of which this soul is the subject can only go on in connection with certain nervous processes taking place in the cerebral cortex.

Nor is the state of the case altered when we take into account the ascertained facts of cerebral localisation. What follows from these facts is simply this: we cannot have certain experiences in the way of sensation and sensational imagery, unless certain circumscribed areas of the cerebral cortex are excited. But it does not follow that no other condition is ultimately involved in the occurrence of sensations and images. The sensations and images are themselves utterly heterogeneous in nature from anything which takes place in the cortex; and this naturally suggests the presence of some other factor to account for their peculiar nature. From the point of view of physical science we look for no

consequences from merely physical conditions except physical consequences. When therefore something comes into being radically distinct from any material state or process, it would seem that we must either treat its emergence as something totally mysterious and unaccountable from the scientific point of view, or postulate the co-operation of a factor which is not itself material.

The difficulties in this view arise from a more precise analysis of what is implied in the notion of interaction. The natural sciences in dealing with the material world and its processes, demand that all factors, agencies, and conditions which are not themselves material should be excluded. All motion and all redistribution of material energy must on this view be explained according to general laws as the result of previous motion and distribution of energy.

This principle is applied, not only to inorganic matter, but also to living organisms and, in particular, to occurrences within the brains of men and animals. Neurons and groups of neurons are simply portions of matter, just as a stone is, and the propagation of nervous impulses from neuron to neuron is as much a physico-chemical process as the burning of a candle. In explaining how a candle burns, science assumes that a complete account of what takes place can be given without referring to anything but the existence of material things and their states and processes. Similarly, in explaining how nervous impulses are generated and propagated it is assumed that no condition comes into play except previous and simultaneous states and processes in the nervous system itself, in the rest of the body, and in the material environment.

Now if we suppose that in consequence of the agency of any immaterial existence or occurrence something happens within the cerebral cortex which would not otherwise happen in the same way as the outcome of purely material conditions, the unbroken continuity of physical explanation is destroyed. A factor is introduced as contributing to determine occurrences in the material world which is not itself material. But consciousness seems utterly heterogeneous in its nature from extension and motion in space. Hence, to introduce a conscious being, as such, in order to account for what takes

place in the brain, is to introduce an immaterial factor in the explanation of material processes.

The movement of striking a match is due to the contraction of certain muscles, and this again is due to the propagation of nervous impulses which have their commencement in the cerebral cortex. If we say that the cortical process is initiated or in any way controlled or modified by the desire to light a cigarette, we introduce a condition which is quite foreign to the order of the material world. Abiding by the point of view of physical science, we must say that the cortical process is traceable only to material conditions simultaneous with it and immediately preceding it. As for the desire to light the cigarette, we must say that this somehow arises in connection with the cortical process, and that wherever a cortical process, sufficiently similar, takes place, a similar conscious state comes into being. But we must not say that the desire, as distinguished from the brain events which accompany it, has any influence in determining the nature and course of nervous impulses. At no point does the conscious state intervene as an independent factor, so as to cause anything to take place within the cerebrum which would not otherwise have taken place owing to physical and chemical conditions operating according to physical and chemical laws.

Continuity in the physical explanation of physical phenomena would be broken by the admission of a psychical factor as conditioning physical processes within the brain. This general presumption, which might otherwise be dismissed as merely a hardened prejudice, takes shape as a special argument in connection with the principle of the conservation of energy. According to this principle, energy can be neither created nor destroyed within the material world, but only redistributed. It is urged that if an immaterial agent co-operates in the production of material phenomena, it must in so doing increase or diminish the quantity of energy in the material system on which it does work, and so violate the law of conservation.

Abstractedly taken, it seems a sufficient reply to this argument to point out that the law of conservation refers only to redistribution of energy within purely material

systems. What it affirms is that no material conditions can bring into existence or destroy energy. It does not determine what may happen when an immaterial factor is brought into play. But this suggestion seems to be undermined by the special results of experimental research on the energy-transformations of the human body. It has been shown by exact inquiry that "the energy value of the output of the human body in the form of work, heat, chemical products, and so forth, equals almost exactly the energy value of food and oxygen absorbed—that is, the value of the sum-total of energy supplied to the body."[1] Hence it seems to follow that if the mind acts on the body, it cannot do so by increasing or diminishing material energy.

Does it therefore follow that there can be no interaction between body and mind? This is by no means an inevitable consequence. For modes of interaction are conceivable which do not involve any exception to the principle of conservation. It may be that material energy is being continually transformed into psychical energy and retransformed into material energy. Again, it may be that the agency of mind is merely directive, so that it guides and determines redistribution of energy without increasing or diminishing its amount. The possibility of this has been maintained and defended by the greatest authorities on physics such as Lord Kelvin; and there seems to be no doubt that it is a tenable hypothesis.

None the less, it seems to me that the experimental verification of the law of conservation in the special case of living organisms does decidedly count in favour of the view that here as elsewhere material processes are to be explained through purely material conditions; and that this presumption ought only to be given up where it is plainly inconsistent with ascertained facts.

A more general argument against interaction is based on the utter dissimilarity of mental and material facts. Interaction between *a* and *b* means that change takes place in one of them because change takes place in the other. But why should change in *a* make any difference to *b*? If *a* and *b* are other-

[1] McDougall, *op. cit.*, p. 93.

wise unconnected, there is no sufficient reason. Both from the nature of the case, and in view of all that we know in detail about causal connection, it would seem that *a* and *b* must be related to each other in special ways in order to account for the possibility of their interaction. All material things, for instance, are connected as having extension, position, and motion in space, and their causal relations are throughout conditioned and determined by their spatio-temporal relations. The interaction of physical things only ceases to be mysterious when both antecedent and consequent are described in terms of common attributes and are knit together in the unity of a single continuum.

It is true that in common speech no such unity and continuity is clearly recognised. We speak of the frost as being the cause of a leaking pipe in spite of the apparent diversity and discontinuity between the cause and the effect. But in the analysis which is involved in 'explaining the connection' dissimilarity is removed. It is precisely the task of scientific investigation to reinterpret the facts as a sequence of events in a continuous process. In the course of this reinterpretation antecedents and consequents are defined in terms of the attributes which they possess in common. The unresolved differences which remain are differences in the appearances to some mind. But the doctrine of interaction, not only asserts that they are appearances to a mind, but also treats the appearances as being produced within the mind by physical things. The sense in which they are so produced is very different from that in which the physical antecedent produces its physical effect.

From this standpoint the difficulty is not so much that the objective reality and the subjective appearance are too disparate for interaction to occur as that they are much too intimately connected. The antecedent in this case consists of some variation in the primary spatio-temporal properties which, it has been discovered, largely by inferential means, the object really has. The consequents are in general deferred by the distinctive secondary properties which rightly or wrongly it merely appears to have. The alleged interaction would therefore involve causal relations between the possession

of primary and secondary properties, real or apparent as the case may be. But while these properties are in certain ways interdependent it is difficult to establish the connection in terms of the causal relation.

The difficulty seems to be very real; it constitutes a problem which can only be solved by bold metaphysical speculation concerning the ultimate nature of matter and mind and their relative place in the universe. The traditional discussions of the problem have generally been conducted on the assumption that matter and mind constitute two independent kinds of existents. There are many reasons for doubting this assumption, and if there are not two things to interact the question of interaction does not arise. The uniform concomitance and variation of mental and bodily change, so far as it goes, may imply a connection even more intimate than that of interaction.

The results of this prolonged discussion may be summed up as follows: Neither parallelism nor interaction, in the forms in which these doctrines have generally been expressed, provide a satisfactory account of the relations between physical and psychical facts. There is a certain parallelism between physical and mental change, but the doctrine of strict point-to-point correspondence is not borne out by the empirical evidence nor does it admit of any simple hypothetical formulation. Moreover, it leaves the connection of body and mind wholly mysterious.

On the other hand, the doctrine of interaction is not without its difficulties. If interaction occurs it is of an entirely different kind from the interaction of physical things, and ultimately the connection is as mysterious as it is on the alternative theory. The problem is in fact largely extra-psychological. Its solution depends in part on metaphysical questions with regard to the nature of causation and the ultimate nature of matter and mind.

10. The Bearing of the two Hypotheses on Psychological Procedure.—There is one final question which remains to be considered. What difference ought the rival theories of interaction and parallelism to make to us as psychologists? The answer is that it ought to make no essential difference

which of the two views we accept. The reason is that the theory of the relation of body and mind must be founded on the data supplied by psychological research and not inversely. Psychology in its own independent procedure must supply the facts and the indispensable assumptions to which any such theory is bound to conform.

Now there is only one vital requirement which must be fulfilled by any hypothesis concerning the connection of body and mind in order to bring it into general harmony with the psychological point of view. It must recognise that conscious striving after ends, with the intelligence and interest which it involves, plays a real and indispensable part in the attainment of these ends. The full recognition of this is an indispensable presupposition, not only of psychological science, but of all history and biography, of all social intercourse, and of the commonsense knowledge through which alone we can live our daily lives and adjust our actions to the world of which we are a part.

If we look back upon the time which has elapsed since the first advent of man upon this planet, we find that during this period the face of the earth has been transformed by human endeavour. If, for instance, we survey such a city as London we are confronted on every side by objects which are the work of human beings, not merely the work of human hands but the work of human minds. Railroads, telegraph wires, telephones, streets and houses, shops with their contents, parks, gardens, and so on in endless catalogue—all these are embodiments of human thought and will. In the time when man dwelt in caves or trees, these things were not. They have come into being by a long process of development—a process which can only be described as the gradual self-realisation of conscious endeavour or purpose.

Again, there is another and even more important aspect of human development. Conscious endeavour in realising itself has also transformed itself. Not only has it shaped more complex and varied means for its own satisfaction, but in doing so it has itself become more varied and complex. A printing-press would have been of little use to a cave-dweller, not merely for lack of knowledge how to work it, but also because the interests which it is constructed to satisfy

were not felt by him. As conscious striving has moved towards its own satisfaction, it has itself grown and expanded. In and through the process of supplying existing wants, other wants and sources of interest have come into being.

The whole of this progress, be it noted, presupposes not only that conscious beings, as such, are really agents determining the course of events, but also that they proceed on the assumption that they are so. If they had proceeded on the opposite assumption that they were merely passive puppets—mere playthings of external forces—they would not have advanced a step towards the satisfaction of their needs.

Plainly any doctrine of the relation of body and mind which is incompatible with the function of conscious beings, as such, in determining their own development and in shaping the external world in accordance with their requirements, stands self-condemned from the outset. Now, it is clear that interactionism satisfies this test; for the interactionist explicitly and unambiguously asserts that the mind shapes and uses the brain as an instrument in the fulfilment of its own interests. But what about parallelism? Does not the parallelist reduce conscious agency to a pure illusion?

The answer is that all depends on the way we interpret the fundamental thesis of parallelism. The thesis, apart from any special interpretation, is merely that conscious processes regularly accompany certain nervous processes, without interaction between them. If, now, we proceed to add the further statement that the conscious processes are merely an idle and superfluous accompaniment which might be omitted altogether without making any difference, then conscious agency is abolished and parallelism so interpreted is therefore an utterly indefensible position.

Doctrines of this type have been put forward by high authorities—under such names as materialism, automatism, or epiphenomenalism. Perhaps the word which best characterises the general position is epiphenomenalism. Consciousness is regarded as a superfluous apparition or phenomenon which unaccountably crops up at a certain stage in the course of material processes; it cannot be accounted for as following from material conditions in accordance with the laws of

material causation; and when it does come into being it remains aloof in lonely isolation without in any way taking part in the general business of the universe. It has no more influence than the sound of the steam whistle has on the motion of a railway train.

But this view of consciousness as an idle and superfluous bye-product is by no means essential to parallelism. The parallelist may say, and, if he is strictly consistent, he ought to say: I do not deny but rather affirm conscious agency: my position is merely that wherever there is conscious agency it is accompanied by a parallel series of occurrences in the brain, and that unless it were so accompanied it would not be effective in the attainment of its ends. Human action involves both factors in inseparable unity.

This, of course, raises the question: What distinctive functions are we to assign to the two partners thus inseparably united? To conscious endeavour, on the one hand, and nervous process on the other? For neither of them can be a sleeping partner.

Here there seems to be only one course open to the parallelist. He must distinguish two aspects in the products and results of human activity. On the one hand, they may be regarded merely as modifications of the position and motion of bodies and of the redistribution of energy. Under this aspect, they will, according to the parallelist, be exhaustively accounted for by reference to purely material conditions, including especially what takes place in the neurons of the brain. But, on the other hand, they have also and as well the quite distinct character of being embodiments or expressions of human thought and will. Under this aspect, they cannot be accounted for by any material conditions, but only by the agency of conscious beings as such.

What the parallelist denies is that mind and body are connected in the way that is suggested by the analogy of the pilot and his ship. He denies that the mind may be considered as a disembodied spirit acting upon a body without a mind. The conscious self only produces physical effects because it possesses bodily constituents in its nature. In the immediate awareness of our own agency, say in the movement of a limb,

the antecedent is not purely mental and the consequent is not purely physical. A psycho-physical antecedent is followed by a psycho-physical consequent—an experience of a body in discomfort being followed by a change which is both a change of bodily position and a change in experienced satisfaction.

Let us take a more complex example, say a play of Shakespeare. On the theory of parallelism, "if we knew thoroughly the nervous system of Shakespeare, and as thoroughly his environing conditions, we should be able to show why, at a certain period of his life, his hand came to write on certain sheets of paper those crabbed little black marks which we for shortness' sake call the manuscript of *Hamlet*. We should understand the rationale of every erasure and alteration therein without in the slightest degree acknowledging the thoughts in Shakespeare's mind."[1]

As we have seen, the parallelist, in asking us to believe this, demands much more than the evidence warrants. But even if we concede what he postulates, there is still left over something which is not explained. What is left entirely unexplained is just the play of Hamlet, as such. The play, as such, is not merely the material thing which we describe as constituted by certain black marks on certain sheets of paper. It is rather the *meaning* of these marks and of their arrangement. But this cannot be accounted for by material conditions. The only possible explanation is that the thought and will of Shakespeare expressed themselves in and through the written characters, so that the making of the black marks on paper was for him a means to an end.

Physical science, on the contrary, knows nothing of ends or of means to ends. Teleological activity is a concept peculiar to Psychology. It is so because it presupposes the relation of the subject, as such, to its objects, as such. It is a transaction between a conscious subject and its object, as such. A certain actual situation is perceived or believed to exist, there is the thought of its being altered in a certain way, and the change is not only thought of but desired. This constitutes the direction of mental activity towards an end.

[1] James, *Principles of Psychology*, Vol. I., p. 132.

The advocate of parallelism holds that the mental activity is always conjoined with a corresponding material process in the brain, and that its efficiency in producing changes in the external world is coincident with the operation of the concomitant material process.

But if he is to avoid absurdity, he must not affirm that the material conditions taken by themselves supply a complete explanation. The complete explanation is to be found only by taking together both the psychical and the physical factors. Either in detachment from the other yields only a one-sided account of the total fact. For the purposes of Physiology the one-sided account referring only to the physical conditions may be all that is required. For the purposes of Psychology the one-sided account referring only to the psychical conditions may be all that is required. But on the hypothesis of parallelism, rationally interpreted, both the psychologist, as such, and the physiologist, as such, miss an essential aspect of the whole truth. The position of neither is ultimately tenable in isolation from that of the other.

The enlightened parallelist will therefore account for the production of the manuscript of *Hamlet* as follows. The manuscript may be regarded from two points of view, each taking account of only one aspect of its nature. In the first place, it may be regarded merely as one portion of matter among others, possessing in a special form only the attributes common to the material world in general. From this point of view, its existence can be accounted for through merely material conditions, including especially certain occurrences in that portion of matter which we call Shakespeare's brain. But the manuscript is not merely a material thing; it is also the manuscript of a play to be read and acted and criticised. From this point of view, explanation in terms of material conditions entirely break down. What is essential here is the mind, not the brain of Shakespeare; what is essential is Shakespeare as a subject, thinking, feeling, willing, and adapting means to ends. It is this teleological point of view which is distinctive of Psychology; and whether we adhere to the hypothesis of parallelism or to that of interaction, this teleological point of view remains unaffected.

BOOK I.

GENERAL ANALYSIS.

CHAPTER I.

ULTIMATE MODES OF THE RELATION OF THE CONSCIOUS SUBJECT TO ITS OBJECTS.

1. Problems of Analysis.—Psychology, we have said, grows out of prescientific thought. Its problems are to analyse experience at the level of adult human life, to trace the course of development and to formulate the laws of mental process.

In Book I. we shall be concerned with the analysis of individual experience and the fundamental laws by reference to which mental development is to be explained. Experience at the adult human level is very complex. It is the product of a long process of development. But clearly we can commence nowhere else than at the higher levels. We can understand primitive experience only so far as we can reconstruct it in the light of concepts derived from the analysis of our own mental life, or so far as it can be inferred from external manifestations, the interpretation of which also presupposes some preliminary analysis.

To begin with, our original illustration—the case of the man watching the waves—will again serve our purpose. Even a superficial analysis of his experience in the course of a few minutes would bring to light the chief constituents of normal mental life. He will experience *sensations*, vague organic sensations, sensations of warmth or cold, sensations of colour and sound, etc. He may think of other scenes and other situations. In so doing *images* will probably float before

his mind. But sensations and images will in general be incidental to a fact of much more fundamental importance—the fact that he will be occupied in various ways with objects in the physical world. He will be thinking of perceiving things other than his own sensations and images. We may therefore defer consideration of sensations and images, and examine first the fundamental relations of the experient to the world of presented things.

So far as the man is merely engaged in watching, his relations to the world might appear to be simply *cognitive*; but closer analysis shows that there are three distinctive ways in which he is related to his objects. In perceiving, believing, or otherwise apprehending that such and such things exist and have certain characteristics, or that such and such things are possible, his attitude is cognitive in the strict sense of the term. But the cognitive attitude is not present alone. He is pleased or displeased or otherwise affected by what he apprehends. This is the affective attitude. He is also active about his objects; he tries to know more about them, to answer the questions they raise. He wishes them to be altered in some way. This is the active or conative attitude. The conative attitude is essentially involved in attention, but it becomes more prominent in practical activity, when, for instance, his wish to know more about the object or to alter its nature finds practical expression in overt behaviour.

2. Thought.—Behind all more special relations of the conscious subject to its objects there is a more general relation which they all presuppose, the general relation itself of subject and object, considered abstractly in distinction from the special forms which it may assume. It is a pre-condition of the cognitive attitude, the feeling attitude, and the conative attitude that there should be something before the mind with which they are concerned. When we wish to express the bare presence of an object to consciousness without indicating any more special relation we may speak of its presence in thought.

It may be suggested that thought really comes under the head of cognition. But a closer examination of the facts shows that the cognitive or theoretical attitude always involves

a more special relation of the mind to its object. It involves either judgment or doubt or mere supposition. Let the object before the mind be what is meant by the words "that the moon is made of green cheese" or "the moon's being made of green cheese." Thought requires only that the meaning of the words should be understood. But besides this there is always either belief, disbelief, doubt, or supposal. The moon's being made of green cheese is either accepted as fact or rejected as fiction, or a question is raised as to whether it is a fact or not; or again, it may be only provisionally assumed for a certain purpose, as when we say "if the moon be made of green cheese, there must have been a cow to supply the milk," or when we allow ourselves to fancy this to be so in reading or inventing a fairy tale.

The term 'thought reference' may also be employed to cover affective and conative reference.[1] The close connection between thought and cognition depends upon the fact that we can never refer in any other specific way to an object without cognition also being involved. We cannot be pleased that something is the case or wish that it were different without being in some measure aware of the nature of that which pleases or repels us.

The object of thought is whatever the mind means or intends to refer to. The book I see before me on the table is an object to me, inasmuch as I perceive it. The immortality of the soul is also an object to me whenever I think of it. *Nothing* is an object to me, whenever I use the word *nothing* and attach a meaning to it; so is a Centaur when I imagine one. To perceive or think at all is to perceive or think of something, and this something, just because it is perceived or thought of, is an object presented to consciousness.

[1] The term 'thought' is sometimes restricted to the modes of cognition. But for cognition in general and for each of its special forms other terms are available. On the other hand, some term is required for the general relation of subject to object irrespective of its special form. In everyday language we are said to be thinking of an object not only when we are perceiving it or making judgments about it, but also when we are wishing for it or feeling somehow about it. The usage here adopted thus accords with that of common speech.

When we ask a man what he is thinking of, he may reply "the moon," or "the college," or "the soul," or "my tooth-ache." But such answers are essentially incomplete. Their incompleteness is shown by the fact that they always leave room for such further questions as "*What* are you thinking about the moon?" "*What* are you thinking about the soul?" These questions require some such reply as: "I am thinking of the moon attracting the earth, or of its causing the tides, or of its being made of green cheese, or of its existence"; "I am thinking of the question whether there is a soul, or the question whether the soul is immortal." The total object before the mind is not merely the moon or the soul, but what is meant by such expressions as "that the moon causes the tides," or "that it attracts the earth," or "that the soul either exists or does not exist," or "that it either is or is not immortal."

In general, it would seem that a complete object can only be adequately described in language, not by isolated words but by propositions capable of being asserted, denied, doubted, or assumed. The full object requires to be expressed in the form that "something is or is not so-and-so." This is most clearly seen when thought takes the determinate form of believing. We cannot believe the moon, we must believe something about it. Similarly when we are said to perceive or know something this may be taken to express the fact that we perceive or know that something is the case.

This will help us to understand another point, which ought not to be omitted by the psychologist, though full discussion of it must be reserved for Logic and Metaphysics. The object of thought retains for consciousness an identity which is independent of time and change—identity of meaning. Events begin and cease; but what the mind apprehends is not the mere event as it occurs, but the "fact" that it occurs or the fact of its occurrence. Now though the event itself begins and ceases in time, the fact of its occurrence does not thus begin and cease. The battle of Waterloo began and ended on a certain day in June 1815. But the fact of the battle's occurrence at that date is not limited by time conditions. That the battle took place at that date is a fact at the present moment.

It follows from this that our transient experiences or feelings as they come and go can never be complete objects of thought. In thinking of them we think something about them, "that they exist" or are felt or are of such a nature. My present toothache when, in addition to being an immediate experience, it is also an object of thought is such only as being involved in the apprehension of some fact such as the fact that it is felt by me; and the fact of its having been felt by me does not disappear for me when the feeling itself is over. The fact of its having been felt is permanently recognisable as identical with itself whenever I think of it; the fact of its being felt at a given moment can never be changed into the fact of its not being felt at that moment.

We must distinguish the act of thinking from its object. The former is an event which happens in our own mental history; the object is a meaning which is the same whenever it is apprehended. We may think the same thought again and again: by this is meant that we again apprehend the same object, that we again mean to refer to the same thing. But the acts of thinking or apprehending are distinct events in the time-order of our conscious life. I can apprehend the colour red again and again on different occasions, and identify it as the same. But on each separate occasion I have a separate perception. The perceptions are so many distinct events or occurrences in the history of my individual experience. The sensible quality is not an event in the history of my experience at all. It is an object which may be perceived and identified as the same in many different phases of my life-history widely separated in time.

The same distinction becomes still more obvious if we take other instances. If I perceive a triangle, my perception is not triangular—it is not made up of lines and angles. On the other hand, the triangle as it appears to me when I see it is not an occurrence in the history of my individual consciousness; it is a geometrical figure, which is a very different thing. Again, in a moment of time I may think of eternity: it is obvious that the specific modification of consciousness which exists while I am thinking of eternity, and disappears after I have ceased to think of it, is not itself eternity or eternal.

Similarly, I may think of non-existence; this is an actually existing thought; and the specific modes of consciousness which give it its specific nature must actually exist. They cannot, therefore, be identified with the object of the thought, which is non-existence. The object itself can never be identified with the present modifications of the individual consciousness by which it is cognised.

It is particularly important to note that this identity of the object remains unaffected by its being more or less fully apprehended. This is regarded as only a difference in relation to us which leaves the object unchanged in other respects. It is the same object which is first less fully and then more fully before the mind. Try to bring before your mind the events of yesterday or the fifth proposition of Euclid or what you know of the relation of body and mind. At first your thought is relatively vague and incomplete; but, as you proceed, details gradually emerge which were not apprehended before; in a sense these details are relatively new objects; but they are apprehended as partial aspects or features of the one total object with which you are throughout occupied, the events of yesterday, or the fifth proposition of Euclid, or the relation of body and mind.

Similarly, in observing something presented to the senses, such as a flower, different parts and characteristics are presented successively to sight and touch. But throughout the mind recognises its total object as the same; the identical object is the nature of the flower, which is disclosed now under this aspect, now under that. In general, when we are observing or thinking about an object, the object without ceasing to be recognisably the same appears under different aspects. Now this, now that characteristic feature or relation is brought before consciousness. Indeed the processes of observing and thinking essentially consist in an endeavour to cognise relatively new phases of their object. So far as the object is already known there is nothing for them to do.

3. The Cognitive Attitude.—I *perceive* that the table on which I write is approximately square, I *recognise* it as being that which I used yesterday. I *remember* that it was then

rather weak at the joints, and I can *imagine* it breaking. I *doubt* whether it can be satisfactorily repaired, but *expect* that it will serve my present purpose.

The italicised words express certain variations in my attitude to the objects of thought, but they have something in common as expressing not only the general relation of subject to object, but also variations in the more specific attitude of cognition. I may in addition be sorry that the table is broken and may wish to have it repaired. But in describing my attitude nothing was directly expressed with regard to the affective or conative attitudes. These attitudes differ from all the cognitive attitudes in some important ways in which the latter do not differ from one another.

The clearest of the cognitive attitudes, perhaps, is that of *belief*, with which there stands in contrast the attitude of *supposal*. The characteristics of cognition may therefore be considered by reference to these contrasted attitudes.

"If ice were heavier than water, what we now call the temperate zones would be uninhabitable." I believe this proposition; in making it I judge. But in making it I have also before my mind two propositions which I do not believe, but disbelieve. I think of what is meant by the words "ice is heavier than water," and "the temperate zones are uninhabitable." Yet I do not judge either that ice is heavier than water or that the temperate zones are uninhabitable. What I do is to consider first certain general properties of ice and water, sufficient to enable me to recognise what I intend to mean by those words, *e.g.* the fluidity of water and the solidity of ice, and the temperature at which water freezes. I am then aware that these general characters, taken by themselves, leave an open field for certain special alternative possibilities and in particular for the special alternatives of ice being heavier than water or of its being lighter than water. But I do not commit myself to either of these alternatives as being the one which is realised; I do not even raise the question which of them is actual fact. What I do is to *suppose* one of the alternatives realised, that of ice being heavier than water. Having made this supposition, I find myself committed to another, that of the temperate zones being uninhabitable.

It is characteristic of supposal that the mind has a range of arbitrary choice between alternative suppositions. It remains aware, in supposing one alternative to be realised, that it might equally well suppose others to be realised. On the contrary, it is characteristic of belief that the alternative believed in is determined for the mind and not by it. It is imposed on the mind by the nature of the object with which it is dealing. From this point of view, doubting and questioning must be regarded as belonging to the attitude of belief rather than to that of supposal. It is true that so far as we doubt, we are free to make alternative suppositions. But this is not what is distinctive of doubt. What is distinctive of doubt is that this very freedom is felt as an obstacle which we have to get rid of. So long as it lasts it holds the mind in suspense. What we are aiming at is a definite judgment that one of the alternatives is realised; and this means that we are seeking to bring before our mind conditions which impose this alternative to the exclusion of others.

I doubt, for instance, whether a certain drawer in my desk contains papers or not. I am equally free to suppose either alternative realised. But this is unsatisfactory, because what I want is not a supposition but a judgment. I accordingly open the drawer, and the ensuing experience imposes one alternative to the exclusion of the other. The drawer is empty. I can still make the supposition, "if this drawer, which is in fact empty, were full." But in doing so, I have provisionally to disregard the new datum supplied by opening the drawer.

Suppositions, as we have seen, occur as subordinate parts of judgments. But this relation is reversed in the free play of fancy or imagination. Here, the primary and pervading attitude of the mind is supposal. In composing a fictitious narrative, the advance is from supposition to supposition, each step enlarging and supplementing what precedes, and the whole thus constructed is itself only supposed, not believed. Similarly, the reader or hearer of the fiction, who takes it for fiction only, accepts its successive statements only as something supposed.

For instance, I find, in the beginning of a novel, the following sentence: "It was in the dusk of a July evening of the year

1813 . . . that I first met Captain Coffin as he came, drunk and cursing, up the Market Strand, with a rabble of children at his heels."[1] In reading these words, my mental attitude is not one of believing or of disbelieving, or of doubting as regards the existence of a person making this statement, or as regards the incident he describes. I am, from the outset, prepared for fiction; and this means that I am prepared to accept propositions put before me by the author in the way of supposal or make-believe or what children call 'pretending.' I am not disbelieving or doubting, simply because my belief is not challenged. The author invites me to make a series of suppositions under his guidance, and this I allow myself to do. If anyone should require me to proceed as if the fiction were fact, I should at once begin to disbelieve or doubt.

The attitude of supposal is, however, in no case quite unmixed with judgment. For instance, Sir A. Quiller-Couch, in writing the novel quoted above, is dealing with human life—and with human life in England and particularly in Devonshire in the year 1813. He has therefore to construct his imaginary incidents and scenes and characters in conformity with certain conditions which are accepted as real and are not merely supposed. Further, he is bound to be consistent. What he says on one page must agree with what he says on another. Having made a certain supposition he has to accept its consequences. In both these ways judgment intermingles with supposal and restricts the range of its free choice between alternatives.

In the order of mental development supposal comes later than belief. In the child, the first evidence of its existence is supplied by playful pretending, as when a boy gets astride of a stick and pretends he is galloping on horse-back. It may also enter into the play of animals, as when two dogs playfully enact a mimic fight or hunt, yet refrain from seriously hurting each other.

There are many special forms of the cognitive relation. They are distinguished partly by their connections with sensation or imagery, and partly by their temporal reference.

[1] Quiller Couch, *Poison Island*, p. 1.

Perception depends upon sensations; imagination, expectation, and memory depend upon the presence of images.[1] These special modes of cognition are also distinguished by their temporal reference. Perception refers to what is present in time, memory to the past, and expectation to the future. In imagination there is no essential reference to any special time. We may, of course, imagine an event as having happened yesterday or as going to happen to-morrow, but such dating is an incidental part of what is imagined, not an essential feature of imagination as such. In the same way we may remember that we were intending to do something to-morrow. Here there is a primary and essential reference to the past and a secondary reference to the future. In terms of this distinction we may say that imagination has no primary or essential temporal reference, though in the secondary way it may refer like memory to any time whatever.

4. The Affective Attitude.—The cognitive relation of the subject to its objects is distinguishable from the interest it takes in them. The Latin *interest*, the third person singular of *interesse*, means primarily "there is a difference," and so comes to mean "it makes a difference." The word 'interest' is here to be understood in the wide sense suggested by its derivation. The subject is interested in objects if and so far as they are not indifferent to him. Now an object could be entirely indifferent only (1) if the subject felt in no degree either pleased or displeased with it, neither liked nor disliked it, and (2) if he neither wanted it in any way altered nor wanted to maintain it unaltered. There are thus two ways of being interested: (1) the *affective*, and (2) the *conative*. Affection and conation usually go together and are blended in intimate unity. None the less it is important to distinguish them, for affection covers the passive side of our nature as conscious subjects and conation the active side. Let us begin by considering the affective attitude or, as it is sometimes called, the feeling-attitude.

[1] With certain qualifications to be noted in another place. Cf. § 8 of next chapter.

The affective attitude consists in being pleased or displeased with something, in liking or disliking it. We must distinguish carefully between the subjective state of being pleased or the reverse, and the objects which we find agreeable or disagreeable. When we say that music, or hockey, or football, or the eating of chocolates are pleasures, we mean that they are, more or less permanently and uniformly, sources of agreeable feeling. But it is the agreeable feeling itself as actually felt in relation to these objects which constitutes the affective attitude.

The importance of this distinction becomes obvious when we take account of a fact which is of fundamental importance for the general nature of affective states, the fact that few definite objects or none can invariably be counted on as agreeable or disagreeable at all times and under all conditions. Pleasing things do not always please and displeasing things do not always displease. They agree or disagree with us according to their relation to the varying phases of our mental life as a whole. The taste of honey or the bright blue of the sky are approximately similar in character on their recurrence. But the connected feelings have not a corresponding constancy. The honey is pleasant if we have an appetite for it: otherwise it may disgust. The blue sky may be a source of joy if we are attuned to enjoy it; if, on the other hand, we are in a depressed and irritable mood, it may only increase our depression and irritation. The jest which would please us in an hour of relaxation may annoy us if we are in deadly earnest about some serious business.

The same point is illustrated by the varying affective values of the same objects according as they are variously combined, related, or contrasted. The same colours or lines may displease according to the varying ways in which they may be arranged.

Further, the affective value of an object is, to a very great extent, dependent on the frequency of its recurrence. We get tired of the finest melody when it is hackneyed by constant repetition. Partridges may be palatable, but it is proverbial that in this case one may have too much of a good thing. On the other hand, even very disagreeable medicines become less so as we become used to taking them.

This relativity of affective values to the complex totality of our psychical life at the moment supplies a characteristic distinction between affective states and sensations which recur with comparative uniformity whenever a sense-organ is similarly excited. It also explains the fact that, unlike cognition, feelings may appear sometimes to be purely subjective and objectless experiences. I may be pleased without discriminating any special feature in the total situation as *the* object of my pleasure. But under such conditions the experience is not totally devoid of objective reference. What happens is either that the total situation is regarded as pleasant or that the feeling ' fastens upon ' object after object in a relatively undiscriminating way. It is never literally objectless. It is for this reason that we must distinguish the cause of the affective state from its object. The cause of displeasure may be something which is forgotten or something which we have failed to discriminate in cognition. In this case the feeling continues to exist by being directed upon a variety of irrelevant objects. It is this direction upon objects which distinguishes pleasure and displeasure from sensations. We cannot be hot or cold *with* anything or about anything. Sensations are not directed upon objects, they are objects.

Another characteristic difference is that distinct affective states are not capable of existing together in a simultaneous plurality as sensations are. Colour-sensations are constantly occurring together without blending in a single colour-sensation in which the parts are not separately distinguishable. The same holds good for touch-sensations and sound-sensations, and it holds still more obviously for combinations of experiences belonging to different senses—for combinations of sound-sensations with colour-sensations, or of colour-sensations with touch-sensations. The sensuous presentations do indeed unite with each other in complex wholes; but they do not lose their separate identity. It still remains possible, under sufficiently favourable conditions, to discriminate them from each other as distinct though related sensations. But affective states do not thus co-exist independently side by side, so that we can say: I have the feeling of being pleased

and also along with it the simultaneous and distinct feeling of being displeased.

It is true that we may, and very commonly do, experience affective states which are neither purely pleasant nor purely unpleasant. Pleasantness and unpleasantness are then blended in a peculiar and indescribable way; but they are blended in a single indivisible feeling; they cannot be discriminated as two distinct feelings separately experienced side by side. The true description is to say that there is a single affective state which partakes at once and in varying degrees of the character of pleasure and of the character of pain.

That such experiences constantly occur seems undeniable. Melancholy must always be tinged with sorrow or it would not be melancholy at all; yet there is such a thing as pleasing melancholy. In dwelling in memory on the words and actions of a beloved friend whom we have lost by death our experience often has a pleasing aspect, indivisibly blending with the pain of bereavement. But we do not have two distinct feelings, one of pain and one of pleasure. The case is not comparable with that of experiencing two distinct colour-sensations, as when we see a strip of blue side by side with a strip of red. A far better analogy is to be found in the relation of the sensation of purple to the sensations of pure red on the one hand and of pure blue on the other. The purple is a single simple sensation; it is not a sensation of red plus a sensation of blue. Yet, on comparison, we find that its quality is more or less akin to blue and also more or less akin to red. It is a reddish blue or a bluish red. Thus the various purples can, from this point of view, be arranged in a graduated series passing at one end into pure red and at the other into pure blue. The same is true of red-yellows, and of blue-greens, and of greys as intermediate between black and white. Similarly, affective states form a graduated series between pure pleasure and pure pain. The pure states are relatively rare, pure pleasure being decidedly rarer than pure pain.

The wrong doctrine on this subject is well illustrated by the speech which Shakespeare in *Hamlet* puts into the mouth

of King Claudius, who is made to describe his state of mind at his wedding with his brother's widow as follows:

> "With a defeated joy,—
> With one auspicious and one dropping eye,
> With mirth in funeral, and with dirge in marriage,
> In equal scale weighing delight and dole."

Claudius was not only lying, but his lie was a psychological absurdity. One eye could not be weeping tears of sorrow, while the other eye was beaming with joy. Similarly, delight and dole could not exist simultaneously and separately like two weights in opposite scales.

Can our total consciousness at any moment be entirely devoid of pleasure and displeasure? This is a question which we may be at first sight tempted to answer decidedly in the affirmative. I may, it would seem, perceive a stone, or a clod of earth, or a geometrical diagram, without feeling either agreeably or disagreeably affected towards these objects. But the apparent plausibility of this answer disappears when we look more closely into the case. Why do we notice these objects at all? Perhaps we do so merely with the view of settling by experiment the question we are now discussing. But if that be so, the issue of the experiment itself is more or less satisfactory or unsatisfactory. We are in some degree pleased that our own pre-conceived view is confirmed, or displeased because it is apparently upset. If we have no pre-conceived view, we are pleased or displeased because we do or do not succeed in obtaining an answer to the question proposed. Thus, the affirmative answer turns out under these special conditions to be due to an oversight. We have not taken into account our total consciousness in relation to the object, but only a small and unimportant part of it.

Now, suppose that, instead of having a pre-existing motive for noticing the object, we simply take cognisance of it because it happens to pass before our eyes. Here it may be said that we are purely neutral in regard to it. But there are many things presented to our bodily vision of which we take no cognisance. The more pre-occupied we are, the more entirely they escape notice. If this or that object so obtrudes

itself when our minds are pre-engaged on some other topic as to divert the current of our thoughts, it must have some interest of a pleasant or unpleasant character. If it does not divert the current of our thoughts, the cognisance we take of it will be slight and transient, and will form only a small and insignificant portion of our total consciousness. Thus our total consciousness may involve pleasant or painful interest, although this small portion of it does not contribute in any appreciable degree to its pleasantness or unpleasantness. Again, our minds may be comparatively disengaged, so that they are free to attend to surrounding things; but it is the characteristic of these idle moods that we are more or less amused or bored by the trivial objects which obtrude themselves on our senses. On the whole, the presumption appears to be that our total consciousness is never entirely neutral.

The student must here be warned against a common fallacy: we are apt to suppose that we are only pleased or displeased, when we expressly notice, at the time, that we are, or remember afterwards that we have been, pleased or displeased. But in fact we only notice or remember when the pleasantness or unpleasantness is specially conspicuous. There is a customary level of agreeable or disagreeable feeling which we are apt to treat as a neutral state. In like manner, we do not notice that we are hot or cold, unless we feel more hot or cold than usual. Similarly, what we call silence is not absolute silence, but only a comparative absence of sound. This is shown when we pass from what we call silence to a still more complete absence of sound. The previous state then ceases to appear to us as one of silence. As a matter of fact, sound of some sort is rarely if ever wholly absent from our experience. The same is in all probability the case with pleasure or displeasure. One or the other, or both, are always in some degree present, although we by no means always notice their presence.

When we wish to say that pleasure or displeasure belongs to this or that mental process, we may say that the process is pleasantly or unpleasantly toned. 'Hedonic tone' is a generic term for pleasure and the reverse, considered as belonging to this or that mental process.

5. The Conative Attitude.—Conation, considered merely as a mode of consciousness in relation to objects, consists in wanting the object to be in some respect other than what it is or in wanting it to continue as it is. Clearly, the conative attitude, as thus defined, is distinct from the cognitive. But it may not be so clear that it is distinguishable from affective states. Is not being pleased with a certain situation identical with wanting it continued, and is not being displeased with it identical with wanting it changed? This question may be decided by considering two classes of cases: (1) those in which the affective state presupposes as its condition a conation distinct from it; (2) those in which the affective state is prominent, when conation is comparatively feeble and obscure, if it exists at all.

As a typical instance coming under the first head, we may take the unhappiness of a zealous student if he is debarred from his favourite studies, excluded from books and papers, or disturbed by noises and intrusions. It is here untrue that the student first feels unhappy in his actual situation and that his desire to pursue his studies either simply is this unhappiness or follows from it. If he did not begin by wanting to pursue his studies the privation of books and papers would not make him miserable. He does not, in the first instance, want to study because he feels unhappy; we must rather say that primarily he feels unhappy because he wants to study and cannot do so. All pleasures and pains which are conditioned by success and failure belong to this type. They presuppose conation and cannot therefore be identical with it or even be regarded as generating it.

Of course, there are also many instances in which the conative attitude arises in dependence on the affective. We begin by feeling pleased or displeased with a certain object, and in consequence we want it continued as it is or we want it to be changed. But where this is so, there is still a clear distinction between the affective attitude and the conative attitude which results from it. The affective attitude is concerned with the object as it presents itself to consciousness at the present moment; the conative attitude is directed in a peculiar way, which cannot be further analysed

or described, towards the future, toward what is not yet, but is to be.

The distinction between conation and feeling is clearly seen when we consider the relation of the two modes of the former to the positive and negative forms of the latter. Conation assumes the two forms of appetition and aversion. These, however, though perfectly distinct modes of experience, are only abstractly separable. Normally, appetition directed to one object is accompanied by aversion from anything recognised as incompatible with it. We distinguish states as desires or aversions according as one or other mode is prominent. Aversion from a state of affairs which would otherwise be neutral and indifferent arises in conjunction with the consciousness of some attractive alternative, and aversion would similarly arise with regard to any other situation incompatible with the desired end. Here appetition is primary and aversion derivative. In experiencing bodily pain aversion is the primary response. The correlative end of appetition may be vague and indeterminate. Activity is directed to securing a state of affairs broadly thought of as simply 'anything but this.'

Pleasure and displeasure are not simply coincident, the first with appetition, the second with aversion. There may be positive pleasure in the escape from definite evils to a neutral state of affairs; and appetition so long as progress is slow and difficult tends to be unpleasant.

The object of conation may be described as an 'end,' but a certain ambiguity attaches to this term. It may mean either (1) the actual satisfaction of conation, or (2) the conditions of satisfaction as they appear to conative consciousness before the satisfaction is actually and completely attained.

In sense (1) the term 'end,' whatever else it may imply, implies also its ordinary literal meaning of termination or cessation. When conation is completely satisfied it completely disappears. Appetite for food ceases after a full meal; intellectual curiosity ceases when the problem is solved, and so on. The end in which striving consciousness finds satisfaction is, when completely achieved, the termination of the striving. This fact is apt to be obscured by two circum-

stances. The first is that in the process of satisfying one conation others frequently come into being. Thus, in finding the answer to one question we may find other questions emerge of equal or greater interest. But it remains true that our initial curiosity concerning the first question ceases when that question is fully answered. In the second place, there are some ends so complex that they can only be realised by a long series of successive steps, and some, such as the moral idea, which can never be realised completely. But even in these cases, so far as satisfaction is attained, conation ceases. We press on, forgetting the things that are behind. The end, in this sense, implying actual satisfaction, and with satisfaction the cessation of the conative process, may be called by way of distinction the 'end-state' or 'terminus.' We may then confine the word end to its second meaning as *object* of conative consciousness—the conditions of satisfaction as apprehended by the subject before actual attainment.

In this connection it is important to remember that the subject may be mistaken as to what he really wants, that his initial clue may be very vague and fragmentary, whereas the actual conditions which would satisfy him are definitely fixed by his own constitution and that of the world in which he lives. It is a general condition of conation that the subject should initially have some cognisance of what it is that he is seeking; but this initial apprehension may be exceedingly vague and incomplete. In all cases, the subject is confronted with a situation which he is aware of as alterable and wants altered. But he may not have any definite apprehension of the special kind of alteration required. All that is necessary to constitute an object of conative consciousness is such cognisance of the conditions of satisfaction as may serve as a clue, however vague and fragmentary, to the subsequent development of the psychical process. The clue may be very vague indeed; it may be so vague that we should not in ordinary language describe it as a cognition of the conditions of satisfaction. All that is required—though more is frequently present—is attention to some idea or percept which prevents the course of the conative process from being entirely indeterminate.

It should also be noted that even when the initial presentation is relatively precise it may be misleading. I may desire to eat an apple which I assume to be in my pocket; but on trial I may find that no apple is there. Or I may find the apple, and then be disappointed when I come to eat it. I discover that what I really want—the actual satisfaction—is not what I supposed it to be. Strictly speaking, we only come to know what we want with complete determinateness in the actual process of attainment. In 'learning by experience' the initial presentation of the conditions of satisfaction is continually being corrected, defined, and enlarged by trial and error. We are continually finding out what we do or do not really want.

Suppose that I sit down to solve a chess problem. I start with a certain end in view (the object of conation). I endeavour to discover a certain series of moves, limited in number, bringing about inevitable mate. So far the end is defined as an object of consciousness at the outset. But it is not wholly defined. Its full determination comes only with its attainment. If I possess at the outset the knowledge of just that series of moves which is required, satisfaction is already attained: there is no problem, for the problem is already solved. Just in so far as the conative process has anything to achieve, its end is not already determined, but relatively indeterminate. Initially the end is only so far presented as to give a prompting clue, which starts the mental process in a certain general direction. In the course of the process the subject may imagine many things which he supposes will produce satisfaction, but which fail to do so when attained.

We may further note that the end state or terminus is never the complete object of conation. The hungry man looking forward to a meal thinks of the whole process of eating, not of the moment at which his appetite will be completely appeased.

The active side of our conscious being is essentially connected with the conative attitude. The nature of this connection requires careful explanation. Evidently the mere wanting or desiring or consciously requiring something is not of itself sufficient to constitute agency. We must also add that such

modes of consciousness have causal efficiency, that they operate as factors determining the course of events.

But the causal connection, by itself, is not sufficient. A man, in attempting to shoot a bird, unintentionally shoots another man, of whose presence he was quite ignorant. This result is not ascribed to his conscious agency, although it is, in a sense, a consequence of his wanting to shoot the bird. It is not ascribed to his conscious agency because it is only an accidental outcome of his action. It is neither what he primarily desired nor any part of the means or conditions recognised by him as required for the attainment of his end.

In general, conative consciousness constitutes the active side of our being, not merely because it is a factor operative in determining the course of events, but also because by its very nature it tends to bring about its own fulfilment. Further, this kind of causality is so connected with the intrinsic nature of conative consciousness that it can belong to nothing else. Apart from reference to such states as wanting, desiring, requiring, etc., we can have no conception of what it means. We may, indeed, think of a bent spring as if it were trying to unbend; but in doing so, we are vaguely investing the spring with some sort of conscious life analogous to our own.

The words 'failure' and 'success' have meaning only in relation to conscious agency, as thus defined; and such agency is just as much implied in the conception of failure as in that of success. When we are aiming at a mark, we are equally active whether we hit it or miss it. Indeed, the characteristic nature of subjective activity is most fully expressed by a series of trials in which relative or complete success is gradually reached through partial failures, as in the case of the spider whose perseverance encouraged Robert Bruce, or in the case of Bruce's own reiterated attempts to gain the Scottish crown. Where failure leads to persistency with varied effort, in which relatively satisfactory modes of procedure are, *pro tanto*, continued or renewed, while relatively unsatisfactory modes of procedure are discontinued or altered, conative consciousness operates throughout as a tendency towards its own fulfilment. It is only a tendency, because the ultimate result does not depend on it alone, but also on the

co-operation of other factors, and where these fail ultimate success is unattainable.

6. Interrelations of Cognition, Feeling, and Conation.—Cognition, feeling, and conation are abstractly and analytically distinct phases in any concrete psychosis; but they are not separable. They do not occur in isolation from each other.

Cognition, as we have seen, is presupposed both by feeling and conation. Hence it has been suggested that the three modes of experiencing follow one another in a certain determinate cycle. But granting some form of priority to cognition, what is the relation of feeling and conation?

If in the 'pleasures of pursuit' feeling presupposes conation can this relation be generalised? Can we say that pleasure and displeasure invariably depend upon the success or failure of prior conative activity? The difficulties in this hypothesis arise chiefly in connection with sensory and perceptual pleasures. Certain colours and tastes, for example, seem to be pleasant or painful apart from prior conation. What conative tendencies are finding satisfaction when we find a picture or a pattern pleasing?

In the latter case it has been suggested that feeling is dependent upon certain conative tendencies involved in all perceptual process. Certain groupings of forms and certain arrangements of lines facilitate discernment. Others thwart and baulk the process of attention, producing bewilderment and unsatisfied curiosity. The former are, in accordance with this theory, pleasant, and the others unpleasant. This may provide a partial explanation; but the difficulty still remains that relatively simple sensory experiences are pleasant or unpleasant without any obvious basis in conation. Tastes provide some of the most striking examples. Of these cases, McDougall, one of the chief exponents of the theory in question, offers the following explanation:

"Consider first the case of sweet substances. It may be said that for the normal human being, and apparently for many animals, the taste of sugar is intrinsically pleasant. But, the proposition is, I think, demonstrably false. I submit that the taste of sugar is pleasant only in so far as it

promotes—renders more intense and effective—the conative impulse to consume food, and that the taste itself (the cognitive fact) does this, while the feeling depends upon and is consequential upon the conative process. For sugar is pleasant only when and in so far as the hunger-impulse is at work. As soon as satiety is reached the sweet taste of sugar becomes unpleasant; we cease to desire the sweet food, and, if it is forced upon us (as by the obligation to respond to an over-zealous hospitality) we find the food unpleasant, though still sweet."

"Here we have, as it seems to me, the clearest possible evidence of the dependence of feeling upon conation even in the case of very simple sense-perception. Sugar is, I submit, a specific excitant of the hunger or food-taking impulse, and is pleasant only in so far as it promotes the activity of the digestion of food. It is a common experience with me that, if I am a little below my normal health, my appetite is apt to fail while I eat my morning roll or toast. The addition of a little marmalade then stimulates my impulse anew, and I can take more food and find satisfaction in doing so."[1]

As it stands, however, this explanation hardly meets the requirements of the theory. To excite an appetite or to render it more intense does not necessarily promote it or make it more effective. So far as the taste of sugar or marmalade merely stimulates and intensifies an appetite, without satisfying it as well, the experience would have the unpleasantness of unsatisfied desire. According to the hypothesis these tastes should be pleasant because they themselves satisfy an appetite, not because they stimulate an appetite for something else. It might, however, be sufficient to say simply that the perception of the taste of sugar is both exciting and is satisfying some dispositional tendency—a conation directed to the consumption of sugar itself. The taste of sugar, it may be, not only presents the quality of an object, it presents the occurrence of some bodily process of a favourable kind. If this were so it would be not only an object of cognition but in

[1] "Pleasure, Pain, and Conation." *British Journal of Psychology*, Vol. XVII., No. 3.

addition an object in terms of which some conative tendency is defined.

Allowing that some such explanation of the sensory pleasures might be given in accordance with the theory, there remains the question of the function of feeling so aroused. It is not suggested that feeling is devoid of any consequences to subsequent mental process. On the contrary it is generally asserted that so far as any activity is pleasurable it tends to persist or be renewed, and so far as it is unpleasant it is discontinued or varied. But if this be so the dependence of feeling upon conation does not entail the priority of the latter. The relation would be reciprocal; feeling would be dependent upon conation, but the direction of conative activity would also depend on prior feeling.

A similar reciprocity obtains between conation and cognition. Conation undoubtedly presupposes cognition. No striving or desiring is wholly blind. But cognition may also be said to involve conation. We become progressively aware of the character of presented objects because we want to know more about them. The questioning attitude is present in the process of perception as much as in ideational activity. It is true that at the developed level of mental life we see because we have eyes, and objects are thrust before our attention. But seeing involves more than passive recipience. There is always some degree of active interest in the environment. We want to see what is there at least sufficiently for the purpose of deciding whether to observe it more closely or to direct our attention elsewhere.

In general, therefore, the conception of a cycle of cognition, feeling, and conation is over simple. We should be safer in concluding that the cognitive, affective, and conative phases of any concrete subjective process jointly determine the phases of the next, and that a variation in any one both presupposes and entails variation in the rest.

CHAPTER II.

SENSATIONS AND IMAGES.

1. Thought and Sentience.—One of the central questions for psychology is how particular objects come to be apprehended by the individual subject at this or that moment in his life history. What determines a particular thinker to think a particular thought when he does think it? In dealing with such problems it is necessary to keep in view the fundamental distinction which we have already made between two kinds of objects—those which are and those which are not immediately or actually experienced. Among the former certain distinct units stand out as discriminated sensations and images. When a bell is rung and I hear the sound, my sound-sensation exists at the moment as my own private experience. It did not exist before it was experienced by me, and it will not exist after it is experienced by me. On the other hand, the fact of a similar sound having been experienced before and the possibility of experiencing a similar sound again are not immediately experienced at the moment. The same is true of the bell itself and of the power of the bell to produce the sensation.

Now we may lay down, at least provisionally, the general principle that something of the nature of sensation or imagery conditions the apprehension of all other objects, either directly by its actual existence as an immediate experience at the moment, or indirectly through dispositions formed in the course of previous experience. In one way or the other, the reference of thought to what is not immediately experienced is conditioned in a thoroughgoing way by what is or has been immediately experienced, so that all other variations and differences in the objects which the mind apprehends from moment to moment are correlated with corresponding variations and differences in immediate experience. It seems to

be the function of the objective constituents in immediate experience to specify and determine the direction of thought to objects other than themselves.

In the light of this principle it will be seen why we have dealt with thought before dealing with sensations. "Sensations" wrote William James, "are first things in the way of consciousness." In one sense this is true, but it does not mean that we can start with an account of sensation and proceed to explain all experience as the fusing, compounding, and interaction of sensations. It would be truer to say that the mind's knowledge of and practical dealings with material things is the first thing in the way of experience. In the course of such dealings the mind is compelled to distinguish between the object as it independently exists and its own sensations, which exist only as part of its own life history and its own immediate experience. When this distinction is drawn the mind may come to see that its prior knowledge of other things was in fact conditioned by sensations which it had failed at first to distinguish from the object apprehended. An analysis of the way in which this distinction emerges provides the best approach to the study of the sensory experiences themselves.

2. The General Nature of Sensation.—Sensations are commonly defined by reference to the way in which they are produced. The most immediate conditions of sensation consist in processes occurring in our brain; these are set going by antecedent events taking place in certain organs situated either at the surface or in the interior of our body, which in their turn are initiated either by other processes within the body, as in the case of such organic sensations as hunger and thirst, or by occurrences in the environment of the body affecting the external organs of sense, such as the eye, ear, or skin. This, however, does not tell us what a sensation is, nor does it adequately distinguish it from the perceptual experience as a whole which follows with equal immediacy upon external stimulation.

From the standpoint of the experient we find that in perception we are immediately cognisant of objects characterised

and related in various ways. We are aware of a complex presented situation of houses and trees, for example, under the blue dome of the sky, with ourselves 'out of the picture' but nevertheless equally clearly presented, in part at least, as a body also qualified in various ways, as warm or cold, fresh or fatigued, etc. Apart from special inducements to the contrary we take the qualities and relations so presented as qualities and relations of physical things. The greenness belongs to the trees, the blueness to the sky, the warmth or cold to the bodily self.

If anything is picked out by common sense as being a sensation it is something of the nature of the immediately experienced warmth or cold, *e.g.* a specific twinge of pain, or a touch located in or at the surface of the body, rather than anything outside. In popular speech the term 'sensation' tends to be restricted to what is experienced when we apprehend our bodily states or events located within the body.

Psychologists, on the other hand, have found this restriction inconvenient, and have extended the term to cover the visual data, the sounds, the tastes, and smells which may enter into immediate experience. Various considerations justify this extension. In the first place, experience of illusions provide the motive and the occasion for distinguishing physical objects as they really are from the appearances they exhibit. The distinction which is obvious in extreme cases is found also to be required in normal perception.

The distant mountain appears blue and smaller than the hand. We know that it is not really so, and in endeavouring to account for the fact, we are led to distinguish between the mountain which is really large and that which actually enters into our experience as smaller than the hand. When the distinction has been drawn it is found to apply equally to cases in which appearances may happen to be veridical. There is on the one hand that which is known as being so and so, and which will remain unchanged whatever happens to me, and there is that which actually enters into my experience, but which is conditioned by my experience as a whole, and will change or cease to exist according to the way in which I happen to move.

In this way we are led to distinguish that which is actually experienced from the object to which thought refers, without raising the question whether the former truly or falsely presents the latter as it is in itself. In this respect we can treat the visual and auditory data as on a par with the bodily sensations. Later, we find other reasons for grouping them together as sensations—or sensa, as they may be called—when we consider them in abstraction both from the presented object and the experiencing subject. We find, for example, that they all vary, not only in accordance with variation in some presented external object, but also in accordance with variations in our bodily organs. They share, too, in certain characteristics which we have already briefly considered. They are private to the individual whose immediate experience they are, and within the unity of individual experience they manifest various forms of inter-dependence.

But the distinction so drawn between the objects presented and the immediate data of sense does not warrant us in supposing that the latter have any separate or independent existence. Still less are we entitled to assume that they have any intrinsic resemblance to subjective experiences, or that they are 'modifications of the mind' or 'states of consciousness.'

If we endeavour to interpret 'appearances of an object' as copies or effects, or in any other way regard them as possessing an independent existence, we are plunged into a bottomless abyss of nonsense. We have on the one hand the experience of an individual self: on the other, the real world beyond it. This real world itself would not enter into individual experience at all, but only more or less imperfect copies or representations of it. These copies would be all that the individual is aware of. He would know only his own sensations which would intervene, like a painted screen, between him and what really exists. Thus it would be for him exactly the same as if there were nothing else. He could never distinguish what seems to be from what is. He would not be able to apprehend the representations which alone exist for him, as being representations of something

beyond themselves. Still less would he be able to get outside the inner circle of his sensations so as to determine how far they conform or fail to conform to the outer circle of real or 'objective' being.

The absurdities of this position are avoided if we recognise at the outset that sensations, though objective in nature, are not in themselves complete and self-subsistent objects. So far as we can discover, it is an essential condition of apprehending them as objects at all that something else which is not immediately experienced should be apprehended in connection with them. All recognition of a sensation as of a certain kind and all apprehension of it as continuing to be of the same nature or as changing in nature at different moments, involves this reference beyond immediate experience. For at any one moment there is no immediate experience except the immediate experience of that moment. Its identity of nature or difference in nature in relation to past or possible future experiences can only be an object of thought transcending the immediacy of sense.

Another way in which sensations seem always to be inseparably connected with thoughts which transcend their own immediate existence is that to which we have already referred. They seem always to put the thinking mind, as such, in communication with what we call external objects. They mean something beyond themselves. A sensation of red, for instance, means something red or something which appears red.

To a very large extent the meaning thus conveyed by sensations is acquired through retentiveness and association. But it would seem that it cannot be entirely acquired in this way. Derivative meaning ultimately presupposes original meaning which cannot be accounted for by retentiveness and association.

It thus appears that we can never have absolutely pure sensation, sensation absolutely devoid of meaning either original or acquired. We may even go further than this and lay it down as a general principle that sensations always have derivative meaning; for retentiveness and association operate from the very beginning of mental life. It may be

urged that this cannot be the case in the earliest moment of experience. But even if we set aside what may perhaps be due to the results of ancestral experience transmitted by heredity, we have to recognise that the first instant of conscious life is only an ideal limit, which we cannot definitely mark off so as to consider it separately. Thus, even from this point of view, the concept of absolutely pure sensation is an artificial abstraction. No actual sensation with which we can definitely deal is absolutely dissociated from past experiences.

3. The Attributes of Sensation.—Two mutually supplementary methods are available in the investigation of the constitution of objects generally. We may show how a given object is composed of an aggregate of parts; and we can analyse its nature so as to show how it comprises in its unity a variety of attributes. Thus a material thing, such as a brick, can be shown to be composed of a number of particles of clay cohering in a certain way. We can also represent it as an object characterised by a specific size, shape, weight, colour, etc. The former method of treatment may be called 'partition,' the latter 'analysis' in the stricter sense of the term.[1]

Partition yields parts which are objects of the same sort as that which is given for partition. Analysis, on the other hand, yields components of an entirely different kind, viz. abstract properties. Sensations admit both of partition and of analysis. A massive feeling of pressure may be conceived as containing in some way a number of smaller sensations of pressure; a large field of colour is composed of smaller patches. But whether a thorough going atomism is possible in the treatment of sensation is, to say the least, extremely doubtful.[2]

But whatever unit we adopt any homogeneous sensation will manifest by analysis a variety of characters. With respect of some these attributes not only is it true that they

[1] Following the usage suggested by Johnson, *Logic*, Vol. I., Chap. VII.

[2] For an attempt to treat sensations in this way see Watt, *The Sensory Basis and Structure of Knowledge.*

can have no existence in isolation, but it is also true that the sensation can have no existence without these attributes. These we may call the essential attributes of sensation.

The clearest examples of sensation are bodily aches and pains. A toothache is a sensation in the most popular and in the most technical sense of the term. Now such an ache will be found to manifest a certain characteristic *Quality*, a certain *Intensity*, a more or less clearly defined *Extensity*, 'massiveness' or 'spreadoutness'; *Protensity* or duration, and what is termed '*Local Sign*.' Some of these attributes are certainly essential, and in many sensations all are present, but it has been questioned whether every sensation is endowed with all of them. Many of the questions raised call for discussion in connection with the details of the special senses, but some general considerations call for notice here.

(*a*) *Quality*.—Qualitative differences are of two sorts. When two classes of sensation so differ in quality that they cannot be regarded as species of a common genus, the difference may be called one of kind or of modality. Sounds and colours are distinct kinds or modalities of sensation. Though both are recognisable as sensations, yet there is no common class of sensations to which both belong as sub-classes. On the other hand, blue and green or salt and sweet, do not differ in kind; for both blue and green are colours and both salt and sweet are tastes. When sensations do not differ in kind, it is often possible to find intermediate transitions leading gradually from the one to the other. Pure blue and pure green are connected in this way by an intervening series of bluish-greens and greenish-blues. Obviously there is no such gradual transition between sounds and colours, or between tastes and sounds

It is important to distinguish a quality as a characteristic of a physical object from the same quality as an attribute of sensation. Primarily, qualities are predicated of physical objects: they are not predicated of the sensation. The sky is blue, but the sensation by which I apprehend the sky is a sensation *of* blue or *of* blueness. The road may be hot and fatiguing; the pedestrian hot and fatigued. His sensations, however, are not hot nor fatigued nor fatiguing. They

are sensations of heat and of fatigue. Similarly a sensation of sweetness is not itself sweet.

(*b*) *Intensity.*—When we hear a sound of a certain pitch, its pitch constitutes its quality. But a sound of the same pitch may vary in loudness; this is a difference in intensity; the same quality is experienced more or less intensely—in a stronger or weaker form. Intensity is as unique and irreducible an attribute of sensation as quality. Differences in intensity are analogous in every department of sense, but we cannot directly equate the intensity of a sensation of one modality with that of a sensation of a different modality. We cannot compare the intensity of a sound with that of a smell.

(*c*) *Protensity.*—Every sensation has a sensible duration. A sound, for instance, as an immediate experience, has a different character according as it lasts a longer or shorter time. The sound which lasts a second feels differently when it ceases from the sound which lasts thirty seconds. This is a difference in protensity or duration.

(*d*) *Extensity.*—A further attribute belonging to many kinds of sensations, though it has been questioned whether it belongs to all, is that variously described as 'extensity,' 'extensiveness,' 'voluminousness,' 'diffusion,' or 'spreadoutness.' If you plunge only one finger into hot water and then immerse the arm up to the elbow, the resulting experiences differ otherwise than merely in intensity or quality. They differ also inasmuch as the second is more diffuse or extensive than the first. There is a similar difference between the sensations which arise when a few hairs of the head are pulled and when a large handful is pulled. Again, when a thing is first seen as a speck in the distance and then its appearance gradually grows bigger as it is approached, the change is a change in the extensity of the visual sensation.

It is important to distinguish this attribute from what is ordinarily understood by 'extension.' Extension is an attribute of bodies, which exists, persists, and changes independently of the coming and going of sense-experiences in individual minds. When we walk towards a tree or other visible object, the visual sensation through which we perceive

it increases in extensity the nearer we approach it. But the extension of the thing seen does not therefore alter. When we look at the full moon we have a visual presentation very much smaller than we should have from a frying-pan held out at arm's length. But the extent of the moon's surface which is turned towards us enormously exceeds the extent of the surface of the frying-pan. The extensity of the visual presentation of the moon is not measurable in inches, feet, or miles at all; for these are measures, not of extensity, but of extension. Extensity does not admit of measurement in this way. In fact, the same problems arise with regard to the measurement of extensity as arise in the measurement of quality and intensity. The same kind of law holds between variation in extension and variation in extensity as holds in the parallel cases of quality or intensity and their physical conditions.

(*c*) *Place-Differences and Local Signs.*—An extensive sensation is in a peculiar way complex; it includes within the unity of an extensive whole a plurality of partial sensations simultaneously experienced. The difference between these parts of the extensive whole cannot be ultimately identified with qualitative or intensive difference. It would still exist even if the partial sensations were entirely similar in quality and intensity.

Differences of this kind are separately descriminated and recognised when we assign to the parts definite *places* in the extensive whole, so as to apprehend one as here and the other as there, and so as to be able to determine or attempt to determine their position and their distances from each other. But the mere existence of such 'place-differences,' as we may call them, is by no means sufficient to account for the determinate apprehension of place as here or there. For they may be only implicitly perceived: they may be perceived only in perceiving the whole to which they belong; they may not be severally discriminated.

What this means is well brought out by experiments in which two neighbouring points of the skin are simultaneously touched, *e.g.* by the two points of a pair of compasses. If the two points of the skin are sufficiently far apart, we have

what may be called a perception of 'apartness'; we are aware of two contact-sensations as separated and connected by an interval. But when the points lie nearer to each other this is not so. We then fail to single out separate contact-sensations from the whole tactual presentation. None the less, our sense-experience is not the same as it would be if only one compass-leg touched the skin. The sensation due to the double contact is more extensive or diffused. It is blurred, spread out, and referred to a wider area. The local sign differences are, therefore, still present, though they are not separately singled out. That they are really present is shown by the fact that it is frequently possible to discern the two touches separately when the compass-points are applied successively instead of simultaneously. This is especially easy when the first point is removed before the application of the second.

Another fact which points in the same direction is that the power of perceiving apartness improves greatly and rapidly with practice. Practice cannot create the local sign differences. It can only give greater ability in discriminating them.

We shall find reason for regarding the implicit apprehension of local sign differences as more primitive than the explicit distinction of the parts of an extensive whole and the awareness of relation between them in the way of apartness, position, direction, and distance. The most rudimentary forms of extensity, belonging to other senses than those of sight and touch, and including also, as we shall see, certain sorts of skin-sensation, do not seem capable of this kind of development.

Organic sensations, for example, such as those of hunger, thirst, repletion, headache, etc., are more or less diffuse. But in their case we do not seem capable, except perhaps in an extremely rudimentary way, of singling out the several parts of the extensive whole. We cannot, for instance, separate by lines of demarcation a portion of a diffused stomachache or headache so as to discern the way in which it is bounded by other parts and thus become aware of it as having a definite shape.

The same indefiniteness seems to attach to cutaneous pain-sensations, such as the smart of a bruise or a blow or a burn. Where an extensive presentation is thus apprehended without explicit apprehension of the distinction and relation of its parts, we may say that there is a crude or inarticulate awareness of extensity. On the other hand, where there is explicit apprehension of apartness, position, shape, etc., we may call this developed or articulate awareness of extensity.

More is required for the fixing of places than the mere complexity that is involved in extensity. We shall have to consider further conditions in dealing with spatial perception. At present it will be sufficient to refer to the importance of qualitative and intensive differences as marking off one place from another. Of these there are two classes: (1) those which vary with the way in which the sense organ is stimulated (under this head come such differences as that between blue and yellow, rough and smooth); (2) those which vary not with the stimulus, but with the local diversity of the parts of the sensitive surface on which the stimulus acts; these are known as 'local signs.'

Suppose a uniform expanse of white spread out before the eyes so as to occupy the whole field of view. We can certainly distinguish within it a diversity of places, but we do so only in an indefinite and fluctuating way. We cannot steadily and definitely bound off any one determinate part of the whole; in particular we cannot discern any definite shape.

Now suppose a black spot somewhere on the white surface. The contrast between the blackness and the surrounding white determinately fixes the place of the blot, and outlines its shape. Within the extensity of an organic sensation such as hunger or headache there seem to be no qualitative differences of this kind sharply enough contrasted to demarcate place and bound off shapes. The same holds for smells, tastes, and sounds. Simultaneous smells or sounds tend to coalesce into one complex smell or sound, and extensity belongs rather to this complex than to its components.

How are we to account for the comparatively indefinite discrimination of places which is still possible at any rate for sight and touch, even when there is no appreciable difference

of quality of the sort which varies with the stimulus. It is here that local signature is probably indispensable, and certainly of great importance. Local signs are qualities or sub-qualities which vary, independently of the nature of the stimulus, according as this or that part of the sensitive surface is affected. The right hand feels differently from the left. Contact of a pencil point at the bridge of the nose feels differently from its contact with the tip of the nose. Visual experience differs according as the central or marginal parts of the retina are stimulated by light of the same wave-length and intensity. The ground of this diversity of local signature is to be found in the fact that no two portions of the sensitive surface of the body are anatomically quite alike.

Local signs are more finely differentiated in some sense organs and parts of the same sense organs than in others. In this respect sight is superior to touch, and the centre of the retina to the margin, and the finger tip to the back of the hand. In organic sensations, tastes and smells we must assume that such differences in local sensitivity have been developed only in a very rudimentary way.

In the typical sensation—such as a twinge of pain—all the attributes discussed are clearly present. It is more doubtful whether all are present in every sensation. Quality is universal, and every sensation separately discriminated is referred, vaguely or determinately, to a place.[1] The attribute of intensity has been denied for visual sensations and extensity for sounds, but on the whole the presumption would seem to be in favour of a general uniformity in principle throughout the whole domain of sense experience. This uniformity provides an additional ground for the wider psychological use of the term sensation, as contrasted with that of everyday life. The extension in effect consists only in disregarding for certain purposes the distinction between localisation within the body and localisation elsewhere.

[1] Even where place-differences are not discriminated within a special department of sense, a sensation in that department is distinguished from others of different modality by place differences. Smells, for example, are localised vaguely around the nostrils—they do not blend with organic sensations.

4. The Perception of Form.—The physical world as sensibly perceived is not a mere plurality of disconnected objects. It is a unity embracing a variety of special modes of synthesis or elements of form. In the same way particular sensations arise only within a continuum which manifests a variety of formal elements.

When a series of different sensations belonging to the same class—colours, for instance, or sounds—follow each other continuously so that the end of each overlaps or coincides with the beginning of the next, there arises as an inseparable aspect of the whole successive complex a peculiar experience—the experience of change. This does not consist merely in the fact that one sensation comes after the other. Its distinctive character is that the process of transition is itself experienced in a peculiar way.

One case of the general rule is afforded by the immediate experience of motion. This is closely connected with extensity. It arises within an extensive continuum when a sensation otherwise similar continuously varies in local sign, so that there is no discernible interval between the old local sign and the new. This happens, for instance, when we pass the point of a lead pencil across the skin of the hand, or when we so move the hand that the different parts of the skin touch the pencil point in unbroken sequence. The resulting experience cannot be analysed without remainder into a mere succession of local sign differences. There is also a peculiar aspect of the experience corresponding to the transition between them. Two points in contact with the skin may be so close to each other as to produce contact-sensations which cannot be separately discriminated. Yet, if one of the points moves towards the other, so as even to decrease the interval, the peculiar motion-experience may be distinctly discernible. In this way, the existence of motion may be perceived, when we cannot determine in what direction it is taking place or where it begins.

Another illustration is supplied by sensations in the extreme margin of the field of vision. These are indefinite, so that apart from previous knowledge it is impossible to make out their shape or number. But if they move there is at once a

well marked motion-sensation, although we may not be able to distinguish the direction of the displacement.

Change is only a special case of a more general principle. Any specific sensation or image forms part of a total field in which spatio-temporal forms and other types of unity are as real and ultimate ingredients as the particular items united. Admittedly, the development of experience involves the emergence of new forms which were not perceptible at the outset; but such development does not consist in the intrusion of form into what was originally formless. It is rather that simpler forms are displaced or absorbed by forms of greater complexity.

Even in the most primitive experience the awareness of complex unities would seem to be present. Change is attended to before the specific character of that which changes is discerned, and responses are determined more by the perception of relations than by the determinate perception of the terms related. This is a fact which has been thoroughly exemplified by the experiments of the 'Gestalt' psychologists.[1] It has been shown, for example, that if an animal is trained to select its food from the darker of two grey backgrounds, and if the backgrounds are then varied so that what was previously darker is now the lighter, the animal will tend to turn for its food to the new background—the relatively darker—rather than persist in reacting to the absolute colour of the ground against which the food is presented.[2]

5. Mental Imagery.—As perception of what is actually present here and now depends upon sensation, so the apprehension of objects as past, future, or merely possible depends in general upon images. The question of imageless thought will occupy us later. For the present we may restrict attention to the modes of cognition involving more or less distinct and discriminable images. Just as an object as it sensibly appears

[1] The most accessible account for English students of the work of this school is to be found in Koffka's *Growth of the Mind*, and Köhler's *Mentality of Apes*.

[2] For a more detailed discussion of the perception of form see also the author's *Analytic Psychology*.

to this or that individual under specific circumstances may be called a percept, so, as presented to the individual as merely remembered or imagined, it may be called an idea. The image is related to and distinguished from the idea in the same way as the sensation is related to and distinguished from the percept.

Like sensations, images have commonly been defined in terms of their physiological conditions; they are said, for example, to be immediate experiences of a certain kind which arise in the absence of external stimulation. They are distinguished from sensations through being 'centrally excited.' In accordance with this definition, hallucination and after-sensations are treated as images. This procedure, however, ignores important distinctions to mark which the term 'mental image' is urgently required. Hallucinations possess all the intrinsic characteristics of sensations, and the same applies to the so-called 'after images' due to the continued excitement of the sense organ after the external stimulus has ceased to operate. Images proper, on the other hand, are, apart from special limiting cases, clearly distinguishable from sensation without any reference to the physiological conditions of either. It is primarily the characteristics in virtue of which discrimination is ordinarily effected that call for definition.

We may note at the outset that it is possible for every sensory experience to have its counterpart in an image. We might perceive a succession of lights, sounds, etc., and later live through the whole experience again in terms of imagery. Not only is every special quality of sense capable of being represented in imagery, but every attribute might be duplicated as well. A good visualiser can watch a light moving from one position to another, passing through various changes of hue, brightness, and form, and later 'see' the whole performance repeated 'in his mind.'

In actual fact, however, imagery is in various ways and degrees defective, and in the early stages of development may be absent altogether. But though the defects of imagery in practice assist us in distinguishing images from sensations, they do not constitute the only difference; nor can images properly be defined by reference to these deficiencies.

6. Characteristic Differences of Impression and Image.—(*a*) *Fragmentariness of Image.* Our actual sense-experience at any moment forms a continuous totality. Particular impressions of touch or temperature form an unbroken unity with the mass of impressional experiences due to the constant excitation of the sensitive surface of the skin over the whole body. The impact of sound waves not only produces auditory sensations, but also tactual sensations due to vibrations set up in the external ear and in other parts of the organism. These tactual experiences on the one hand form part of the general mass of cutaneous sensation, and on the other they unite with the proper sensations of sound so intimately that it needs an effort of analysis to distinguish them. Moreover, taste-sensations, being intermingled with touch-sensations of the tongue and palate, are continuous with cutaneous impression in general; and the facts are similar for sensations of smell.

As regards sight, each particular visual impression is part of the total experience due to stimulation of the whole retina, and the entire mass of visual sensation is bound up with tactual and muscular experiences due to position and movement of the eye-lids and of the eye-ball in its socket. All joint, tendon, and muscle sensations enter into the general 'consentience,' as we may call it. Finally, all the special sensations of touch, sight, sound, taste, smell, tendon, joint and muscle are intimately united with the organic sensibility and its varying modifications.

Now in the mental image there is little or no reinstatement of this consentience. The sensory elements of the image are detached from the total mass of impressional experience of which they would form part, if they occurred as actual sensations. If we mentally image a sound, the imaged sound is not part of one continuous whole with the totality of cutaneous, motor, organic, and other sensations occurring at the moment. Whatever sensations are being produced at the time by the impact of sound-waves on the ear enter into the general consentience; but the merely represented sound is outside the impressional context and remains relatively isolated.

The distinction has, in fact, been employed to determine whether a given type of imagery is present at all, as distinct from the mere reinstatement of sensation. Thus Titchener writes: "I could not decide whether my kinaesthetic memories were imaginal or whether they involved an actual reinstatement, in weaker form, of the original sensations. I had no criterion by which to distinguish the sensation from the image. However, as so often happens, I had hardly recorded my difficulty when the criterion was found: a ground of distinction so simple that one wonders why there should have been any difficulty at all. It may be roughly phrased in the statement that actual movement always brings into play more muscles than are necessary, while ideal movement is confined to the group of muscles concerned. You will notice the difference at once—provided that you have kinaesthetic images—if you compare an actual nod of the head with the mental nod that signifies assent to an argument."[1]

In general, we may affirm that all mental imagery as compared with actual sensation has this fragmentary character. The elements revived in the image are cut off from their context, and appear in relative detachment.

(*b*) *Intensity*.—Hume is perfectly right in affirming that percepts differ from images "in the force or liveliness with which they strike upon the mind." But the statement is ambiguous.

We must examine with great care the nature of this force and liveliness, which, according to Hume and others, is distinctive of sensations.

We cannot affirm that a sound or a colour as actually sensed is always louder or brighter than the corresponding image. On the contrary, it would seem that variations in the *degree* of a sensible quality are reproducible in much the same way as variations in *kind*. I may mentally recall the brightness of an electric light, and I may then actually look at the comparatively dim flame of a candle. On comparing the image with the percept, I may recognise that the electric light as mentally revived has a higher degree of brightness

[1] *Experimental Psychology of the Thought Processes*, p. 20.

than the candle-flame as actually seen. It is true that the power of representing gradations of sensible quality varies in different persons, just as the power of representing the qualities themselves varies. But good visualisers seem to possess it in a very high degree. A person so endowed, in giving an account of his mental picture of the morning breakfast-table, says: "I have more power to recall colour than any other one thing; if, for example, I were to recall a plate decorated with flowers I could reproduce in a drawing the exact tone, etc. The colour of anything that was on the table is perfectly vivid."[1] An image is not merely another sensation of weaker intensity. We may, in fact, have an image of a minimal sensation.

We are not forced, however, to reject altogether the distinction between images and percepts as respectively 'faint' and 'vivid.' But we must mean by vividness something different from intensive gradations which may be equally present in impression and image. What is this vividness? The answer seems to be contained in Hume's words. According to him the distinctive characteristic of percepts as compared with images is the force and liveliness with which they strike the mind. This "striking the mind" is the essential point. At bottom the difference is a difference of kind, not merely of degree. Images do not strike the mind in the same way as actual sensations.

To bring out the nature of the difference it will be most convenient to consider first cases in which it is conspicuous. It is most conspicuous where the sensation breaks in upon consciousness in a violent manner, so as to interrupt and disturb the flow of mental activity. A dazzling flash of lightning or the piercing scream of a steam-whistle may serve as illustrations. The shriek of the steam-whistle invades consciousness in a violently disturbing way. There is a sense in which the degree of loudness of the sound might perhaps be mentally reproduced with tolerable accuracy by a person possessed of exceptional powers in this direction. But the mode of occurrence in consciousness would be different. The

[1] James, *Principles of Psychology*, Vol. II., p. 56.

mentally revived sound would not " strike the mind " like the sound as actually heard. No mere image ever does strike the mind in this manner.

In such experiences as that of the steam-whistle the primary impression is by no means the only factor at work. The whole organism receives a shock giving rise to a mass of organic and motor sensations. In ideal revival these concomitant sensations fail to be recalled except in a very imperfect way. It may be suggested that it is their presence in the actual sense-experience which gives to this experience its aggressive character. Now it seems evident that they cannot give an aggressive character to the experience unless they possess this character themselves, and as a matter of fact they are highly intrusive and obtrusive. But if organic sensations can ' strike the mind ' in this way, there is no reason why other sensations should not do so too. The ultimate appeal must be to introspection. This shows in the case of the steam-whistle that the sound itself is aggressive in the same way as the organic sensations which accompany it. The organic sensations follow the beginning of the sound after the lapse of about a second, but the sound itself is aggressive from the outset.

The steam-whistle is an extreme case, involving violent shock and disturbance. But there are abundant instances in which sensations strike the mind without overwhelming it in this painful manner. The chimes of a bell heard as we are passing in front of a church break in upon consciousness with notable force and liveliness. But they need not have a disturbing effect, and they need not be accompanied by conspicuous organic sensations. None the less they have an impressiveness or aggressiveness analogous to that of the steam-whistle.

The same holds true generally of sensations produced by a stimulus which is stronger than we are accustomed to. But there is a certain normal level of intensity of stimulus at which and below which we do not naturally notice the aggressive character of the sensation, unless it occurs suddenly and finds us unprepared. At these lower intensities the aggressiveness of the sensation does not under ordinary conditions catch our

attention: but it would be wrong to conclude that it has therefore ceased to exist. We do not usually take note of what is familiar to us, but only of what is relatively unfamiliar. It is therefore natural that the characteristic of sense-experience which is expressed by such metaphors as 'striking' the mind or 'laying hold' on the mind should normally be noticed only when it is present in an unusual degree of intensity.

Its presence even in these lower phases of intensity may be detected if we pass from the comparison of impressions with impressions to the comparison of impressions with images. If we look at a sheet of white paper, and then, closing our eyes, call up a mental picture of the paper, its brightness as actually seen may be revived with approximate accuracy in the image. But if we again open our eyes, and pass from the mental picture to the actual percept, we may note in the moment of transition a difference which can only be described by saying that the image does not strike the mind as the actual percept does.

We may vary the experiment by first calling up mentally the image of an electric light, and then looking at a dimmer object, such as a candle-flame. The imaged brightness of the electric light is greater than that of the candle-flame; but the actual sensation of brightness which we have in looking at the candle-flame enters and persists in consciousness in a different manner from the mental picture of the electric light. It strikes the mind with some degree of force and liveliness; whereas the mental image does not strike the mind in the same way.

Our conclusion is that at bottom the distinction between image and percept, as respectively faint and vivid states, is based on a difference of kind. The percept has an aggressiveness which does not belong to the image. It strikes the mind with varying degrees of force or liveliness according to the varying intensity of the stimulus. This degree of force or liveliness is part of what we ordinarily mean by the intensity of a sensation. But this constituent of the intensity of sensations is absent in mental imagery. Since it is distinctive of impressions, we may call it 'impressional intensity.' Impres-

sional intensity may depend on suddenness. A slight sound, when we are totally unprepared for it, may enter consciousness in a violent manner; but in the main impressional intensity increases or decreases concomitantly with the intensity of the stimulus. The smaller it is the less effectively will it serve as a mark distinguishing percept from image. Hence when it is very slight it may be practically inoperative. Thus we may fail to distinguish between a very slight sound as actually heard, and the mental representation of it. The possibility of this has been shown experimentally; but it does not, as has been supposed, constitute a valid argument for regarding the distinction between image and percept as merely one of degree.

(*c*) *Distinctness.*—Images as compared with percepts have for the most part a sketchy or schematic character. Part of the filling in of the actual sense-experience fails to reappear in its reproduction, which is therefore blurred and hazy.

This does not apply without exception to all mental imagery. Most persons, if not all, can reproduce in a precise and delicately differentiated manner certain kinds of experience. The internal language by which trains of thought are habitually carried on in human beings is often a very precise reinstatement of signs used in the interchange of ideas between different persons. In many cases words as mentally reproduced are fairly exact counterparts of words as actually spoken. Both sound and motor articulation are revived in a precise and clear-cut way. The image lacks impressional intensity; but its qualitative content is indistinguishable from that of the percept. In some persons the motor activity of articulation is very precisely revived, but the auditory element is absent or almost absent. Others mentally envisage printed or written characters either in addition to, or instead of, internal speech.

Even those persons who can reproduce articulate sounds with maximum distinctness may be unable to recall inarticulate noises except in the vaguest manner. When they make the attempt, they tend to substitute some imitation by the human voice for the noises themselves.

The schematic character of ideal representation is best exemplified in the mental reproduction of the appearance of

material things as they are presented to sight and touch, and explored by movements of the eye and hand. In most persons this reproduction is predominantly visual, though some depend mainly on motor and tactual revivals. We shall here only consider visual imagery. This often includes motor revival: for, with many persons, the 'inward eye' follows the contours of objects and scans their parts successively much as the bodily eye does.

It is well known that there are very great differences between the visualising powers of different individuals. Some few seem to be capable of calling up mental pictures of what they have seen, possessing a vividness, distinctness, and wealth of detail little short of actual vision. But the accounts which these people give of themselves must certainly be accepted in many instances *cum grano salis*. They are usually untrained in introspection, and they probably do not express themselves with rigorous precision. In any case we must make a point of distinguishing between what a man is capable of in the way of visualising when the occasion requires him to do his best and the imagery which enters into his ordinary trains of thought.

We shall see at a later stage that the habitual recall of all the concrete detail of actual perception would in ordinary thinking, such as takes place by means of words, be not only a superfluity, but an encumbrance, destroying efficiency. A man who can call up mental pictures equal in distinctness to the reality is no more likely to do so habitually, than a man who can take very long leaps is likely to substitute these for ordinary walking. Setting aside certain exceptional cases as not yet sufficiently investigated, we may affirm that ordinary visual imagery is more or less sketchy and blurred in comparison with actual vision. In some men, including many of the best introspective psychologists, such as Fechner, it is so very blurred and sketchy that it could scarcely become more so without ceasing to exist altogether. The mental pictures of these persons can scarcely be called pictures at all. They are rather the indescribably attenuated ghosts of pictures. They are, to use Fechner's language, "airy, unsubstantial and vaporous." Persons possessing a much higher visualising

power than Fechner will readily recognise the aptness of these terms as applied to the greater part of their own visual imagery.

Very poor visualisers often find the greatest difficulty in indicating what it is that they actually see with the mental eye. Thus one of James's pupils, asked to call up a picture of his breakfast-table, replies: "There is nothing definite about it. Everything is vague. I cannot say *what* I see. I could not possibly count the chairs, but I happen to know that there are ten. I see nothing in detail. The chief thing is a general impression that I cannot tell exactly what I do see."[1]

This is a somewhat extreme case. But it brings out the point which most requires to be emphasised in this connection. The indistinctness of mental imagery is to a large extent of a quite peculiar character. It is different in *kind* from the indistinctness of percepts such as may be due to dimness of light, distance, and the like. It is also different in kind from the indistinctness of positive and negative after-sensations in the various phases through which they pass. An image is sketchy and schematic, because it contains only an extract from the content of sense-perception. But it is a surprise to most people who subject these images to introspective scrutiny when they discover how the extract is often made. It becomes quite intelligible to them that Alice in Wonderland could see the grin without the cat.

This applies not only to complex objects, but also in the experience of some persons to apparently simple sensible qualities such as colours and sounds. On comparing a certain definite shade of red as imaged with the same shade as perceived, I am able to identify the two as the same colour. But they are the same with a difference which does not wholly consist in absence of impressional intensity. There is a 'filling in' in the percept which is non-existent in the idea.

The comparative indistinctness of images is traceable to various causes. It is partly due to what Ward has called 'obliviscence.' Some parts of the impressional experience have disappeared from the image, simply because of a

[1] *Op. cit.*, Vol. II., p. 54.

deficiency in our power to retain or at least reproduce them. The vagueness of the mental image is also increased by what Ward calls "reduplication." It is the product, not of a single perception, but of a plurality of perceptions which agree only in certain points, and differ in others. Only the points of agreement are recalled in a fixed and definite manner. The divergent details by their very divergence obstruct the process of reproduction. Hence, so far as they are concerned, the image is vague and fluctuating. "One who had met the king but once would scarcely be likely to 'think' of him without finding the attendant circumstances recurring to his mind as well; this could not happen to one who had met the king in a hundred different scenes."[1]

But there is a still more important reason for the comparative indefiniteness of ideal revival. It would be not only useless, but disadvantageous, to recall all the details of impressional experience. A connected train of ideas is in its character conative. It takes place in the service of some practical or theoretical interest. Only so much need be revived as may be required by the dominant interest of the moment; all else being irrelevant would be a mere encumbrance, hindering and embarrassing the course of mental activity.

If I wish to recall what I did yesterday, in order to find out how far I have fallen short of the moral ideal, or for any other practical reason, a few minutes will probably suffice for retrospect. But how is it that I can recall in a few minutes experiences which occupied twelve hours? Only by omission. We simply make an outline sketch, in which the salient characters of things and events and actions appear, without their individualising details. Mere forgetfulness in part helps to make this possible; but there is much also which I do not forget, and yet do not recall. I pass it over simply because it would not help me, being irrelevant to my guiding interest. "If I picture myself as eating my breakfast at the beginning of the day, it is enough to have a generic image of the breakfast-table and the succession of particular incidents which

[1] Ward, *Psychological Principles*, p. 199.

took up the half-hour spent in eating. Hence it is possible for me to recall the whole event of taking breakfast, which occupied half an hour, in the fraction of a minute, and then to pass on to something else."[1]

In general, mental imagery is more detailed and vivid in persons whose interests are concrete rather than abstract. The savage, the uneducated person, and the poet or artist have usually far more power at least of mental visualisation and often of other modes of imagery than the mathematician or the philosopher. As we noted above, persons habituated to abstract thinking have often little or no definite imagery, except reproductions of words.

(*d*) *Relation to Subjective Activity.*—In actual sensation we are relatively passive and receptive, because impressions are determined by a factor which is not psychical at all—the stimulus. What the stimulus does for us in perception, we have to do for ourselves in the case of free ideas. Images are attended to only so far and so long as they connect themselves with the general direction of mental activity at the moment or arouse a new current of activity by bringing into play pre-existing conative tendencies. Impressions on the other hand tend by their impressional intensity to compel attention. If they are sufficiently intense they may forcibly divert attention from the most absorbing train of thought.

Impressions, so long as the stimulus persists on which they depend, display a steadiness which is absent in the case of images. Images are maintained before consciousness purely by an effort of attention; when we are attending to a percept, impressional intensity due to the stimulus co-operates with our subjective activity, steadfastly sustaining it. Now attention is never perfectly fixed and continuous. It flags at intervals and constantly tends to pass from one point to another; it is probably subject to a regular rhythm of remission and concentration Hence the peculiar unsteadiness of images even when we deliberately attempt to arrest and detain them.

As Ward says, the image, in spite of our efforts to fix it, " varies continually in clearness and completeness, reminding

[1] Stout, *Analytic Psychology*, Vol. II., p. 185.

us of the illuminated devices made of gas jets common at fêtes, when the wind sweeps across them. . . . There is not this perpetual flow and flicker in what we perceive."[1] Ward perhaps goes too far in attributing this "flow and flicker" to all mental imagery. The statistical evidence seems to show that some exceptionally gifted persons can maintain a visual image before their mental view without these fluctuations. But even in these cases the detention of the image costs a kind and degree of mental exertion which is not required in attending to impressions and percepts

The same contrast manifests itself in another way when we compare impressional change and transition with the sequence of images. Images, as vehicles of ideas, usually follow each other in accordance with purely psychological conditions; their sequence is determined by preformed associations together with the general trend of mental activity at the moment. The flow of images thus depends on the continuous self-development of the attention-process. Changes in impressions, on the contrary, are only partially initiated by the changing direction of attention. They are determined to a very large extent by alterations in the nature of the stimuli affecting the organs of sense. So far as this is the case they bear the character, not of a continuous development of conscious process, but of something which *happens* in consciousness. This character is most conspicuous when external changes suddenly introduce experiences for which the mind is unprepared, as when the chair we are sitting on unexpectedly gives way beneath us. But even when we are awaiting an event and are prepared to act appropriately when it comes, there is still a certain discontinuity or abruptness in the mode of its occurrence in consciousness as compared with the sequence of ideas in a train of thought. It is not a continuation of our own mental activity; it is something which happens to us, something which strikes upon the mind from without.

(*e*) *Relation to Motor Activity.*—Inasmuch as percepts depend on external stimulation proceeding from surrounding

[1] *Op. cit.*, p. 171.

things, they must vary with the spatial relations of the organism and its parts to environing conditions. Hence our perceptions vary with our movements. We can carry our images about with us; but if we turn our head away or close our eyes we can no longer see what we saw before. In particular the sensations we receive vary with the adaptation of our sense-organs. For most distinct vision we bring the eye into such a position that the rays from the object fall on the yellow spot; we accommodate the lens so that they form a distinct image on the retina, and so forth. The presence of these motor adjustments forms an important distinction between actual vision and visual imagery. The same holds good *mutatis mutandis* of the other senses.

7. Relative Independence of Impression and Image.—Whilst images reproduce all the fundamental attributes of sensation, there is something peculiar and distinctive about their localisation. The subjects of Galton's well-known questionnaire are invited to state where their images are located—in the eye-ball, in the head, before or near the eyes, or at a distance corresponding to reality.

The question is difficult to interpret and discordant replies are received. The discrepancies are not wholly due to individual differences. It is extremely unlikely that anyone naturally localises a visual image in his head or eye-ball, though of course anything can be imagined as being anywhere.[1] Those who refer to visual images being localised in the eye-ball or head are probably referring to the local signature of the sensations of strain involved in imagery. Visual images are normally localised at a distance 'corresponding to reality.' But for them to appear at this distance it is often necessary that we should first imagine ourselves to be somewhere other than where we actually are. If whilst in Scotland we call up a mental image of St. Paul's Cathedral we do not locate the image at a place some four hundred miles away. Such distances do not enter into imagery any more than into

[1] The distinction is analogous to that already drawn between primary and secondary temporal reference.

perception. In imaging St. Paul's we image ourselves as being, say, on Ludgate Hill, from which 'point of view' the image of St. Paul's appears at a distance corresponding to reality. The image of Ludgate Hill, like the image of St. Paul's, is at a distance corresponding to reality—*from ourselves*. But where is the image of oneself? If we say, as it seems we must, that it is where images of the self always are —at the psychologically absolute 'here,' which is the origin of all spatial reference in perception[1] and imagery alike—we are led to conclude that the image of St. Paul's has the positional character of objects about two hundred yards away.

In this respect it is in some sense co-incident if our eyes are open with some actual percept. And this co-incidence is still more clearly evident in imagery which involves no transportation of oneself to another region. If we close our eyes and call up a mental image of what was previously perceived —say the pages of this book—there is no change in local sign. The book is perceived and imaged about eighteen inches away. Nor is the situation affected if, instead of closing our eyes, we cover the pages with a sheet of paper, and image the print beneath.

Now this fact draws attention to one of the most important facts concerning mental imagery. The perceptual and the imaginal fields neither coalesce nor conflict. In either field singly certain qualities are 'incopresentable.' A sensation of red and one of green cannot be presented at the same time and in the same place. As stated by Ward "certain sensations or movements are an absolute bar to the simultaneous presentation of other sensations or movements. We cannot see an orange as at once yellow and green, though we can feel it as both smooth and cool."[2]

But gazing at the blue sky, we may, as Ward observes, mentally picture a portion of it as red instead of blue. Now it is very important to note that most people, while they are imagining the sky as red, do not cease to see it as blue. The

[1] The argument is not affected by the fact that there may be no image of oneself. One cannot, it seems, have an image of what is actually perceived whilst it is perceived, as and where it is perceived.

[2] *Op. cit.*, p. 80.

red does not get between them and the sky so as to hide its blueness. Similarly, in calling up with closed eyes a visual image, most persons find that this image does not form part of the grey field which is due to the retina's own light. It may sometimes appear to be merging itself in the grey field. But when this happens it is in reality disappearing altogether as an image and becoming an impression. The more distinctly it has the character of an image, the more disconnected and independent it appears relatively to the sensations which have their source in the state of the retina.

The case is similar with other senses. I can imagine how the fingers which are now holding my pen would feel if they were dipped in warm water. But the mental image does not annul actual sensation. Similarly, I can clearly distinguish a mentally articulated word, however faint it may be, though my ears are simultaneously assailed by a deafening din. I can also articulate a word mentally when my organs of speech are motionless or engaged in uttering other sounds. Facts of this kind show that percepts and images possess a relative independence.

This independence provides indeed one of the most important marks by which we distinguish an image from a sensation. Normally the whole sensory apparatus is engaged in providing us with actual sensations.[1] Even when nothing is actually touching a given portion of the sensitive surface of the body our total experience is different from what it would have been had this portion been quite insensitive. The intrusion of a new sensation either totally displaces what was previously present or fuses with it. Images do not interact with or displace sensations in this way.[2]

8. Imageless Thought.—An idea can no more exist without an image than perception can exist without sensation. But

[1] Sleep provides an exception. Perhaps it is for this reason that dreams cannot, in the dreaming state, be distinguished from actual impressions.

[2] So far as they do—in such cases as that of 'eidetic' imagery and other forms intermediate between sensation and image proper—they are proportionately difficult to distinguish from sensation.

the image is no more identical with the idea than sensation is identical with perception. The image is only one constituent of the idea; the other and more important constituent is the meaning which the image conveys. If I think about the Duke of Wellington, the image present to my consciousness may be only the shadowy outline of an aquiline nose. But this of course is not my idea of the Duke of Wellington. My idea depends on the cumulative result of many complex mental processes, such as the reading of Napier's *Peninsular War*, etc. If I had been thinking of someone else with an aquiline nose, my mental attitude would have been very different, though I might have had the same image. The same mental image may thus have very different meanings according to context and circumstances. The meaning varies with the train of thought in which the image occurs.

There are some people, especially those who are much occupied with abstract thinking, who are inclined to deny that they have any mental imagery at all. They are almost or quite unable to visualise objects, and their general power of mentally reviving auditory and tactile experiences may also be rudimentary. The images which with them mark the successive steps in a train of ideas are mainly or wholly verbal. What they mentally reinstate in the way of an image is the motor process of articulation, or the sound of spoken words, or both. The words and their meaning are all that are present to consciousness in such cases. Images resembling features or concomitants of the object thought about are absent. But it is inaccurate to say that such persons think without images; for the verbal image is just as much an image in the psychological sense as a visual picture of the object is.

It should be noted, however, that the verbal image is specially adapted for conveying a kind of meaning which the visual picture or other revivals, imitative of the sensible appearance of the objects thought of, can only convey very imperfectly. All higher modes of conceptual thinking are possible only by means of words. To conceive is to think of the general or universal in contradistinction from the particulars which it embraces and connects. If I think of life, for instance, I think of a general kind of process mani-

fested in an indefinite diversity of special ways. The word 'life' enables me to fix attention on the common form of process in contradistinction to its manifold modes of manifestation. A mental picture imitative of the object is less adapted to fulfil this function than the word 'life.' Certainly a mind which depended merely on such pictures or similar images could never have formed the conception of life in general for the first time. An imitative image is adapted to represent some very special and obvious manifestation of life, rather than life in general in contradistinction from its particular phenomena.

Conceptual process may be regarded as a higher development of ideational process. As we shall see later on, the transition is a gradual one, and the germs of conception are present even in rudimentary trains of ideas. What concerns us here is that even the highest developments of conception still involve imagery, though the imagery may be and often is purely verbal, or of the nature of mathematical symbols. In the present chapter we have to deal with the nature of mental imagery in general as distinguished from actual sensations, or, as we may also call them, impressions.

The object of perception is never merely sensation; it is always sensation as meaning something more than its own immediate existence at the moment in which it is being experienced. This meaning is partly original and partly acquired. The like holds good for images. With one important reservation, the original meaning of an impression belongs also to its revival in the image. The reservation is that the *present* existence of external objects is ultimately and directly determined for thought only by actual sensation. Acquired meaning in the case both of impressions and images is the result of dispositions and associations formed and organised by previous processes of continuous attention.

But at this point there arises an important question. Is it not possible for us to think of things without any accompaniment of images? Persons who are not habitual visualisers can understand the meaning of the word 'yellow,' without having any definite image resembling the sensation which they have in seeing something yellow. The only definite image in

their mind may be that of the word itself. Are we then to say that the word suggests a pure thought which does not in any way depend on sensuous experience? We cannot assert this unless we are also prepared to say that yellow would have been thought of in the same way if there had been no previous sensations of yellow, or if these had vanished, like reflections flitting across the face of a mirror, without leaving any trace behind. This seems impossible. The natural hypothesis is that the dispositions generated in previous sense-experience endure and operate, although they do not give rise to a distinguishable image or mental picture.

Why should not these pre-formed dispositions come into operation without the revival of any distinguishable image and yet give rise to at least vague apprehension of what is meant by the word 'yellow'? Such awareness of meaning need not be supposed to consist in pure thought divorced from immediate experience; for the excitement of mental dispositions is undoubtedly sometimes accompanied by vague modifications of experience, peculiar ways of feeling, which do not take shape as images; and it is at least a plausible hypothesis that this is always the case. There is no reason therefore why imageless thoughts in this sense should not occur. As a matter of fact, it would seem that they do occur.

Consider the way in which we apprehend meanings more complex and remote from actual sense-perception, such as that of the word 'wealth.' On hearing or seeing this word, we at once apprehend its distinctive meaning. Yet there need be no sensuous image in the mind except that of the word itself. If there is an image it is bound to be totally inadequate of itself to determine what we mean. We are likely to have some such mental picture as that of a bale of goods lying on a wharf. But this does not enable us to picture what we mean by wealth, but at the most only one small item connected with this very complex concept. A child who has not yet formed the concept so as to be able to understand the word may picture a bale of goods on a wharf just as vividly and distinctly as we do; and the same image might serve equally well for different concepts—for that of a cargo, or a bale, or a seaport, as well as for that of wealth.

Are we, then, to conclude that our apprehension of the meaning of the word wealth is, in the main, an act of pure intellect without any adequate cue, direct or indirect, in immediate experience? We shall see that this is an unfounded supposition, by considering the way in which the word has originally acquired its meaning for us. In part, we have come to annex this meaning to it, because we have heard it in combination with other words and have had to find a sense for it suitable to its context. But this only pushes the question further back. In the long run, words have acquired their meaning through their application in connection with objects directly perceived through actual sensations. The word 'wealth,' for instance, has been applied to piles of goods, to rich cornfields, to abundance of flocks and herds, etc. If the corresponding sensations had not generated mental dispositions and if these dispositions had not been associated with each other and organised in a complex system, we should not be able to apprehend what is meant by the word 'wealth.' When this word is heard, it throws the preformed dispositions as a whole into a state of nascent excitement which is the essential condition of our understanding what the word means in the absence of adequate imagery. If the word be 'health' instead of 'wealth,' a different complex disposition is incipiently stirred by it, determining the direction of thought to a correspondingly different object.

It is not, perhaps, so clear that the nascent excitement of complex dispositions is accompanied by modifications of immediate experience. Here introspection is difficult because the experiences to be observed are, from the nature of the case, vague and elusive. In the attempt to examine them they tend to resolve themselves into series of mental images. None the less, it seems safe to assert that in understanding the word 'wealth' we not only have the intellectual apprehension of a certain object, but feel in a peculiar and distinctive way, and that in understanding the word 'health' our immediate experience is, so to speak, coloured in a different way.

This is most evident where there is an abrupt transition between disconnected systems of dispositions. Puns supply

good examples; we may illustrate by one quoted by Lamb from Swift. "An Oxford scholar meeting a porter who was carrying a hare through the street, accosts him with the extraordinary question: 'Prithee, friend, is that thy own hair or a wig?'" Lamb speaks of the "despondent looks of the puzzled porter." What, we may ask, took place in the porter's mind? Was it merely an oscillation and conflict between one meaning of the same sound and another? Was it not also an oscillation and conflict between two conspicuously different modes of immediate experience?

One reason why these peculiar differences in immediate experiences are so difficult to recognise is that they emerge by insensible gradations. For instance, in reading a book, our total experience at any given stage is mainly determined by our initial view of the subject-matter and by what we have already acquired in reading what precedes. As we read on, each successive word or sentence, taken singly, contributes but little to the total impression: hence the difference which it makes is not separately appreciable.

What is the relation of these vague experiences to subconscious sensations? It has been maintained that there is here no essential difference. The only difference, in this view, is that in the one case we experience sensations which we fail to discern and that in the other we experience images which we fail to discern. When, for instance, I hear and understand the word wealth, there are really in my mind separate subconscious revivals of the special sensuous experiences through which I have learned to apprehend the meaning of the word.

This position, however, seems untenable. It ignores a vital distinction. When I notice sensations of sound, or sight or touch, which had previously been experienced without being noticed, I am usually aware that they were there before, without being noticed. But when I turn my attention to what I mean by the word wealth, so as to resolve it into its constituent details, I get a different result. It is true that if I push my scrutiny far enough, I come upon groups and series of mental images; but it is not true that I recognise them as having pre-existed before they were noticed. On the contrary, I seem to be clearly aware that they were not there

before, and that they emerge for the first time when I distinguish them.

To take a simpler case; when we are trying to recollect definite details, such as a man's name, " what we are trying to recollect seems to waver, now at the tip of our tongue and the next moment completely gone, then perhaps a moment afterwards rising into clear consciousness. Sometimes when asked, say for the name of a certain college contemporary, we reply: 'I cannot tell, but I should know his name if I heard it.' We are aware that we could 'recognise' though we cannot 'reproduce.' "[1] In such instances, our previous experience of the name does contribute to modify in a peculiar way our present experience. But it seems clear that no image of the name arises until the attempt to remember it succeeds.

In general, it is not merely or mainly through images, either distinct or sub-conscious, that the excitement of a complex disposition tells on our conscious life, and conditions the thought of objects which are not directly experienced. It operates also by giving rise to indefinite and not further describable experiences which may be called imageless thoughts.

Sometimes such amorphous objects are all that is objective in the immediate experience relevant to the theme we are attending to. It is true that, in general, the onward movement of thought involves a train of successive images, —images of words if there are no other. But the images do not follow each other quite continuously. There are gaps between them. Though such intervals are empty of imagery, they are by no means absolutely empty. They are filled by immediate experiences which have a quite specific character, although they are vague and indistinct. When, in writing, I have to consider what I am going to say next, my mind may be intensely active and I may have a quite peculiar feeling corresponding to the special nature of the topic with which I am dealing; and yet I may not have a single definite image. The mind may be stirred to its depths without anything floating to the surface.

[1] Ward, *op. cit.*, p. 95.

It is a grave defect of the earlier psychologists, and especially of English psychologists, that they failed to recognise the importance of such vague states in our mental life. No one has done so much as James toward correcting this error. The real state of the case is well summed up in the following quotation from his *Principles of Psychology*.

"The definite images of traditional psychology form but the very smallest part of our minds as they actually live. The traditional psychology talks like one who should say a river consists of nothing but pailsful, spoonsful, quartpotsful, barrelsful, and other moulded forms of water. Even were the pails and the pots all actually standing in the stream, still between them the free water would continue to flow. . . . Every definite image in the mind is steeped and dyed in the free water that flows around it. With it goes the sense of its relations near and remote, the dying echo of whence it came to us, the dawning sense of whither it is to lead. The significance, the value, of the image, is all in this halo or penumbra that surrounds and escorts it—or rather that is fused into one with it and has become bone of its bone and flesh of its flesh."[1]

These vague states enter into the constitution of ordinary trains of ideas. Their function is to fill gaps in which relevant images are absent. When I am occupied with a topic I may find that the onward flow of thought is relatively easy and free: verbal and other images emerge in close succession; but there are occasions when I am arrested by a difficulty in making my thought articulate, in formulating it definitely. I may still continue to be intensely occupied with the whole topic and with a certain phase of it. The system of dispositions connected with it may continue in a state of excitement, and my immediate experience as a whole may have a peculiar colouring, so to speak; and yet my thought may fail to find rallying points in any definitely discernible images.

These imageless transitions may last for a longer or shorter time. Probably they play a much greater part in the mental life of some persons than in that of others. They may frequently occur so transiently as to escape detection. Hence

[1] *Op. cit.*, Vol. I., p. 255.

James may well be right in maintaining that such states, as he calls them, are constantly present as links between imaged ideas. The stream of consciousness on this view is "like a bird's life"; it is "made of alternations of flights and perches. . . . The resting-places are usually occupied by sensorial imaginations of some sort . . .; the places of flight are filled with thoughts of relations, that for the most part obtain between the matters contemplated in the periods of comparative rest. Let us call the resting-places the 'substantive parts' and the places of flight the 'transitive parts' of the stream of thought."[1] It should, however, be noted that the occurrence of imageless thought is not limited to such transitive states. It sometimes yields a comprehensive view of the total result reached by successive steps. "When we have listened to a poem recited," or "to a melody sung," we may forget the words and the tones "while yet all that was in them lives on in an abiding mood of our soul. After the definite outlines" of a landscape "have long disappeared from memory" we may still preserve an indelible total impression. In such cases, "myriads of details are lost, as such, becoming merged and fused in a whole, which we but reluctantly again analyse into its constituents, in order to communicate it to others."[2]

Imageless thought may therefore be recognised as an important factor in our conscious life provided that the phrase is not taken to mean thought that is wholly independent of sensation and imagery. Even where a distinct meaning is conveyed in the absence of a distinct sensation or image, it is conveyed by means of some modification of the objective factor in immediate experience.

Moreover, it must also be recognised that when such meanings become the object of attention, and when they require to be determinately apprehended, this is only possible in the last resource by the resolution of these vague states into determinate sense experience or imagery. Imageless thought is not a higher or super-sensible mode of cognition.

[1] *Ibid.*, p. 243.

[2] Lotze, *Microcosmus*, Bk. V., Chap. III., translated by E. C. Jones. Lotze, however, has in view "the possibility of not only imageless thought, but of purely 'supersensible intuition.'".

CHAPTER III.

ATTENTION.

1. Mental Process in General.—As a result of the foregoing analysis we have found that the individual experient is presented with a world of objects of which he is in various ways aware and with which he is actively engaged in the pursuit of his ends. We may now proceed to inquire more particularly into the nature of the mental life which such relations entail.

Within conative process we can broadly distinguish two directions of mental activity—the practical and the theoretical. Practical activity is that which consists in some form of interference with the objective properties of presented things. In theoretical activity there is no interference.

When I am interested in an object, the satisfaction of my interest may depend partly or wholly on keeping it before my mind or in obtaining more definite and adequate knowledge of it. My attitude may be essentially an interrogative or questioning attitude. I am then active in making the object disclose its nature more fully and unambiguously, without altering it in other respects, except as a means to this end. The end towards which conative consciousness is directed is attained merely by the fuller apprehension of the object, the formation of judgments and suppositions concerning it, the answering of questions and the removal of doubts, the growing distinctness and fullness of the play of imagination, or, in some cases, the mere maintenance of the object before consciousness until interest in it is exhausted.

So far as the work of the mind on its objects is of this kind, it is what we call Attention. Attention is simply conation so far as it requires for its satisfaction fuller cog-

nisance of its object without other change in it. It is thus a subsidiary phase of conation in general from which it can be only abstractly distinguished.

Theoretical and practical activity, though they are abstractly distinguishable, yet constantly blend with and condition each other. The attainment of practical ends constantly requires fuller knowledge of what is aimed at and of the means of obtaining it. To this extent practical interest involves a theoretical interest which takes the form of Attention. Thus, we may have a practical end in view, and we may, for the sake of this end, attend to the conditions and means of its attainment. I may wish to climb a rock, and I first observe it carefully to determine the best mode of ascent. So far, all I have gained is more complete knowledge. This is a partial satisfaction of my original desire. It carries me a stage nearer to my end; but it does so only because it makes further steps possible.

On the other hand, my interest may be theoretical, and fuller knowledge of the object may require me to make experiments with it. If I simply desire to know the geological structure of the rock, mere observation may be sufficient; but it may be necessary for me to climb it or to fracture it in order to discover its nature more fully. Here practical activity subserves theoretical interest.

In dealing with mental life we have thus two interconnected lines of development to consider: the development of cognition, and the development of practical conation. The two phases of growth are so intimately connected that separate treatment is hardly possible and so far as it is possible is only to be justified as a convenience in exposition.

If we consider conation in the abstract, we can distinguish its positive from its negative phase—appetition from aversion. We can also distinguish its varying degrees of intensity and persistence and its feeling-tone. But beyond this all differentiation of conative consciousness is differentiation of cognitive consciousness. This does not imply that conation is secondary to and dependent upon cognition. What is meant is rather that conation and cognition are different aspects of one and the same process. Cognition gives the process its determinate

character: without conation there would be no process at all to have a character.

From this point of view, we may distinguish different levels of conative process as connected with different levels of general mental development. On the plane of perception we have the perceptual impulse; this includes instinctive impulses. Its general characteristic is that the activity involved in it finds immediate expression in bodily movement guided by external impressions.

The perceptual impulse without losing its essential character may involve a certain amount of ideal anticipation. But we reach a distinctly higher plane when ideas become " sufficiently self-sustaining to form trains that are not wholly shaped by the circumstances of the present." " We can 'desire' to live again through experiences of which there is nothing actually present to remind us."[1] The mere ideal representation of an end may be the primary starting-point of an activity directed to its realisation; and this activity may itself partly or wholly take the form of trains of ideas. It is at this stage that the word 'desire' as its most appropriate application. Perceptual conations are better described as impulses.

With the development of ideational thought, higher forms of desire arise. The process of generalisation brings with it generalised conative tendencies. We aim at the fulfilment of rules of conduct instead of the production of this or that special result in this or that particular case. Ideal construction sets before us ends which have never been previously realised. These ends may be so complex that they can only be realised gradually by activities persistently renewed as opportunity allows. The writing of a book, and sometimes the reading of it, may serve as an example. Sometimes the ideally constructed ends are such as the individual recognises to be unattainable in his own lifetime. He can only contribute his share towards bringing them to pass. Sometimes there is a doubt whether they can be completely attained, or even a certainty that they cannot be completely attained. Ends of this last kind are the highest, and are generally called " ideals."

[1] Ward, *Psychological Principles*, p. 281.

Now as practical conation presupposes cognition so cognition presupposes conation. Cognitive development is the product of attention conditioned by retention. The results of prior process provide the basis and starting point for subsequent progress. But apart from attention there would be no prior process to provide a basis at all. We may therefore commence with the study of attention.

2. The General Nature of Attention.—Attention is not infrequently defined as though it were simply identical with mere clearness or prominence in what is presented. But while the two things are intimately connected they are not the same. Some degree of prominence would seem to be presupposed before an object can engage attention at all.

In order that an object may be attended to, it is necessary that it should be separately discerned. But it does not follow that whatever is separately discerned must therefore be attended to. For attention essentially consists in something more than such discernment. It consists in a felt tendency to dwell on the object so as in some way to adjust ourselves to it theoretically or practically. Where there is no subjective interest leading us actively to occupy ourselves with the object, however faintly and transiently, there is no attention.

Clearness and prominence are characteristics of what is attended to—the object of attention; but in this connection the term 'object' suffers from a serious ambiguity. By the object we may mean that with which attention is concerned as it is at the time at which attentive activity is called forth. On the other hand, attention, as fundamentally conative, has an object or end—that to which it is directed, and that which it tends to bring about. In the first sense what is prominent is not the object of attention—rather the reverse.

Attention is not so much concerned with what is already clear and distinct as with what is relatively vague and indeterminate. Prominence, clearness, and distinctness are, however, ends to which attention is directed and which, if successful, the process ultimately bring about. To emphasise the connection between attention and clear cognition is to stress only

the terminal phase of a process which can be viewed, so to speak, from either end.

If I attend to a moving figure on the horizon I may in a sense be said to be attending to the movements of my friend Jones —if that is, as a matter of fact, who the figure turns out to be. It would, however, be less misleading to say that I was attending to a vague and indeterminate figure. It is in fact only so far as it is vague and indeterminate that it occupies my attention, so far, that is to say, as it is not distinct enough for me to say precisely what or who it is and what it is going to do. When it becomes determinate I either lose interest and transfer attention to something else or proceed to some practical adjustment. In either case the work of attention, as such, is at an end. In the former it literally terminates and in the latter it gives place to practical conation.

3. Attention and Inattention.—Let us call the totality of objects which are present to the mind at any one moment the 'field of consciousness.' Only part of this field is attended to; with the remainder we are not actively occupied. Thus the total field of consciousness is broadly divisible into two parts, the field of attention and the field of inattention. This is frequently illustrated by comparison with the field of view presented to the eye. At any moment only those features of the field of view are clearly and distinctly seen on which we fix our eyes, so that impressions coming from them reach a certain circumscribed portion of the retina called the yellow spot. The other parts of the visual field seen, as we say, 'from the corner of the eye' are, in a peculiar way, blurred and dim.

Similarly, the field of consciousness normally embraces a central area of clearly apprehended objects and a marginal zone of objects which are apprehended indistinctly. Now it may not be true that all the clearly apprehended objects are, therefore, attended to; but we may affirm that all other objects escape attention.

To justify this statement it is necessary to define the nature of the indistinctness which is to be regarded as incompatible with attentive awareness. An object is indistinct, in the

sense required, when, though it is present to consciousness, it is not separately discerned. This is the case when it is apprehended only implicitly instead of explicitly. There is implicit apprehension when anything is apprehended in the act of apprehending a whole of which it forms a part, without being separately distinguished as a constituent of this whole. For example, in glancing at a printed page we are distinctly aware of the page as a whole, but not separately of the shape of each individual letter which it contains, especially if the characters are unfamiliar to us, *e.g.* if they are Sanskrit or Russian. In hearing a foreign language for the first time we are aware of a confused jumble of sounds, but we fail to discriminate separate words and syllables. In listening to an orchestra we may clearly apprehend the total sound as a confused mass without discriminating the several tones produced by the different instruments.

Such implicit awareness is called 'sub-consciousness' as distinguished from clear or distinguishing consciousness; and throughout our mental life the contents of our field of consciousness are to a very large extent contents of the field of sub-consciousness, which are indeed present to the mind, but not separately discerned. We are constantly receiving innumerable impressions from things without us and from the varying states of our internal organs, which give rise to sensations experienced but not discriminated.

Suppose that I am reading a book by the light of a candle standing immediately beside me on the table. The object with which my mind is occupied at the moment is the topic treated of in the book; my mind is occupied with this object under the special aspect in which it is presented by the sentence I am following with my eyes. I take no notice of the lines on the opposite page or of other lines on the same page or of the margin of the page, or of the candle flame, as such, or of the surface of the table, or of the clothes in contact with my skin, or of the clock which is ticking behind me.

Yet all these things are producing impressions on my senses, so as to affect my consciousness in specific ways. My total experience would be altered by change or removal of these surrounding conditions. It would not be the same if I were

reading by lamp-light or sunlight or twilight instead of by candle-light. It would not be the same if the book I am reading had no margin, or if the opposite page were a blank. It would not be the same if I were lying on my back holding the book in my hand instead of sitting on a chair with the book lying on the table before me. It would seem, then, that conditions of this kind produce effects in consciousness though neither these effects nor the things which produce them are attended to, noticed, or distinguished. Such unnoted experiences are sub-conscious.

How, it may be asked, can the existence of the contents of sub-consciousness be ascertained at all? If they are not discerned while they are occurring, by what means do we obtain knowledge of them? The answer is twofold. In the first place, they collectively contribute to determine our sense of our general condition and situation at the moment. They form a sort of dim background for the object of distinct consciousness. They "tell on conscious life as sunshine or mist tells on a landscape, or the underlying writing on a palimpsest."[1]

In the second place, we may become aware of the previous existence of sub-conscious contents at the moment in which they cease to be sub-conscious. When the clock stops I notice what has happened though I had not previously been aware of the ticking. But this is not all. I can also become aware at the same moment that the sound of the ticking has previously entered into my total experience without being attended to. Again, the margin of a page which I am reading, so far as it affects my experience at all, does so sub-consciously. But if I cease reading and attend to the margin, noting, for instance, that it is broad or narrow, I am aware that I am not bringing into consciousness something absolutely new. I am aware that the presence of the margin before my eyes made a difference to my experience even before I attended to it.

In general, the distinct objects within the field of consciousness stand out in relief against a hazy and featureless background. Whenever we choose, we can turn attention to

[1] Ward, *op. cit.*, p. 94.

this vague background itself, so as to ascertain more precisely its nature and constitution. We then find ourselves picking out, one by one, item after item of sense-experience, previously undiscriminated. In attending successively to this or that part of the skin, we discern sensations of pressure, contact, temperature, prickling, tingling, etc., which had not been previously noted. "In the same way, attentive listening will at any time bring to [distinct] consciousness noises which would pass unnoticed under ordinary circumstances. It may be the gentle rustling of leaves, the rippling of a distant brook, the droning of insects, or in case these and all other external sounds are lacking, there is still left the sound of the blood as it pulses through the ears."[1]

In like manner, the various sensations are progressively revealed which are conditioned by the state of the internal organs, lungs, heart, alimentary canal, etc.

Now in this process of successive discernment there are two points to be observed. The first is that each item successively distinguished is apprehended, not as isolated and self-complete, but only as a partial feature picked out from a larger whole of experience, containing within its indefinite complexity innumerable other features, not as yet separately discerned. What we are aware of includes always an indefinite background which is never exhaustively analysed. The second is implied in the first. It is that each partial sensation as it emerges into distinct consciousness is apprehended, not as then coming into being for the first time, but as having in some way pre-existed within the field of consciousness before being separately discerned.

Sub-consciousness is not confined to the dim background against which discriminated sensations and images stand out in relief. The discriminated sensations and images themselves may contain sub-conscious constituents. An instance of this is supplied by the sound of an orchestra in which the listener does not discriminate the tones of the several instruments composing it. An equally good illustration is afforded by a note as played on a single instrument, *e.g.* a violin. The note

[1] Pillsbury, *Attention*, p. 6.

is really a compound sensation, being constituted by the union of a number of partial tones which may be discerned by a trained ear; but untrained persons usually fail to detect them and distinguish only the peculiar quality of the total experience, which is called 'timbre,' the quality in which a note sounded on a violin differs from the same note sounded on a flute. Similarly, in rolling a peppermint on the tongue, we are aware of the resulting sensation as a whole, but we do not usually analyse this into component parts; yet it is really complex, as is readily seen when we turn attention to it in an appropriate way. It includes sensations of sweetness, of coldness, and of pungency.

In conclusion, we must consider generally the function of sub-conscious sensations and images in our mental life. Sense-experience, in general, conveys apprehension of objects other than itself—of our own bodies and of the bodies which act on our senses. How far does this hold good for sub-conscious sensations? Inasmuch as the sensations themselves are not separately discerned they do not separately convey distinct items of information concerning the external world. None the less, they have an indirect cognitive value of this kind, inasmuch as such cognitive value belongs to the whole within which they form undistinguished components. We distinguish the sound of the violin through the special quality due to the union of its partial tones, although we may not separately discern the partial tones themselves. We distinguish a peppermint, as such, from an acidulated drop, through the confused sense-experience containing sensations of coolness, sweetness, and pungency, although we may not discriminate these component sensations.

The like holds good for the dim background of sub-conscious sensations against which discriminated objects stand out in relief. This does not yield distinct perceptions of what exists or occurs in the external world or in our own bodies. But it does yield a general awareness of our total condition and situation at the moment. It determines the special point of view from which we regard the world and ourselves; and it thus indirectly contributes to determine our view even of the objects of distinct consciousness.

For the rest, the nature and function of sub-conscious sensations may be characterised positively and negatively. Negatively, we can say that they form no part of the current of consciousness. They do not enter into the flow of experiences through which we become progressively aware of the various aspects, features, and relations of an object of thought or perception. They do not call up other contents of consciousness and enter into combination with them. They do not form part of a stream of thought or train of ideas. Such change as takes place in them is due to change in the conditions affecting the organs of sense. Otherwise they remain motionless fragments. When we speak of 'the stream of consciousness' we refer to distinct consciousness—to consciousness as occupied with distinct objects. Sub-conscious sensations seem rather comparable to the waves of a frozen sea. Another negative characteristic is that they lie outside the sphere of judgment or belief. We do not affirm or deny them of anything, nor do we affirm or deny anything of them. We do not even mentally affirm their existence. We have no consciousness of them which could be expressed in such words as 'this,' 'that,' 'there.'

Positively we may characterise them as follows: though they are not distinctly apprehended, yet their subconscious presence is a condition which favours their emergence into distinct consciousness. If my attention flags in reading my book, I may begin to notice a candle-flame. The visual sensations, which had previously been sub-conscious, cease to be sub-conscious, and become separately discerned, yielding at the same time a distinct apprehension of the candle-flame.

We have described the contents of sub-consciousness as stationary in contrast to the flow of sensations and images. But this immobility is a state of tension comparable to that of a bent spring. They wait in the antechamber of attentive consciousness and keep pressing for admittance with an urgency proportionate to their intensity and to the interest of the objects which they are capable of presenting. It is evident that the more intensely a thing affects my sense the more likely it is to attract my notice. The effect of interest may be illustrated by the way in which the sight of one's own

name on a printed page or the hearing of it in a conversation arrests our attention, though other words equally obtruding themselves on the eye or ear pass unnoted.

Any change in our sub-conscious experience is especially apt to divert the current of consciousness. Thus the clock may go on ticking unnoticed; but if it stops I become immediately aware of the fact.

4. The Conditions of Attention.—We have seen that attention to an object presupposes so much discernment as is necessary for that object to be distinguished from others. We cannot attend to that which we do not discriminate. The contents of sub-consciousness escape attention. So far the conditions of discrimination are conditions of attention. But the object must also be sufficiently indeterminately apprehended to evoke the question: What is that? or, What is it going to do? In the detailed analysis of the conditions of attention we have therefore to consider two groups of factors: (1) the objective conditions of discrimination, and (2) the subjective factors arising from the nature of the conative life of the experient. We may begin by restricting our inquiry to perceptual attention.

At the outset, it is to be noted that such external conditions are by no means the only factors determining which among the things affecting our senses will become distinctly presented to consciousness. The preference among the multitude of competing sense-impressions is also conditioned by our predisposition to be interested, due to the native bent of our minds and to our previous mental development. A chicken notices a small grain of corn while failing to notice other things present to its senses. A cat notes and follows attentively the motions of a bird while paying no regard to buttercups and daisies and blades of grass. Other conditions being equal, a Mozart will tend to notice musical sounds rather than other sensations. The whispered name of his mistress will catch a lover's ear amid the confused buzz of louder noises which pass undistinguished by him. The sight of one's own name on a printed or written page will at once emerge into distinct consciousness, while the other words are not separately discerned.

Other striking examples are supplied by the comparative efficacy of different sense-impressions in awakening a person from sleep. "The medical practitioner, in his first profound sleep, after a laborious day, is awakened by the first stroke of the clapper of his night-bell, or even by the movement of the bell-wire which precedes it. . . The mother, whose anxiety for her offspring is for a time the dominant feeling in her mind, is aroused from the refreshing slumber in which all her cares have been forgotten, by the slightest wail of uneasiness proceeding from her infant charge."[1] It is said that a miser may be roused from profound slumber by placing a coin in his hand where more violent measures fail.

In such cases, the dominating condition which determines the emergence of objects into distinct consciousness is what we may call dispositional interest. There are dispositions, congenital or acquired, which are conditions of conation and feeling; and these become effective in determining the flow of conscious life, the more readily in proportion to the strength of the potential interest. If such conditions as these were the only conditions operative in determining distinct consciousness, distinct consciousness would coincide with attention.

But they are not the only conditions. There are other factors which, so to speak, obtrude objects upon us independently of the interest we take in them. These are found partly in associations formed in the course of past experience. But at present we need consider only those which are connected with the nature of the impressions affecting our senses.

The physical conditions which are correlated with the attributes of sensation—quality, intensity, extensity, etc.—are, of course, necessary conditions of anything being apprehended at all, and therefore of attention. Variations in prominence, however, depend more upon some of these attributes than upon others. Intensity is one of the most important.

The more intense the stimulus the more likely we are to become distinctly aware of the sensation which it occasions. A barrel organ or a German band striking up in the street immediately before an open window will, in general, force

[1] Carpenter, *Mental Physiology*, p. 581.

its way into the distinct consciousness of the student, however zealously he may be pursuing his studies. It is not that he is more interested in dwelling on the intrusive noise than on the problems previously occupying his mind. He will indeed be interested in getting rid of it or escaping from it, and this no doubt forms an incentive to attend to it. But such attention is secondary and derivative. The noise does not, in the first instance, obtrude itself because he wants to escape it. The reverse is the case. He wants to escape and so attends to it, because he finds it thrust upon him and maintaining itself without his leave. The size of an object so far as it determines extensity in the sensation is another important factor. Other things equal, a large object, such as a big building, is more likely to be noticed than a little one; the sea is more likely to be noticed than a small pool. Mere extensity however, is relatively unimportant, and its influence may be counteracted by other factors. What is all pervading tends to be overlooked particularly when it merely constitutes a background of other things.

The influence of position is difficult to assess. In the field of vision, for example, that which is central is normally the object of attention. On the other hand, a movement seen peripherally has a peculiar power of attracting attention.

Quality is a determinant of prominence in that some qualities are much more 'striking' than others, but the strikingness of a quality is not simply a matter of its intrinsic nature. It is partly a matter of contrast. Black is not a more striking quality than white, but a spot of ink on a white tablecloth may be more prominent than its ground. The case of quality is, in fact, only a special case of a principle applicable to all the attributes alike. Mere intensity is not so important apart from contrast and change, and this in proportion to the degree or suddenness of the difference or alteration.

"The noise of the train upon which we are riding passes unnoticed after a short interval, while the whirl of the train which passes on the parallel line, although it does not add greatly to the din, will be noticed at once. The lighting of a candle in a dark room" compels our notice "more than the continuous glare of the sun to which we have been long

exposed."[1] The classical instance is that of the miller who at length fails to have any distinct awareness of the clatter of the mill which he is continually hearing, although he notices at once its cessation or any marked change in it. What happens in such cases may be described as a victory of attentive consciousness over the obtrusiveness of the external stimulus. In the case of the miller, the persistent tendency of subjective interest is to turn away from the monotonous noise of the mill and to dwell on other things. In the long run, this results in the permanent exclusion of the noise from distinct consciousness. It is driven below the threshold of distinct consciousness and passes into the field of sub-consciousness.

An important case of change is that of motion. A moving object enters distinct consciousness far more readily and obtrusively than surrounding things which remain stationary. Objects on the extreme margin of the field of view are not usually discerned. But if such an object begins to move suddenly and rapidly, we become at once distinctly aware of its presence. This influence of movement is marked in all animals as well as in man. " Wild animals are startled by the movements of the hunter, while they fail to notice him if he remain perfectly still. . . A horse shies when a piece of paper is blown across his path, though he would remain unaffected by the same object at rest."[2]

Contrast and change are special cases of the influence of form in the presented field. In general the form of what is presented is more important than the simple attributes of the related items as such. In fact it is only as involved in such complex unities that the attributes are of importance in determining the prominence of an object before the mind. This is still clearer when the form is richly endowed with meaning. The form of a face in a rock or a cloud will stand out when the component elements would otherwise lack prominence.

In such cases there is always a basis for such prominence in dispositional interests connected with specific conative tendencies original or acquired. It may in fact be the case

[1] Pillsbury, *op. cit.*, pp. 28-29. [2] *Ibid.*, p. 48.

that dispositional interest must also be invoked in the case of the simpler attributes themselves. Intensity is a factor determining attention perhaps on account of the fact that intense stimuli generally challenge adaptive conduct. So far as this is the case we are justified in contrasting the objective and subjective determinants not as separable or alternative conditions but as conditions of two kinds, which jointly determine the movements of attention.

The operation of dispositional factors has the further consequence that the prominence obtained by any object under attentive scrutiny will not depend solely upon the degree of attention on the later occasions of discernment. Prior attention is presupposed as a basis for existent dispositions, but with repeated presentation, a given degree of prominence is obtained with increasing ease. In some cases clear discernment is almost automatic. But whilst in this way objects may be clearly discerned where attention is minimal, it may nevertheless be the case, that being prominent, they thereupon engage attentive scrutiny. This is a further question: Do objects, so far as they are clearly discerned, evoke an active mental attitude requiring for its development and satisfaction answers to such questions as: What's this? How am I to deal with this? What next? and so on?

The problem is complicated by the difficulty of deciding when attention is wholly absent. There may be an incipient tendency to occupy ourselves with the object—a tendency which fails to develop because it is immediately overborne by other conditions. In such cases, attention may be so slight and transient that we cannot be sure of its existing at all. None the less, it would seem that we cannot regard all apparent instances of discernment without attention as really instances of faint and evanescent attention.

The best evidence is supplied by what we may call 'marginal' awareness. This is a sort of borderland between attentive consciousness and sub-consciousness. When the mind is wholly pre-occupied in attending to an object, all disconnected impressions are merged in a distinctionless total experience, a sub-conscious background. But such total absorption is for most persons an exceptional state.

In general, the pre-occupation is not so entire as to exclude a dim discernment of surrounding objects, which for any reason happen to be conspicuous at the moment. Such objects, may, then, momentarily slip into the region of distinguishing consciousness, and then slip out again without any appreciable tendency to detain them and consider them further. Thus, while my thoughts are engaged with psychological questions, as in writing this chapter, I may catch myself in the act of striking a match, and may recognise the presence of the flame and of the match-box, but without any felt tendency to occupy myself with them—to be mentally active in relation to them. They simply emerge and disappear without my doing anything to detain them.

Such marginal appearances are, for the most part, transient, and are forgotten immediately after they have vanished. But sometimes they are more persistently maintained by the obtrusiveness of the external stimulus, or some equivalent condition. For instance, in a cinematographic show our whole attention may be directed to the pictured movements of some animal; but flickering lines and spots may keep forcing themselves on our notice, apart from any felt tendency on our part to occupy ourselves with them. Again, it has been frequently recorded that in moments of intense emotion quite irrelevant and uninteresting details may be clearly discerned and permanently remembered, though they are not, in the proper sense, attended to.

It is more doubtful whether the mind is ever in a state of complete inattention, so as to be occupying itself with no object at all. It may be thought that there are states of idleness in which one thing after another flits before our mental view without our concerning ourselves even faintly and transiently about any of them. "If I am sitting at ease, with my mind not dwelling, as we say, on any subject, but wandering aimlessly as I regard some well-known scene, I am what everyone would call inattentive generally. If we keep to ordinary language, I am not attending here to anything at all."[1]

[1] Bradley, "On Active Attention," *Mind*, N.S., Vol. XI., p. 2.

But we have to remember that ordinary language aims, not at scientific precision, but only at a measure of accuracy sufficient for the practical purposes of daily life. Thus, when we say that water is 'pure,' we do not commonly imply that it is absolutely unmixed with anything else, but only that it is pure enough to drink without misgiving. The meaning is that it conforms to a certain practical standard of purity.

Similarly, in ordinary language we may speak of inattention in cases where there is not a complete absence of attention, but only a comparative absence. Thus, we say that a man is inattentive when his mind skips easily from one object to another without steadily or seriously dwelling on any of them. But we ought rather to say that the man is giving slight and brief attention to each in turn—that attention is disjointed and volatile rather than absent altogether. This may happen even when the several objects have no specific interest for him. For, besides specific interests, there is a general interest in being mentally occupied in some manner or degree. It is this general tendency to be mentally active which makes us feel bored when it is denied satisfaction.

A much closer approach to complete inattention is found in certain cases of mental disease. In some stages of mania, the patient ceases to notice surrounding objects, and it is impossible to make him answer questions. A sequence of ideas goes on in his mind, but it is utterly disjointed and incoherent. As soon as he has begun to think of one thing he rushes off to another. Between any two immediately successive ideas, A and B or B and C or C and D, there is discernible some link of connection, but there is none between A and C or between B and D. Further, even the connection which is discernible is of the most superficial kind, such as accidental similarity in the sound of words apart from their meaning. The mind seems hurried on by the play of casual associations without any power of active self-direction. Here, if anywhere, the total mental state may be said to be one of complete inattention.

5. Attention to Displeasing Objects.—A special problem arises with regard to attention to displeasing objects or objects

of the aversive attitude. The end of aversion is to avoid, alter, or abolish its object. Attention, on the other hand, tends to maintain and develop the apprehension of the presented object. So far, therefore, as attention is an invariable secondary tendency in conation, there is an inherent element of conflict in the aversive attitude. Antecedently one would expect that as positive conation involves attention to an object so conative process in its negative and aversive form would involve attention *from* its object—a distinctive shutting out of all that is displeasing. But the mind tends to occupy itself with unpleasing, as well as with pleasing objects. Bad news as well as good is attended to.

The difficulty disappears when we consider that, for the most part, we cannot get rid of what displeases us merely by refusing to think about it. If we lose our ticket when on a railway journey, we cannot arrange the disagreeable situation to our satisfaction merely by dismissing it from our minds and thinking about something else. Active adjustment of some sort is required and this involves attention. If, in trying to solve a problem, we find ourselves obstructed by a difficulty, the difficulty is not removed by ignoring it.

Nevertheless we are justified in supposing that aversion does involve a specific tendency to remove attention from displeasing objects to more agreeable matters, though the tendency may be held in check. The degree to which it is operative and successful will depend upon the extent to which the presence or absence of the object is under subjective control and upon the degree to which the desire to avoid thinking of the object is counteracted by other motives.

The course of perceptual experience is much less under subjective control than is memory or imagination. Hence what is called 'repression'—the tendency to inhibit the process of attention in certain directions—is more fully operative in trains of ideas than it is in perception. It is easier to forget a painful scene than it is to avoid seeing it when it is before one's eyes—though under abnormal conditions the latter form of repression may occur.

Subjective control, moreover, is not merely a matter of volition. Aversion of attention may occur deliberately or as

a result of conative tendencies in our nature over which we have no direct control. The fact that it does not occur more frequently than it does must be explained by reference to counteracting tendencies. It is on the whole much conducive to our well-being to 'face the facts' and adapt our conduct accordingly than it is to endeavour to ignore them.

The capacity to control the primitive tendency to avert attention from what is immediately painful is analogous to other capacities to endure present discomfort for the sake of remoter ends. It varies with the state of health, with mental development, and with individual differences of temperament. One person, finding the sight or the thought of the misery of others painful to him, simply turns aside from it and as far as possible ignores it. In another, the impulse to relieve distress is so powerful that the subject persistently absorbs his attention. One person finding a problem difficult will immediately give it up, whereas the same difficulty presented to another mind will arouse it to more vigorous activity.

From this point of view, we can broadly distinguish two types of character, the frivolous or pleasure-seeking and the serious or strenuous. In the first, the prevailing tendency is to evade and ignore what is displeasing. In the second the prevailing tendency is actively to grapple with it so as to remove or amend it. Harold Skimpole in *Bleak House* belongs to the first type. "All he asked of society was to let him live. . . . Give him the papers, conversation, music, mutton, coffee, landscape, fruit in the season, a few sheets of Bristol-board, and a little claret, and he asked no more. . . . He said to the world, 'Go your several ways in peace! Wear red coats, blue coats, lawn sleeves, put pens behind your ears, wear aprons; go after glory, holiness, commerce, trade, any object you prefer; only—let Harold Skimpole live. . . . Suffer him to ride his rocking horse.'" We are told that he had "composed half an opera once, but got tired of it"—a very characteristic trait.

As an example of the opposite type we may take Napoleon. Napoleon was no doubt ambitious and selfish. But he was not a pleasure-seeker. His aim was not to enjoy the world but to shape and mould it in accordance with his desires.

Conditions which would have formed a paradise for Skimpole would have meant misery for him. He was incessantly consumed by an intense craving for work—the harder the better. His pleasures and pains were the pleasures of success and the pains of failure. If he had written half an opera, he might have grown tired of it; but he would certainly have finished it.

6. The Unity and Continuity of Attention.—We have distinguished the diffuse alertness, which is distributed over the whole field before our mind, from the special process of attention which may be concentrated upon particular features or situations which call for practical adjustments. Such processes have a distinctive unity and continuity. Normally, in this sense we attend only to one thing at a time.

This fact is not contradicted by the results of experiments upon what is called the 'span of attention,' but which might less ambiguously be called the span of distinct apprehension. If a varying number of points, lines, numbers, or letters be momentarily exposed before the eye, it is found that only about five 'disconnected' objects can be simultaneously discerned—so far, at any rate, as immediate reproduction or description can be taken as a test of such discernment. We can undoubtedly embrace so many objects within the focus of attention. But they are only disconnected in the sense that they fall into no familiar or clearly recognisable pattern. They are apprehended as a group, and this implies some degree of unity; and they are generally apprehended as involving a specific arrangement. What does not fall into the group at all cannot be reproduced.

This holds good as a general principle; wherever we attend to many things at once, we attend to their interconnection, so that our total object is a single whole. It is single though not simple. Every item contributes to the answer of the implicit question: What is there? where 'there' refers to a restricted and unified field selected in advance for attentive scrutiny.

The partial features of the total object are apprehended successively as well as simultaneously. Here also experimental

results are relevant. There is a temporal span which is independent of counting. When a series of taps succeed one another regularly every quarter of a second, the subject can just apprehend groups of eight. "If one group (the first member of which is accentuated by a bell) consists of eight taps, while another group (similarly accentuated) consists of seven taps, the subject can, without counting, distinguish the one group from the other; but beyond groups of eight taps his judgment becomes unreliable."[1]

There is, however, unity and continuity of attention for very much longer periods. This applies even in the special case of divided attention. When a person writes one letter while dictating another, or plays two games of chess simultaneously, each task has its own special unity and continuity. There is an oscillation of the mind between the two tasks, inasmuch as attention is specially concentrated now on the one and now on the other. But, even during concentration on the dictated letter, the written letter does not wholly slip out of the field of attentive consciousness. The total object is the problem of writing the one letter while keeping in mind that the other has to be dictated. If we add that when a sentence has been mentally prepared the actual writing or speaking may proceed automatically without further attention, we seem to have a fairly satisfactory account of what takes place.

The successive discernment of the partial features of a single object in relation to each other is especially characteristic of attention. We are mentally active in making the object gradually disclose its nature and relations with increasing fullness of detail. This is what is meant by saying that attention consists in a felt tendency to dwell on the object so as to develop it—to unfold or unroll it.

The development may take place in various ways and by various means. It may consist in the successive discernment of items, already sub-consciously present, as when we distinguish within the total sound of an orchestra the separate notes of the instruments. It may involve the getting of new sensations by active movements of the body and of the organs

[1] Myers, *Textbook of Experimental Psychology*, p. 322.

of the special senses, as when a shop-keeper tests a suspicious coin by looking at it, biting it, and ringing it on the counter; and, generally, in all observation of material objects. Where, in the pursuit of ends, we produce changes in our environment, these changes and their foreseen results form part of our total object, the attainment of the end we are aiming at. In all cases, there are processes of interpreting, identifying, classifying, recognising, etc., by which the object is brought into relation with the results of previous experience as retained and organised in pre-formed mental dispositions. In this way what is fragmentary in it is supplemented and expanded, links of connection are supplied for its relatively unconnected parts, and the whole is fitted into its place in the pre-acquired system of knowledge, belief, and imagination.

The older name applied by psychologists to such processes was 'apperception.' Apperception is involved in all distinct perception and especially in all attentive perception. When we see the wet ground, its wetness is not an original datum of sight, but one of touch. Its connection with a peculiar visual appearance has been learned in previous experience. When a thing looks smooth, all that is given merely through visual sensation is the lustre or sheen of the surface; the smoothness is primarily perceived by touch and comes to be connected with the visible appearance through association. In general, when we look at any thing only one side of it is visible, the other side is not seen but suggested. When we say that we hear someone's footstep on the stair, all that we are aware of through the ear alone is a sound of a certain kind; that the sound is due to a footstep, that the footstep is that of some particular person, and that it is on the stair, all this is an interpretation based on previous experience.

These are obvious cases; but it is a main part of the business of psychology to show the same process at work where it is by no means so obvious, to show how very little, comparatively speaking, can be ascribed to the original data of sense and how much is due to apperception. One instance of this may be given here by way of illustration. In reading, only a very small proportion of the printed matter is brought within the area of distinct vision so that the shape of the

letters can be directly recognised. "Erdmann and Dodge proved that the eyes in reading do not move constantly and smoothly over the line, but go by a series of short movements with rests between." The individual letters are discernible only when the eyes are at rest. "It is quite easy to determine from the length of the line and the number of rests, the number of letters which are read at a single glance. It was found that this was considerably greater than the number that could fall at one time on the area of the retina sensitive enough to permit them to be read. The other letters must, it is evident, be supplied by association from the material gathered in earlier experiences."[1]

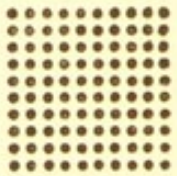
Apperception may take place easily and rapidly, or it may involve a more or less complex and prolonged process. It is easy and rapid, for the most part, in the case of familiar things in familar surroundings. It is longer and more complex where the object is comparatively unfamiliar or is presented in a novel situation. The same is true even for the familiar, when our general mental development has raised new questions concerning it so that we apprehend it in a new light. Before a man has learned geology a stone may immediately find its place in the general context of his experience. But after he has become a geologist, hours of study may be required to adjust it to his new system of ideas. Now, the more readily and rapidly apperception takes place the less attention it requires, and the more difficult it is the more attention it requires. Where there is not sufficient interest in developing the object, apperceptive processes, otherwise possible, fail to occur.

7. **The Effects of Attention.**—The effects of continued attention have already been indicated in the preceding section. In general, attention has a twofold function in the development of objects; in attending we seek to mark and keep distinct from each other the various parts and aspects of the whole with which we are dealing; and at the same time we seek to apprehend more fully and clearly the interconnection of these distinct features within the unity of the

[1] Pillsbury, *op. cit.*, pp. 117-18.

whole. Both the distinctions and the relations are ultimately founded on the nature of the object. But, in part, they may be introduced or at least emphasised in other ways depending on our own initiative, and our apprehension of them in part depends upon conditions other than our own initiative. It may, however, be furthered by subjective activity. So far as this is the case cognitive development is the product of attention.

The results of this activity have already been referred to as clearness and distinctness of discernment or as prominence in consciousness. But this 'clearness and distinctness' calls for further examination. The latter term primarily implies differentiation or contrast. An object sometimes becomes distinct by its lines of demarcation being emphasised by qualitative contrast between the object and its ground. This is seen in the case in which increasing distinctness is involved in the approach of an object or in its transference from the margin to the focus of vision. A square composed of dots, such as that in the accompanying figure, when seen at a distance or by oblique vision, appears as a uniform grey, hardly distinguishable from its background. As it approaches or moves to the centre of vision the contrast between it and its ground becomes more marked, and it is distinctly apprehended as a square.



But such differentiation is emphasised and hastened by attention, and attention may favour the appearance of distinction where objective differentiation is lacking. At close inspection the square may be perceived as composed of dots arranged in rows or as dots arranged in columns. Both are equally there, but the difference in the two ways of apprehending the total object does not depend upon any change in the object apprehended. The distinction of an

individual row may in part depend upon qualitative differentiation. The dots composing it seem to be a deeper black, whilst the others are absorbed into the relatively undifferentiated ground. Similarly the intervening spaces which unite the dots into a single line may undergo a similar variation.

But qualitative contrast alone will not account for the distinctness of an object seen. A group of dots can only be apprehended as a line by the perception of the form of their arrangement. So far as distinctness depends upon the progressive emergence of contrast, so far it admits of degrees. An object is more or less distinctly apprehended according to the degree of contrast involved. The line, however, is either distinctly seen or it is not seen at all. When we see the square as composed of rows we do not see the columns, and when we perceive the columns the rows are out of mind.

The term 'clearness' covers various characteristics. Frequently it is treated as a synonym for 'distinctness,' and very commonly 'clearness and distinctness' is employed as a unitary phrase with a single unanalysed meaning. Some psychologists have treated clearness as a simple and ultimate attribute of sensation co-ordinate with the attributes commonly recognised. But co-ordinate, at any rate, it certainly is not. It may qualify an object in respect of any of the ordinarily recognised attributes; quality, intensity, extensity, and so forth may each be clearly or obscurely apprehended. Attention to an object makes its quality clearer when, for instance, we test a tobacco or a wine; it may render extensity clear when we compare the size of one thing with another. The intensity of a sound is clearer when we make an analogous comparison in respect of loudness. In general the clearness of this or that attribute depends upon the direction of attention; it varies according to the character of the object evoking interest.

This clearness is not simply a matter of distinctness. The determinateness of the character attended to is very largely involved. When an object passes quickly before our eyes it may be perfectly distinct in the sense that it is contrasted vividly with the ground, but our knowledge of its attribute is wholly indeterminate. It is coloured, and 'darkish,' but what

specific colour it is we cannot say. The same applies to size and shape. We can affirm that it was larger than a fly, but smaller than a bird, and that it was too angular to be a ball. In other words, we can define it in general terms, but cannot assign determinate characteristics. In general the first vague awareness that awakens attention is awareness of an object which can only be indeterminately described. The work of attention is to replace indeterminate by determinate cognition.

In addition to increasing the determinateness of the apprehension of characters of the object attended to, attention produces certain specific changes in the attributes of the sensations involved in the perceptual process. The intensity is heightened, duration increased, and the order of the arousal of different sensations to some extent affected. It does not matter whether we say that attention increases or distraction decreases the intensity of sensation, the fact referred to is the same: within certain narrow limits the intensity of the sensation varies with the degree of attention accorded. By listening carefully we can just hear sounds which otherwise would be below the threshold of discrimination. If two sounds corresponding to identical stimuli are compared, one under conditions of maximal attention the other with attention diverted, the former will be judged the louder.

Similarly the duration of the sensation is said to be increased by attention, but here the direct evidence is not conclusive. Much more certain is the fact that of two simultaneous stimuli the one expected and attended to rises into clear consciousness more rapidly than the other. *Ceteris paribus*, "for a flash of light to be perceived earlier than a momentary sound, the light must precede the sound by from 60σ to 100σ [thousandths of a second]; when this interval falls to about a quarter of this value the sound is 'perceived' before the light."[1] But the direction of the subject's attention makes an important difference. In one case, for instance, it was found that when expectant attention was directed to the expected sound, "the latter apparently preceded the light stimulus, when actually it followed by an interval of about 50σ."[2]

[1] Myers, *op. cit.*, p. 315. [2] *Ibid.*

These facts find a ready explanation in the general function of attention. It is the function of attention to facilitate cognition, and cognition is facilitated by increasing the intensity of the sensation, by facilitating its rise into consciousness and by maintaining it until discrimination is complete.[1]

Parallel with the development of cognition of the object's sensible attributes, there is a growth in the apprehension of its nature as an organisation of partial components. The central object of attention is distinguished from its ground, and its parts are similarly distinguished and related. Here, too, the process depends in part upon external conditions and in part upon our own initiative.

This is well illustrated by the way in which we tend almost irresistibly to introduce a rhythmic grouping in series of impressions recurring monotonously at regular intervals. Thus, in listening to the ticking of a clock we accentuate alternative ticks, so that what we apprehend is not tick, tick, tick, etc., but tick-tack, tick-tack, etc. Similarly, in attending closely to a group of dots or lines we tend to divide them mentally into smaller groups having a definite arrangement, although their actual distribution may be indifferent to the order which we give them.

Another way in which we may introduce an order and distinctness into the object, which is not directly found in its own nature, is by transferring to it the character of some other object more or less like it. This is the method used in illustrative metaphors and similes. The stars are distributed in more or less distinct groups; but the human mind has increased for its own apprehension both the internal unity of each constellation and its distinctness from the others by assimilating them to the figures of well-known animals and other familiar objects: the Great Bear, the Little Bear, the Wain, etc. But the most important artifice of this nature is the use of arbitrary marks or signs. The robber in the Arabian Nights applied this device when he made a chalk mark on a

[1] These facts, together with the experimental evidence, are formulated by Titchener under the title of "Laws of Attention." See *The Psychology of Feeling and Attention*. New York, 1908.

door to mark off a particular house from other houses similar and similarly situated.

All use of language comes under this head. In attaching names to objects of thought we fix for permanent reference both their internal unity and their distinction from each other. The permanent possession by the mind of a complex idea as part of the current coinage of thought depends very largely on whether it has a name annexed to it or not. Thus, as Locke remarks, "killing a man with a sword or hatchet are looked on as no distinct species of action; but if the point of the sword just enter the body, it passes for a distinct species; as in England, in whose language it is called stabbing." Though the complex object may in the first instance be apprehended without the name, yet the name is "the knot which ties its parts fast together.[1]

The unity thus imposed by subjective activity always presupposes some unity in the nature of the object itself. Such unity may vary greatly in kind and degree; but in all cases it is clearly distinguishable from any of the parts combined or all of them together. The relation or form of combination has always to be considered as a separate factor, giving a specific character to the whole. "By transposing a tune from one key to another, we may obtain two entirely diverse aggregates of notes, and yet the melody may remain unchanged. On the other hand, by varying the order of the notes two distinct tunes may result from the same collection of tones."[2] The same holds good for the interval between any two notes. There may be the same interval between different pairs of notes, or a different one between the same notes when their order is inverted: and in either case the whole complex is different.

Similarly, the metrical form of a sonnet or of a hexameter line may remain identical though its component words and syllables may be varied throughout; a red triangle on a green background has a formal identity with a blue triangle on a yellow background; the general form of a syllogism in Barbara

[1] Locke, *Essay on Human Understanding*, Bk. III., Chap. 3, § 10.

[2] Ward, *Encyclopaedia Britannica, Eleventh Edition*, Vol. XXII., p. 593.

remains the same in spite of variation in its terms. The progression, 1, 2, 4, 8, 16, etc., is identical in its form of unity with the progression 3, 6, 12, 24, etc. The gradual fading of a blush is formally akin to the gradual dying away of a sound.

A complex whole is characterised by its specific form of unity has attributes which do not belong to any or all of its parts; and inversely the parts may have attributes which do not belong to it. A heap of stones may be a pyramid, though no single stone is a pyramid; each stone may be round, though the heap is not round. An animal may pursue or lie in wait for its prey; but we cannot say that the animal's legs or head or tail pursue the prey or lie in wait for it. A triangle is a closed figure. But its lines or angles are not closed figures.

It is above all important from the psychological point of view that a whole object in its unity has a distinctive function and value as a factor in mental process, different from that of its parts. A melody yields a pleasure which is not due to its component tones considered apart from their union. The same holds good of pleasing combinations of colours or lines or movements. The line "Thoughts that do often lie too deep for tears" affects our sensibility in a peculiar way; but if we take away any of the component words, or alter their order, the effect is lost. Similarly, a discord is displeasing when the discordant tones are in themselves pleasing.

Again, an object as a whole has associations which do not belong independently to its parts, and so may call up ideas which its parts fail to recall. Certain lines drawn on paper may in their union irresistibly suggest a man swimming in the sea, whereas severally they have no such effect. They have no such effect even when they are all apprehended, if they are not apprehended in the right order and combination. This is well shown in puzzle pictures, where a figure may, in a sense, be before our eyes for a long time before we are able to see it. The several constituents, or *disiecta membra*, are all perceived. But they do not suggest, for example, a man swimming until they are detached from their other relations within the picture and apprehended in a special connection with each other. To take a simple instance, the word 'man' as a

whole calls up the idea of 'human being,' but no such association attaches to its several letters or to all of them together unless they are united in an appropriate way.

The unity of a complex object varies greatly in degree, according to the nature of the object. Any closed figure, as such, is a unity; but a regular figure is more so than an irregular figure; for its parts are combined according to a uniform rule of construction. For the same reason a line of verse, in virtue of its metrical form, has more unity than a line of prose. A concord is a more intimate unity than a discord. An army has more unity than a mob; and an army with a leader has more unity than an army without a leader.

It is the function of attention to bring to light whatever unity may be inherent in the nature of its object. This process of discovery is often prolonged and gradual, each stage preparing the way for the next. Planets, for instance, move round the sun in regular periods: but in what precise path and according to what precise rules? The intense and prolonged attention of Kepler discovered answers to these questions, which are formulated in his three laws of planetary motion. Planetary motion was throughout his single object: and it was in the development of this object, so as to define more fully and precisely the kind and degree of unity belonging to it, that he discovered his three laws.

Among the most important of the effects of attention are the differences it makes to subsequent experience. We know in general that we remember the things that we attend to. This is a special consequence of a much more comprehensive principle—the general law of retention. Cognitive development can only be understood by considering attention in conjunction with retentiveness. The facts relating to the latter require a chapter to themselves.

CHAPTER IV.

RETENTIVENESS.

1. Retentiveness.—Retentiveness in some form is an indispensable condition of development or progress of any kind. Advance would be impossible unless the results of prior process persisted as the basis and starting-point of subsequent process. In marching, each step has its point of departure from the new position secured by the previous step. In marking time there is continual reversion to the same position and no advance. No house could be built if each brick vanished as it was laid, and had to be replaced anew. A rope cannot be formed of dry sand, which crumbles away as it is put together. Similarly, mental development would be impossible unless previous experience left behind is persistent after-effects to determine the nature and course of subsequent experience. These after-effects are called, in psychology, 'traces' or 'dispositions,' and the psychological law of retentiveness may be stated as follows: *when and so far as mental development takes place through mental conditions, it does so because specific experiences leave behind them specific traces or dispositions, which determine the nature and course of subsequent process, so that when they are modified it is modified.*

Prima facie, the persistence of dispositions is not absolute; they tend to decay, and may perhaps disappear altogether if they are not maintained by renewal of the corresponding mental processes, or of mental processes connected with these. In this respect there is a great difference between different individuals. Some are more retentive than others. But even in the most retentive minds, traces tend to fade away: "so that if they be not sometimes renewed by repeated exercise of the senses, or reflection on those kinds of objects which at first occasioned them, the print wears out, and at last there remains nothing to be seen." Thus the experiences, "as

well as children, of our youth, often die before us; and our minds represent to us those tombs to which we are fast approaching, where, though the brass and marble remain, yet the inscriptions are effaced by time, and the imagery moulders away."[1]

It is, however, sometimes suggested that nothing is ever really forgotten. Sometimes seemingly trivial details from early life are revived in dreams or hypnotic states; and it is suggested that all that appears to be forgotten is really retained though inaccessible for recall under normal conditions. But the evidence from these cases also goes to show that the trivial details revived under these special circumstances are only seemingly trivial. The presumption remains that what is really trivial is really forgotten, and that in this real forgetting there are individual differences. They are in part, at least, differences in original endowment. As Locke remarks, some minds retain the characters drawn on them "like marble," others "like freestone," and others "little better than sand."

2. The Facts of Retention.—Stress has already been laid on the distinction between objects which are immediately experienced and those which are not. Sensations and mental images or copies of sensations are the most obvious examples of the former. A pressure-sensation or a sound-sensation, for example, actually exists only in the moment in which it is actually being experienced.

On the other hand, in being aware of a pressure-sensation we also are cognisant of something which presses, and in being aware of a sound-sensation we mentally refer to something as its source. In general, the apprehension of immediate experiences in the way of sensation carries with it the apprehension of objects which are not immediately experienced—objects which are thought of as having a being independently of what passes in our mind in the moment of our becoming cognisant of them.

Now it is clear that originally our awareness of other objects is conditioned by sensations. In apprehending things

[1] Locke, *Essay on Human Understanding*, Bk. II., Chap. 10, § 5.

as rough or smooth, hard or soft, we must have special touch-sensations; in apprehending them as red or green we must have correspondingly special colour-sensations; in apprehending them as sweet or salt we must have appropriate taste-sensations. In general, the mind is dependent on immediate experiences for the cues which at any moment determine the direction of thought to objects which are not immediate experiences. It is the function of sensations to enable the mind to refer to objects other than themselves.

Retentiveness, association, and reproduction seem, in general, to involve the same principle. It is only because sensory experiences leave behind them traces or dispositions that the connected objects are capable of being retained or revived. In recalling to mind the colour of an orange, I am very likely to do so by means of a mental image, which is a revival of actual sensations which I have experienced in seeing oranges. Here, the actual sensations have, in disappearing, left behind them a disposition which makes possible the mental image, and this, again, gives a cue to the thought of yellow as a quality of an external object.[1]

In tracing the development of cognition we have thus two parallel and connected lines of growth to consider. On the one hand there is the increase in the range and complexity of thought; and on the other, there are the changes in immediate experience through which objects are brought before the mind.

At its simplest, retention is shown by facilitation and inhibition. The occurrence of any experience or the performance of any action facilitates the recurrence of that experience or the repetition of the action. Inhibition is the negative side of facilitation, whatever facilitates the recurrence of a given process is so far a bar to the recurrence of certain others.

Continuous with facilitation but going beyond it we find certain modification of experience on the basis of prior process. What is again presented is not only more easily apprehended but is presented as familiar and with acquired meaning.

[1] The only qualifications required to this general statement are those noted in Bk. I., Chap. II., § 8.

Under this general head various special cases require to be distinguished.

A third level of development is one in which the meaning of sense-impressions becomes more explicitly defined in terms of imagery. At this level what is presented is only in part sense-given, but what is given through images is inseparable from it. This is the level of ' complication,' ' preperception,' and of ' tied ideas.'

Finally we reach the stage of ' free ideas.' Here thought is conditioned by images which are sufficiently distinct from impressions to admit of being variously associated and combined in free imagination. This is also the level of memory proper as distinct from retentiveness in general.

3. Facilitation and Inhibition.—When attention is directed upon an object the object is at first only obscurely and indeterminately apprehended. But gradually its characteristics, its parts and their interrelations are discerned so that it is finally presented as a complex, differentiated, and ordered whole. The dispositions formed by this process facilitate the perception of similar objects later. On re-presentation the process of discrimination is effected with greater speed and ease. The influence of prior attention in making subsequent attention to the same or kindred objects more effective is of fundamental importance in the development of our mental life. Apart from forgetfulness, the general principle is that the results of previous attention-processes are carried forward into subsequent process and constitute a basis for further operations, so that the mental work which has been already performed does not need to be done over again.

It is to the habitual direction of attention that we must ascribe all special power of discriminating and interpreting sense-impressions which does not depend on superior delicacy in the organs of sense. A savage will discern a snake from a withered branch, or distinguish and identify an animal in the distance, where a civilised man entirely fails. But careful investigation has failed to show any superiority in the eyesight of the savage. His greater power of discrimination in certain directions is due to practice beginning in childhood and

continued throughout his life. The same savage who can track game where his white companion can discern no trace of it would be reduced to tears and despair if he were condemned to pick out the inverted s's on a page of print.

The special development of touch discrimination in the blind, shown, for instance, in their reading of raised print, is also due to the habitual direction of attention to tactual impressions. Where hearing as well as sight is absent, as in the case of Helen Keller, it has been found possible to acquire the power of following oral speech intelligently by touching the lips and throat of the person speaking.

Progressive differentiation is a corollary of this principle. Were it necessary only to reach the same degree of discrimination as that previously attained, the effects of retention would be restricted to increasing ease and speed. There is, however, always more to be discerned. Consequently the importance of retention does not so much reside in favouring rapid recapitulation as in promoting further advance. In many trades and professions powers of discrimination are acquired which far surpass those of the untrained man. "The steel-worker sees half a dozen tints where others see only a uniform glow."[1] The seaman "makes out the distinct 'loom of the land' where the landsman can detect nothing but an indefinite haze above the horizon line."

Inhibition is the negative side of facilitation. Whatever facilitates the occurrence of one mental process will act as a hindrance to the occurrence of some other. Experiments carried out by Professor Pillsbury clearly illustrate this fact. Printed words variously mis-spelt were successively exposed on a screen for a period of about one-fifth of a second. The subject of the experiment was called on to read off these words. He did so for the most part incorrectly, and most often without noticing the wrong spelling. Here, frequent prior perception of the correct form facilitated the perception of this form and inhibited the perception of the actually presented letters.

When some other word having association with the word about to be shown was called out before the exposure was

[1] Ward, *Psychological Principles*, p. 76.

made the result was always a great increase in the number of mis-spellings overlooked. "In only a very few cases did the word called out suggest the word to be shown before the latter was seen, and then the misprints were observed quite as frequently as at other times. In most cases, the relation between the two words was noted after the printed word was seen. In such cases, the association helped the entrance of the word. It seemed to confirm the results of the visual impression, and to give a feeling of confidence that the word seen was the word intended."[1] The words called out, though they did not of themselves actually reproduce other words, yet facilitated the perception of one word rather than of another.

Similar cases are familiar in the sphere of action. The acquisition of one skilled movement will inhibit the learning of certain other movements. The use of a typewriter may interfere with the movements required for playing a piano. Possibly no two processes are wholly neutral and independent in relation to one another. One tends to hinder the occurrence of the other if and so far as it does not facilitate its occurrence; and so far as one is retained so far will it facilitate or interfere with subsequent recurrence of the other.

4. The Acquirement of Meaning.—A sense-impression or image has meaning in so far as it refers to something other than itself—in so far as it enables us to think of an object. To say that it has meaning is to say that in experiencing it an object is brought before the mind, that we know of the existence and, in some measure, of the nature of what is presented.

Not all meaning is acquired. A certain visual sensation, by processes which we have yet to consider comes to mean an orange. But we need not assert that the visual sensation has no original meaning of its own, distinct from what may accrue to it through its connection with other presentations. It may be that of itself, when it is apprehended with sufficient distinctness, it is inseparably connected with the thought, however vague and rudimentary, of an external object. The

[1] "A Study of Apperception," *American Journal of Psychology*, VIII., 3.

sensation of yellow carries with it the thought of something yellow. On the other hand, our apprehension of the yellow thing, as something rough to the touch, juicy, having a certain odour and taste, etc., is not part of the original meaning of the visual presentation. It has been acquired, and acquired in the first instance through primary retentiveness conditioned by the conative continuity of attention.

The first stage in the acquirement of meaning is that which is correlated with the formation of what we may call a 'cumulative disposition.' Retentiveness is manifested not only in the facilitation or inhibition of perceptual processes qualitatively alike, it modifies subsequent experience in certain peculiar ways, which can only be explained by reference to the progressive changes which take place in the disposition left by prior process. In continued attention to the same total object a disposition is formed which may be called cumulative, since it is the resultant of the entire process as a whole. Continued attention is, in fact, only possible on the basis of the progressive formation of such a disposition. At the same time this cumulative disposition is itself subject to modification by each new sensation as it emerges. Ward has given an example which partially illustrates this point.

"Suppose that in the course of a few minutes we take half a dozen glances at a strange and curious flower. We have not as many complex presentations which we might symbolise as $F_1, F_2 \ldots F_6$. But rather, at first, only the general outline is noted, next the disposition of petals, stamens, etc., then the attachment of the anthers, form of the ovary, and so on. . . . It is because the traits first attended to persist that those noticed later form an addition to them so that the complex at length may be complete."[1]

This example excellently illustrates the working of retentiveness where there is continuity of interest. But it does so only partially and for a special case. The case adduced is one in which earlier apprehensions recur as separate discernible parts of the same simultaneous whole with the later. The process by which the earlier apprehensions were

[1] *Ibid*, p. 81.

originally formed is not itself repeated, inasmuch as the preparatory dispositions left behind by previous experience render it unnecessary. Hence, there is room for further advance—for growing distinction and definition within the total presentation. But with the new distinctions the old also are combined in the same complex whole. This is one of the ways in which pre-formed dispositions may operate. But it is by no means the only way. The persistent traces of past experience may modify present experience and be modified by it, without reappearance of the detailed content of the past experience in the actual moment of present consciousness.

The effect of rhythmic repetition of the same stimulus is peculiarly instructive, because the external occasion of each successive impression is throughout the same, so that modifications of consciousness arising in the course of the process must be due to the working of retentiveness—to the cumulative disposition left behind by previous impressions. The sequence of physical stimuli is a, a, a, . . . , the sequence of mental states is a_1, a_2, a_3, . . . The mere fact that a_2 comes before consciousness as a *repetition*, as *another* of the same kind, constitutes an important difference between it and a_1. But, besides this, there may be a gradual modification as the series advances, until a point is reached in which each new impression produces an effect relatively so small, in comparison with the accumulated result of previous impressions, as to be inappreciable.

This is well brought out in experiments on the 'span of attention.' The purpose of these experiments is to ascertain how many successive objects of a certain kind can be apprehended as a single group. It is found that, after hearing as many as eight successive sounds at regular intervals of, say, a quarter of a second, the subject is then able to distinguish this series as a whole from another equal or unequal to it. Counting is not admitted, and the successive sounds are, of course, not all simultaneously discriminated at the close of the series. This is evidently a cumulative effect.

Apart from special experiments in the laboratory, anyone can easily verify the statement that successive series of a rhythmic character can at their close be apprehended as a

whole without mentally reproducing and discriminating in the moment of apprehension the several sequent parts which compose them. Thus, in walking, we may mentally divide our successive steps into distinct groups, and be aware without counting when one series ends and another begins. We need not even know the number of steps which are grouped in this way within a single series. We may simply begin by walking a certain number of paces without counting them, and then as we proceed mark the points at which the initial series has repeated itself.

We have so far considered only the regular sequence of physically identical impressions. But the most important cases of rhythm are those in which recurrent similarity in certain respects is combined with diversity in other respects. The rhythm of verse, which depends on a more or less uniform recurrence of long and short or of accented and unaccented syllables, may serve as an illustration. In hearing a line from Milton or Virgil we need not at any moment have more than one word actually present to consciousness. Yet this single word appears as part of the whole and is qualified in a quite specific way by its place in the whole. The sound of the word 'unpremeditated' has a quite different value for consciousness in the present sentence or in a dictionary from that which is acquires in Shelley's lines:

> "That from heaven, or near it,
> Pourest thy full heart
> In profuse strains of unpremeditated art."

Substitute 'unstudied' for 'unpremeditated,' and the result is not merely one word in place of another. On the contrary, the occurrence of the wrong word is for consciousness the ruin of the whole rhythmic structure.

What is true of verse is still more obviously true in the case of music. The last note of a melody may be the only note of which we are aware at the moment it strikes the ear. Yet in it the entire melody is in a sense present. It comes before consciousness as part of a quite specific whole and derives a specific character from its place in that whole. The cumulative disposition generated by the ordered sequence of previous notes co-operates with the new stimulus to the

organ of hearing, and the ensuing state of consciousness is the joint product of both factors mutually modifying each other. If a wrong note be struck, the whole melody is at once marred. The same happens if a note is unduly prolonged. Throughout the process the part is determined by the whole, and the whole by the part.

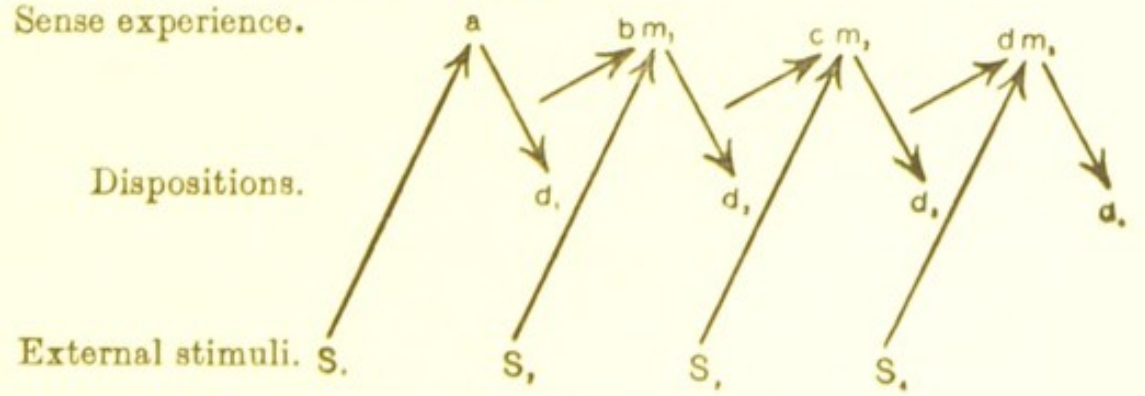
In reading a sentence or a paragraph, when we come to the final word, the meaning of the sentence or paragraph as a whole is present to our consciousness. But it is only as a cumulative effect of previous process. What is directly given as a special datum is the last word itself and its meaning. In a similar way, the cumulative effect of one paragraph or chapter of a book qualifies and determines the meaning of another. We may set by the side of this highly complex case a very simple one. Pronounce successively the words 'fructify,' 'mystify,' 'identify,' 'simplify'; all these words terminate in the same sound. When we are just finishing or have just finished the utterance of each word, the special item of sensation before consciousness is the final sound they have in common. The preceding sounds in which they differ have vanished from consciousness; nevertheless, in each case we are aware that we have said one word and not another, that we have said 'fructify' and not 'mystify,' and so on. This can only be because in each instance our consciousness, when the final sound is being pronounced, is modified by the cumulative effect of the preceding sounds.

It is in connection with active movement that cumulative dispositions are formed in the earliest stages of mental development. The child, for instance, has to learn how to grasp things with his hand under guidance supplied by sight. To begin with he does not do this at all, and he gradually acquires the power of doing it through a series of trials. In this process, the experiences due to active movement, to sight, and to touch, give rise to a total disposition, which, when it is fully organised, enables him to aim at and seize accurately what he sees within his reach. It is in such ways that sensations become integrated or synthesised in special groups or systems, which are apprehended in their unity as distinct from the general mass of sense-experiences which accompanies them.

The same holds good for the activities of the body and sense-organs by which the child learns to speak, to creep, to walk, etc., and to correlate the data of different senses in the perception of single things, so that one such datum comes to stand for the unity of the whole, as, for example, a patch of yellow colour comes to stand for an orange. The appearance of sugar is, initially, disconnected with its taste. It is through the act of grasping the visible sugar and putting it into the mouth, that a single complex percept is formed in which the sight of the sugar 'means' its sweetness.

This cumulative effect of the preceding phases of a conative process on the succeeding may be called 'primary' retentiveness, in order to distinguish it from the retentiveness which is involved in reproduction and association.

Primary retentiveness is correlated with what we may call primary acquirement of meaning. If, in any perceptual process such as those we have considered, we denote the specific items of sense experience which would arise independently from the stimuli or external conditions, s_1, s_2, s_3, and s_4, by a, b, c, and d respectively, then a,... b,... c,... d... by no means adequately symbolises the course of experience when these stimuli are serially presented. For when s_2 occurs the resulting state of consciousness is the joint product of s_2 and of the persistent disposition left by a. Similarly when s_4 occurs the resulting state of consciousness is due to s_4 in co-operation with the persistent disposition left behind by the antecedent states of consciousness. The total process may be represented as follows:



Here m stands for the modification of actual experience in consequence of the disposition formed by previous experience.

Now, these modifications do not primarily consist of discrete sensations or images coexisting with *a*, *b*, *c*, *d* in a way that the employment of a separate symbol might suggest, but in a peculiar character or modification of these items which arises in virtue of their being a part of a certain whole, and on account of which they may *mean* that whole. Hence we may speak of the process as the primary acquirement of meaning. It is not, however, the modification itself which is the meaning. The meaning of a sense-impression is not itself another sense-impression nor is it a modification of a sense-impression. But in virtue of such modification sense-impressions may come to mean what they did not originally mean. So far as it is dependent upon part experience, it may be said to be acquired, and so far as it is dependent simply upon the cumulative effect of a continuous process of attention, without reproduction, it may be said to be 'primarily' acquired.

5. Association and Reproduction.—On seeing a flower, I am told that it has a certain name. Afterwards, I hear this name again: it may then call up to my mind a mental picture of the flower, though no flower is actually present. It is clear that if I had never seen the flower, the mental picture of the flower would not have arisen. Now suppose the original perception of the flower had left no trace behind it after itself ceasing to exist—that it had flitted over the surface of my mind like a shadow over the surface of a stream, without producing any permanent result. The case would then have been just the same as if I had never seen the flower. The mere hearing of the name would be inoperative unless there were something for it to act on—an appropriate *trace* of past experience constituting a preparatory *disposition* for future experience.

But primary retentiveness is not in this case sufficient. More is implied than the mere cumulative effect of the previous phases of a continuous process determining succeeding phases. Retentiveness in this instance works by way of reproduction and association. The specific nature of the original experience, which we call the perception of the flower, is partially reinstated in the mental image of the flower. The name, as we say, *reproduces* the mental image.

It does this through association. The actual perception of the flower occurred as part of the same continuous conscious process as the hearing of the name. Hence, when the name occurs again, it may re-excite the mental disposition left behind by the perception, and re-excite it in such a way that the mental image of the flower rises before the mind althongh no actual flower is present to the senses.

In so far as the mere fact that a certain modification of consciousness has already occurred constitutes the general possibility of its recurrence, retentiveness takes the form of reproduction. The general possibility of recurrence is for the most part actualised in each special case by association. The disposition left behind by the previous experience must be re-excited if the experience itself is to be reproduced. The re-excitement is mostly, though not always, effected by an experience similar to some experience which has formed part of the same total process with the experience which is to be reproduced. This is expressed by saying that the re-instatement takes place by the previous association of the reproduced and reproducing experience. In the example given, the association is between the perception of the flower and its name. Repetition of the name revives by association the image of the absent flower.

Reproduction has a great many modes and degrees, according as the original experience is more or less fully and independently reinstated. The least that can happen, in order to make the word 'reproduction' applicable at all, is found in a process of fundamental importance which we may call the 'revival of acquired meaning.' We must distinguish between meaning as first acquired and meaning as revived. Primary acquirement of meaning accompanies the first occurrence of any series having continuity of interest. Secondary or revived meaning accompanies its recurrence, and depends on the fact that it has occurred before. In the series a, bm_1, cm_2, dm_3, on its first occurrence d has a meaning, m_3, due to the cumulative disposition left behind by a, b, c. Now, suppose that on a future occasion the process as a whole is repeated. Its point of departure is in a, but a now excites the cumulative disposition produced by the previous occurrence

of the whole series a, bm_1, cm_2, dm_3. The starting-point of the series is therefore no longer a, but am_4. In other words, a reproduces by association an *acquired meaning*.

The general principle involved in association is the reinstatement of context. But such reinstatement may take various forms. In the simpler cases what is reinstated is merely the kind of modification which is produced in the formation of a cumulative disposition—where what is actually sense-given coalesces with what is revived. In the more complex cases, such as that of recalling the appearance of the flower when its name is heard, the reinstatement takes the form of a separable and discriminable image. Various intermediate grades of reproduction are found between these extremes.

Let us consider the example of a tune. On first hearing it, the successive notes have each a significance—a value for consciousness derived from their connection with the whole. Now suppose that the tune has been repeated often enough to become recognisable. In order to recognise it, it is not necessary to go through the whole again. You know what the tune is as soon as you have heard a certain portion of it. This stands for or *means* the rest; and if you are only interested in recognising the tune, it is quite unnecessary to go further, or even mentally to reproduce what follows. So, if I begin to say, " Twice one is two, twice two "—there is no need for me to go further. A hearer who knows the multiplication table knows what follows as a whole without detailed repetition. The beginning of the series is equivalent to the whole without the whole being distinctly imaged. It is just because it *means* the whole that it is unnecessary to repeat the whole in detail.

The same principle is exhibited in practical learning by experience at quite low levels of mental life. A chick on emerging from the shell, and without previous experience, tends to peck at, seize, and swallow all small objects.[1] This is a conative process, which has for its end the cessation of the appetite for food. Now the chicken does not, at first, distinguish between what is edible and what is not. This it has

[1] This example is taken from Lloyd Morgan, *Habit and Instinct*, p. 41.

to learn by experience. It will at the outset peck at and seize all worms and caterpillars indiscriminately. There is a particular kind of caterpillar called the cinnabar caterpillar. When this is first presented to the chicken it is pecked at and seized like other similar objects. But as soon as it is fairly seized it is dropped in disgust. When next the chicken sees the caterpillar, it looks at it suspiciously and refrains from pecking.

Now, what has happened in this case? The sight of the cinnabar caterpillar re-excites the total disposition left behind by the previous experience of pecking at it, seizing it, and ejecting it in disgust. Thus the effect of these experiences is revived. The sight of the cinnabar caterpillar revives its *acquired meaning*. It means the experiences which in the first instance followed it; and just because it means them it may more or less dispense with the necessity of actually repeating them. It may so determine the course of action that repetition or reinstatement of the specific items of the previous experience is needless. To this extent, it is practically equivalent to them: it works instead of them.

When one thing *means* another, it can, for certain purposes, or in reference to a certain end, be substituted for another. If *a* means *b*, this does not imply that *a* carries *b* along with it or about with it. We might as well suppose that a five-pound note must always have five sovereigns literally wrapped up in it. The note will pass current instead of five sovereigns, and in like manner the peculiar visual appearance of the cinnabar caterpillar will, in some degree, pass current instead of the peculiar sensation of disgust which as previously followed it. It re-excites the whole disposition left behind by the previous process, and it re-excites this disposition as it has been modified in the course of previous process. Consequently, this process will not take place again as it took place before. But to understand the special kind of transformation which it undergoes, we must take into account the essential nature of appetitive process. This lies in its being directed to an end—in the case of the chicken, to the satisfaction of the appetite for food.

This tendency towards an end is manifested in one general character of all appetitive process. Lines of action, if and so

far as they are unsuccessful, tend to be discontinued or varied; and those which prove successful, to be maintained. In this way, for instance, accuracy in the act of pecking is attained by the chicken. When it misses it tries again and again with slight variations until it succeeds, and it is the successful adjustments which tend to persist, and the unsuccessful which are eliminated.

The endeavour towards an end, whether the end be definitely foreseen or not, is *ipso facto* an endeavour to avoid failure and obstruction. Everything in the way of check or impediment or want of success causes dissatisfaction and altered behaviour. This holds good of appetitive activity in its primary occurrence; it is always characterised by persistence with varied effort. The same must also hold good for its repetition. Here, too, the lines of action which proved unsuccessful on its primary occurrence will be suppressed whenever the conditions under which they previously led to failure are recognisable. Thus, the sight of the peculiar markings of the cinnabar caterpillar will, at the outset, by its acquired meaning, repress the tendency to peck and swallow. In other words, so far as the end of action is concerned, the sight of the caterpillar is superior to the actual taste of it, just as cheques and paper money are for certain purposes superior to coin.

The process which we have called the revival of acquired meaning is the minimum in the way of reproduction required to explain learning by experience. All more specific modes of reproduction presuppose it, and owe their guiding efficacy to it. All revival of specific items of sensation and the like, in so far as it makes possible intelligent adaptation to the result of previous experience, must make more definite and explicit the peculiar consciousness which arises from the re-excitement of the total disposition left behind by previous process.

The case we have analysed is sometimes explained in a different way. It is said that when the chick sees again the caterpillar, which it has previously ejected in disgust, the previous sensation of disgust is reproduced by the sight of the peculiar markings of the caterpillar. The primary experience of disgust prompted the ejection of the caterpillar; hence, it

is argued, the revived sensation will lead the chicken to refuse the unsavoury morsel.

Now, it is probable enough that something which may be called a revival of the disgusting sensation actually takes place; but this is not sufficient, and possibly not necessary, to account for the result. According to the proposed explanation, the chick has (1) a primary sense experience, the sight of the caterpillar, and (2) a faintly revived sensation of disgust.

What must follow? Each of the two sensations, the one primary, and the other secondary, independently prompt to a certain kind of action, and the result can only be a sort of mechanical interference, not intelligent guidance. The visual experience prompts to picking and seizing. The revised distaste prompts to the act of ejecting or dropping from the beak. The tendency to ejection ought to interfere with the act of pecking only in so far as the two movements are mechanically incompatible. One would expect a nondescript blend of the two movements, or an alternation between them.

It is, however, no more necessary to assume explicit revival of the disgusting sensation than it is to assume the revival of all the intervening sensations of pecking, etc. The final sensation prompting rejection is present only in the sense in which the whole series is present—in having contributed its influence to the modification of the visual sensation in virtue of which it now prompts to rejection. At a later stage this may take the form of 'complication.' Still later it may take the form of a discriminable image. But these are certainly later stages.

Revival of meaning is that mode of reproduction which approaches most nearly in its nature to primary retentiveness. It might indeed be deduced *à priori* from the existence of primary retentiveness. If the successive phases of a process concur to form a total disposition as their cumulative effect, the renewal of a part of the process must tend to re-excite this disposition. Just as in primary retentiveness it is not the specific items of previous experience which persist in succeeding experience, but only a modification of consciousness due to the cumulative disposition, so the re-excitement of the cumulative disposition does not necessarily involve revival

of the specific items of previous experience, and it must involve something different from this. It must involve what primary retentiveness involves—that peculiar modification of consciousness which we can only call 'apprehension of meaning' or 'significance,' the peculiar character which the part derives from its relation to the whole.

At this point we must pause a moment to settle a question relating to the use of a psychological term. Are we to call a reproduced meaning an 'idea'? Certainly, when I see an orange and recognise it as such, it is natural to say that the visual sensation revives or recalls the idea of an orange. Similarly, when the line " The curfew tolls the knell of parting day " brings at once before my mind the poem as a whole, it is natural to say that the words I read or hear call up the idea of Gray's *Elegy*. In both cases it is natural to say that what is directly given to the mind is ideally extended or supplemented through associations formed in my past experience.

It would be an awkward restriction to debar ourselves here from the use of such terms as idea, ideal revival, and ideal representation. But if we are to avoid confusing very different modes in which retentiveness and association work, we must make an important distinction. We must distinguish between free and explicit ideas, on the one hand, and tied and implicit ideas, on the other.

When the opening words of Gray's *Elegy* suggest to me the poem as a whole, I may or may not proceed to recall it in detail, as I should do if I mentally repeated it to myself. Such repetition would involve a series of verbal and other images, each conveying its own distinct meaning and so constituting a separate idea.

If I do not proceed to recall details in this manner, what I apprehend is merely the poem as a whole, without separate discernment of its parts. Such apprehension of the whole without separated discernment of its parts may be called a tied and implicit idea. It is implicit because it involves details which are, as it were, wrapped up in it, which are not unfolded for consciousness; it is tied because it does not break loose from the sensations or images which suggest it,

so as to have a distinct existence as a separate member of a train or procession of ideas capable of evolving itself when the original sensations or images have disappeared.

Similarly with the orange. Whatever in our apprehension of the object is not merely due to our immediate sensation in seeing it, is ideally supplied. How much is thus supplied is shown by cases of disappointed expectation, as when what is taken for an orange turns out to be only an imitation in wax, or when a jug which is taken to be full of water turns out to be empty. Yet the ideal extension of the datum of actual sensation need not assume the form of separately distinguishable ideas. In looking at the orange, and recognising it as such, we need not have a mental picture of its pulpy contents or of the opposite side which is hidden from our sight, or a separately revived sensory image of its sweet and acid taste. The ideal revival may be mainly implicit.

But even when revival is implicit, we can distinguish modes of reproduction more specific than what is involved in the recall of acquired meaning as dependent merely on the nascent re-excitement of a total disposition. There are intermediate stages between this and explicit ideas. Further, when ideas begin to be explicit they may none the less continue to be bound up with actually present sensation, so that they do not break loose from this as successive members of a train or series of free ideas, capable of proceeding by itself independently of actual sensation. Thus we have to consider (1) Complication or Preperception, (2) Ideas which are explicit but not fully free or detached from sense-impressions.

6. **Complication.**—In complication, the ideal revival, though not separately discernible as an explicit idea, alters the character and adds to the complexity of actual sensation. "The sight of ice," says Ward, "yields a fore-feel of its coldness, the smell of baked meats a foretaste of their savour."[2] What we have in such cases is rather a preperception than a mere forethought. The ice is not merely thought of as cold, it has a cold look. The residua of past sensations of cold

[1] *Op. cit.*, p. 186.

become entwined with our visual sensation so as to modify its character as an immediate experience. Yet we have not a separately distinguishable idea of the coldness of the ice with a separately distinguishable image as its vehicle, side by side with our visual perception. The revival and the original sensations coalesce into a single complex sensation.

We may take as a typical example of complication the peculiar differences of quality which attach to sounds according to the various modes in which they are produced. We distinguish clapping, crashing, clashing, hissing, bursting, splitting, rending, grinding, rushing, and whistling noises. Now these sounds doubtless have distinctive qualities, considered merely as auditory sensations. But it seems clear that they also have acquired peculiar characters due to association with sensations of different modality. In producing them we have in each case certain distinctive experiences of movement and resistance, and in seeing them produced similar experiences are excited in a partial and inchoate way. When the sounds are merely heard their quality is partly constituted by a partial and modified reproduction of these sensations. The reproduced element is not usually distinguished without an express act of analytic attention. But it is none the less present as a peculiar modification of the auditory experience.

Perhaps this will be most clearly brought out by considering the imitative words by which the nature of such sounds is commonly expressed. The word ' clap ' resembles the sound of clapping, the word ' hiss ' the sound of hissing, and the word ' tear ' the sound of tearing. But on examination it soon appears that the resemblance by no means lies wholly in the sounds considered merely as ear-sensations. It depends also on the movements of articulation. In saying ' clap,' the lips are clapped together; in saying ' hiss,' the breath is driven through a narrowed aperture; in saying ' tear,' the tongue is pulled away from the palate. In these and similar instances we do not ordinarily distinguish between the motor and the purely auditory imitation. So in the original experiences which are imitated the two factors are combined without distinction, constituting a complex sensory

quality which escapes analysis until the reflective scrutiny of the psychologist is brought to bear upon it. In this complex quality the sound as such is the dominant constituent, and the associated motor element appears as a modification of the sound.

Further illustrations are afforded by the qualification of sight by touch and resistance, and of touch and resistance by sight.

"The sight of a suit of polished armour," says Ward, "instantly reinstates and steadily maintains all that we retain of former sensations of its hardness and smoothness and coldness."[1] The armour *looks* hard, smooth, and cold. But this peculiar appearance to the eye does not necessarily involve any distinct representation or idea or separate sensation of hardness, smoothness, or coldness. The corresponding tactile and other experiences are not reproduced as separate and distinct modes of consciousness. They are not discriminated from the visual experience itself. The reproduction manifests itself rather as a modification of the visual experience —an addition to its unanalysed complexity. Similarly, ice looks cold because we have felt it to be cold. If it had been always warm to the touch, it would have looked warm. Yet its cold look is not a suggested idea; nor is it a distinct temperature-sensation. It is something which is presented as if included in the visual appearance as an integral part of it. Any attempt to separate it destroys both its own specific character and that of the visual experience.

In the second case, the qualification of actual touch experience by revived visual experience, we find the union of the constituents of the complex much looser. This does not mean that they are more easily separable; for the association in normal human experience is almost, if not quite, indissoluble. But when the tactual experience is primary, the reinstated visual experience is much more prominent, more readily distinguishable and separately appreciable, than is the reproduced tactual element when the visual experience is primary. We have here a case of complication which approaches most

[1] *Ibid.*, p. 168.

closely to free reproduction, and very frequently and easily passes into it. When we close our eyes and touch an object, we need not indeed have a distinct picture of the surface touched. But the slightest reflective scrutiny is enough to show that the total impression is complex, containing a visual as well as a tactual constituent, and also, in most cases, that the visual constituent is as prominent as the tactual or even more so.

The term 'preperception' is commonly employed for a process which, though closely connected with complication, is of a somewhat different nature. As distinguished from complication, it involves not so much the modification of actual sensory experience as a process of supplementation and filling in. In most normal processes of perception, comparatively little can be ascribed to the actual data of sense.

Preperception is most evident when attention is expectant. Of course, all attention is, in a sense, expectant or prospective. In seeking the development of our object we look forward to the appearance of new features and relations belonging to it, which are not yet apprehended. In proportion to the unity of our total object and the degree of our interest in it as a whole, whatever is thus included in it or related to it will tend to occupy the mind in preference to disconnected objects which might otherwise be suggested by sense-impressions or irrelevant associations of ideas.

Preperception is particularly liable to occur when something is already more or less definitely anticipated in idea, but requires for its further development an actual sense-perception. When this is so, we notice what we are expecting in preference to other things. "It is much easier to see any lost article if you have a definite picture of what is sought. In fact, searching for anything consists ordinarily of nothing more than walking about the place where the object is supposed to be, with the idea of the object kept prominently in mind, and thereby standing ready to facilitate the entrance of the perception when it offers itself."[1] We may, in fact, have the perception of the object in the absence of the appropriate

[1] Pillsbury, *Attention*, p. 36.

stimulus. This is specially noticeable when we look for someone in a crowd. We see what we expect to see instead of what is really present. If we expect to meet A at a certain place and time and B appears instead, we are likely to mistake B for A; we tend to apperceive the given sense-impression through the wrong group of mental dispositions and so to misinterpret it. "During the conflagration at the Crystal Palace in the winter of 1866-7 . . , it was supposed that the chimpanzee had succeeded in escaping from its cage. Attracted to the roof with this expectation in full force, men saw the unhappy animal holding on to it, and writhing in agony to get astride one of the iron ribs. . . . But there was no animal whatever there; and all this feeling was thrown away upon a tattered piece of blind, so torn as to resemble to the eye of fancy the body, arms, and legs of the ape."[1]

In complication and preperception it is impossible to separate by inspection what is actually sense-given from what is ideally supplied, and between such cases and explicit ideal representation, recognised as such, there are many intermediate stages. The next clearly distinguishable phase of development is that which involves what we may call explicit ideas which are not free, explicit ideas which are, as Ward says, "sense bound and sense sustained."

7. Explicit Ideas which are not Free.—There may be explicit ideas which merely extend and supplement present sense-perception instead of breaking loose from it so as to form members of an independent train of ideas, which may go on after the perception has ceased or even apart from any sense-perception at all. A hunter seeing a tiger may call up a distinct mental picture of the tiger's coming leap; he has then an explicit idea; but this does not lead to a train of ideas relating to the nature and habits of tigers, or to his previous experiences in tiger hunting, or to relevant anecdotes which he has heard. On the contrary, it only seems to give him a fuller apprehension of the present situation and guide him in taking immediate measures to meet it.

[1] Quoted from Carpenter, *Mental Physiology*, p. 208.

Again, when we are looking for a box of matches in the dark, in passing the hand over the side-board or in jogging the coal-scuttle with the foot, the large glossy shape of the one and the irregular blackness of the other may be distinctly pictured. But they do not usually give rise to independent trains of ideas. Instead, they yield us guidance in feeling about for the match box. It is in this form that ideas first become explicit—as extensions of present perception, and as helping to prompt and guide the actions which directly depend on present perception.

8. Free Trains of Ideas.—In free reproduction, the reproduced presentation, *b*, is capable of existing apart from the *a* which reinstates it. *b* has an individuality of its own distinct from *a*, and it can follow *a* in time, so as to continue to exist when *a* has disappeared. In complication, on the other hand, and in ideas which are explicit but not free, the existence of *b* is bound up with the existence of *a*. "To realise this difference," says Ward, "we need only to observe first how the sight of a suit of polished armour, for example, instantly reinstates and steadily maintains all that we retain of former sensations of its hardness and smoothness and coldness, and then to observe how this same sight gradually calls up ideas, now of tournaments, now of crusades, and so through all the changing imagery of romance."[1]

Often trains of ideas go on without any reference to surrounding objects; thus J. S. Mill composed a great part of his *Logic* while walking through the streets of London to and from his place of business. All detailed reminiscences of series of events as they followed each other in the past and all detailed anticipations of series of events as about to occur in the future are possible only through free trains of ideas. Under the same head comes all contemplation of possible alternatives, as such, and of their consequences; as when we say, "if *a* then *b*, and if *b* then *c*," etc. The like holds for all comparison of objects which have not been perceived in spatial and temporal connection with each other, as when one

[1] *Op. cit.*, p. 168.

compares the shape of a rock to that of a lion, or a valley in Cumberland with a valley in Devonshire.

The characteristics of ideas and their distinction from perceptions are topics which will be discussed at a later stage. Here we need only note that normally the sequence of ideas in a train is conditioned by a sequence of mental images of some sort, for example, pictures seen in the mind's eye. The images, however, may consist wholly in revivals of words or of some kind of symbols, such as those of mathematics.

CHAPTER V.

PRACTICAL CONATIVE ACTIVITY.

1. The Practical Aspect of Conative Activity.—We have distinguished two direction of conative activity, the theoretical and the practical. Mental activity is theoretical so far as it is directed simply to the attainment of fuller knowledge of presented things. It is practical so far as it is directed to any form of interference with these things either in the way of producing changes in their nature or behaviour, or in preventing changes which would otherwise occur. These two directions of activity are closely interconnected. Normally the theoretical activity of attention is subservient to and preparatory for practical action. But practical activity may subserve theoretical interest. This is most notable in what are called movements of fixation.

2. Movements of Fixation.—The direction of mental activity towards an end involves the tendency to use whatever means may be found conducive to the attainment of the end. This applies to attention as a striving after the fuller apprehension of its object. When we are trying to make out the form, colour, and movements of a bird, we may use a field-glass to give us a clearer and more detailed sight of it. The field-glass is an artificial contrivance expressly devised for this purpose. But, from the outset, there are other and more primitive means provided in the constitution of our own body and organs of sense.

Thus, when we are interested in something which is present to our senses, there are various movements by which we can actively obtain sense-experiences from it, so as to make our apprehension of it more full and distinct, and by which we can exclude the disturbing effect of irrelevant impressions. There

are, in the first place, special movements of adaptation of the sense-organs for the receiving and detaining of sensations. When something in the field of vision catches the attention, the eyes normally turn towards it, so that we look directly at it. The ocular movements are such as to bring what is seen within the area of distinct vision for each eye and for both at once. Besides this, there is accommodation of the lens of the eye so as to obtain a clear image on the retina. When the thing seen is so large that we cannot make the requisite adjustments for all of it at once, we follow its outlines with our eyes, bringing its parts successively within the area of distinct vision. Such movements are to some degree acquired in the course of individual experience; but to a large extent they are provided for by the original constitution of the nervous system.

To evoke the ocular movements of adaptation it is not necessary that the object attended to should be itself within the field of vision. "In attending to impressions from other sense-organs, the eyes are adjusted to receive the impression even if it is dark, or there is some other condition which prevents the object from being seen. An excellent instance of this can be obtained by watching a man trying to attend to two tuning forks held one before each ear. As the attention turns from fork to fork there is an accompanying movement of the eyes from side to side in the most striking manner, in spite of the fact that the forks are held in such a position that it is impossible to see either."[1]

Special adjustments occur in the case of other sense-organs as well as in that of the eye. The moving hand explores the surface touched so as to ascertain its shape and texture. Even before actual contact, when "the question whether a surface is rough or smooth comes into the mind,"[2] there is a tendency to move the fingers towards the surface, if it is within reach. In listening we turn our heads so as to be in the most favourable position for catching the sound; and there are also probably special adjustments within the ear itself, though their nature is obscure.

[1] Pillsbury, *Attention*, p. 16. [2] *Ibid.*

In attentively tasting, we roll the morsel on the tongue and press it against the roof of the mouth. In attentively smelling, we sniff the air.

It has been held by some psychologists that these adaptive motor activities really constitute the process of attending to perceived objects instead of being the means or instruments for making attention more effective. But this position seems quite untenable. In the first place, though adaptive movements of the sense-organs usually accompany attention to sensory impressions, it is by no means necessary that they should always do so. It is quite possible to attend to sensations in the margin of the field of view without bringing them into the area of distinct vision. It is quite possible to attend to purely passive touches. In the second place, the suggested view puts the cart before the horse. The movements of adjustment are normally determined by previous attention to the object instead of being prior to it. This point is well brought out by Pillsbury. The only condition " for the occurrence of the movement is that an object catches the attention, and as soon as it attracts the attention, the movement which is necessary to give the most favourable condition for " observing it " follows at once."[1]

Besides the special adjustments of the special sense-organs used in the perception of an object, there is also in strenuous attention a general posture of the body as a whole, for excluding or weakening the influence of irrelevant sense-impressions. There is a convergence of all movements towards the one end of fixing and detaining those sense-impressions which are relevant to the attention-process, and there is a tendency to suppress all other movements. In intent listening or looking, locomotion ceases, and we stand fixed in a tense and motionless attitude. There is sometimes even an involuntary holding of the breath.

Another highly important way of fixing attention on a perceived object is by imitating its behaviour. There are, as we shall see later, many kinds of imitation. But the most primitive is a direct consequence of the principle that attention

[1] *Ibid.*, p. 14.

to a movement involves a tendency to make the movement ourselves. This tendency may be and for the most part is suppressed by counteracting conditions: but where opposing influences fail to operate, as when attention is entirely absorbed in following the movements of an object, independently of other interests, it manifests itself in obvious ways. This is illustrated by the case of the spectators at an exciting football match, "where there is a marked tendency of the whole mass of observers to follow the movements of the players with their bodies. In some moments of excitement the entire body will move forward in complete unconsciousness of the fact that any movement is being made. . . . And in most cases the whole crowd will have changed its position very considerably without being conscious that a step has been taken."[1]

Imitation of this type arises directly out of the attention-process and is at the same time a means of increasing its efficiency inasmuch as it yields more full, vivid, and definite apprehension of the object imitated. It is mainly in this way that young children and animals learn by imitating the actions of others.

We have considered the means of aiding and facilitating attention to objects which are present to the senses. There are also special ways of fixing attention on mental images and ideally represented objects. But the treatment of these may be postponed to a later stage, when we come to deal with imagery, ideas, and the use of language.

3. Attention and Motor Activity.—Attention is essentially involved in all practical action. Ultimately we cannot attain any practical end apart from attending. The only way in which we can produce changes in our environment is through bodily movements. But we cannot actively determine our bodily movements without attending either to the idea of making the movement or to the result which is to be brought about by it. Given that we are able to perform the required movement, all that is necessary for its performance is a certain

[1] *Ibid.*, p. 10.

exclusive predominance of the thought of it or of the end to be attained by it.

The general principle is that when the 'doing of something,' the thought of something to be done, occupies consciousness to the exclusion or repression of conflicting suggestions, then the action follows. "Try to feel as if you were crooking your finger, whilst keeping it straight. In a minute it will fairly tingle with the imaginary change of position; yet it will not move sensibly, because *its not really moving* is also a part of what you have in mind. Drop this idea, think of the movement purely and simply, with all the breaks off: and presto! it takes place with no effort at all."[1]

Normally, such exclusive dominance of the thought of an act or of its result is due to our wanting or desiring the act or its result. To this extent the performance of the act is our deed; it is a development of our conscious agency. For instance, we may cease to think of keeping our finger straight and attend to the proposed crooking only because we want to crook it and don't want to keep it straight. Or we may simply forget about keeping it straight and then the same act follows involuntarily.

When the dominance of the idea of something to be done is not due to our wanting, wishing, or requiring it to be done, but to other conditions, the ensuing action is called 'ideo-motor.' Ideo-motor action is well illustrated by cases of so-called 'thought-reading,' in which a person who has hidden some small article concentrates his attention as completely as possible on the article and its hiding-place. When he does this he involuntarily and unawares makes slight movements which are capable of revealing to others the direction in which the concealed object is to be sought. Similarly, in certain stages of the hypnotic trance, the subject performs every act which is suggested to him, simply because the idea of the act occupies his consciousness to the exclusion of conflicting alternatives.

Ideo-motor action is also a common occurrence in daily life. "Whilst talking I become conscious of a pin on the

[1] James, *Principles of Psychology*, Vol. II., p. 527.

floor, or of some dust on my sleeve. Without interrupting the conversation, I brush away the dust or pick up the pin. . . . The mere perception of the object and the fleeting notion of the act seem of themselves to bring the latter about."[1] Sometimes the transition from idea to action is contrary to desire. "A youth about to make his first speech foresees that he will tremble and turn pale and perhaps become incoherent." What he wishes is to behave in quite a different manner: and yet at the critical moment, the idea of how he fears to behave so occupies his mind "that he inevitably behaves in the way he expected."[2]

4. Ascending Levels of Conative Development.—One conative experience may be distinguished from another according as it is primarily appetitive or aversive; variations may occur in respect of intensity and duration, and in the nature of the end which is consciously held in view. Differences in each of these respects will find expression in external behaviour, and will leave correspondingly different dispositions. We have now to inquire into the nature of these differences as they are found at successive levels of mental life, and we have to endeavour to trace the stages through which specific forms of conative activity arise.

There is no reason to suppose that in the development of mind there is any important variation in the intensity of conation considered in abstraction from its specific ends. The dominant propensities of the lower animals would seem to be neither weaker nor stronger than those which are dominant in us.[3]

[1] *Ibid.*, p. 522. [2] Shand, *Mind*, N.S., Vol. II., p. 453.

[3] Whether any *specific* tendencies are of unvarying strength is more difficult to decide. It is not infrequently asserted that the specific tendencies described as 'primary instincts' are of unvarying strength throughout the whole course of racial history. In the absence of appropriate means of measurement it is difficult to know if this is so. Individual differences, at any rate, would seem to be possible, and this would provide a basis for variation of groups. Of course, in the absence of any alternative means of securing the end for which the proclivity provides, large variations would tend, by natural selection, to the elimination of the variant species.

The chief differences between higher and lower levels of conation arise from cognitive development. There are also differences in the pertinacity with which an end may be pursued, and in the degree to which more specific trends admit of organisation within more complex wholes. At the lower levels of conation, action is mainly guided by sensory cues. It is in consequence impulsive. Being controlled by what is sensibly present, it continues only so long as it is maintained by external stimulation, and it proceeds in relative independence of other tendencies for which memory or foresight would be required.

With the growth of ideation the immediate impulse comes to be controlled by a wider view. Conflicting tendencies are simultaneously aroused and may be harmonised by deliberation. With the presence of free ideas, remoter ends may be consistently pursued, and intelligence is employed for the invention of novel means by which the ultimate ends may be attained. There is thus a broad distinction to be drawn between perceptual and ideational conation.

5. Specific Forms of Conative Activity at the Perceptual Level.—Perceptual conation embraces many specific forms; relatively simple responses to sensory stimulation, habit, instinct, and emotional expression, imitation, behaviour, play, and so forth. Can all these special modes of behaviour be assigned a definite place in a process of orderly development?

Many attempts have been made to exhibit the emergence of all these specific forms of conative activity as resulting from the modification and integration of primary reflex acts. There is no doubt that the ascending levels of conative consciousness broadly correspond with grades of increasing complexity in neural organisation in a way that admits of representation in terms of reflex arcs. But it would be rash to assume that what is externally simpler corresponds to what is genetically prior, or that growth consists merely in integration. The practised performance of the expert juggler has all the appearance of simplicity when contrasted with the complex blundering movements of the novice. Here the process of development is in large measure a process of

simplification, and there is much to suggest that the reflex act must itself be similarly explained.

In any case, in a psychological inquiry we cannot start from reflex action as it is physiologically conceived. Its nearest psychological counterpart is the sensation-impulse—the quasi-automatic response to a simple perceptual situation, such as withdrawing the hand from a flame or brushing an irritant from the skin.

When, however, we examine these impulsive actions closely they appear to be neither analytically simple nor genetically primitive. To begin with, the sensation-impulse presupposes considerable complexity in perceptual consciousness. It involves the discrimination of some presented object in the total presented field, and it implies at least some dispositional knowledge of the appropriate movement to be made. The enormous complexity here involved is evident when we consider that the appropriate movement will differ according to the posture of the organism when the stimulus is applied.

Take, for example, movements of fixation. When a spot of light is projected on to the periphery of the retina there is a tendency to move the eye in a way that brings the presented object to the centre of vision. If, in the accompanying diagram, A_1 is the point of fixation and the spot appears at C_1 there is lateral movement of the eye which brings the spot to the centre. If A_2 is the point of fixation, a similar movement would bring a spot of light at C_2 to the centre.



But while similar, the two movements are by no means identical. Different movements are required according to the position of the eye and head at the time of stimulation.[1] Moreover, fixation may be effected either by movements of the eye or by movements of the head. Similar considerations apply even more obviously to the responses made to irritation

[1] This illustration is from Koffka, *The Growth of the Mind*, Chap. III, § 5.

of some portion of the skin. To touch the affected area will require different movements for every different position of the relevant limbs at the moment of stimulation.

What is described as a specific sensation-impulse thus embraces the capacity and the tendency to perform an almost infinite variety of movements which agree only in their ends. All these movements, moreover, are conditioned by the perception of the external object in conjunction with a more or less determinate awareness of the position of the body and its limbs. The sensation-impulse must therefore be regarded as a conative tendency capable of controlling an immensely complex motor mechanism; but from the complexity of the factors involved it is one which is likely to be perfected only by repeated experience and practice. Originally, one can presume only a most indeterminate awareness of the external situation which calls for change, an indeterminate awareness of the sort of change required and an indeterminate awareness of the kind of movement to be made.

In endeavouring to account for developed modes of action a number of concurrent processes have to be borne in mind. In the first place conative development is through and through conditioned by parallel growth in cognition. As the result of continued attention, conditioned by retentiveness, there is a progressive differentiation and articulation in the apprehension of the external world. Secondly, there is a parallel development of the apprehension of the body and its limbs and of their capacities of movement. Thirdly, there is the formation, chiefly by trial and error, of specific motor associations to situations which frequently recur, and these responses tend to become automatic. Fourthly, there are certain specific ways in which automatic responses admit of modification and extension in accordance with changing situations or fuller knowledge of attendant circumstances.

Moreover, throughout the investigation of these processes it is essential to bear in mind the unity of the presented field and the corresponding unity of movements. Responses are primarily evoked not by isolated data but by the perceptual situation as a whole. Attention may later come to be restricted to specific items as being those which more par-

ticularly call for action. Similarly the response is in the first place a response of the body as a whole, though later, as useless movements are abandoned, activity may be more or less restricted to a single limb. This general principle is of special importance when we come to deal with distinctive conative systems which embrace a number of more specific trends. The explanation of these systems does not lie in showing how isolated responses admit of integration. It is rather a question of tracing the phases through which what was once a diffuse response undergoes differentiation in various special ways.

6. Motor Association.—Owing to the intimate correlation of mental and nervous process, the mental life is from the outset constantly connected with impulses passing from the central part of the nervous system to the rest of the body and so giving rise to changes in the internal organs and in particular to muscular contractions resulting in movements or tendencies to movement. In part, the special movements connected with special experiences are due to the inherited constitution of the nervous system, for example, in reflex actions and in those motor activities which are called instinctive. But such connections are also constantly being acquired through what we may call 'motor association.'

Associations of this kind are initially formed under the control of interest and selective attention. A painful sensation, for example, is, apart from preformed associations, accompanied by diffusive and irregular movements; but if, among these, there is one which leads to relief from pain, this tends to arrest attention and to be repeated whenever a more or less similar situation arises, whereas other modes of behaviour leading to unsatisfactory results tend to be suppressed.

It is not necessary that the painful experience itself should be renewed in order to bring into play the motor association; the recurrence of some other conspicuous feature of the total situation may be sufficient. Birds which have no previous acquaintance with human beings are not disturbed by the mere sight of a man with a gun. They are alarmed and take to flight only when he actually fires among them. But, in

time, they become shy and take to flight whenever they see a man approaching them. In this way preventive movements become associated with the perception of certain objects. "Thanks to the orderliness of things, dangers have their premonitions." "The occurrence of some warning sensation" has acquired a meaning, and, when this acquired meaning is reproduced, an appropriate movement "occurs in time to avert the impending ill."[1]

The same holds good for pleasure as well as pain. Whatever modes of behaviour are found to yield, maintain and enhance a satisfactory experience are stamped in by association so as to recur whenever occasion for them arises. Here, too, there is anticipatory adjustment of conduct due to acquired meaning. "Provided the cravings of appetite are felt, any signs of the presence of pleasurable objects prompt to movements for their enjoyment or appropriation."[2]

Motor associations can be effective in giving rise to corresponding movements and their consequences, only on condition that appropriate objects are actually present to sense-perception. In trains of free ideas what is recalled is rather ideal representations of movement, subserving the formation of plans of behaviour adjusted in advance to future or merely possible circumstances. But where the subject is dealing with an actually present situation, motor association may directly determine the course of action definitely adapted to it, without a previous train of free ideas. Thus when a hungry and thirsty man sees meat and drink before him, there is no need for him to set before his mind a series of ideas of the successive steps of his coming behaviour. On the contrary, he is likely to proceed at once to appropriate action, without previous ideal rehearsal of what he is going to do. The acquired meaning of his sensations is directly developed in detail by means of motor activity and the experiences which accompany and follow it.

When a motor association has become fixed in relation to frequently and uniformly recurring conditions, it may operate independently of attentive consciousness. This happens, for

[1] Ward, *Psychological Principles*, p. 281. [2] *Ibid.*

instance, when we thread our way through a crowded street while our attention is otherwise occupied. A striking example is supplied by the story of the disaster which befell a waiter who had been a soldier. While he was carrying a huge pile of plates some mischievous person called out "Attention!" Immediately the waiter's hands went to his sides and the plates crashed on the floor.

But the working of motor association is by no means confined to automatic habits. When we see a lighted candle the movements required for blowing it out are connected by association with the sight of it; but the association does not take effect unless we want to blow it out—unless we attend to it as a light that is to be extinguished. Similarly, when a traveller suddenly finds himself on the verge of a precipice and steps backward, his movement is determined by motor association, but it is prompted by a conscious appreciation of the meaning of the situation.

In general there are four points to be noted as characteristic of processes of this kind: (1) they supply a means of possessing again series of experiences like those which have occurred in the past under similar conditions; (2) this depends on preformed associations; but (3) the associations do not operate directly by reviving the experiences themselves, but circuitously by renewing the bodily movements on which they depend; and (4), so far as previous experiences are reinstated in this manner, they are not ideally recalled, but occur as actual sensations.

This mode of reinstatement through motor activity guided by motor association is more primitive than trains of free ideas. It is found in children and animals at a stage of mental development in which free ideas are absent or exist only in a rudimentary form. Its occurrence independently of free ideas constitutes a distinctive characteristic of perceptual process. The mental lives of young children and animals are mainly on the perceptual level. Trains of ideas belong to a later development.

Sensations connected with the varying states of the internal organs of the body are reinstated in a way essentially similar. But in the case of these organic sensations, as they are called,

we have to take account of all the outgoing nervous impulses which control vital processes in general, as well as those which proceed to muscles. We have also especially to consider the muscles concerned with such functions as breathing and the circulation of the blood, as well as those on which external movements of the body and its parts depend.

Change in the state of the internal organs is, in a very important measure, determined from within the body by changing conditions of the nervous system. Any strong nervous disturbance tends to discharge itself over the whole organism, affecting respiration, heartbeat, tension of the muscles, circulation of the blood, secretion, etc.

Such a nervous disturbance may, in the first instance, be set up by an external impression such as a wound or a blow. But it may be afterwards more or less renewed by association without the external impression, and it may then centrally generate organic sensations bearing a marked similarity to those which accompanied its original occurrence. The physiological stimulus is indirectly reinstated, and it directly produces the sensation. Tickling is not merely a skin-sensation. The skin-sensation sets up changes in the central nervous system which determine diffused organic disturbance, including spasmodic movements, and the resulting organic sensation constitutes what is most specific in the experience of being tickled. But a similar effect may be induced without actual contact. By merely making believe to tickle a sensitive person it is possible to produce the nervous disturbance with the resulting organic sensations and convulsive movements. In like manner, the mere sight of nauseous food may produce nausea and even vomiting. The intense organic discomfort which may be occasioned by merely looking on at a surgical operation, or even by seeing surgical instruments, has the same origin.

7. Habit and Automatism.—Actions at first requiring attention come to be performed without attention when they are frequently repeated under sufficiently similar conditions. In such instances, the action is said to be 'automatic,' to go on of itself.

"The clearest examples of habitual action taking place apart from attention are those in which attention is otherwise occupied, as when a person knits, or plays on a musical instrument, and at the same time engages in conversation, or threads his way through a crowded street while absorbed in thought. It should be noted that in such instances the diversion of attention is probably never absolutely complete. The musician, for instance, is more or less aware that he is playing a piece of music, and the absent-minded walker is not utterly oblivious of the fact that he is in a crowded street and in motion. What can be asserted confidently is that in such cases there is no persistent and discriminating attention to the details of the action.

"This distinction helps us to understand another group of habitual actions which do not appear to fall into the state of secondary automatism, however much they may be practised. Fencing supplies a good instance in point. The most expert fencer cannot afford to allow himself to be absorbed in an irrelevant train of thought while he is engaged in a duel. On the contrary, the keenest watchfulness is required. The reason is that only certain component parts of the action have become thoroughly habitual; these do not of themselves require to be attended to. The practised fencer has not to think about the proper modes of thrusting and parrying; what requires attention is the tactics of his opponent. As soon as he discerns by sight or feeling the direction in which his antagonist's rapier is moving, the proper reply is made automatically.

"Thus, attention is demanded for the proper combination of a series of movements which are severally automatic, a combination which has to be adjusted to constantly fluctuating conditions. The union of attentive adaptation to relatively novel circumstances with automatic adaptation to circumstances more uniformly repeated is found in all ordinary voluntary action. Thus, the decision to blow out a candle may require attention, but the process of walking towards it and blowing is automatic."[1]

[1] Stout, *Analytic Psychology*, Vol. I., pp. 260-1.

Habit is not confined to bodily actions. There are also habits of thought and of will. Of course, thought and volition are in their very nature processes that involve attention. When we speak of a 'habit of thought' or a 'habit of will,' we do not mean that the special acts of volition or the special trains of thought can go on without attention. We have seen that in such bodily activities as fencing, "automatic processes may enter as component parts into a total process which as a whole is very far from being automatic. The inverse of this is seen in habits of thinking and willing. Here a comprehensive habitual tendency realises itself on special occasions by means of special processes which are not habitual."[1] We may take as an example the habit of answering letters on the day on which they are received. Here, what is habitual and automatic is not the actual process of writing the reply—this, of course, requires attention—but the writing of the reply on the same day on which the letter is received is a habitual and automatic procedure. It takes place as a matter of course. The alternative of postponing it to another day is not entertained without exceptional motives.

A good instance of a habit of thought is that of the making of puns. There are some persons who continually make puns simply because they have fallen into the habit of doing so. Of course each single pun requires attention; but the general trend of attention in this direction rather than in other directions is a matter of habit.

The formation of habit involves the operation of two distinct conditions. The first is retentiveness; the second lies in the essential nature of conation, according to which conative processes cease, if and so far as their end is attained.

Let us take as an example the child learning to walk. This at the outset involves full attention. "At the outset, performance falls far short of intention: only a certain series of contractions of certain muscles, in proper proportions and in a proper order, is capable of realising the end aimed at, with the maximum of rapidity and certainty, and the minimum of obstruction and failure, and corresponding effort. At the

[1] *Ibid*, p. 262.

outset of the process of acquisition, muscles are contracted which are superfluous, and which therefore operate as disturbing conditions. Others are not contracted at the right moment, and in the right measure, so that action is deranged. Now the effort to attain the end is, *eo ipso*, an effort to avoid failure and obstruction; hence there will be a constant tendency to alter muscular adjustments in so far as they are unsuccessful. Hence arise gradual approximations to success, and it is these which are permanently retained, while all that belongs to the process of trial, as such, disappears. In this way a fixed and uniform series of movements is organised, which can go on of itself without conscious effort—without trial and failure."[1]

It will be seen that the formation of habit is an example of facilitation. The dispositions left behind by previous conation facilitate subsequent conation in the attainment of its end. When this process of facilitation reaches a point at which conscious endeavour is no longer necessary, the action becomes automatic.

8. The Modification of Specific Tendencies.—In the modification of pre-established tendencies to action the same general principles are operative as account for the formation of the original tendency. This applies whether the tendencies in question belong to the innate equipment of the mind or are acquired through past experience, though the latter, of course, are in general more easily modified. When any situation calls for movement, behaviour takes the form either of diffusive and random movements or of specific reactions acquired in more or less similar situations. If the first specific responses fail to prove effective the original random variation follows, and new responses are acquired in the ordinary way, by the confirmation of those which achieve success.

We have to take account, however, of two broadly contrasted ways in which established tendencies come to be modified. On the one hand a given response may come to be evoked by a different perceptual cue, on the other hand with repeated stimulation, the response itself may change.

[1] *Ibid*, pp. 267-8.

Under each head several special cases call for separate attention. We may begin with changes on the receptive side.

(*a*) *Simplification.*—Responses are primarily evoked by complex situations involving various forms of stimulation, each of greater intensity than may subsequently be required. With recurrent experience the response not only comes to be more easily performed, it is also more readily evoked. Simpler or weaker stimuli are sufficient to produce the response. At first actual aggressive behaviour on the part of a dog may be necessary in order to provoke a kitten to flight. Later, the distant appearance of its enemy will be enough. In learning to read, the child is dependent upon a complete presentation of the written word, but to the practised reader the merest fragment in perception is sufficient to prompt the correct articulation. Particular importance attaches, as we have already seen, to the earlier phases of a complex experience, for by the process of simplification these may act as premonitions and evoke the appropriate response by anticipation.

(*b*) *Restriction of the Response by Attendant Circumstances.*—The converse process to that considered above arises when the normal response is found to be premature or when its success in fact depends upon a hitherto unnoticed constituent in the total situation. In general, satisfaction will be experienced by the chicken which pecks at objects of the caterpillar type. But the cinnabar caterpillar has an unpleasant taste. In consequence attention comes to be devoted to its peculiar marks. In this way rough general rules of action undergo refinement, and the responses become conditional upon much more complex cues within the perceptual situation.

The process is further illustrated by experiments upon animal learning. In these experiments it is common to introduce some contrivance whereby the impulse is thwarted and pain experienced if attention is not paid to some attendant circumstance. The aim of such experiments is generally to elicit information with regard to the animal's powers to perform the necessary act of discrimination. For example, food is placed at a certain point to which there are two avenues of approach, one marked by a red sign, the other by a green.

Normally such signs would play no part in determining the response. But under the special conditions, if the animal approaches by the red path an electric shock is received and the food is lost, while the green avenue is negotiated with comfort and success. Under these circumstances attention is drawn to the signs and the original response comes to be restricted to situations which present not only the bait but the appropriate sign as well.

(c) *Attachment to New Objects.*—The fact that the perception of a certain object calls out some specific response is commonly expressed by saying that the response is 'attached to' this object. In this terminology, therefore, the expression 'attachment to new objects' describes the process whereby things originally incapable of calling out this response acquire the power of doing so. This process is particularly evident in the case of fear. Originally, it seems, fear is aroused only in a limited number of different situations. A flash of lightning, for example, fails to arouse it in a child, while the clap of thunder which follows will almost certainly do so. But as a result of the frequent conjunction of the two things, the former acquires the capacity to evoke the response primarily connected with the latter.

The principle underlying this extension may be stated most generally in the following way: If an object, *O*, originally evokes the tendency to the response *R*, then any other object *A*, *B*, or *C*, which frequently accompanies or immediately precedes *O*, will acquire the capacity to evoke *R* even in the absence of *O*. In virtue of this principle any preformed tendency admits of almost unlimited extension, and a specific response come to be employed in a variety of alternative situations. Modifications on the side of reception are closely connected with modifications on the side of the response. Here, again, certain special cases may be separately considered.

(i) *Facilitation.*—Facilitation of the perceptual process normally involves facilitation of the response. If a weaker or simpler stimulus is capable of evoking the same response, a constant stimulus will admit of an augmented response. But facilitation is not simply a matter of intensification. It may

take the form of increased accuracy or speed, greater economy or ease, or any of the other special features involved in motor learning. Which form it will in fact assume will depend on the end in view—accuracy or speed according as accuracy or speed is what the situation requires.

(ii) *Adaptation.*—The reverse of facilitation occurs when the experient 'adapts himself to irritants within his environment.' A colt enclosed in a meadow adjoining a railway line will at first take to flight with the passing of every train. There is, however, a progressive weakening of the response until the animal becomes totally unresponsive to occurrences of this kind.

The general principle, in accordance with which facilitation or adaptation occurs, is that to which we have already referred. So far as no harm results from the weakening of the response this weakening is likely to occur. Facilitation takes place just so far as is needful for the particular ends in view.

(iii) *Formation of New Responses.*—It is a moot point whether any response can be correctly described as absolutely new. On general grounds it would be safe to say that any response whatever is a modification or synthesis of responses that have previously been employed. Continuous modifications, however, have discontinuous and therefore novel effects. Progressive refinement of hand and eye co-ordination will at some point enable the tyro to hit the ball which previously he has missed. In an important sense a new capacity has thereby been acquired.

At the perceptual level, novelty of response is mainly brought about by random variation. But variation is probably never entirely at random. It is always to some extent conditioned by an awareness of the nature and degree of prior failure or success. Failure to strike a presented target leads at first to minor variations in the movements previously employed, small changes, for example, in the speed of the movement and in its direction. It does not lead at once to the use of other limbs or to movements of a radically different kind. It is only when finer adjustments fail that the task is likely to be approached in a totally different way. Every variation involves the use of intelligence in a greater or less degree, and

in a higher or lower form. It is only so far as at least a modicum of intelligence is employed that the so-called method of trial and error is capable of eventually leading to success.[1]

We have so far considered only the modifications of the primary motor tendencies which are to be found at the perceptual level. The whole process of learning, and mental activity in general, undergoes important modes of transformation at the level of free ideas. At this level specific responses may be evoked, not only by actual percepts, but by memory or imagination. Similarly the response may consist not only in overt action but in action as ideally conceived. Certain forms of intelligence consist to a large extent of trial and error in imagination, and a solution is found before overt action occurs at all. These processes, however, will call for special consideration later.

9. The Unity of the Presented Field and the Unity of Response.—Throughout the foregoing account of motor activity we have assumed that the sensory experience through which the experient comes into practical relations with external things is from the outset a unity of a distinctive kind. That is to say, the response is primarily conditioned not by specific stimuli acting in isolation, but by complex changes in the perceptual situation as a whole. This general principle has already been illustrated by reference to the apparently simple sensation-impulse. The response is in general conditioned by a peculiar conjunction of internal and external impressions. Moreover, the internal components of the total situation are not limited to the sensations which convey awareness of bodily position. All sensations which in any way present the internal organic state are also relevant here. An animal responds to the sight of food only if it is hungry, and in general reacts in different ways according to its 'mood.'

Similar considerations are of importance in the study of the response. If we speak of specific sensations as ingredients of a certain 'perceptual pattern' we may similarly speak of

[1] On the failure of 'mechanistic' explanations of the process of learning, cf. McDougall, *An Outline of Psychology*, particularly Chap. VI.

specific movements as ingredient in the patterns of the response. The primitive matrix of all specific patterns is what James[1], following Bain, has described as the "diffusive wave."

Primarily, the effect of an afferent impulse, externally initiated perhaps in a single receptor, is a response of the organism as a whole. It results in a redistribution of energy throughout the total system of efferent discharges.[2] When we speak of a twitch in this or that muscle as being *the* response to a given stimulus, we mean only that it is the most obvious of the complex changes to which the stimulus gives rise. These interconnections within the nervous system provide a basis for plasticity in behaviour and for the organisation of responses into complex systems.

10. Primary and Secondary Tendencies.—Any specific conative tendency being established, others are likely to arise in a subsidiary *rôle*. The tendency to hoard nuts is derivative from the tendency to eat them. The impulse on the part of a bird to collect moss and twigs for its nest is derivative from the mating instinct. Such subsidiary tendencies are probably later in origin than the original impulses which they subserve.

There is, however, an entirely different kind of dependence which calls for special recognition. There are certain tendencies which come into play only in conjunction with others of an independent nature and depend upon the success or failure of these primary tendencies, being entirely unaffected by their specific nature. Thus there is the special tendency to vary the means when the primary impulse is unsuccessful, there is the tendency to intensify effort in the face of difficulty, or again, to intensify it with the approach to success. Such specific modes of response to various degrees and modes of success or failure may be described as secondary. They will be found to be of special importance in the theory of emotion and in relation to the complex system of conations described as ' sentiments.'

[1] *Op. cit.*, Chap. XXIII.

[2] The evidence of this lies in an accumulation of data only partially summarised by James in the chapter to which we have referred. Since James's chapter was written the evidence has been considerably augmented.

BOOK II.

SENSATION.

CHAPTER I.

DIFFERENTIATION OF SENSE-EXPERIENCE AND ITS PSYCHICAL SIGNIFICANCE.

1. Sensation and Reflex Action.—Reflex action is primarily a physiological, not a psychological, fact. It does not depend on consciousness at all, but only on a stimulus affecting the nervous system. The stimulus may evoke its appropriate response in the way of movement without giving rise to sensation. In this way the pupil of the eye contracts or dilates with varying degrees of illumination. The movements of the frog whose brain has been removed seem to be of the same type. Similarly, the reflex movements which belong to the ordinary and normal routine of the vegetative life of the organism—the beating of the heart, the constriction and dilatation of the blood-vessels, breathing, swallowing, the secretion of saliva, and the like—are not normally accompanied by distinctly appreciable sensations.

Unconscious reflexes of this sort normally occur when all that is required is a regular and uniform reaction in response to conditions which are uniformly and regularly recurrent. On the other hand, where a stimulus is of comparatively occasional occurrence and prompts a special combination of movements to meet a special emergency, merely reflex action without concomitant sensation ceases to be sufficient. It becomes necessary or advantageous for the ends of animal life that the attention of the subject should be called to the situation. Attention may be required in order to form associations which make possible preventive measures or other

preadjustments when similar conditions recur in the future. Thus, a young child may withdraw its hand from the burning flame by reflex action alone. But this does not account for its future refusal to touch fire. Attention may also be required to arrest or control a reflex action, as when we suppress an inconvenient sneeze or cough.

Now, in such cases, there is only one efficient way in which attentive consciousness can be brought into play so as to supplement or control the reflex process. The stimulus which evokes, or tends to evoke, the reflex movement must also coincidently give rise to a sensation. Further, this sensation must be so vivid and so strongly pleasant or painful that it cannot be easily ignored. Hence when the stimulus which leads to reflex action also produces a discernible sensation, this is commonly of a peculiarily obtrusive character. The pupil expands or dilates with varying intensities of light without any concomitant sensation. This is a merely physiological reflex. But if a speck of dust gets lodged in the eye the case is otherwise. The stimulus not only elicits the reflex movement of closing the eyelid; it also, at the same time, gives rise to an intense and intensely disagreeable sensation. Even reflexes which normally proceed unconsciously, or with only a comparatively faint accompaniment of sensation, compel attention in this manner when they are in any way obstructed. Obstructed breathing, for instance, is accompanied by the feeling of suffocation or stifling.

2. Stimulus and Sensation.—Sensations arise, in the first instance, only when a sense-organ is stimulated so as to give rise to nervous impulses propagated to the brain. A sense-organ essentially consists in a specially differentiated group of cells, so constituted that they respond by special processes when they are excited to action by appropriate occurrences in the external world or within the body itself. Normally such organs do not respond to modes of stimulation other than those to which they are specially attuned. Thus, in the eye there is a special apparatus which is normally excited by light-vibrations, and does not usually or readily react to other external agencies. Similarly, in the ear there is a special

organ ordinarily responsive to air-vibrations and not to other stimuli. The stimulus for which each sense-organ is peculiarly adapted is called its 'adequate stimulus.'

But the stimulus for which it is specially fitted is frequently not the only one which is capable of affecting it. When it responds to agencies other than those appropriate to it, it is said to be excited by an 'inadequate stimulus.' Where this is the case, the general character of the resulting sense-experience depends not on the nature of the stimulus, but on the sense-organ which is stimulated and its central connections in the nervous system. However the organ of vision may be stimulated, if any sensation follows, it is always one of light or colour. A blow on the eye makes us see sparks. A sensation of light may even be elicited by stimulating the optic nerve after the eye has been excised. Sensations of sound result from mechanical or electrical excitement of the organ of hearing. To some extent the same principle holds good for special varieties of sensations belonging to the same sense; for instance, the various qualities of colour or of sound. This is a point to which we shall have to recur in dealing separately with each of the special senses.

3. Perceptual Value of Sense-Experience.—The importance of the sensation is primarily dependent on its power to rouse attention through its own intensity and affective tone. The value of sense-experience is similarly conditioned by its own obtrusiveness wherever its function is to challenge attention to some change directly and seriously affecting the welfare of the organism, as when a part of the body is cut or bruised, or when a light is so strong as to impair the power of vision by dazzling the eye. In such cases what is important is the nature of the bodily change as directly affecting the well-being of the organism rather than the special character of the agent which produces it. A cut or bruise may be produced indifferently by a stone or a piece of wood or a knife. However it may be conditioned, the resulting mischief is similar and the sensations immediately due to it are similar.

But sense-experience has another function besides that of compelling attention to incidents immediately affecting the

welfare of the organism at the moment. It serves also to regulate and guide the detailed development of such complex actions as that of a cat hunting a bird, or of a bird building its nest, or of a woman threading a needle. Processes of this nature involve delicate adjustment of movements and coadjustment of many movements in response to constantly varying external circumstances; and, in so far as they are not purely instinctive, they are conditioned not by the mere existence of sensuous impressions but by their acquired meaning and, in general, by their preformed associations.

What is important here is not the obtrusiveness of single sensations, but the perceptual 'value' of complex combinations of different sensations as yielding discrimination and recognition of external objects, their changes and their relations. This perceptual value in its higher development is incompatible with any special obstrusiveness of single sensations due to their own vividness and intense pleasantness or painfulness. For the obtrusiveness of the sensation, as such, would distract attention from its acquired meaning, from the ideal revivals which it calls up, and from the general course of the action which it contributes to guide.

4. Sense-Differentiation.—The development of mental life is thus connected with gradual decrease in the relative prominence of single sensations and increase in the perceptual value of groups of sensations; and this involves a corresponding difference in the nature of sense-experience itself. The more developed is perceptual consciousness the more delicately differentiated is sense-experience. In other words, there is a finer correspondence between differences in the nature of the external stimulus and differences in the sensation produced.

The distinction between what we call the higher and lower senses rests on this contrast between the intrinsic impressiveness of sensations and their value for perceptual consciousness. Organic sensations, temperature sensations, smells, and tastes are relatively low in the scale. On the other hand, sensations of touch proper, of sight, and of sound, are relatively high. The relatively higher senses deserve this

title in proportion as they are more delicately discriminative and more capable of being combined in successive and simultaneous groups and series while preserving their distinctive differences. On the other hand, each several sensation is proportionately less important through its own intensity and pleasant or painful character.

We find the same antithesis when we compare more primitive with more advanced stages in the development of animal life. Broadly speaking, lower modes of sentience come earlier than higher. Even what we now call the higher senses, such as sight and hearing, in their beginnings in the ascending scale of animal life, partook of the character of the lower and were probably more or less akin to organic sensations.

"Colours," says Ward, "are with us so distinct from sounds that—except as regards the excitement of attention . . .—there is nothing in the intensest colour to affect the simultaneous presentation of a sound. But, at the beginning, whatever we regard as the earliest differentiation of sound might have been incopresentable with the earliest differentiation of colour, if sufficiently diffused; much as a field of sight all blue is now incopresentable with one all red. Or, if the stimuli appropriate to both were active together, the resulting sensation might have been not a blending of two qualities, as purple is said to be a blending of red and violet, but rather a neutral . . . sensation without the specific qualities of either."[1] Thus "increased differentiation seems to be intimately connected with increased 'restriction.'"[2] With differentiation and restriction there is loss of the intensity and of the intrinsic pleasantness or painfulness of the sensation itself. Any direct effect produced by its own intrinsic intensity and affective tone would interfere with its value in the apprehension of physical objects. Thus, as perceptual consciousness becomes relatively more prominent and important, sensation is more delicately differentiated, more definitely restricted, less intense, and less strongly toned in the way of pleasure or pain.

[1] *Psychological Principles*, pp. 79-80. [2] *Ibid.*

5. Differentiation of Sense-Organs.—Degree of discriminative sensibility corresponds broadly to the complexity and differentiation of the organs of sense. If the nerve-fibres running to the skin in human beings are laid bare and directly stimulated, "then, however they be stimulated, be the stimulus weak or strong, if consciousness be affected at all, the affection takes on the form of pain; psychological examination of the subjective result discloses nothing that can be called a sensation of touch."[1] Touch- or pressure-sensations, delicately differentiated as they are, and almost neutral in tone, and capable of combining in one moment of consciousness a great variety of qualitative differences, can only be developed by the help of special terminal organs. But cutaneous pain-sensations, and all organic sensations which are vague, diffusive, and strongly-toned, arise without the help of highly differentiated end-organs. Now, in the ascending scale of animal life, we find a growing complexity and differentiation of the terminal organs of sense and of their nervous connections, marking a correspondingly graduated displacement of sensational by perceptual consciousness.[2]

In following the ascending scale of animal life, we find a gradual evolution of specialised structures for the reception of special kinds of external stimulation; beginning with those which are scarcely distinguishable from the general surface of the body, and ending with such elaborate organs as the human eye or ear. The best illustration is drawn from sight, because most is known about it. It must be understood that the word 'sight' is here used to mean merely 'sensitiveness to light.' It must not be assumed that the sensations produced by luminous vibrations are the same in the higher organisms as in the lower.

A very rudimentary beginning of a special structure for the reception of light-stimulation consists simply in groups of pigmented cells with a nervous connection. The pigmented material occurring in a semi-transparent organism arrests and

[1] Foster, *Textbook of Physiology*, p. 1427.

[2] This is only meant as a broad and schematic statement. In this or that special direction an animal lower in the scale may have a more differentiated sensibility than an animal higher in the scale.

absorbs the light. The limpet has eye-spots of this simple kind "on the outer side of the tentacles where the eyes are situated in more highly organised species."[1] The skin is thrown into a pit within which the epithelial cells are elongated and pigmented.

The next steps comprise the development of a lens for condensing the light in the manner of a burning-glass, and the development of a rudimentary retina. Some species of worms have only pigmented cells, other have a concentrating apparatus. These simple eye-spots, consisting of pigmented cells and a vitreous body or condensing lens, may exist in great numbers over the general surface of the organism. Thus in a species of worm called *Polyophthalmians* there is a series of eye-spots "along the sides of the body, in pairs from the seventh to the eighteenth segments."[2]

The rudimentary retina, essentially consists in a layer of rod-like nerve-endings. The eye of the snail is situated on its hinder horn or tentacle. It consists of a cornea or transparent horny integument, a lens, and a retina composed of three layers, (1) the rods, which are the proper organ of vision, (2) a cellular layer, (3) a fibrous layer. "In all probability the eye does little more than enable the snail to distinguish between light and dark. . . . It does not seem to be aware of an object unless it is brought within a quarter-of-an-inch of its tentacle."[3] The rods of the retina in which the optic nerve terminates in all probability merely render the animal differently sensitive to different directions of the light.

In many animals which possess these retinal rods the formation of an image in any way comparable to that thrown on the retina of the human eye is impossible from the position and convexity of the lens. These eyes with rudimentary retinas, more or less sensitive to direction, may be spread in great numbers over the surface of the body. There are certain species of a genus of sea-shore slugs called *Onchidium* which have these scattered eye-spots in varying numbers, some a hundred, others as few as twelve. The number differs

[1] Lubbock, *The Senses of Animals*, p. 139. [2] *Ibid.*, p. 134.
[3] Lloyd Morgan, *Animal Life and Intelligence*, p. 293.

in different individuals of the same species, and the eyes " are continually growing and being re-absorbed."[1]

The next stage in the development of the eye is the formation of a retinal image by means of a lens; it is necessary for this that each diverging pencil of rays from a point in the object shall be brought again to a focus in one point, and in only one point, of the retina. The delicacy and perfection with which this is effected depends on the complexity of structure of the retina, on the nature of the lens, and on the power of adjusting it for different distances. Cuttle-fish and their allies have well-developed apparatus for the formation of images. So have vertebrate animals, but of course in varying degrees. Many fishes do not distinguish their food —worms—at a greater distance than three or four feet. On the other hand, some of them have very accurate vision for short distances.

Besides this main line of development of the visual organ which leads up to the eye of vertebrates, with its apparatus for forming a distinct image by means of a lens and delicately sensitive retina, there is a branch line which leads to the compound or facetted eye of insects and of crustacea such as crabs and lobsters. The surface of these compound eyes is divided up into a great number of hexagonal areas, each of which is called a facet, and in some insects forms a little lens. A kind of dragon-fly is stated to have twenty thousand of these hexagonal facets. Beneath each facet is a crystalline cone, with its base towards the facet and its apex turned inwards, where it ends in great elongated cells, in the midst of which there is a nerve-rod. Dark pigment is developed round each of the cones. " Starting from a simple form of eye consisting of a lens and a nerve-fibre, we should arrive at the compound eye by bringing together a number of such eye-spots, and increasing the number of lenses, while the separate cells beneath each lens coalesced to form a single crystalline cone and rod."

As regards the way in which these eyes perform their function, there has been much dispute. One explanation is

[1] Lubbock, *op. cit.*, p. 143.

to the effect that the facetted organs, taken collectively, fulfil in a different way the same office as the lens in the eye of vertebrates. Only those rays of light which go straight through a crystalline cone affect the nerve-rod. All the rest, which strike the cone obliquely, are absorbed by pigment. Thus, each of the cones conveys to its own nerve-rod a single minute spot of light coming from a single point in the field of view, and from that point only. The result is what Lloyd Morgan calls a "stippled image,"[1] The range of vision with such eyes is much smaller, and the image which they form must be far less accurate and distinct than in the higher vertebrates.

Differentiation has proceeded to very unequal lengths in the different special senses, and it is by no means certain that any of the sensations we now experience are really primitive and unmodified. Probably the most primitive sensations we now experience are those derived from the stimulation of the termination of sensory nerves which are not provided with any special sense-organ or other accessory apparatus. "The genial light, warmth, and freshness which we seek as exhilarating, or the sultry glare and stifling heat which we avoid as depressing, furnish us with sensations of this kind, and we can readily imagine them to exist—nay, we can actually experience them—without any apprehension of the specific qualities we may now discern along with them."[2]

[1] *Op. cit.*, p. 290. [2] Ward, *op. cit.*, p. 110.

CHAPTER II.

ORGANIC, CUTANEOUS, AND MOTOR SENSATIONS.

1. Organic Sensations.—Some sensations are due to stimuli in the interior of the body: others are due to stimuli affecting sense-organs situated on the external surface of the body. Thus we have a broad division into internally and externally initiated sense-experiences. But this distinction is not important from a psychological point of view. We are interested as psychologists in the intrinsic resemblance and difference of various sense-experiences.

But there is no well-marked common character distinctive of internally conditioned sensations as contrasted with those occasioned by external stimuli. The sensations of nausea, cramp, or headache are internally initiated; the smarting sensations arising from a wound or blow are initiated from without. The sense-experiences which accompany the varying positions and movements of a limb are, for the most part, due to the excitement of nerves ending in joints, tendons, muscles, and bones; sensations of contact and pressure arise from impressions on the surface of the body. None the less, both as regards intrinsic nature and function in the mental life, a headache sensation has more affinity with the smart of a blow than with the sensations connected with the position and movement of a limb; and the sensations of contact and pressure have more affinity to muscle, joint, and tendon sensations than to the smart of a blow.

Hence, the distinction between external and internal stimuli does not of itself supply an adequate basis for the commonly recognised distinction between organic sensations and those of the special senses. The difference is more fundamental. Organic sensations have their source in such bodily processes as affect the nutritive or vegetative life of the organism; their stimuli are to be found in the varying condition of the blood supply, the digestion and assimilation

of food, the secretions, the supply of oxygen by breathing, and, generally, in such changes as make a difference to the efficiency of the bodily tissues in the performance of their vital functions. On the other hand, the sensations of the special senses arise from sense-organs specially adapted to respond to certain kinds of stimulus without reference to their effect on the vegetative life of the organism.

As illustrative examples of organic sensations we may take hunger and thirst. These experiences are partly due to the state of the stomach and pharynx: they consist in vaguely localised gnawing sensations which normally disappear when food or drink is taken. Sensations of dryness in the throat play an important part in the sensation of thirst. In hunger, the state of the stomach is not the only or the most fundamental condition. "A dog feels hunger after the complete removal of the stomach." "A man is usually less hungry after his ten hours' fast which has included the night's rest than after a four hours' abstinence in the working day." In both cases the stomach is equally empty. The difference depends on the processes of waste and repair which have been going on in the tissues of the body. The injection of nutritive material into a vein relieves the hunger without introduction of food into the stomach. "The feeling of hunger is relieved, is even converted into a pleasurable satiety, before the blood is saturated with absorbed material."[1]

It thus appears that, apart from the state of the stomach itself, the general character of the supply of blood and lymph which bathe the tissues and condition their vital processes is of essential importance.

The muscle, joint, and tendon sensations which are connected with the position and movement of our limbs belong to special senses, for position and motion are common to our bodies and other parts of the material world. But the sensations of muscular cramp and fatigue are organic; for they arise from changes in the state of the muscles which affect their vital efficiency. Fatigue, for instance, seems to be conditioned by the accumulation of waste products in the

[1] Sherrington, in Schäfer's *Textbook of Physiology*, Vol. III., pp. 991-2.

blood due to muscular action. It may be removed by the injection of fresh blood.

The smart of a wound, bruise, or burn is essentially similar in character. "The temperature at which the skin begins to evoke pain is that at which nerve-substance begins to suffer injury. The sensation caused by the pressure of a sharp point (*e.g.* a needle) on the skin is felt to be painful just below the pressure sufficient for the instrument to break into the skin, *i.e.* the stimulus becomes painful just before it does injury."[1]

In general, organic sensations lack distinctness. Though, for example, they have extensity, so that we can speak of them as being more or less diffuse, yet their extensity is crude, so that we cannot separately discern its parts and their relation, or apprehend anything which can be called a shape or outline.

On the other hand, they are very important as conditions of affective and conative consciousness. What we ordinarily call bodily pleasures and pains and bodily appetites are in the main connected with organic sensations. Such sensations constitute a large part of our immediate sensory experience in every moment of our conscious lives. Our vague total awareness of bodily well-being or discomfort, our 'feeling well' or the reverse, depends on an indefinite multitude of impressions reaching the brain from the internal organs, giving rise to sensations which in the main are subconscious and only confusedly apprehended. Total experiences of this kind are called states of the common sensibility or the coenaesthesis.

Sometimes a single organic sensation, through its peculiar intensity or novelty, detaches itself from the general mass and becomes salient in consciousness. The sensation thus singled out is usually of an intensely pleasant or painful character and obtrudes itself on the attention. It is disengaged from its context and marked off as a distinct sensation of headache, or cramp, or nausea.

A further peculiarity of organic sensations, which they share only with muscle, joint, and tendon sensations, is that they can be directly produced and modified by impulses

[1] *Ibid.*, p. 974.

proceeding from the central nervous system outwards to the bodily organs and leading to more or less widespread changes in the action of the heart and lungs, in the circulation of the blood, in the secretions, and in vital processes generally.

This influence of the varying states of the brain on organic process is always present in some degree. One of its consequences is that the stimulus of what we recognise as a single organic sensation is always more or less complex or diffuse. It may originate in some special modification in the state of this or that special organ of the body; but this gives rise to nervous excitement which overflows in outgoing nervous impulses affecting other organs and so adding further constituents to the sensation. For instance, the painful sensation produced by a wound is a complex sensation depending not only on injury to the skin, but also on disturbance to respiration, circulation, and the whole motor apparatus of the body.

Even the sensations of the special senses, when they are at all intense, are accompanied, for the same reason, by further organic change and the resulting experiences. The grating of a slate pencil may set the teeth on edge. It is disagreeable largely because of the widespread organic disturbance which accompanies it. What we call differences in the quality of pleasures and pains connected with sight and sound and other sensations of the special senses are partly, at least, traceable to this escort of organic experiences.

2. Cutaneous Sensations.—The exploration of the skin by punctate stimuli shows that it contains a mosaic of tiny sensorial areas, each yielding a certain special sort of sense-experience and apparently no other. Four classes of sensations can be distinguished: (1) sensations of touch proper, contact or pressure; (2) sensations of heat and of warmth; (3) sensations of cold and of coolness; (4) sensations of an organic character, which are called pains because they are, as a rule, intensely disagreeable.

The adequate stimulus for touch-sensations is mechanical, consisting in the pushing of the surface of the skin inwards, or the pulling of it outwards. The adequate stimulus for temperature sensations is an increase or diminution of the

temperature of the skin beyond a certain limit, which varies according to the pre-existing state of the end-organ. The adequate stimulus for pains is damage or threatened damage to the skin and the nerves which terminate in it. But some spots are also found to respond with their own distinctive sensations to inadequate stimuli. For instance, heat of from 45° to 50° C. applied to a cold spot produces a sensation, not of heat, but of intense cold. However a sensory spot may be stimulated, if it responds to the stimulus at all, it usually responds in the same way. If a fine needle be thrust into a touch-spot, there is " a sharply localised sensation of pressure unaccompanied by smart or sting or any painful quality. . . . The sensation is unaccompanied by cold or warmth even when a cold or warm needle is employed."[1]

Touch-spots, heat-spots, cold-spots, and pain-spots are, in general, intermingled with each other in varying proportions in different parts of the skin. The tip of the finger is especially rich in touch-spots, the cheek in heat-spots. It is the cheek " to which a washerwoman holds her iron when forming a judgment of its temperature."[2] The cornea—the transparent part of the outer membrane coating the eyeball—is furnished almost exclusively with pain-spots. On the other hand, pain-spots are few within the cavity of the mouth, and absent from certain parts of the inside of the cheek.

In distinguishing special areas for pain-sensations the quality of sensory pain must be distinguished from its unpleasantness. It is not implied that no other cutaneous sensations are disagreeable. They may be agreeable or disagreeable according to their varying intensity, duration, and other conditions. What is distinctive of pain-sensations is that they have a stinging, smarting, or pricking character. They are, in addition, nearly always unpleasant.

An important extension of our knowledge of cutaneous sensibility was initiated by Head, who severed a bundle of nerve fibres supplying the surface of the skin of his own arm and observed the gradual return of sensibility as the fibres grew again.

[1] *Ibid.*, p. 921. [2] Halliburton, *Physiology*, p. 767.

When the bundle of nerve fibres supplying a certain region of the skin is cut through, the immediate result is, of course, the abolition of all sensations depending on end-organs situated at the surface. None the less, it is still possible to produce sensations by impressions on the skin. These are due to the stimulation of sensory organs lying underneath the surface, supplied by nerve fibres coming from other bundles—those which also send fibres to muscles, joints, and tendons. It is, in this way, possible by relatively heavy pressure to elicit touch-sensations and also pain-sensations. But, under such conditions, there are no sensations of temperature; and there are no sensations of pressure or pain so long as the stimulation is confined to the skin itself, and is not communicated to underlying tissues. "A fold of the subject's skin may be gently raised between finger and thumb and even powerfully squeezed; yet the subject experiences no sensation of touch or pain."[1]

What is most interesting to us, however, is the manner and degree in which the 'heavy' touches are localised. To understand this, it is necessary to distinguish two different and relatively independent kinds of localisation. The first is tested by requiring the subject merely to indicate what part of the skin has been touched. He either keeps his eyes closed throughout the experiment, and then, without opening them, attempts to indicate the spot at which the experimenter has touched him; or opening his eyes, the subject endeavours to mark this spot on a life-size photograph of the region—for example, the arm—under examination.[2] Now, estimated in this way, localisation for 'heavy' touches is remarkably accurate.

But there is another kind of localisation. By 'localising' we may mean the perception of the position and direction of tactual or other sensations relatively to each other. This involves the perception of apartness, the discernment of two simultaneous sensations as end-points of an extensive interval separating and connecting them. This distinction of two sensations as being two, and as having an interval between

[1] Myers, *An Introduction to Experimental Psychology*, p. 4.
[2] *Ibid.*, p. 3.

them, is absent where there is nothing but heavy contact. For some time after the severance of the nerve, Head was unable thus to distinguish simultaneous pressures on the part of the skin affected. They appeared to him as a single blunt or diffuse pressure. Yet two sensations were discriminated as two when pressure was applied successively instead of simultaneously to neighbouring spots of the skin.

The fibres of the divided nerve grew again gradually in such a way that various sorts of skin-sensation returned more or less separately from each other until a normal state of sensibility was recovered. I quote Myers's account of the earlier stages.[1] Forty-three days after the operation islets of sensibility to pain "arising from stimulation of the skin itself made their appearance within the insensitive area." One hundred and twelve days after the operation, "there was . . . evidence of the first return of sensibility to cold." Twenty-five days after this, "the whole area had recovered sensibility to cold; but was insensitive to heat. Only a very small area now remained which was insensitive" to the pain of skin pricks. "One hundred and sixty days" after the severance of the nerve, "a patch of the affected area first became sensitive to very light touch." At the end of one hundred and ninety days, "cold was everywhere appreciable, and thenceforth the number of heat and cold spots increased rapidly. At this point, therefore, we have reached a stage when the touch-spots were just beginning to resume their function, and the sensations of cold, heat, and pain spots were already fairly restored."

The various sensations experienced at this stage showed certain characteristic peculiarities sharply contrasted both with those due to heavy pressure and with another form of sensibility which developed subsequently, and has been called 'epicritic.' As distinguished both from deep and from epicritic sensibility, the cutaneous experiences, at this point, belong to a class known as 'protopathic.' They are distinguished partly by the special modes of stimulation on which they depend, and partly by their intrinsic nature. The touch

[1] Myers, *Textbook of Experimental Psychology*, Chap. I.

sensations are indeed due to the skin itself, and not to pressure transmitted to underlying tissues.

Temperature sensations are excited only by stimulation of heat-spots and cold-spots. These spots react explosively, so that the intensity of the sensations depends on the end-organ which is stimulated rather than on the intensity of the stimulus. But they react at all only to high degrees of heat and cold, being insensitive to intermediate temperatures. The heat-spots never react to temperatures below 37° C., the cold-spots never react to temperatures above 27°. In general, protopathic skin sensations arise only through stimulation of the end-organs of separate sensory-spots.

In their intrinsic character, protopathic sensations partake of the nature of organic sensations. They are relatively intense and conspicuously disagreeable. They possess extensity; but localisation in both its forms is very rudimentary. The general reference of a sensation to the part of the skin affected is vague and inaccurate; and relative localisation, involving the perception of apartness, is almost completely absent. The sensations are commonly referred, not to the place stimulated, but to a place remote from it. "A prick applied to the forearm, for example, is not felt as a prick at all; it sets up a widely radiating pain over the thumb; . . . the same indefinite diffuseness and remote reference characterise the tingling sensations produced by the light touch of hairs of hairy regions."[1] The stimulation of heat-spots and cold-spots also yields vaguely radiating, tingling, and remotely localised sensations.

The point of greatest interest is the failure of the power of relative localisation, the power of definitely discriminating simultaneous touches so as to discern their position, distance, and direction relatively to each other. In merely protopathic sensibility, the awareness of apartness is almost entirely wanting; two simultaneous sensations are not perceived as distinct end-points bounding an extensive interval interposed between them. Protopathic extensity is crude or inarticulate and it seems intrinsically incapable of becoming otherwise.

[1] *Ibid.*, p. 12.

It consists of an indefinite diffuseness without detailed discrimination of parts and without definite form or outline. In this respect, protopathic sensations resemble those due to heavy pressure transmitted to underlying tissues. But where only protopathic sensibility is present, there is also a failure to indicate with any approach to accuracy the place stimulated. It is to be noted that when, with the gradual growth of the fibres of the divided nerve, the protopathic stage supervened on that of deep sensibility, even the power of localising, which existed previously, was lost. The characteristics of the earlier state were obscured by the later.

Epicritic sensibility, when it first began to appear, was confined to a small triangular patch of skin. Within this small area no protopathic sensations could be elicited. The subject was sensitive, in this region, to deep pains and pressures, but he did not experience the vague tingling touches due to contact with hairs, or the heat, cold, and pain sensations due to heat, cold, and pain spots. Instead of this protopathic sensibility, and in addition to deep sensibility, there was a finely discriminative sensitiveness to superficial touches, independent of the presence of hairs; there were also feelings of coolness and warmth arising on stimulation by temperatures intermediate between 26° C. and 37°. These sensations of touch and temperature were identical with those evoked from a normal skin area as regards "their capacity for being discriminated and localised" and "in the absence of remote reference and radiation." The subject could correctly name or point to the part of the skin stimulated. Besides this he could now, for the first time, discriminate two cutaneous sensations as being separate and as having an interval between them. He could perceive apartness, relative position, and direction. Hence this form of sensibility is called 'epicritic' —discriminative.

At this stage in the recovery from the effects of the experiment, protopathic without epicritic sensibility had returned over almost the whole of the region affected by section of the nerve. Only in one small patch were epicritic sensations present; and within this patch they occurred in separation from the protopathic so that they could be examined

by themselves. The restoration of normal conditions required that protopathic sensibility should be recovered by the small triangular patch and that epicritic sensibility should come back to the rest of the region affected. Both these processes took place slowly and gradually.[1]

The power of relative localisation, and consequently the appreciation of relative position and direction, and of shape, seem clearly to demand as an indispensable condition the presence of the epicritic system of sensations. But it is still a question whether the mere presence of epicritic sensation is by itself sufficient without the co-operation of other factors.

A very significant group of facts bearing on this question has been brought to light by cases of disease affecting nerves as they travel through the bulb and spinal cord between the brain and the skin or motor apparatus. Here also the work of Head is of great importance. He has examined a large number of cases in which the perception of apartness was very greatly impaired over the surface of a limb, although the limb was "completely sensitive to all cutaneous stimuli." He further found that this failure of relative localisation was constantly conjoined with the loss of the muscle, joint, and tendon sensations which yield awareness of the varying positions and movements of the limb affected. In the absence of these motor sensations, the patient was able to name accurately the part of the skin touched, without seeing it. When required to point to it, he was troubled by a difficulty in finding the limb at all; but when allowed to grope tentatively with the fingers, he came closer and might ultimately touch the very spot.

Head holds that this kind of localisation is not seriously impaired. The initial helplessness in finding the limb itself is evidently due to the absence of muscle, joint, and tendon sensations connected with it.

[1] Head's experiment has been repeated by Trotter and Morriston Davies and by Boring. His empirical observations have been in the main confirmed, but his physiological interpretation has not met with general acceptance. The psychological distinction between protopathic and epicritic sensibility—as descriptive of differences in sensory experiences—remains unaffected, however this distinction is to be accounted for.

In one case, where all knowledge of the position of the limbs, otherwise than by sight, was lost, the following experiments were performed. The patient's legs "were extended in the bed and he was allowed to see the position into which they had been placed. Then his eyes were closed and he was touched over the sole, instep, and just below the knee-cap"; on being asked where the point of contact was situated "in every instance his answers were correct, even though the touch was made with cotton wool. With his eyes still closed, the leg was moved into an entirely new position, and his answers were equally correct, although he was entirely ignorant that his leg had been moved and believed that it lay extended before him. Directly he was asked to point out the spot that had been touched and which he had named correctly, he beat the bed idly, entirely unable to find the limb.

"With the profound disturbance of the power of recognising the position of his limbs was associated an inability to discriminate compass-points" simultaneously applied; "on the outer surface of the left leg he failed when they were separated to 15 cm. and over the front of the left thigh at 20 cm. distance."[1] At the same time there was less of the power to discern shape, size, and weight. In such cases, skin sensibility was normal as judged by every other test except that of relative localisation.

Such evidence as this clearly shows that when there is no other defect in cutaneous sensibility, the perception of apartness, of shape, and of size, may be abolished or gravely impaired. This is not due to any peripheral condition, but only to something which takes place in the central nervous system. The lesion which produces the disturbance of function does so by interference with the course of nervous impulses travelling through the posterior columns of the spinal cord, and by interference with their further course in the mid-brain, or even in the cortex. Many cases occur where these parts are unaffected, and there is no failure in local discrimination in spite of other defects of sensation.

[1] Head and Thomson, "The Grouping of Afferent Impulses within the Spinal Cord," *Brain*, Vol. XXXIX.

The explanation of these facts is probably to be found in what I have already said in discussing local signs. It is not unlikely that the immediately experienced diversity of places within an extensive whole probably depends on central rather than on peripheral conditions. Head's work strongly confirms this position. It seems to show that the immediately experienced diversity of places depends on special nervous arrangements which may be independently interfered with, although cutaneous sensibility is otherwise unimpaired. When this happens, relative localisation together with perception of size is correspondingly affected. At the same time there is loss of motor and deep sensibility because the nervous impulses from muscles, joints, and tendons follow the same course as those on which local signs depend. From the loss of motor sensibility there follows the failure to determine the position of the limb and to appreciate weight.

This interpretation of Head's results presupposes the absence of what I have called local signs—immediately experienced place-differences which are nothing but place-differences. But if these are absent, how is the patient still capable of absolute as distinguished from relative localisation? How can he, for instance, distinguish contact with the sole from contact with the instep? The reason is that, except for the absence of local signs proper, the sensibility of the skin is otherwise unimpaired, and that this varies owing to peripheral conditions in complex and finely differentiated ways for different parts of the sensitive surface.

"Scarcely two portions of the sensitive surface of the human body are anatomically alike. Not only in the distribution and character of the nerve endings, but in the variety of the underlying parts—in one place bone, in another fatty tissue, in another tendons or muscles variously arranged—we find ample ground for diversity in the local colouring of sensation."[1] These local colourings are wrongly identified by Ward with local signs proper. They may be regarded as secondary or auxiliary local signs; but they cannot fulfil the function of the unique experience of place-difference which is

[1] Ward, *Psychological Principles*, pp. 147-8.

centrally and not peripherally conditioned. What seems to follow from Head's researches is that such colouring affords a sufficient basis for absolute localisation when an ideal representation of the spatial relations of the body has been already acquired through past experiences. But it does not make relative localisation possible.

When there is nothing to discriminate, there can be no discrimination. Hence the abolition of local signs proper involves the abolition of the perception of apartness and other relations which presuppose it. But we must be on our guard against assuming the inverse proposition—that where local signs proper are present, this by itself adequately accounts for the perception of apartness, distance, direction, shape, and size. On the contrary, there is reason for holding that the definite awareness of local distinctions and relations is to a large extent, if not wholly, acquired by a gradual process involving other factors besides extensity and local signs.[1] In this process a most important part is played by experiences involving active movement with the concomitant series of muscle, joint, and tendon sensations. It is mainly through such active movement that we apprehend relations of direction, distance, and position.

It thus appears that local signs are not the sole factor on which relative localisation depends. None the less, they are of fundamental importance. Their presence or absence constitutes the difference between epicritic sensations on the one hand, and deep or protopathic sensations on the other. The varying degrees in which they are present also determine the possible fineness of local discrimination. It has been mentioned that the minimum distance between two compass points required in order that touch-sensations due to neighbouring contacts may be discerned as separate and as connected by an interval, varies with the variable sensibility of different parts of the surface of the skin. This minimum distance is called the threshold or 'liminal' distance. For the tip of the tongue, the threshold is ·1 cm.; for the tip of the finger it is ·2 cm.; ·7 cm. for the tip of the nose; 2 cm. for

[1] Fineness of local discrimination improves greatly and rapidly with practice. Children learn gradually to appreciate spatial relation.

the inner surface of the lips; 5·4 cm. for the back of the neck; 6.8 cm. for the arm and thigh. The tip of the tongue is thus more than 60 times as finely discriminative, in this respect, as the arm or thigh.

We have to add that the amount of the felt interval between the two contact-sensations also varies correspondingly for different parts of the sensitive surface. "If two points kept equidistant . . . be drawn across the skin so as really to describe a pair of parallel lines, the lines will appear farther apart in some places than in others." They will appear to approach each other and recede from each other. "If, for example, we draw them horizontally across the face, so that the mouth falls between them, the person experimented upon will feel as if they began to diverge near the mouth and to include it in a well-marked ellipse."[1] Similar results are obtained when contact with a continuous line or surface is substituted for contact with two separate points. The minimum length of a line required to enable us to perceive it as being a line is less than the threshold interval for the perception of apartness of two points. But in this case the direction of the line is not apprehended.

The shape of a surface pressed against the skin is discerned only when the area touched distinctly exceeds in extent the threshold for the perception of apartness. The diameter of a circle must be at least 3·3 mm., if the circle is to be felt as circular by the tip of the tongue, whereas the threshold interval for apartness is 1·1 mm. The sensitiveness of the skin of the same area for local discrimination is, in general, greater in a transverse than in a longitudinal direction, greater across a limb than along it. This makes a difference to the apprehension of shape. The cross-section of a circular tube pressed on the skin appears as if it were transversely oval; whereas a true oval, with its longer axis lying lengthwise on the skin, may appear circular.[2]

Another point which has some theoretical importance is the following: "When two skin-points (*a* and *b*) are simultaneously touched with the compass tips, the distance between them

[1] James, *Principles of Psychology*, Vol. II., p. 141.
[2] Schäfer, *op. cit.*, Vol. II., p. 943.

appears greater than if one point travels not too slowly from *a* to *b*."[1] The quicker it travels, the shorter appears the distance; the more slowly it travels the longer appears the distance. If it travels very slowly the distance may seem greater than when *a* and *b* are touched simultaneously. This shows that actual motion-experiences, when they occur, are factors in the perception of apartness, thus confirming the view that their revival by association is important when the actual sensations are not present. Another fact which clearly points in the same direction is that the power of relative localisation on the surface of a limb is greater or less in proportion as the limb is more or less used in active movements of exploration. In much used areas, such as the finger tips, local discrimination is very fine; whereas in regions comparatively little used in the active exploration of objects, such as the upper arm or the middle of the back, the reverse holds good.

3. Motor Sensations.—Under this head we bring all sensations, not organic in their character, which depend on afferent impulses passing to the brain from the endings of sensory nerves in the organs of movement—in joints, tendons, and muscles. They are called motor because they have their adequate stimuli in the variable states of the motor organs. They are also sometimes named kinaesthetic sensations. Through them we are aware of the posture and of the motion of our limbs and body, so far as this is not accounted for by sight and touch.

Ordinarily, we have some visual perception of the spatial relations of our body to surrounding things and of its parts to each other. Besides this, the cutaneous sensations which we are constantly experiencing, together with the meaning they have acquired through highly complex associations, give us normally a perception of the shape and size of our limbs and of the position of the parts of our skin relatively to each other. Hence, if one hand, for example, touches the other, we are aware through tactual sensation that it is the hands and not other parts of our body which are in contact, though

[1] *Ibid.*

muscle, joint, and tendon sensations also help in the identification. In the same way, we are aware which part of each hand is touching the other.

But conditions of this kind fail to account for our discernment of the posture and changes of posture of our limbs when they are held in various positions or moved in various directions without being seen and without contact with other parts of the body. They cannot inform us of the position of our hand when, the eyes being closed, it is stretched out in front of us or held out towards one side, or raised above the head; or of the position of the leg when it is raised to take a step. They cannot account for our ability, in the dark, to touch any selected finger of one hand with any selected finger of the other, whatever may be the initial positions of the hands and fingers. In such cases, we depend on the sensibility of organs in muscles, joints, and tendons.

Motor sensations are also of great importance in appreciating weight and resistance. Pressure-sensations, more especially those belonging to deep sensibility, fulfil this function to some extent. But the accuracy of the judgment is very much increased when sensations due to varying degrees of tension in muscles, joints, and tendons are also brought into play, as when a weight is lifted and lowered in the hand. These strain-sensations make possible the estimation of weight, even when the skin is insensitive. Where a limb is entirely anaesthetic, so that both motor and tactual experiences are absent, there is no distinction of lighter and heavier, except through inference from the external appearances of objects.

If, instead of actively initiating a movement ourselves, our limbs are passively shifted by another person, or if they are set in motion by an electric current passing through the muscles, the appreciation of changing position and of resistance is virtually unaffected. The main difference is that in the first case we are aware of the movement as due to our will, and in the second as involuntary. In pathological cases where the sensibility of the muscles, joints, and tendons of a limb is lost, the patient is aware that he has attempted to move the limb in a certain way, but, with closed eyes, he has no sufficient means of determining whether the movement

has actually taken place. He then proceeds on the sole clue he possesses, and assumes that the movement has followed because he has willed it, though in reality it may not have done so. If, for instance, he attempts to shift his leg or arm, he assumes that the attempted change of position has really occurred, even though the leg or arm has been held fixed in the same place.

It was once supposed that actively initiated movements involved a peculiar sort of sensation connected directly with the discharge of nervous impulses from the motor areas of the brain to the muscles, and not due to incoming impulses from joints, muscles, and tendons. The existence of this 'innervation-sense,' or sense of energy put forth, is now generally denied. It is hard to reconcile with the fact that the motor areas of the cortex yield no sensation when they are directly stimulated by the electric current, whereas sensations can be elicited in this way from the areas situated immediately behind them which receive afferent nerves from the skin and motor organs.

Further, the supposed sense of innervation accounts for nothing which cannot be as well accounted for without it. It is not required to explain volition; for volition is not sensation of any kind. Nor is it needed to explain the consciousness of attempting or of having attempted to make a certain movement which is still found in the absence of the resulting motor sensation that informs us of the actual occurrence of the movement. It is true that in making the attempt there must be some anticipation of the desired result. But ideal anticipation is sufficient. In all probability such ideal anticipation always involves some re-excitement of the experiences in the way of muscle, joint, and tendon sensation which we have had in previous similar movements of the same limb. There is also usually some forecast of the result in terms of visual and other kinds of sense experience which do not belong to motor sensibility at all. It is quite unnecessary to posit, over and above these conditions, a unique sensation originally connected with the passage of motor impulse from the brain toward the muscles.

When a limb is paralysed, the attempt to move it may be attended by a feeling of motor effort, although there is no

movement of the limb and consequently no motor sensation due to it. But this is explicable by two conditions taken together. (1) The subject has the experience of attempting to make the movement; (2) he experiences, as the result of his attempt, other motor sensations due to the contraction of muscles which do not belong to the paralysed limb. "Any attempt at movement is never confined to a single muscle or limb, but always involves other parts of the body. The muscles of the opposite part of the body or of the respiratory system are commonly involved; when, for example, we endeavour to lift a weight, the glottis closes and the abdominal muscles and diaphragm contract."[1] The experiences due to these collateral processes suggest that the required movement has been executed even when the limb itself is insentient.

It must not be supposed that the information normally conveyed by motor sensations is wholly due to the existence and nature of these sensations themselves. On the contrary, it is essentially a meaning acquired by habitual association with experiences of touch and sight. Our acquaintance with the shape and size of our own body and limbs and with the positions and distances of different parts of our skin relatively to each other is not due, in the first instance, merely to muscle, joint, and tendon sensations. Primarily, we obtain this definite spatial apprehension of our body, partly by experiences arising from the mutual contact and mutual exploration of the different parts of the skin, as when the hands rub against each other, or one of them passes over the surface of the face or leg; partly again, by seeing our body and its parts both at rest and in motion.

Now motor sensations, due to muscles, joints, and tendons, are constantly and intimately united with these cutaneous and visual experiences, so that in attending to the one we must also attend to the other. When, for instance, the two hands are rubbed against each other, the successive contacts are each accompanied by different modifications of the motor experience due to the muscle, joint, and tendon sensation of the elbow or wrist or both at once. Similarly, if we are

[1] Myers, *Textbook of Experimental Psychology*, p. 217.

looking at the hands, as their visual appearance changes its position in the visual field, there is a corresponding series of changes in the sense-experience due to the organs of movement.

Thus, this habitual connection of the motor sensations, on the one hand, with the tactual and visual experiences, on the other, will give rise to total dispositions, re-excitable as a whole even when part of the original experiences which contributed to form them is absent. The resulting association is of that intimate kind which we have called 'complication.' The complication is even more intimate than that between the sight of ice or water and the tactual experiences of coldness or wetness.

It follows that motor sensations must acquire the meanings which primarily belong to the associated experiences of touch and sight. This explains how and why we are constantly and immediately aware of the position of our limbs at any moment and of the direction and extent of their movements through muscle, joint, and tendon sensations, independently of actual touch and sight.

It is difficult for the developed consciousness to disentangle such experiences from their associations so as to determine what meaning they are capable of conveying through their own nature and their combination with each other. Yet it is possible clearly to distinguish their presence by a suitable direction of attention. When, for instance, we crook a finger or bend our arm at the elbow, by attending to what appears to take place at the joints we can discern, besides sensations due to crumpling of the skin, etc., other sensations, more akin to touches and pressures than to any other kind of sense-experience, but much vaguer than epicritic touch. They have a crude extensity, which, when it is attended to, involves a crude awareness of extension. But there is no perception of apartness or of shape.

On the other hand, as the finger or elbow is being bent, we are aware of change-sensations referred to the joints, comparable to the immediate experience of motion which we have when, for example, the finger tip is passed over the palm of the opposite hand. There is, however, this important difference: that movement-sensations referred to the joints lack the

definiteness which depends on epicritic sensibility. We do not discrimate simultaneously the point whence the movement has started from the point at which it has arrived. None the less, the successive phases of the motion-experience are finely differentiated, like successive pressures on the skin which excite the 'deep,' as distinguished from the epicritic, sensibility.

We also localise in the neighbourhood of the joints the various degrees of tension felt in making an effort against resistance by pushing or pulling or lifting. In pressing my fingers against the table I can distinguish clearly between skin sensations and other similar though vaguer sensations referred to the locality of the finger-joints and of the wrist.

In the apprehension of the positions and movements of a limb, it seems clear that joint-sensations play the leading part. The special importance of the joints is proved by experiments carried out by Goldscheider, who "caused his fingers, arms, and legs to be passively rotated upon their various joints in a mechanical apparatus which registered both the velocity of movement impressed and the amount of angular rotation. No active muscular contraction took place. The minimal felt amounts of rotation were in all cases surprisingly small, being much less than a single angular degree in all the joints except those of the fingers."[1] Anaesthesia of the skin made little difference to the result. Anaesthesia of the joints themselves greatly decreased the power of discrimination.

Sensitiveness to movement at the joints is partly dependent on the extent of the movement and partly on its speed. The same extent of movement which is discernible when the movement has a certain rapidity becomes imperceptible when its rapidity is decreased. Speed being kept constant, sensitiveness varies for different joints. With a speed of, say, ·3° per second, an excursion of from 1·15° to 1·30° in extent is just appreciable at the ankle-joint, of 9·5° to 9·8° at the hip, of ·26° to ·42° at the wrist. Given the same range of movement about the joint, the speed required to make it discernible is

[1] James, *op. cit.*, Vol. II., pp. 192-3.

also different for different joints. If the rapidity required for the shoulder is 3° per second, that for the elbow, with the same range of movement, is 7° per second, that for the first joint of a finger is 12·5° per second.

A much smaller and also a much slower movement is just noticeable in the case of the larger joints situated near to the body than at those which are farther away from it. If we take into account both the "speed and largeness of the excursion of the limb required to give a just discernible sensation, the sensitiveness of the shoulder is more than forty times that of the fingers."[1] Of course, both extent and speed of movement are measured as we measure the motion of the hands of a clock, in terms of the magnitude of the angles traversed.

The importance of the rate of movement for awareness of excursions of the limbs like in extent, shows that the motion-sensations of the joints are not reducible merely to a series of position-sensations, each such as might have been experienced with the limb at rest. Undoubtedly our awareness of the place of an unmoved limb depends on the presence of these 'stataesthetic' sensations, as they have been called. But the awareness of motion as conditioned by the sensibility of the joints does not consist in a combination of stataesthetic sensations strung together in succession.

There is in addition the unique and irreducible transition-experience. This may be discerned where there is no discernment of successive positions. "The effect of transmitting a electric current through a joint is to obliterate awareness of position, while awareness of movement (although much more obtuse than in the absence of faradisation) is still preserved. . . . It is also found that a passive movement may be recognised, and yet the *direction* of movement and hence the nature of the change of position may be doubtful."[2]

The special value of the joints for motion-sensations is connected with their structure. They are double organs, consisting of two sensitive surfaces, which rub against each other as the limb moves. The conditions are so far com-

[1] Schäfer, *op. cit.*, Vol. II., pp. 1614-15.
[2] Myers, *Textbook of Experimental Psychology*, p. 69.

parable to those of the mutual exploration of different parts of the skin, as when the two hands are rubbed against each other. Only we have to remember that the joint surfaces have not epicritic sensibility, but only something analogous to the deep sensibility of the skin. The contact and movement of the joint surfaces relatively to each other seems incapable of yielding the perception of the simultaneous apartness of two contacts. None the less, this is compatible with delicacy in the discernment of motion-sensations and of successive position-sensations, which is all that is required to enable the joint-experiences to give, through their acquired meaning, minute and accurate information concerning the position and motion of our limbs.

Joint-sensations are, as James observed, capable of parallel variation to all the various peculiarities of external motion. "There is not a direction in the real world nor a ratio of distance which cannot be matched by some direction or extent of joint-rotation. Joint-feelings are 'roomy.' Specific ones are contrasted, *inter se*, as different directions are contrasted within the same extent. If I extend my arm straight out at the shoulder, the rotation of the shoulder joint will give me one feeling of movement; if then I sweep the arm forward, the same joint will give me another feeling of movement."[1]

The meaning which joint-sensations are capable of conveying by themselves, apart from their association with other experiences, is, as I have said, usually merged and lost in their acquired meaning. The reason is that it is the acquired meaning alone which normally interests us. A more or less parallel case is found in the use of such instruments as a pen, a knife and fork, or the surgeon's probe, or the stick with which a blind man guides his steps.

[1] *Op. cit.*, p. 194.

CHAPTER III.

TASTE AND SMELL.

1. Taste.—The greater number of the sensations which are usually ascribed to taste are in reality odours. If the nose be held and the eyes shut, it is very difficult to distinguish, in eating, between an apple, an onion, and a potato; the three may be recognised by their texture, but not by their taste. Cinnamon applied to the tongue under the same conditions appears like flour; the taste may appreciate a slight sweetness, but that is all. There are four undoubted taste-sensations—sweet, salt, acid, and bitter. What is known as an alkaline taste is held to be a blend of salt and sweet together with characteristic touch-sensations; it may be imitated by mixing strong solutions of salt and sweet substances. Metallic tastes are supposed to be due to a mixture of salt and sour.

All taste-sensations appear to be intermingled with and qualified by tactile sensations. An acid, too slight to be distinguished as such, produces a peculiar touch-sensation by its astringent character; and as the acidity is increased the touch-sensation becomes stinging, and finally passes into a pain-sensation which completely dominates the special experience of acidity. Salt is also accompanied by a stinging sensation; but this does not reach the same pitch of intensity as in the case of acids. The sensation of softness and smoothness is associated with sweetness; this is appreciable when the sweet substance is present in quantities so small that it cannot be discerned as such. As the sensation of sweetness becomes intensified, the touch-sensation is dominated and obscured by it. But it emerges again as the sweetness is further increased. Very intense sensations of sweetness are sometimes accompanied by a biting sensation.

The tip of the tongue is especially sensitive to sweetness, the edges to acidity, and the base to bitterness. The tip and edges are equally sensitive to salts, the base less so. When

the mouth has been washed out, and some neutral substance, such as distilled water, is applied to the tongue, the result differs according to the point of application, and varies in different persons. The base of the tongue appears, in general, to respond by a sensation of bitter. In some persons the same sensation is aroused to whatever part of the tongue the distilled water is applied. Others feel no sensation except at the base. Others feel a sensation of sweetness at the tips and of acidity at the edges.

There appear to exist among taste-sensations relations somewhat analogous to the contrast of colours. Salt, by a sort of contrast, makes distilled water taste sweet. It has the same effect on solutions of sweet substances which in themselves would be too weak to be appreciable. It also has an intensifying effect on solutions which are strong enough to be appreciable. It operates in this way both when the same part of the tongue is successively stimulated, first by a salt, then by a neutral or sweet fluid, and also when the salt and the sweet are simultaneously applied to homologous parts of the tongue—to corresponding points on the right and left edges of the tongue.

Sweet has a much weaker contrast effect on salt, than salt on sweet. Sweet, instead of making distilled water taste salt by contrast, makes it taste sweet. On the other hand, contrast with sweet makes distinctly appreciable a salt solution in itself too weak to be perceived. Similar relations have been observed between salt and acid, and between sweet and acid; but in the case of sweet and acid they are manifested only when the two stimuli are applied successively to the same part of the tongue, not when they are applied simultaneously to homologous parts. Bitter appears neither to produce contrast effects nor to be affected by them.

There is also compensation and rivalry between tastes. When two stimuli act simultaneously on the same organs they may give rise to a sensation differing from that which either would produce separately; but they may also partially or wholly neutralise each other, as sugar neutralises the sourness of fruit or the bitterness of coffee. This is compensation. It also sometimes happens that, under such con-

ditions, two tastes are experienced alternately as if there were a conflict between the two stimuli, now one prevailing and now the other. This is rivalry.

The sense of taste can be stimulated only by fluids. Solid substances must be dissolved in the mouth before they can affect it.

2. Smell.—The appropriate stimulus for the sense of smell, appears to consist of particles conveyed to the membrane in a gaseous or liquid medium. The sensations of smell have not been adequately classified or analysed into their primary constituents: there appears to be a very great variety of them[1]. They are often modified by mixture with touch and taste sensations. The pungency of an odour is not strictly a sensation of smell at all, but a peculiar kind of tactual experience. Odours proper do not appear to produce sneezing: this is due to irritation affecting the sense of touch.

Odorous sensations take "some time to develop after the contact of the stimulus with the olfactory membrane, and may last very long. When the stimulus is repeated the sensation very soon dies out: the sensory terminal organs speedily become exhausted. The larger, apparently, the surface of olfactory membrane employed, the more intense the sensation; animals with acute scent have a proportionately large area of olfactory membrane. The greater the quantity of odoriferous material brought to the membrane, the more intense the sensation up to a certain limit; and an olfactometer for measuring olfactory sensations has been constructed, the measurements being given by the size of the superficial area, impregnated with an odoriferous substance, over which the air must pass in order to give rise to a distinct sensation. The limit of increase of sensation, however, is soon reached, a minute quantity producing the maximum of sensation, and further increase giving rise to exhaustion. The minimum quantity of material required to produce an olfactory sensation may be in some cases, as in that of musk, almost immeasurably small."[2]

[1] Reference may be made to the work of Zwaardemaker and Henning.

[2] Foster, *Textbook of Physiology*, pp. 1389-90.

The sense of smell plays an immensely important part in the life of animals. It is to them what sight and hearing are to us. The animal detects its prey and follows it by means of scent. On the other hand, the scent of the pursuer warns the prey and guides its efforts to escape. Probably every individual and every species has its own characteristic and distinctive odour. There are some men who can distinguish human beings by smell; dogs and other animals posses this power in a very high degree.

The ants of one nest attack those of another nest or of another species who may intrude among them; whereas they never under normal conditions attack ants belonging to their own nest. It has been clearly shown by experiment that this is due to the peculiar and distinctive odours belonging to different nests and their inhabitants. The unfamiliar odour of an ant coming from a strange nest has an exasperating effect. The intruder is attacked and usually killed. If before being introduced into a nest it is first bathed in juice produced by crushing the tenants of the nest, no notice is taken of it however widely it may differ in appearance from these. It is incorrect to say that ants 'recognise' other ants as belonging or not belonging to their own family: all depends on the irritating effect of the unfamilar odour of strangers.[1]

The comparatively small part played by smell in the mental life of human beings may be accounted for by the fact that trains of ideas constitute so large a part of human experience. Smells are not adapted to ideal revival in serial succession as sounds and sights are.

[1] See Albrecht Bethe's *Dürfen wir den Ameisen und Bienen psychische Qualitäten zuschreiben, Archiv für die gesammte Physiologie,* Bd. 70. Bethe also shows that some species of ants find their way to and from their nests by means of smell. In moving they leave an odorous track behind them.

CHAPTER IV.

LIGHT-SENSATION.

1. Nature of the Stimulus.—The differences in physical theories concerning the nature of light do not affect the psychological questions with regard to light-sensations. For our purposes the stimulus may be conceived as an undulating movement of the particles of a generally diffused medium, analogous to the waves which pass along a rope, when it is fixed at one end and jerked up and down by the hand at the other. As the wave traverses the rope, what travels along it is not of course the material particles of the rope themselves, but only a form of movement which is transmitted from one set of particles to another.

The hand may move more or less quickly; the more quickly it moves, the shorter are the waves. In the undulating movement the particles of the rope first rise above and then fall beneath their position of equilibrium when the rope is at rest. They rise to a crest, and sink into a hollow. The length of the wave is measured by the distance along the rope between the point at which this movement begins and the point at which it terminates. Longer waves traverse the rope in the same time as shorter ones; hence the shorter wave must be more frequently repeated in the same time. Thus the shorter the wave the shorter the time it takes to complete itself.

The amplitude of the wave must be carefully distinguished from its length. The hand, while continuing to repeat its movements in the same time, and consequently producing waves of the same length, may take a more or less extended swing. The more extended the swing, the greater is the amplitude of the waves that traverse the rope. The particles of the rope rise higher and sink lower; their crests are higher and their hollows deeper.

Suppose now that the hand, in making its excursion to and fro, also trembles. Different kinds of impulse are then communicated to the rope, each of which separately would give rise to waves of different length. The result is waves of a more complex form which can be mathematically explained as if they were formed by a combination of the waves which the separate impulses would severally produce.

Thus we can distinguish three characteristics of an undulating movement: (1) wave-length, (2) amplitude, (3) simplicity or complexity. In the case of light, each of these characters of the physical undulation is specially connected with a corresponding characteristic of visual sensation.

Differences of *wave-length* are specially connected with differences of *colour-quality* other than those which are constituted by degrees of paleness or darkness, viz. by more or less resemblance to white or black. Colour-quality in this restricted sense is called *colour-tone*. For example, the difference between yellow and green, or between yellow-green and a still yellower green, is a difference of colour-tone. The difference between yellow and yellowish-brown is difference in saturation due to a darkening of the yellow.

The *amplitude* of the wave is specially connected with the *intensity* of the sensation. Any specific colour-tone, such as green or red, produced by light of a certain wave-length, may be made brighter or less bright by increasing or diminishing the intensity of the light, viz. the amplitude of the vibration. It may become brighter without alteration of its colour-tone. If we have a series of greys including what we call white, arranged in a graduated scale of brightness, it is possible to fix the brightness of a given colour, such as green, by comparing it with the greys. It is judged to be equally bright with one of them, and more or less bright than the rest.

The *complexity* of a wave determines what is known as the *degree of saturation* or purity of the corresponding colour. We can, as we have seen, compare a green with a grey or white in respect of intensity or brightness: but we can also compare it in another respect: we can ask how far the green resembles the grey in quality. It may be a greenish grey or a greyish green, or apparently a pure green. The more it approximates

to grey, the less saturated it is, and the more free it is from any apparent admixture of grey, the more saturated it is.

It must not be supposed that colour-tone is determined solely by wave-length, intensity solely by amplitude, and degree of saturation solely by complexity. It is only within certain limits that the physical intensity of light can be varied without affecting colour-tone. Variation in the intensity of the light also affects saturation; increase makes the colour whiter, and decrease makes it darker. Wave-length not only determines colour-tone, but also helps to determine brightness. Some colour-tones are brighter than others, even though the physical stimulus is less intense. Complexity of vibration is a very important factor indeed in determining colour-tone. The same colours which are produced by simple waves can be produced by complex waves also, though in some cases they are less pure or saturated. White or grey results from a combination of lights of all wave-lengths, and also from various other combinations. In ordinary daylight, all wave-lengths are combined.

2. Structure of the Eye.—The eye as a whole is analogous to a photographic apparatus. "In it a camera or dark chamber of notable size exists similar to that which a photographer uses, having a lens in the fore part, and a sensitive curtain at the back. . . . When the photographer looks in at the back of his camera, he sees on the ground glass plate the image depicted which he wishes to photograph, placed upside down, but faithfully delineated in all its colours; and such an inverted landscape is formed in like manner in the back part of each of our eyeballs. And as the photographer adjusts the focus of his instrument by altering the position of the lens, screwing it nearer or further from the screen, so we adjust the focus of our eye instinctively according to the distance of the object looked at, not indeed by changing the position of the lens but by altering its form so as to make it stronger or weaker as required."[1]

The sensitive curtain is called the 'retina'; when an object is looked at directly by a normal eye the optical image of that

[1] Cleland, *Evolution, Expression, and Sensation*, pp. 77, 78.

object is focussed upon a small oval area about the centre of the retina known from its colour as the 'yellow spot.' This area, in the centre of which is a minute depression or pit called the *fovea centralis*, is in an ordinary light by far the most discriminative part of the retina, and it alone gives distinct vision of an object. Near it on the nasal side, the optic nerve enters the eye and pierces the retina to send its fibres radiating over the inner surface, and the spot at which the optic nerve comes through, being insensitive to light, is called the 'blind spot.'

The retina, although a very thin and delicate membrane, consists of several distinct layers. In the innermost layer the fibres of the optic nerve are spread out. The outermost layer consists wholly of minute rod-like structures packed closely side by side and perpendicular to the surface of the retina. These are the elements in which the light rays produce their immediate effect, probably chemical changes. They are of two kinds, called respectively the rods and the cones, and are connected with the nerve fibres of the innermost layer by highly complex systems of fibres which make up the middle layers of the retina. In the *fovea centralis* the cones alone are present of all the retinal constituents. The proportion of rods to cones increases from the *fovea* towards the periphery, and outside the area of the yellow spot the rods predominate largely. The retina differs from all the sense-organs except the olfactory in being an out-growth of the brain.

3. Analysis of Light-Sensations.—We must distinguish between neutral tints and colours proper. Neutral tints consist of black and white and intermediate greys. Starting with pure black, we can arrange the greys in a series, so as to pass by gradual transitions to pure white. Each grey may be interposed between two others which it resembles so closely as to be barely distinguishable from them. It differs from the one which precedes it in being a little lighter, and from the one which follows it in being a little darker. Thus, though the greys differ, the general form of transition between them is throughout identical.

The eye is capable of distinguishing about seven hundred shades of grey, from the deepest black to the most brilliant white. It should be noted that though black is not due to a positive physical stimulus, as other visual sensations are, it is yet a positive experience. The eye which sees darkness is not at all comparable with the back of the hand, which sees nothing. There is reason for believing that the so-called 'retina's own light'—the grey field which remains present to consciousness in the continued absence of light—is due directly to a brain-process, and does not involve excitation of retinal elements at all.

Differences of colour-tone, apart from differences of saturation and intensity, are best studied in the order in which they occur in the spectrum. The spectrum is formed by passing ordinary white light through a prism, and so breaking it up into its component simple lights, and projecting these on a screen. The simple components of the white light are then arranged in a series in the order of their wave-lengths. At one end are the longest wave-lengths, giving the sensation of red, at the other the shortest, giving the sensation of violet, viz. a blue tinged with red. Between the red end and the violet end are interposed all the various colour-tones, with the exception of the purples. The purples can be formed by intermixing red and violet lights in varying proportions. The spectrum completed by the addition of these purple tints provides the total range of colour tones. But unfortunately the spectrum is unsuitable in some other respects for analytic comparison of colour-tones. In comparing a series of colours merely with reference to their colour-tones, their brightness and saturation ought to be kept as uniform as possible. But the colours of the spectrum differ greatly in brightness. Hence in what follows we shall suppose a series of colours arranged in the order of the spectrum, but uniform in brightness and saturation. Such a series may be made by taking bits of transparent coloured paper, and adjusting their degree of brightness and saturation by placing bits of grey or white paper underneath them.

The whole series of colour-tones, beginning with red and returning to red through purple, is continuously graduated,

like the grey series of which we have just spoken. But there is an important difference. In the region of greatest wave-lengths, the transitions are from red to yellow; each member of the series is interposed between two others which it resembles so closely that the difference is barely perceptible, but it differs from the one in being redder, and from the other in being yellower. Thus the form of transition in the series is uniform throughout, and is quite analogous to that between black and white. But after passing yellow, there occurs what may be best described as a change of direction. The transition is still continuous; but it now takes place between yellow and green. We begin with greenish yellows, and pass by the smallest perceptible transitions to yellowish greens, and so to pure green. After passing green there is another change of direction; we now have a green-blue series. There is still another turning-point after passing blue; the series which follows is blue-red, passing from blue through violet and purple to red.

The change of colour in the spectrum is throughout so continuous that it is not possible to fix the exact point at which these changes of direction begin. All that can be said is that they begin somewhere in the region of red, yellow, green, and blue, respectively. Since the change of direction occurs, it must occur somewhere. At the precise point of its occurrence, there must be a simple colour-tone, such as pure red, pure yellow, pure green, or pure blue. For instance, pure yellow is the point of transition between the red-yellows and the green-yellows, and pure red is the point of transition between the purples and the red-yellows.

So far we have only considered difference in colour-tone, apart from difference in intensity and saturation; but all the colours of the spectrum may vary in either of these respects so as to form a graduated series. Each of them may be made more or less pale by an admixture of white light. If the general intensity of the illumination be increased or diminished while the spectrum is being examined, and if the increase or diminution is not too great, the result is that all the colours in the spectrum vary in brightness while remaining the same in colour-tone.

But the change in brightness is in general accompanied by a change in saturation. Increased brightness makes a colour paler, and decreased brightness makes it darker—causes it to approximate to black. When the increase or decrease is made sufficiently great, the colour-tones tend to disappear in mere whiteness or blackness, respectively. They may be mixed with white light, and also lowered or increased in intensity, so that both changes are combined. All the colour-differences recognised in ordinary life may be accounted for in these various ways. They are constituted by differences in primary colour-tone, in intensity, and in saturation. Pink and rose-colour are whitish reds; maroon is a dark red—a red so diminished in intensity as to be strongly infused with black. Olive is a dark green.

4. Total Colour-Blindness and Dark-Adaptation.—The extreme margin of the retina is totally colour-blind. Let the eye be fixed upon an object immediately in front of it, and let someone gradually introduce an unknown coloured object into the field of view from one side. On its first entrance into the field of view, the object will appear white, grey, or black. Its colour will only become recognisable as it approaches the centre of the field.

Again, when the illumination is sufficiently faint, the whole of the retina, with the exception of the yellow spot, is totally colour-blind. All the colours of the spectrum pass into grey when the light is made dim enough. When we pass from ordinary daylight into a dark room, we are not at first able to discern objects: but after a time the eye adapts itself to the faint illumination. When this dark-adaptation has taken place, it becomes possible to discern objects but not their colour-tones. Everything is seen in various shades of grey.

It has been shown that the sensation of grey which persists when the illumination is so lowered that colour disappears is, in all probability, a function of the rods only. Accordingly the *fovea centralis*, in which rods are not present, does not become adapted in the same way. If a small patch of coloured light is thrown upon it, decreasing illumination

causes the colour suddenly to disappear, without first transforming it into a patch of grey. Where there has been no adaptation of the eye for darkness, the same holds also for other parts of the retina. If several transparent patches of colour are illuminated from behind, and the light thus transmitted through the transparent patches is gradually decreased, while the general illumination remains that of ordinary daylight, the colours retain their distinctive hue until they give place to blackness, without first passing through intermediate shades of grey. This is expressed by saying that there is no 'photo-chromatic interval,' such as occurs when the retina becomes adapted to faint light.

Where the general illumination is gradually diminished so as to give rise to a photo-chromatic interval, there is also a marked change in the comparative brightness of different colours. The colours of the red end of the spectrum appear relatively darker, those of the blue end brighter, while the region of maximum brightness passes to the green, whereas under ordinary illumination it is found in the yellow. This change of relative brightness begins before the colours become grey. But it is most pronounced after this stage has been reached.

Cases have been carefully examined and recorded of persons who showed an entire want of sensibility to colour-tones, not only under faint illumination, but under all conditions. They saw everything in black and white. In most of these pathological cases, though not in all, there is an alteration in the distribution of the intensity of light-sensation in the spectrum. For the normal eye the region of greatest brightness is that of yellow light; for the totally colour-blind, it lies in the green rather than in the yellow portion of the spectrum. We have just noticed that the spectrum, as seen under sufficiently faint illumination, shows the same change in the distribution of the brightness of its parts.

The totally colour-blind cannot for the most part bear illumination of ordinary strength. They can see well in a dim light, but are painfully dazzled by full light. This indicates that their ordinary condition is analogous to that of a normal person whose eyes have been adapted to twilight

vision. Colour-blindness is common to both cases. In both cases a special retinal apparatus is at work yielding only sensations of grey, while that for colour vision and for white and black is either non-existent or in abeyance.

5. Partial Colour-Blindness.—Between the outer margin of the retina and the yellow spot, there is a zone which is partially colour-blind. It is sensitive to blue and yellow, but not to red and green. This is shown by the fact that when the colours of the spectrum are seen sideways, so that they fall on the partially colour-blind zone of the retina, the blue-green region appears grey. This grey divides the whole spectrum into two parts. The part containing light of greater wave-length appears yellow, that containing light of smaller wave-length appears blue. Red and green are not discernible.

It is well known that there are many persons whose whole retina is affected by a partial colour-blindness, consisting in an inability to distinguish between red and green. Now, abstractly considered, this inability to distinguish between red and green may arise in either of two ways. A person who was insensitive to both red and green could not of course distinguish them from each other. But the same might hold true of a person sensitive to red and not to green, or to green and not to red. If we suppose yellow to be due to a combination of the retinal processes which are produced by red light and green light respectively, persons insensitive to red would see all yellows as green, and those insensitive to green would see all yellows as red.

Both modes of explaining partial colour-blindness have been, and still are, advocated. On the whole, it seems likely that in the partially colour-blind the retina is equally incapable of giving rise to sensations either of red or green. The evidence shows clearly that there are two distinct types of partial colour-blindness, and it has been maintained that in the one type the sensation red is absent and in the other type the sensation green. But instances have occurred in which only one eye has been colour-blind, the other eye being normal. These instances have belonged to the type which would be classed as red-blindness by those who distinguish

between red-blindness and green-blindness. Now in such cases the colour-blind themselves testify that the colours they see with the abnormal eye are yellow and blue, and those they fail to see, red and green. They see the spectrum as composed of yellow and blue, with a grey region in which normal persons see blue-green.

If we suppose that partial colour-blindness consists in the absence of the sensations both of red and green, we must find some explanation of the difference between two well marked types which are on the opposite view distinguished as red-blindness and green-blindness. In both types it is possible, by mixing in varying proportions light from the short-waved end of the spectrum with light from the long-waved end, to produce all the colour-tones which they are capable of seeing when their retina is affected by intermediate simple lights.

In type (i)—the so-called red-blind—the rays at the extreme end of the spectrum, which give distinct sensations of red to the normal eye, produce no appreciable effect of any kind, and other reddish rays produce much fainter sensations. In type (ii), the retina is sensitive in some way to rays at the red end of the spectrum; and in general, reddish rays produce more intense sensation of some kind than in type (i). In comparing a certain reddish yellow with a yellow almost free from red, the intensity of the reddish yellow light must be made about four times greater for type (i) than for type (ii), in order that the resulting sensations may be indistinguishable in intensity and colour-tone. Clearly there is a great difference in sensitiveness to red light in the two types. But it by no means follows that the red light produces the sensation red in type (ii) and not in type (i). An alternative explanation is that the red light has a greater power of producing the sensation yellow in type (ii) than in type (i).

6. Mixture of Lights of Different Wave-Lengths.—When lights of all wave-lengths are intermingled in due proportion, the result is grey or white. If in the mixture there is a relative predominance of some one light, such as green, the result is a whitish green.

If we select any colour of the spectrum, it is possible to find some other colour which, mingled with it in due proportion, will yield a neutral tint. If one of the components of the mixture is present in greater quantity than is required to produce a grey, the predominant light gives its own colour to the mixture. The other light diminishes the degree of saturation. Thus, if golden yellow and blue be mixed in proper proportions, they yield the sensation of white. As the proportion of blue is increased, the white becomes more and more a bluish white; as the proportion of yellow is increased, the white becomes more and more a yellowish white.

Colours which, intermixed with each other, yield white, are called complementary. Yellow is complementary to blue. The red of the spectrum is not complementary to green, but to a bluish green. It should be remembered, however, that the red of the spectrum is not pure red, but yellowish. As every discernible colour of the spectrum possesses its complement, either within the spectrum or in the purple series, the pairs of complementary colours are indefinitely numerous.

If the simple lights corresponding to colours which are not too far removed from each other in the spectrum are mingled, the result is a colour corresponding to an intermediate light. For instance, by mingling the simple lights which severally produce blue and green, we can obtain all the blue greens. A larger proportion of the blue light yields a bluer green: a larger proportion of the green light yields a greener blue. If we mix blue with yellowish-green, we obtain a green mingled with the white due to the combination of blue and yellow. This green may be relatively pure or it may be bluish or yellowish according to the proportion of blue or yellow light in the mixture.

The combination of pure blue with pure yellow yields white. If, proceeding further, we mix blue with red, we obtain a new colour not contained in the spectrum—purple. By mixing the red light of the spectrum with the green in certain proportions, we produce yellow: by increasing the quantity of red light, the yellow is made redder; by increasing the quantity of green light, the yellow is made greener. The laws of combination which hold good of simple lights apply also to

those mixtures which produce the same colours as the simple lights.

If we select three colours so related that by combining any two of them we can obtain a colour which is complementary to the third, it is possible, by varying combinations of the three, to produce all the colours of the spectrum. But there is only one triplet of colours by which the rest can be produced in a high degree of saturation. This triplet is red, green, and a bluish violet. For this reason red, green, and violet have been called primary colours.

The best method of mixing lights of different wave-lengths, so as to ascertain the resulting sensation, is to allow two different parts of the spectrum to fall on the same part of the retina at the same time. Another way is by using the colour-wheel. Sectors of the colours to be investigated are placed on a disk. The pigments used in colouring must be as pure as possible; in other words, they must as nearly as possible reflect simple and not compound lights.[1] The disk is set rapidly spinning so that one kind of light is brought to bear on the retina before the effect of the other has ceased. Thus the different modes of stimulation are superposed. If one sector of the disk is blue, and another yellow, and if the colours are present in due proportion, the rapidly rotating disk will appear grey.

7. The Effects of Contrast.—A man passing a street-lamp in moonlight casts two shadows. That which is cut off from the light of the lamp and only illuminated by the moon appears blue. Now moonlight is white or nearly so. The blue appearance of the shadow is due to contrast with the yellow illumination thrown by the lamp on the surrounding field of view. The excitement of the retina by the yellow light indirectly affects that portion of the retina or of the central nervous matter which is not directly excited by it. The influence thus exerted by the yellow light produces an

[1] The mixture of the pigments themselves, in the way that artists mix them, is by no means equivalent to a mixture of the lights which they reflect.

effect similar to that which would be produced by a blue light acting directly.

Now blue is complementary to yellow. In general, a colour in any part of the field of view tends to tinge adjoining parts with its complementary colour. The effect is greatest when a large field of uniform colour acts on a small one. A small spot of grey on a relatively extensive field of blue appears distinctly yellowish. If a small spot of red be substituted for the grey, it will combine its own colour with the contrast colour. It will appear yellowish red or reddish yellow. The effect of contrast is most marked at the meeting-point of the two colours. It is interfered with by lines of demarcation separating them, such as a pencil-mark drawn round the red spot on the blue field. It is also interfered with by differences in the texture of the coloured surfaces. For these reasons, it comes out most clearly when contours are obliterated, and differences of texture reduced to a minimum.

The most favourable conditions are obtained in the case of coloured shadows, or by projecting the light from coloured glasses on a wall, or by means of coloured disks in rapid rotation with the colours in concentric zones. A simple method is to place a small piece of paper on a larger sheet, and to cover both with a sheet of tissue paper. The tissue paper obliterates contours and conceals difference of texture. The contrast effect is of course in general stronger in proportion as the direct excitation of the part of the retina affected by it is weaker; thus grey is better to experiment with than white. The influence of contrast is also operative between black and white. The same grey will appear darker on a white background, and lighter on a black background. If contrasted colours are complementary to each other, the contrast renders them more saturated.

8. After-Images.—If, after looking steadfastly at a white patch on a black ground, the eye be turned to a white ground, a grey patch is seen for some little time. A black patch on a white ground similarly gives rise, when the eye is subsequently turned towards a grey ground, to the image of a white patch. These after-images, which follow the removal of the primary

stimulation, are called 'negative' images. When a red patch is looked at, and the eye subsequently turned to neutral ground, the negative image is a greenish blue; that is to say, the colour of the negative image is complementary to that of the object. Orange produces a blue, green a pink, yellow an indigo-blue negative image, and so on. When the primary stimulation is very transient, it may give rise in the first instance to a positive image, as we shall see later. Negative images arise also when the eye is simply closed after the primary stimulation as well as when it is turned to a different background.

It is not however necessary for the occurrence of negative images that the primary stimulus should be removed. The same result may be brought about by diminishing its intensity. If we steadfastly gaze at a red spot on a yellow ground, and then diminish the intensity of the illumination by turning down the light or otherwise, a green spot upon a blue ground will appear instead of the red spot on a yellow ground.

The same process is manifested in a different way while the eye is actually subject to the primary stimulation in undiminished intensity. If we gaze long and steadfastly at any colour, it gradually becomes less saturated; the effect of steadfastly gazing at yellow is the same as that produced by gradually mingling the yellow light with more and more of its complementary blue. It becomes paler.

We may gather these facts under one formula. The continuance of the same mode of stimulation tends to produce a contrast effect, not only on adjoining portions of the retina, but also on that portion which the stimulus directly excites. This contrast effect takes the form of a negative image when the primary stimulation is withdrawn or sufficiently weakened. When the stimulus is continued so as to maintain its positive effect, the contrast effect mingles with this, so as to produce loss of saturation. In this way, the yellow illumination of a gas-light or candle practically becomes equivalent to a white light when it is long continued.

It is noteworthy that negative images modify each other's colour-tone by contrast, and this even in cases in which it is difficult to obtain a contrast effect under ordinary conditions.

The negative image of a red patch on a white ground is blue-green; the negative image of the white ground which surrounds it is reddened by contrast. This shows that contrast phenomena are not due to errors of judgment, as has been maintained by Helmholtz.

Light acting on the retina takes a certain time to produce its full effect, and the retinal excitement takes a certain time to disappear after the stimulus has been removed. If we take a black disk with a white sector, and set it in very rapid rotation, the whole disk appears to the eye as a uniform grey. As the white sector is whirled round, it affects successive portions of the retina, but by no means so intensely as if it continued to act on the same part. Owing to the rapidity of the rotation, it returns again to the same point before the effect of the previous stimulation has become appreciably diminished. The result is a uniform grey identical with that which would be produced if the white light from the sector were equally distributed over the whole surface of the rotating disk at rest.

The persistence of the visual sensation after the stimulus has ceased gives rise, under certain conditions, to what is known as the 'positive' after-image. This is most marked when the eye briefly glances at an object, instead of steadfastly gazing at it. The conditions are most favourable when an eye which has for some time been withdrawn from the influence of light is momentarily exposed to a somewhat strong stimulus. "Thus, if immediately on waking from sleep in the morning the eye be directed to a window for an instant and then closed, an image of the window with its bright panes and darker sashes, the various parts being of the same colour as the object, will remain for an appreciable time."[1]

It should, of course, be clearly understood that these visual experiences, though commonly called 'after-images' both positive and negative, are in reality 'after-sensations.' They are due to the continued excitement of the organ of sense after the external stimulus has ceased to operate, and cannot therefore be regarded as images. They are also easily dis-

[1] Foster, *Textbook of Physiology*, p. 1265.

tinguishable from what has been called the primary memory-image. This is the peculiarly vivid and definite ideal representation of an object which we can maintain or recall by a suitable effort of attention immediately after perceiving it. The persistence of the so-called after-image does not depend on an effort of attention, but on the abiding effect of the external stimulus. It passes, for the most part, very rapidly from a positive to a negative phase and undergoes other modifications which do not affect the primary memory-image. There is also another conspicuous and important distinction: whatever may have been the spatial arrangement of the perceived objects, the corresponding 'after-images' are spread out in a flat expanse; but the solidity and perspective of objects as actually seen reappear in the primary memory-image and in ideal images generally.

9. The Sensation of Blackness.—It is now held by nearly all psychologists that black is a positive sensation, and not merely the non-existence of visual experience as stillness is an absence of auditory experience.[1] There is, however, no external stimulus to which this sensation can be due. It seems to arise, not, like white and colours, through the action of light on the retina, but rather through the absence of such action. This is possible because the state of any part of the retina or of the cerebro-retinal apparatus is determined not only by external stimulation but by its own previous state and the simultaneous processes going on in other parts.

When the eye has become adapted to faint illumination so that only the rods are sensitive, there is no experience of black as distinguished from grey. "Black is only experienced when an area of the retina, previously excited by white light but now unexcited by external stimuli, is in a state other than that of dark-adaptation. Thus, when first we enter an absolutely dark room after quitting daylight, the retina is as yet unadapted to darkness; hence black is experienced. Similarly, when a given area of the retina is unstimulated and

[1] The opposite has, however, been maintained by some authorities, for example, Ward. See *British Journal of Psychology*, Vol. I., p. 407.

the rest of the retina is stimulated by light, that area can never reach a state of complete dark-adaptation; hence, again, black is experienced."[1]

Black, then, though not directly produced by an external stimulus is yet dependent on an excitement of the retina due to contrast.

10. Physiological Theories of Light-Sensation.—Little is known by direct observation and experiment about the physiological processes, either in the retina or in nervous matter, corresponding to light-sensation. The theories on the subject are hypothetical constructions based on physical and psychological data. The two which are best known are those connected with the names of Helmholtz and of Hering respectively. Neither of these is satisfactory; but they are of great historical importance as yielding the basis from which all subsequent discussion of the problem starts.

The theory of Helmholtz is primarily based on the facts of colour combination regarded from a physical point of view. The aim is to account in the simplest way for the production of the same colour by many different combinations of physical light. Helmholtz believed that this could be done by assuming three, and only three, ultimate physiological processes. Each of these processes takes place in the first instance in the retina and is conveyed by its own special nerves to the brain, where it produces a correspondingly specific nervous excitation. The processes severally correspond to the sensations of a slightly bluish red, a slightly yellowish green, and an ultramarine blue. Their combination in equal proportions yields the sensation of white or grey. Every kind and combination of light excites all three processes. Hence no colour under ordinary conditions of stimulation is ever quite saturated. It always contains a certain intermixture of white. By combining in various proportions the red and the green processes, the green and the blue, the red and the blue, all the colours of the spectrum, together with the purples, may be obtained.

[1] Myers, *Textbook of Experimental Psychology*, pp. 96-7.

This theory seems a highly satisfactory account of the results of combining lights of different wave-lengths, so long as we do not test it by psychological analysis of the resulting sensations. But when we do this, a difficulty occurs in the case of white and yellow. By mixing green light with blue light, we obtain a blue-green. This, says Helmholtz, is due to a compounding of the physiological processes corresponding to blue and green respectively. His account of the matter is borne out by a scrutiny of the sensation itself. A blue-green partakes of the nature both of blue and green: it resembles both of them at once. It resembles each in varying degrees according as blue or green preponderates.

But by mixing red and green lights we produce, not reddish green, but yellow. The yellow does not partake of the nature both of red and green, as blue-green partakes of the nature both of green and blue. No analytic scrutiny of sensation can discover such a colour as a reddish green. The same is true of white. White, according to Helmholtz, is a compound of all three ultimate physiological processes. But, as a matter of fact, the sensation of white does not partake at once of the three colour-tones, red, green, and blue. Now there is no reason why a retinal process set up by a combination of two kinds of stimulus should yield a sensation akin in quality to each of the sensations which the stimuli would separately produce. But it is reasonable to assume that there must be a vital difference in the conditions, retinal or central, when this is so and when it is not so. The theory of Helmholtz leaves no room for such a distinction.

A serious objection to the theory arises from cases of partial colour-blindness. It is evident that, if Helmholtz is right, the absence of one or more of the elementary colour-processes must involve the absence of the sensation of white, which is due to their combination in equal proportions. "A person who is green-blind ought, upon this supposition, to see in white only its red and blue constituents, and hence white ought to look to him as purple looks to us. As long as his defect made him incapable of explaining to us what he felt, this might perfectly well, for aught we knew, have been the case. But we know now that a person who is green-blind in

one eye only sees white with his defective eye exactly the same as he sees it with his normal eye."[1]

A similar argument applies also to yellow. The partially colour-blind usually retain the sensations of yellow and blue, although they are without the sensations of red or green or both. There is a marginal zone of the retina at which the sensibility to red and green ceases, and that to yellow and blue is retained. So, with great increase in the intensity of illumination, red and green are still discernible in the spectrum, though yellow and blue disappear. Such facts as these are hard to reconcile with the supposition that yellow is producible only by a combination of the red process and the green process.

If the theory of Helmholtz is unsatisfactory in its account of colour-combination, its failure to explain other facts of light-sensation is still more conspicuous. It accounts for contrast effects between adjoining colours as errors of judgment. A fuller investigation of these phenomena has shown that such an hypothesis is quite untenable. The colour produced by contrast appears and behaves in all respects like the colour produced by direct stimulation.

Negative images are explained by Helmholtz as due to fatigue. By long continuance, one or more of the ultimate colour-processes become exhausted, so that the others are predominantly aroused either by stimulation from without, or from the retina's own light. One objection to this view is that, on the principles of Helmholtz, fatigue of all three processes must be constantly taking place, as all three are excited by every kind of light. Now the fatigue which is to explain negative images must take place in the course of a few seconds. Hence we should expect a very conspicuous effect of fatigue from the odinary use of the eyes in daylight. Hardly any capacity for light-sensations of any sort ought to be left at the end of an hour, especially after exposure to predominantly white light, which must exhaust all three processes equally.

[1] Cf. Ladd Franklin, "On Theories of Light-Sensation," *Mind*, N.S., Vol. II., p. 479.

In Hering's theory, a strenuous attempt is made to escape the difficulties which beset that of Helmholtz. Following the clue given by psychological analysis of light-sensations, he assumes six ultimate processes, corresponding to the sensations of white, black, red, green, yellow, and blue. These he arranges in three antithetic pairs; white and black go together, and similarly red and green, blue and yellow. To each pair there corresponds a separate retinal substance, and a distinct modification of central nervous matter. Each kind of retinal substance is continually undergoing two opposite processes of assimilation and dissimilation. It is continually being broken down and at the same time built up.

The whole theory has reference to the variable relations which these opposite processes in the same substance may bear to each other. They may compensate each other so that there is equilibrium between them. In this case, the red-green and the blue-yellow substances yield no sensation; the black-white substance, on the contrary, yields the sensation of neutral grey which is experienced after prolonged darkness. Any disturbance of equilibrium in any of the substances yields sensation; if change in the direction of assimilation preponderates the resulting experience is of blue or green or white; if change in the direction of dissimilation preponderates the resulting experience is one of yellow or red or black.

It is, further, an essential part of the theory that, when and so far as equilibrium is disturbed, there is a tendency to its restoration of such a nature that a preponderance of one process of itself excites and maintains the opposite process until equipoise is established between them. Thus if red light acts upon the red-green substance so as to produce a preponderance of dissimilative change with the concomitant sensation of red, an assimilative process is at the same time set up, which in the end leads to equilibrium so that the red light produces no sensation. Thus the eye after prolonged exposure to red light no longer sees red. If now the red light is withdrawn, a negative after-sensation results.

Hering's explanation of this depends on another vital feature of his theory. There is according to him not only a general tendency to equilibrium; there is also an ultimate

tendency towards a special kind of equilibrium, that which ensues when the retinal substance is not stimulated by light at all. This he calls 'autonomous' equilibrium. Now the balance of opposite processes which exists after the adaptation of the eye to red light is not of this kind. The retinal substance as a result of the action of the stimulus is more disintegrated than in autonomous equilibrium. Hence the return to autonomous equilibrium, on withdrawal of the stimulus, involves a preponderance of assimilative process giving rise to the negative after-sensation.

Hering explains simultaneous contrast as directly due to the influence of process in one part of the retina on process in other parts. Assimilative change in one retinal area tends to set up dissimilative change in adjoining areas; dissimilative change in one area tends to set up assimilative change in adjoining areas.

Neither the theory of Hering nor that of Helmholtz in their original form succeeds in giving a satisfactory explanation of all the important facts of colour-vision. Attempts have been made to reconstruct them and even to compromise between them so as to remedy their defects.[1] An interesting new theory is that of Ladd Franklin.[2] One point seems to emerge clearly. The older writers were wrong in considering exclusively processes taking place in the retina. "Evidence is gradually accumulating that before" the physiological change which conditions sensation "reaches its full development, it undergoes a process of complicated elaboration, of the details of which, however, we are as yet totally ignorant. This elaboration doubtless takes place at different stages, at different nervous levels in the cerebro-spinal system, and it is quite conceivable that stimuli which react peripherically on separate neural elements, overlap in their actions on more central elements." "But at present we are powerless" to separate the more peripheral from the more central occurrences; "we can only speak of changes in one vast unravelled complex—the cerebro-retinal apparatus."[3]

[1] See, for example, McDougall's article in *Mind*, N.S., Vol. X.
[2] This theory is outlined in her *Colour and Colour Theories*.
[3] Myers, *op. cit.*, pp. 99, 100.

CHAPTER V.

SOUND-SENSATION.

1. Nature of the Stimulus.—The physical stimulus which occasions sensations of sound consists of vibrations of the particles of the air. As in the case of light, we can distinguish wave-length or rapidity of vibration, amplitude, and complexity. Wave-length determines pitch; amplitude loudness, and complexity timbre.

2. The Organ of Hearing.—The drum of the ear is thrown into vibration by impact of air-waves. This vibration is transmitted by a chain of small bones to a fluid—perilymph—within the 'inner' ear. The waves in this fluid pass through the cochlea, and in so doing set in vibration the membranous walls of the cochlearic duct and the endolymph within. The vibrations in the endolymph stimulate the hair-cells of the organ of Corti which are directly connected with the fibres of the auditory nerve.

3. Noises and Musical Sounds.—Noises are characterised by confusion and indefinite complexity, and for the most part by irregularity. A musical sound is marked by unity and uniformity of character. "The vibrations which constitute a musical sound are repeated at regular intervals, and thus possess a marked periodicity or rhythm."[1] Musical sounds are also produced when the periodicity, instead of being regular, varies continuously.

Regular vibrations, which would otherwise produce musical sounds, give rise to noises when a large number of them, differing but little in wave-length, occur together, as when a number of adjoining keys of a piano are simultaneously

[1] Foster, *Textbook of Physiology*, p. 1361.

touched. But, in general, noises occur when the stimulus consists of a series of vibrations differing from one another in period, and also when successive vibrations are too few in number to give rise to a tone.

There is, however, no sharp line between noises and musical sounds. "Between a pure and simple musical sound produced by a series of vibrations, each of which has exactly the same period, and a harsh noise in which no consecutive vibrations are alike, there are numerous intermediate stages. Much irregularity may present itself in a series of sounds called music, and in some of the roughest noises the regular repetition of one or more vibrations may be easily recognised."[1]

4. Pitch.—The greater the rate of air waves stimulating the ear the higher is the pitch of the resulting sound. "Hence the pitch of a sound is determined by the *length* of the wave, a low note having long, a high note short wave-length. We are able to distinguish a whole series of musical sounds of different pitch, from the lowest to the highest audible note."[2] In this series each note has its fixed position between two others which are barely distinguishable from it; the one being somewhat higher, and the other somewhat lower. The arrangement is therefore linear, and comparable to the series of greys intervening between white and black. It has been maintained that, as in the greys we can distinguish varying degrees of affinity to white and black respectively, so in the scale of notes of different pitch, two ultimate modes of sensation are involved, corresponding to black and white.[3] But this view has not been generally accepted.

Vibrations having a recurrence below from fifteen to twenty per second fail to produce a sensation of sound. There is a similar limit for high notes. This upper limit is about 22,000 vibrations per second. In music, only a comparatively small portion of these tones are used, beginning with about 22·6 and ending with about 4,096 vibrations a second.

The power of distinguishing differences of pitch is very highly developed within a certain range. In tones rising from 100

[1] *Ibid.*

[2] *Ibid.*, p. 1362.

[3] See Mach, *Analysis of the Sensations* (English trans.), pp. 127, 128.

to 1,000 vibrations in a second, practised observers under favourable conditions can discriminate differences of pitch corresponding to differences of one quarter or one fifth of a wave-length. Tones above 4,000 or below 40 are distinguished from each other with much less accuracy. Towards the higher end of the scale, differences of hundreds or even of thousands of vibrations a second may not be recognisable.

5. Harmonic Intervals.—When, of two notes simultaneously produced, the vibration period of one is exactly twice as rapid as that of the other, the two sensations show a strong tendency to blend into one. It is hard to distinguish them as two. The result of their union is a richer and fuller sensation, peculiarly agreeable to the ear. There is also a tendency to confuse the two sensations even when they do not occur simultaneously. When even a practised musician is called upon to imitate upon the piano a tune whistled by the mouth, he frequently produces the tone which corresponds to half or double the number of vibrations per second, or, in other words, the upper or lower octave of the note which he has to imitate.

What is peculiarly interesting is that the tendency to confuse a note with its octave in memory, and to hear them as a single musical sound when they are simultaneously produced, does not depend on similarity in pitch. Notes much nearer in pitch are easily and clearly distinguished. What has been said of the octave holds also of other musical intervals, the double octave, the fifth, and the twelfth.

6. Combination of Musical Sounds from Different Sources.—When musical sounds occur together, it usually requires attention to discriminate them. It is, as we have seen, peculiarly difficult to do so when the one is the octave, the fifth, or the twelfth of the other. The greater the relative intensity of one of the notes as compared with the others, the more easy it is to discern it as a separate tone. It is harder to distinguish in proportion to its relative faintness. The combination of tones yields a specific experience, which cannot be regarded as merely the sum of the separate experiences of the separate notes. Even when the constituent tones

are discriminated, they are still apprehended as integral parts of a whole. This whole has its own characteristic pitch and its own characteristic intensity.

7. Beats and Dissonance.—"If two tuning-forks," sounded together, "are not of the same pitch, but so related that the period of vibration of the one is not an exact multiple of that of the other, the sensation which we experience has certain marked features. We hear a sound which is the effect on our ear of the compound wave formed out of the two waves; but the sound is not uniform in intensity. As we listen the sound is heard now to grow louder and then to grow fainter or even to die away, but soon to revive again, and once more to fall away, thus rising and falling at regular intervals, the rhythmic change being either from sound to actual silence or from a louder sound to a fainter one.

"Such variations of intensity are due to the fact that, owing to the difference of pitch, the vibratory impulses of the two sounds do not exactly correspond in time. Since the vibration period—the time during which a particle is making an excursion, moving a certain distance in one direction and then returning—is shorter in one sound than in the other, it is obvious that the vibrations belonging to one sound will, so to speak, get ahead of those belonging to the other: hence a time will come when, while the impulse of one sound is tending to drive a particle in one direction, say forwards, the impulse of the other sound is tending to drive the same particle in the other direction, *i.e.* backwards.

"The result is that the particle will not move, or will not move so much as if it were subject to one impulse only, still less to both impulses acting in the same direction; the vibrations of the particle will be stopped or lessened, and the sensation of sound to which its vibrations are giving rise will be wanting or diminished: the one sound has more or less completely neutralised or 'interfered' with the other, the crest of the wave of one sound has more or less coincided with the trough of the wave of the other sound.

"Conversely, at another time, the two impulses will be acting in the same direction on the same particle, the movements of

the particle will be intensified, and the sound will be augmented. And the one condition will pass gradually into the other. The repetitions of increased intensity thus brought about are spoken of as *beats*."[1]

Beats are separately discernible when the difference between the vibration frequency of the concurrent tones is very small. As the difference becomes greater, the beats occur more rapidly, and are not so clearly discernible. They then give rise first to a thrusting or stabbing and then to a rattling or whirring effect. This ceases as the frequency of the beats increases. But even then the beats still manifest their presence by imparting to the sound a certain roughness. This experience may persist even when there are hundreds of beats in the second. When the beats occur with sufficient rapidity, the roughness or harshness ceases. Before this point is reached, the sound, because of the harsh effect of the beats, is said to be 'dissonant.'[2]

The number of beats produced by two notes which approach each other in vibration frequency is equal to the difference between the number of vibrations per second of each. Thus two tuning-forks vibrating respectively at sixty-four and seventy-two a second, will give eight beats a second, because the shorter wave overtakes the longer eight times, so as to give to the vibrating particles opposite impulses, which neutralise each other.

We have seen that as the interval between the combined tones becomes greater, the beats become so rapid that they are no longer appreciable; but they recur again when the interval is sufficiently increased. They recur when the interval is somewhat greater or less than the octave, and again when it is somewhat greater or less than the twelfth, the double octave, etc. Two tones of 200 and 396 vibrations in a second give four beats; four beats are also produced by tones of 200 and 404 vibrations in a second. The number of beats is equal to the difference between the vibration number of the higher tone and that multiple of the vibration number

[1] Foster, *op. cit.*, pp. 1367-8.

[2] This may not be the only condition of dissonance. Whether it is or not is disputed.

of the lower tone which comes nearest to the vibration number of the higher tone. Thus if the notes are 200 and 596 the number of beats is $3 \times 200 - 596 = 4$. This explains why a small deviation from the octave or other musical interval produces a dissonant effect.

8. Timbre.—The same note sounded on a piano, a violin, a trumpet, etc., has a very varying character, though its pitch is identified as the same. Differences of this kind are called differences of 'timbre.' Timbre is due to the complexity of the sensation. Ordinary musical sounds, even when they arise from a single source, are not simple. Attentive analysis can discern a number of distinct partial tones. The power of discrimination varies with musical aptitude and practice in analysis. The pitch of the whole complex is approximately the pitch of the lowest tone. This is called the 'fundamental tone' and is of course identified at the outset.

The overtones, as they are called, are separated from the fundamental tone by harmonic intervals. The most intense of them are usually those which have most affinity with the fundamental tones, such as the octave. Thus, though their relative intensity makes it easier to discriminate them, their harmonic relation makes it more difficult. With sufficient practice, a person of natural musical aptitude acquires great power of discriminating overtones. The less skilled may use artificial helps. Thus the partial tone may be first sounded separately on a tuning-fork, and then kept in mind in attending to the note which is to be analysed. Several tones in succession may be tried in this way; some of them may be discernible as constituent overtones and others not.

A moderate number of relatively low partial tones makes the whole richer and fuller and somewhat higher in pitch. A large number of high overtones of considerable intensity gives to the whole a sharp, penetrating and sometimes somewhat harsh character. The harshness arises from beats between the high overtones.

The combination of partial tones in a complex note produced from a single source is analogous to the combination of notes from different sources, except as regards the great difference

in intensity between the fundamental tones and the overtones. The whole experience due to the combination is specific in its character, and is not a mere summation of the experiences severally due to the partial tones. This is true even when the partial tones are discriminated. They are still apprehended as constituents of a whole having an unique character. Analytic attention in discovering overtones does not appear to create them in the moment of discovery, but to find what is already pre-existing. Thus the composition of an ordinary musical note affords an excellent example of sensations which are experienced without discrimination of their distinctive qualities. So long and so far as the experience is unanalysed, the constituent sensations are present, *qua* sensations, though their presence is not cognised. There is a sense-differentiation without perceptual distinction.

9. General Theory of Sound-Sensation.—Anatomical research seems to indicate that the auditory receptors are vibrations of hair cells in the organ of the Corti. Now, on the physical side, we have the broad fact that impulses which would separately give rise to distinct air waves, blend their action, before they reach the ear, into a single resultant effect. They produce a single wave, the form of which is mathematically accounted for by their combination. This is true whether the several impulses come from separate material objects or from the same object.

Thus the vibrations which produce ordinary sounds are complex in their mode of origin. The forms which they consequently assume can be mathematically resolved into a combination of the forms of certain constituent simple waves. These simple waves are called 'pendular,' because their form is like that described by the sweep of a pendulum. Though one, not many waves, is produced by the impulses which simultaneously set the air in vibration, yet each of these impulses acts separately on the organ of hearing. This is known to be so because the several sensations corresponding to each are distinguishable in consciousness. We can analyse a single note into its partial tones, and we can distinguish a number of notes sounded simultaneously from different sources.

This is the starting-point for the theory of sound-sensations. The organ of hearing must be so constructed as to respond separately to the several impulses which produce the complex wave.

An explanation of this analytic power of the ear was put forward by Helmholtz, and commonly accepted for many years. It proceeds on the analogy of certain physical phenomena. If a tuning-fork, which produces a simple tone without overtones, be laid on the top of a piano, and if the corresponding note be sounded by touching one of the keys, the tuning-fork vibrates in sympathy with it. If the lower octave of the note be sounded, the tuning-fork again vibrates in sympathy; for its own note, being an octave of the note sounded on the piano, is contained in this as one of its overtones. It can be similarly made to vibrate in sympathy with any of the notes which contain its own note as an overtone. It is unaffected by other notes.

Conversely, if the tuning-fork be struck in the neighbourhood of the wires of a piano, those wires will vibrate in response to it which are specially adjusted to the same tone, or to any of the notes which contain this as an overtone. In the second case they do not vibrate along their whole length, but in segments. The wire which corresponds to the lower octave of the tone sounded on the tuning-fork responds by a vibration of which the wave-length is half the length of the wire. Now, the theory of Helmholtz is that the basilar membrane consists of a series of strands, each of which, like the wires of a piano or like a tuning-fork, is adapted to its own peculiar tone, and vibrates in response to this. Thus, however complex the physical sound-wave may be, it produces in the basilar membrane not a single complex vibration, but a number of distinct vibrations, and each of these constitutes a separate stimulus affecting the terminations of the auditory nerve.

The theory of Helmholtz is supported by facts analogous to colour-blindness. There are cases in which the mechanism for conducting sound-impulses is intact, and yet the sensibility for greater or smaller portions of the scale of tones is absent or much impaired. In some instances the tone-deafness extends to the greater part of the scale, leaving sensibility

only to a fragmentary portion of it. One tone of moderate intensity may be clearly distinguished, while another neighbouring tone is indistinguishable, even when it is very loud. It is difficult to explain these phenomena unless we suppose in the ear a system of separate elements, each adjusted to its own peculiar tone, some of which may be absent or incapable of discharging their function while the rest behave in a normal manner. The view of Helmholtz accounts for the possibility of this by assuming that certain basilar fibres may cease to vibrate properly while others remain efficient.[1]

[1] This theory is now being rigorously criticised. "Our present knowledge of the histological organisation of the basilar membrane shows that it is structurally incapable of serving the function of tone analysis in the way postulated by Helmholtz's theory."—C. J. Herrick, *An Introduction to Neurology*, p. 222. See also M. F. Meyer, "The Hydraulic Principles governing the Function of the Cochlea," *Journal of General Psychology*, Vol. I., No. 2.

CHAPTER VI.

THE WEBER-FECHNER LAW.

1. The Experimental Facts.—We can compare any two objects and pronounce them like or unlike. If the objects are disparate in kind, we are unable to say more than that they are unlike. This is the only result of comparing the brightness of the sun with the immortality of the soul. If we compare the brightness of a light with the loudness of a sound, we can say that both possess intensity; but we cannot fix any definite relation between them. For instance, we cannot affirm that the loudness of the sound is equal to the brightness of the light.

On the other hand, if we compare the quantitative variations of the same kind of object in the same respect, we can pronounce more definite judgments. We can, for example, pronounce that one sound is less or more loud or equal in loudness to another. Besides this, we can compare degrees of unlikeness with definite results. We can say that one sound, C, is as much louder than B as B is louder than A. In this way we can select two sounds of different loudness, and then proceed to find a third exactly intermediate between them. We may then compare the intermediate sound, B, with each of the extremes, A and C, so as to interpose between A and B a D, unlike in loudness to A in the same degree in which it is unlike in loudness to B; and to interpose between B and C an E unlike in loudness to B in the same degree in which it is unlike in loudness to C.

It is thus possible to form a scale passing by equal gradutions of unlikeness from a very faint sound to a very loud one. Similar scales can be formed for degrees of unlikeness in pitch, in the brightness of light, in weight as appreciated by pressure on the skin or by lifting, etc.

Now the fundamental fact which underlies Weber's law is that equal degrees of unlikeness in sensation do not correspond to equal increase or decrease in the absolute intensity of the stimulus. If a series of increasing intensities of stimulation be denoted by R_1, R_2, R_3, R_4, and the corresponding sensations by r_1, r_2, r_3, r_4, the degree of unlikeness between r_1 and r_2 is equal to the degree of unlikeness between r_3 and r_4, when $\frac{R_1}{R_2} = \frac{R_3}{R_4}$, or to use an equivalent formula, in some respects more convenient, when $\frac{R_2 - R_1}{R_1} = \frac{R_4 - R_3}{R_3}$.

Long before quantitative methods in psychology were thought of, astronomers had occasion to classify the stars according to their relative brightness. The different classes are arranged in a scale. At the top of the scale comes the brightest; the unlikeness in average brightness between this and the second class is equal to the unlikeness in average brightness between the second and third class, and so on. The corresponding intensities of the physical lights have since been determined; and it is found that they approximately form the geometrical series, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, etc. Here each stimulus is the half of the preceding stimulus. Obviously $\frac{1}{2} : \frac{1}{4} :: \frac{1}{4} : \frac{1}{8}$, and $\frac{1}{4} : \frac{1}{8} :: \frac{1}{8} : \frac{1}{16}$; and $\frac{1}{2} : \frac{1}{4} :: \frac{1}{8} : \frac{1}{16}$.

In experimental investigations, attention has been chiefly given to degrees of unlikeness which are just perceptible. The original stimulus, whatever its absolute intensity may be, must be increased by a certain constant fraction of its own amount, before any unlikeness in the sensation is discernible. The constant fraction is different for different kinds of sensation. In estimating weight by lifting with the hand, the ratio between original stimulus and increased stimulus must be about 29 : 30 before an unlikeness is perceptible; or to use technical language, before the 'differential threshold' is passed.

'Differential threshold' is in one respect a misleading term: the facts do not warrant us in saying that there is no difference in the sensation before the threshold is passed, but only that there is no discernible difference in the sensation. It would

be more accurate to speak of the threshold of discernment than of the threshold of difference.

For brightness of white light, unlikeness only becomes discernible when the ratio of the original stimulus to the increased stimulus is 100 : 101, or, in other words, when the increment is $\frac{1}{100}$th of the original stimulus. "If we place two candles so as to throw two shadows of some object on a white surface, the shadow caused by each light will be illuminated by the other light, and the rest of the surface will be illuminated by both lights. If now we move one candle away we shall reach a point at which the shadow caused by it ceases to be visible, that is to say, we fail at this point to appreciate the difference between the surface illuminated by the near light alone and that illuminated by the near light and the far light together. If now, having noted the distance to which the candle had to be moved, we repeat the same experiment with two bright lamps, moving one lamp away until the shadow it casts ceases to be visible, we shall find that the lamp has to be moved just as far as the candle; that is to say, the least difference between the illumination of the bright lamps which we can appreciate is" in the same proportion "as in the case of the dimmer candles.

"Many similar examples might be given showing a similar result; in fact, it is found by careful observation that, within tolerably wide limits, the smallest difference of light which we can appreciate by visual sensations is a constant fraction (about $\frac{1}{100}$th) of the total luminosity employed."[1]

It should be added that a stimulus must reach a certain degree of intensity before it can produce any discernible sensation at all. The lowest point at which it begins to yield discernible sensations is called the 'absolute threshold.'

2. Interpretation.—The explanation of the facts described has been much discussed. On one view, there is no difference of sensation at all where there is no discernible difference. On this assumption, increase in the intensity of the stimulus fails to produce an increase in the intensity of the sensation

[1] Foster, *Textbook of Physiology*, p. 1211.

itself until the increment is a certain fraction of the original stimulus. This position seems incompatible with the fact that a sensation A may be indistinguishable from B, and B from C, and yet A may be distinguishable from C. If discernible unlikeness in sensation were co-extensive with actual unlikeness, this would be impossible.

If we have a series of stimuli, a, $a + h$, $a + 2h$, $a + 3h$, etc., we obtain a distinguishable difference of sensation only when a is increased by a certain fraction of its original amount, let us say by $\frac{1}{4}$. A difference is discernible only when we reach $a + \frac{1}{4}a$. Suppose now that we start, not with a, but with $a + 2h$, successive increments to this yield a distinguishable difference only when we come, not to $a + \frac{1}{4}a$, but to $a + 2h + \frac{1}{4}(a + 2h)$.

It follows that the increments which do not produce any discernible difference must produce indiscernible or subconscious differences. Suppose two sensations, s_1 and s_2, which are not distinguishable from each other, although the stimulus S_1 which produces s_1 is greater than S_2 which produces s_2; if we say that because there is no discernible difference in the sensation there is no difference in it at all, we get an absurd result. For by further increasing the stimulus we obtain a sensation s_3 which is distinguishable from s_1, but not from s_2. Now if there is no difference between s_1 and s_2, and again no difference between s_2 and s_3, there can be no difference and, *a fortiori*, no distinguishable difference between s_1 and s_3.

It is futile to suggest that increase in the stimulus may be attended by increase in nervous excitement without concomitant difference of sensation. For if increased nervous excitement yields no difference between s_1 and s_2, and none between s_2 and s_3, it can produce none between s_1 and s_3. If s_1 is identical with s_2 and s_2 with s_3, s_1 must be identical with s_3. If we add to the burden on a man's back straw by straw, he will, when sufficient straws are added, become sensibly aware that the weight has increased as compared with some previous stage of the process. But at no point will he discern a difference between the weight he was previously carrying and the same weight as increased only by a single straw.

Hence the successive straws must produce indiscernible differences, in order to account, by their accumulation, for the difference which is ultimately noticed.

In Fechner's explanation of the law this point is recognised. He rightly holds that the sensation varies with the stimulus even when the variation is not perceptible. It becomes perceptible when the degree of variation has passed a certain limit. So far, we may follow him. But he also holds that the increase in intensity of sensation required to constitute a discernible unlikeness is not relative but absolute, so that the variations of stimulus form a geometrical series, while the corresponding variations of the sensation form an arithmetical series. In estimating weight by means of passive pressure, if we begin with an ounce, we must add a third of an ounce before any unlikeness is discernible; if we begin with a pound, we must add a third of a pound before any unlikeness is discernible. In both cases, according to Fechner, the increase in the intensity of the pressure-sensations is not relatively the same but absolutely the same.

There are serious objections to this view. There is a difficulty in testing it, because of the peculiar nature of intensive magnitude. Intensive magnitude is indivisible. We cannot subtract a fainter sound from a louder so as to be able to point to a certain degree of loudness as the mathematical remainder. Hence we cannot in such cases immediately test Fechner's contention that the degree of unlikeness between two sensations is simply proportional to their mathematical difference—to the remainder which would be left if one could be subtracted from the other.

But there are other cases of the application of Weber's law in which this difficulty does not present itself. Weber's law holds good of extensive as well as intensive magnitude, and it also holds good of number. If we compare a line two inches long with a line three inches long, and then compare a line six inches long with a line seven inches long, according to Fechner the degree of unlikeness between the two-inch line and the three-inch line ought to be identical with the degree of unlikeness between the six inch line and the seven-inch line.

In both cases the absolute or arithmetical difference is the same—one inch. This is true from the psychological as well as from the physical point of view. For if we suppose the lines to be presented to the eye under similar conditions, the mode in which an inch affects the retina in the one case may be virtually identical with the mode in which it affects the retina in the other case. The inches are not only equal as measured by a rule; their visual appearances are also approximately equal in extensity. We are therefore dealing with psychical, and not merely with physical, magnitudes. But in spite of the fact that $3 - 2 = 1$, and that $7 - 6$ also $= 1$, there is a greater degree of unlikeness between the line of two inches taken as a whole, and that of three inches taken as a whole, than there is between the line of six and that of seven inches.

The same holds for least perceptible degrees of unlikeness. If we have to increase the length of a line of six inches by a certain amount in order that the unlikenesss may be just discernible, we must increase the length of a line of two inches, not by the same amount, but in the same proportion, in order that the unlikeness may be just discernible. Number as well as extension affords illustration. If we lay a group of three counters on the table beside a group of two, and if we then lay a group of eight beside a group of seven, it is clear that there is a greater resemblance between the group of eight and the group of seven than there is between the group of three and the group of two. Yet in both cases the absolute difference is the same—one counter.

The principle holds also for magnitudes which are not directly perceived, but thought of. Everybody recognises that a billion and one is more like a billion than eleven is like ten. So in the ordinary dealings of life, if we have to pay or receive sums amounting to hundreds of pounds, we feel that it does not matter about odd pence; but a penny more or less is by no means negligible if the sum to be paid or received is under a shilling.

We may then conclude that degree of unlikeness between extensive quantities is neither identical with their absolute difference nor proportioned to it.

In the case of intensive magnitudes, such as the loudness of a sound, or the brightness of a light, there is, properly speaking, no arithmetical difference, because we cannot divide such magnitudes into parts, so as to find a numerical equivalent for each, and subtract the one from the other. None the less, there may be in intensive magnitude something analogous to the arithmetical difference. The velocity of a moving body is an intensive magnitude; but it is a magnitude which can be represented by a number which is a function of the space traversed and the time which it takes to traverse it. It may thus be treated as if it were an extensive magnitude capable of addition and subtraction. There is no reason why the intensity of sensation should not be conceived in the same way. At any rate, the mere fact that we are dealing with intensive magnitude does not in itself constitute an insuperable objection to the abstract possibility of such a mode of treatment.

Hence there is in principle no objection to Fechner's attempt to correlate increased intensity of sensation with increased intensity of stimulus. But he was over-hasty in supposing that equal degrees of unlikeness involved equal absolute differences of quantity in the sensation. On the contrary, the analogy of extensive magnitude seems to show that degree of unlikeness is correlated with relative, not absolute, differences in intensity of sensation. Fechner's problem is yet to be solved. We do not yet know the law which connects increases in the strength of the stimulus with corresponding increments of sensation. We cannot yet assign a number which shall represent degrees of loudness or brightness, as the number obtained by dividing the sum of units of time into the sum of units of space represents velocity.

3. Further Questions.—Here a question of some importance arises. It is often assumed without discussion that all least perceptible degrees of unlikeness between the same kinds of sensible qualities are equal. Now this is by no means self-evident. It is indeed not self-evident that degrees of unlikeness which are just discernible, are therefore equally discernible, that is to say, discernible with equal ease. Even if they are all discernible with equal ease, it does not follow that

they are themselves equal. The appeal in the last instance must be to actual comparison. A valid reason for assuming them to be equal is that they appear equal. Another reason is that they occur under the conditions of Weber's law, which holds in general for equal degrees of unlikeness.

A stimulus must reach a certain degree of intensity before it can produce any discernible sensation at all. The question arises whether it produces any sensation before it produces a discernible sensation. Proceeding on the general analogy of the results we have reached in discussing Weber's law, we must assume that in all probability it does. We have here a special case of the general relation of stimulus to sensation. Within limits, the sensation varies as the stimulus is increased, without the variation becoming perceptible. It is most natural to bring the case of a stimulus, which is not yet intense enough to produce a discernible sensation at all, under the same principle. It is still more improbable that sensations which escape notice merely because our attention is otherwise occupied have no existence as psychical facts. Thus, from our present point of view, we can confirm the doctrine of subconscious sensations.

4. Limitations of Weber's Law.—We have spoken of Weber's law as if it held good exactly and uniformly for all sensations; but as a matter of fact this is far from being the case. Many deviations and limitations have been discovered by experiment. Verification commonly fails for very high or very low intensities of sensation. In view of the complexity of the operative conditions this is not in the least surprising. We might suppose the law to be perfectly exact, inasmuch as it states that unlikeness between sensations depends upon their relative difference, without supposing that this relative difference is determined only by difference of external stimulation. The special structure of the different sense-organs is probably an important factor. To speak of nothing else, the eye and the ear have sensations of their own due to internal stimulation, which it is difficult to allow for.[1]

[1] The treatment of Weber's law in this chapter follows Meinong, *Ueber die Bedeutung des Weberschen Gesetzes*, etc.

BOOK III.

PERCEPTION.

PART I.

CONATIVE ACTIVITY AT THE PERCEPTUAL LEVEL.

CHAPTER I.

PERCEPTUAL PROCESS AND LEARNING BY EXPERIENCE AT THE PERCEPTUAL LEVEL.

1. General Characteristics of Perceptual Process.—The nature of conative process at the perceptual level has already been to some extent illustrated in dealing with the primary laws of mental process in general. It is intelligent, inasmuch as it involves attention, pursuit of ends, appreciation of success and failure, persistency with varied effort, and learning by experience. But perceptual intelligence, in its pure form, is exclusively concerned with the guidance and control of motor activity in relation to an immediately present situation and to its acquired meaning as conveyed by implicit ideas inseparably coalescing with actual sensations.

Thus the perceptual consciousness cannot deal with past, future, and absent objects except in the act of dealing with what is given to it here and now. In the pursuit of ends it is circumscribed by the necessity of always working forward step by step from the actually given situation through a series of others until the goal is reached. It is limited in a way comparable to actual motion; just as in actual motion we cannot transport ourselves from one place to another except by passing through a series of intermediate places, so in

perceptual process we cannot transport ourselves in thought into the future except through an intermediate series of presents.

What reference there is to the future is wholly from the point of view of the actual present. It is involved primarily in the prospective attitude of attention in which the actual present is apprehended as transitional, as something which not merely *is*, but *is to be*. This primary reference to the future is further specialised through experience of results of past activity yielding implicit ideas, which invest what is actually present with acquired meaning.

The train of actions involved in hunting a living prey is shown in the play of the kitten before it has actually hunted, and often without its having had opportunity for learning them by imitation. The kitten first assumes the attitude of watching or lying in wait; it then steals up to the ball or thread or other object which forms its plaything, in a noiseless snake-like manner; in the next place it gathers itself for a spring, and pounces on the *quasi*-prey, seizes it with teeth and claws, and worries it; finally it lets the object go again, and re-commences the process.

The several acts of lying in wait, stealthy approach, crouching for a spring, pouncing on the prey, are phases in the development of the same activity. The same is true of the hunting of an actual prey. In such processes the behaviour of the animal is throughout prompted and guided by actual sense-impressions. But the reaction evoked by each present phase of the developing situation sets body and mind in an attitude of preparation for the next. The whole activity is relative to a series of external conditions which supply in turn occasions for its further development.

Now, if these external occasions are to be utilised in an effective manner, the animal cannot remain purely passive in regard to them. On the contrary, it must meet them half-way by watching for them, and by keeping itself in readiness to act in an appropriate way when they occur. Thus perceptual activity is essentially characterised by attention. Attention is constantly directed towards the external conditions which are relevant to the progress of the action so as to utilise them.

Now attention is always in some manner expectant or prospective. So far as we already know a thing sufficiently for our purpose, the work of attention is already accomplished. The direction of thought, whether perceptual or ideational, coincides with the direction of conation—of appetition or aversion; conation is always pressing forward towards its end; hence attention, which is nothing but conation defining itself in cognition, and so guiding itself by means of cognition, must also constantly be directed forward beyond the 'ignorant present,' to meet what is to come. To attend is always to 'watch,' to 'await,' to be on the 'alert'.

When we take a light to lighten our path through a dark place, we use it to make out whither we are going, not where we have already arrived. It is to guide our future steps, not the steps we have already taken. Now if we care to use a bold metaphor, we may say that attention is the light used by conation to make out its path. Only we must remember that attention is no external illumination, but is simply identical with conation considered in its cognitive aspect. Trains of perceptual activity are marked throughout their course by this mental prospectiveness. Its external sign is the pre-adaptation of the sense-organs to receive impressions, and the pre-adjustment of the body in readiness to act when the opportunity presents itself.

The special forms assumed by adaptive behaviour of this kind may be more or less completely determined by instinctive endowment. But in the higher animals and, above all, in human beings, they are to a large extent acquired through experience. Now, so long as the operative ideas remain implicit, involving only primary acquirement and revival of meaning and complication, this does not alter the fundamental nature of the perceptual process. Thought is still directly embodied in motor activity and confined to the point of view determined for it by the actual sense-experience of the moment. Indeed, the perceptual processes of human beings have in the main been acquired without any definite basis in instincts giving rise to modes of behaviour which are specialised from the outset. The predisposition of man determines certain general tendencies in action which are from the begin-

ning more plastic than the corresponding tendencies in the lower animals.

A man climbing a precipitous cliff may have his attention fully occupied in gaining and retaining foothold and handhold. His activities mainly consist in muscular movement guided by sense-perception. Such an act as threading a needle does not necessarily involve free ideas; attention is fully occupied in the guidance of the hand, and the delicate co-ordination of its movements by the aid of the eye. The same holds broadly true of such performances as walking on a tight-rope, keeping one's balance on a bicycle so far as it may require attention, and, in general, of all games of bodily skill.

In these instances, perceptions are not isolated facts; they form series having a certain unity and continuity similar to that of trains of ideas or trains of thought. Any such series constitutes a single complex perceptual process. It differs from a train of ideas inasmuch as the sequence of its parts does not depend merely on mental conditions such as retentiveness and association. The sequence of its parts depends also upon the sequence of sense-impressions due to the combined effect of external conditions and the motor activity of the subject; inasmuch as it depends on motor activity, it is under subjective control.

Trains of free ideas are not, in this way, bound up with bodily behaviour in relation to a given situation and so confined to the point of view fixed by actual sense-experience. Thought which takes shape in a sequence of explicit ideas conditioned by a sequence of mental images can expatiate freely in the domain of the past, the future, the absent, and the merely possible, in detachment from the circumstances of the immediate present. We may, for instance, while sitting at a desk in London, ideally represent ourselves as on a bicycling tour in Brittany, and we may fix beforehand what places we are going to visit and anticipate what we shall see and do in them.

One consequence of this power of ideally transporting ourselves into the regions of the past, the future, the spatially remote, and the merely possible is that, in the pursuit of ends, we are not bound, so to speak, to live from hand to

mouth. We are able mentally to cross a bridge before we come to it. We can deal ideally with future exigencies so as to form a plan of action before proceeding to put it in execution. Further, in so doing we are not compelled to work forward step by step from the actually present situation. We may, on the contrary, begin at the end and move backwards to the point at which the actual execution of the plan must start. If the desired result is *d*, and the consecutive steps required for its attainment are *a*, *b*, *c*, we may begin with *d*, then pass backward first to *c*, then to *b*, then to *a*.

Another most important point of difference between perceptual process and trains of ideas is that on the perceptual level there are no explicit concepts. By this I mean that there is no apprehension of the general or universal as such in distinction from particular cases or instances. There is no awareness, for instance, of the class 'men' or 'horses,' as as a separate object of thought discriminated from this or that particular man or particular horse; still less are there distinct objects corresponding to the meaning of abstract terms, such as 'human nature' or 'equine nature.' This must not be taken to imply that at the perceptual level there is no awareness at all of the general or universal. In that case, there could be no such thing as recognition or identification. But a dog, of course, recognises a bone or another dog when he sees it. Indeed, continuity of attention is possible only on condition that an object is recognised as the same in different stages and phases of its appearance to consciousness.

The fact is that recognition in its more primitive forms does not require discrimination of the universal from the particular, but only a confused or implicit awareness in which the universal is not separately apprehended as a distinct object of thought. Thus, when in taking my bath in the morning I recognise sponge and towel, each in its distinctive character, I do not usually think of the class 'sponges' as such, or of the class 'towels' as such, in contrast to the particular perceived members of these classes, so as to formulate the judgments, 'this is a sponge' or 'this is a towel.' My awareness of the general nature of sponges or of towels is, so to speak, embedded in my awareness of the particular

sponge or towel and not mentally marked off from this. Thus, though there is a rudimentary judgment of recognition inasmuch as the universal nature of the particular is confusedly apprehended, yet there is no judgment in which subject and predicate are mentally sundered from each other. Still less are judgments possible at the perceptual level in which one general term is subject and another predicate, for example, 'sponges are soft,' or 'horses are quadrupeds.'

Comparison at the perceptual level can exist only in a rudimentary form. At the utmost it is confined to a vague apprehension of likeness and difference. It is only in conceptual thought, which is aware of general features, as such, that attention can be directed to the discovery of the special points in which two objects are alike as contrasted with those in which they differ.

Imitation is limited in the same way. In merely perceptual consciousness attention to an action performed by another produces a tendency to similar behaviour, where the conditions are otherwise favourable. But deliberate or inferential imitation, in which *A* copies the act performed by another, *B*, because he expressly recognises that *B*'s behaviour has led to a certain result which he now desires, depends upon trains of free ideas and the conception of universals, as such, in distinction from particular cases. A child may, through a merely perceptual process, tap a spoon against a tray because he has seen me doing this; he may then be induced to go on repeating the action by the pleasure he finds in it; further, if such spontaneous imitation of a certain person under certain conditions generally yields agreeable results, the general tendency to imitate this person or to imitate under these conditions will be strengthened and may even become habitual. But free ideas are needed before he will take a key to open a drawer and get sweetmeats. He will do this only when, through previous observation of my conduct, he has learned expressly to recognise this mode of procedure as supplying means to the desired end.

Finally, there is for perceptual consciousness no discrimination of alternative possibilities so as to bring them severally before the mind in their distinction from each other. A dog

may hesitate when it is at fault in following up a trail, and it may pause in an attitude of attention until something occurs to decide it to take one turn rather than others. But we have no reason to suppose that anything goes on in its mind resembling what would be expressed by saying: "If this turn, what will follow? if, instead, this other, what will follow?" It is only through trains of free ideas that the mind can follow out possible lines of behaviour or possible series of events.

With this is connected a very important limitation of perceptual process on its productive or constructive side. As the merely perceptual consciousness cannot bring before itself alternative possibilities at all, *a fortiori* it cannot bring before it possibilities which are relatively new in so far as they have no counterpart in previous experience or are even contrasted with what has actually happened. The pig does not imagine itself flying like a bird, and we cannot suppose "a dog regretting, like one of *Punch's* heroes, that he 'did not have another slice of that mutton.'"[1] At the perceptual level there is nothing of the nature of what we shall hereafter refer to as 'ideal construction.' Perceptual process has, indeed, a productive or constructive aspect. But this consists in the intelligent variation of motor activity in response to relatively novel conditions, which is most clearly seen in persistency with varied effort.

I have dwelt mainly on the defects of perceptual intelligence as compared with the flow of free ideas. But against these we must set two advantages. It is only in perception that the mind apprehends what actually exists at the moment in which it actually exists. Further, it is only through the motor activity of perceptual process that we can act on things so as to alter them and adapt them to our needs and purposes.

2. Primary Retentiveness at the Perceptual Level.—In order to understand how learning by experience is operative at the perceptual level we must never forget that it ultimately depends on primary retentiveness. It takes place during

[1] Ward, *Psychological Principles*, p. 189.

the primary occurrence of perceptual activity, though its full result is manifested only on repetition under similar conditions. During the original process previous stages leave behind them a persisting cumulative disposition determining subsequent stages, and it is this disposition as a whole which becomes operative when the process is again enacted on another occasion. Thus, even in the course of the same train of action, the various features of the total situation have acquired meaning due to continuity of attention and primary retentiveness which they would not otherwise possess.

There is one instance of this which is especially instructive —that in which a perceived object disappears for a time and is none the less apprehended as having a continued existence. Examination of our own experience shows that this awareness of continued existence does not necessarily presuppose free explicit ideas such as would be conditioned by separable images. If I am pursuing a man at full speed, and see him turn a corner, I do not need, in order to continue the chase, to keep before my mind a separate mental image of the man as running on the other side of the corner. On the contrary, it is enough for me to keep my eye on the corner and make for that. At this special stage in the development of my activity, the sight of the corner is sufficient for its guidance. In general, actual searching does not necessarily presuppose explicit ideas. Free ideas become indispensable only when the place and manner of search have to be fixed beforehand by something in the nature of a preliminary plan of procedure. In animals such ideal preparation for future action seems to be exceptional, if indeed it occurs at all.

There are, however, abundant and striking examples of animals treating an object as still continuing to exist, though it is out of the range of perception. Under this head come the frequent cases of approaching prey behind a cover which conceals it. The following example, given by Schneider,[1] is typical. A sand-hopper was creeping towards some sea-weed. A crab was watching it and slowly approaching it. Between them was a clump of sea-weed, and the crab availed itself of

[1] *Der thierische Wille*, p. 324.

this as cover. When within about eight inches of its prey, it left its hiding-place, crouched, and crept towards its victim. When the crab was about four inches off, the sand-hopper turned towards its pursuer. Immediately the crab vanished. The next moment the sand rose in the neighbourhood of the sand-hopper and the crab emerged. On its reappearance, it made one or two stealthy steps forward and then pounced on its prey. The conditions of crab-life forbid us to ascribe this behaviour to previous learning by experience of results. We must account for it by highly specialised and definite instinct together with primary retentiveness.

Darwin gives the following instance of looking for a prey which has disappeared.[1] A wasp made a sudden dash at a spider and then flew away; "the spider was evidently wounded, for, trying to escape, it rolled down a little slope, but had still strength sufficient to crawl into a thick tuft of grass. The wasp soon returned and seemed surprised. It then commenced as regular a hunt as ever hound did after fox, making short semicircular casts. The spider, though well concealed, was soon discovered."

For the higher animals, examples are too familiar to need special quotation. All that is required by way of explanation is the assumption that "the perception of the prey maintains its influence after it is past" so as to "cause the same sort of effort to get at the victim as would be put forward were the victim still in sight."[2] In other words, what is required is primary retentiveness, not previous experience of results, still less explicit ideas.

3. Learning by Experience of Results.—Learning by experience of results at the perceptual level is shown both in the gradual modification of instinctive behaviour, and also in action for which there is no special instinctive equipment. We have already given examples of the first kind. The way in which the more artificial performances of animals are acquired is best investigated in experiments appropriately

[1] *Voyage of the 'Beagle,'* p. 34.
[2] Hobhouse, *Mind in Evolution*, p. 96.

arranged so as to exhibit the process of learning in its successive stages. Researches of this nature were first effectively carried out by Thorndike on dogs, cats, and chicks,[1] and his observations have been in the main confirmed by the work of a number of subsequent inquirers. The general method is to place an animal "under the influence of some stimulus which it strives either to get rid of or to get more of": the animal then goes through a series of reactions until one proves successful; on being after an interval of time placed in the same situation, the unsuccessful movements are fewer, and further repetition causes them to be dropped entirely.[2]

Thorndike's aim was to discover the process by which animals learn such actions as opening doors by depressing or lifting latches. "The method was to put the animals when hungry in enclosures from which they could escape (and so obtain food) by operating some simple mechanism, *e.g.* by turning a wooden button that held the door, pulling a loop attached to the bolt, or pressing down a lever. Thus one readily sees what sort of things the animals can learn to do and just how they learn to do them.

"Not only were the actions of the animals in effecting escape observed, but also in every case an accurate record was kept of the times taken to escape in the successive trials. The first time that a cat is put in to such an enclosure, some minutes generally elapse before its instinctive struggles hit upon the proper movement, while after enough trials it will make the right movement immediately upon being put into the box. The time records [plotted down in curves] show exactly the method and the rate of progress from the former to the latter condition of affairs. . . .

"What happens in all cases is this: The animal on being put into the box, and so confronted with the situation 'confinement with food outside,' bursts forth into the instinctive activities which have in the course of nature been connected with such a situation. It tries to squeeze through any openings, claws and bites at the walls confining it, puts its

[1] The best results were obtained for the cats.
[2] Washburn, *The Animal Mind*, p. 219.

paws through and claws at things outside, trying to pull itself out. It may rush around, doing all this with extraordinary vehemence and persistence.

"If these impulsive activities fail to include any movement which succeeds in opening the door, the animal finally stops them and remains quietly in the box. If in their course the animal does accidentally work the mechanism (claw the button round, for instance), and thus win freedom and food, the resulting pleasure will stamp in the act, and when again put in the box the animal will be likely to do it sooner. This continues; all the squeezings and bitings and clawings which do not hit the vital point of the mechanism, and so do not result in any pleasure, get stamped out, while the particular impulse, which made the successful clawing or biting, gets stamped in, until finally it alone is connected with the sense-impression of the box's interior, and it is done at once when the animal is shut in."[1]

Thorndike, in interpreting his results, takes no account of implicit ideas; hence he is led to the conclusion that his cats, dogs, and chicks did not show by their behaviour that they possessed ideas at all. If this be taken to apply only to explicit and free ideas, Thorndike's view seems to be justified by the facts. Evidence for it is to be found—

(1) In the general mode of behaviour of the animals as maintained throughout the process of learning; this was in principle the same when the cat or dog had been repeatedly shut up within the same enclosure as it was when it was first placed there. It consisted in an outburst of diffused motor activity, without any sign of thinking over the situation, so as to make ideal preparation for dealing with it by laying out a plan of action before proceeding to put it into execution. The learning took place by a gradual discontinuance of abortive actions and persistence in those which led to success. Even those which were only relatively successful would be proportionately favoured—there would be more persistence in pushing or pulling a loose bar of the cage than one which was

[1] *Science*, N.S., Vol. VII., No. 181, pp. 818, 820-1; an abstract of the original paper in Monograph Supplement, No. 8, of the *Psychological Review*.

quite unyielding. Now in all this there is no symptom of other mental processes than such continuity of attention, persistence with varied effort, appreciation of relative success and failure, and acquirement and reproduction of primary meaning as may be found at the purely perceptual level.

(2) In the gradual way in which in many cases the time required for the animal to escape decreased.[1] Of course when the decrease is not gradual but relatively sudden, as it was in some of the experiments, this does not prove free ideal preparation. But where it is found to be gradual we are justified in regarding this as affording a strong presumption on the other side. "A human being who had once hit upon the right way to open a lock could hardly fail on being confronted with it a second time, at not too great an interval, to recall an idea of the successful movement and perform it at once, without any unnecessary accompanying movements."[2]

The general result of these experiments is confirmed by others which show the absence of the power of learning by deliberate imitation. Thorndike found that cats which had failed previously to find their way out of a cage did not learn the way out, and were not at all helped in doing so, when they were placed in a suitable position for watching, even repeatedly, the behaviour of a cat which knew how to get out. A later series of experiments with monkeys yielded, in the main, a similar result. Thorndike also found that his animals failed to profit by being 'put through' even the simplest acts by the experimenter—by having a paw placed in a loop and passively made to pull it down. He infers that they were destitute of the power of learning in any way by imitation or by being put through an act.

This, however, is a too hasty and sweeping conclusion. As he himself points out, the animals, under the conditions of his

[1] "Thus the successive times taken by one cat in a certain box were (in seconds) 160, 30, 90, 60, 15, 28, 20, 30, 22, 11, 15, 20, 12, 10, 14, 8, 8, 5, 10, 8, 6, 6, 7." The animals "would, in the case of some difficult associations, happen to do the thing six or seven times, but after long periods of promiscuous scrabbling, and then forever after would fail to do it." (*Psychological Review*, Vol. V., No. 5, p. 552.)

[2] Washburn, *op. cit.*, p. 237.

experiment, did not even attend in an appropriate way. They were given full opportunity to watch how others escaped, but they did not watch them at all. This is, indeed, of itself strong evidence of the absence of the power of deliberate or inferential imitation, in which " an animal, watching another go through an action and observing the consequences, is led to perform a similar act from a desire to bring about a similar result."[1] If Thorndike's animals had been capable of this kind of imitation, they would have attended to the way in which others escaped, instead of totally disregarding this and occupying themselves with other matters.

But it does not follow that they would not imitate spontaneously, could their attention be fixed in the right direction, otherwise than through a desire of discovering a means of escape. In this respect, a very interesting series of experiments carried out by Hobhouse forms a valuable supplement to Thorndike's. " Essentially, each experiment consisted in setting the animal the task of obtaining food by some method presumably strange to it. For example, food was put into a box, which was then shut, and left for the animal to open. . . . The animal was first allowed time to discover the method of obtaining it for itself. If after a little while it showed no sign of hitting on the right method, it was shown, and allowed to get the food. Fresh food was then placed as before, and a new trial began."[2]

Two points emerge clearly from the whole course of these investigations. The first is that, in order that an animal should be influenced at all by 'being shown,' it was necessary to secure its continued attention. The second is that the animals were not initially prepared to attend to Hobhouse's actions through interest in discovering a means to the desired end which they might subsequently employ for themselves. Their attention had to be otherwise evoked. " A mere mechanical performance of the act before the animal, which it may or may not see, has no effect whatever." In every case " the animal is taken up, on the one hand with its desire for food, on the other with its own instinctive or habitual

[1] *Ibid.*, p. 238. [2] Hobhouse, *op, cit.*, p. 153.

method of dealing with the obstacle before it. One's dog will momentarily attend out of politeness to his master, but a cat is moved by no such considerations, nor is an elephant nor a monkey."

So far, however, as Hobhouse did succeed in attracting the attention of the animals to his own actions, he found that they unmistakably profited by being shown how to do things. But how? In general, the results may be sufficiently accounted for, at least in the main, without assuming anything in the nature of deliberate as distinguished from spontaneous imitation. In part, the animals in watching Hobhouse had their attention directed especially to the vital point of the mechanism, so that when left to themselves they would tend to pick out this as the object of their efforts. This result could be secured by mere pointing, if the animal attentively followed the pointing hand; and it can then scarcely be said to involve imitation at all. But besides this the animals were also led more or less to reproduce Hobhouse's mode of action, pushing, for instance, where he pushed, and pulling where he pulled. In focussing attention on his doings they acquired a tendency to act in a similar way themselves, and this tendency became operative, when they were left to themselves, as a condition determining the preference of one line of behaviour rather than others.

It should also be noted that, as the general line of behaviour consisting in attention to the experimenter and following his lead repeatedly brings about satisfactory results, it will gradually be confirmed by success and pass into a more or less confirmed habit. The growth of a general disposition to attend and imitate is clearly discernible in the course of Hobhouse's experiments.[1]

The actions of animals under the conditions of these and similar experiments are, in the main, to be explained as due merely to perceptual intelligence, without trains of free ideas. The whole drift of the evidence forbids us to assume the

[1] Hobhouse seems inclined to favour, or at any rate not to exclude, the hypothesis of deliberate imitation. Without denying that this may occur in the higher animals, I am convinced that the facts in general do not require or admit of this explanation.

presence of deliberate comparison directed to discovering and noting the points in which various modes of procedure agree and differ so as to ascertain precisely what it is that makes one way of dealing with a difficulty right and others wrong. Deliberate imitation, as we have just seen, is also excluded. The facts are equally incompatible with the existence of explicit inference such as involves both the apprehension of general propositions and their application to particular cases.

There is no ground for doubting that causal inference of a rudimentary kind is shown in the appreciation of success and failure, in persistency with varied effort, in the repetition of ways of behaviour which have yielded satisfactory results in the past to the exclusion of others, and also generally in the anticipation of like results when like conditions occur. But there is nothing to indicate that the animals apprehend general rules of causal connection, as such, in contrast to their particular applications. This is not, however, to be taken to exclude all insight into the reason why a certain consequence should follow from a certain condition. A dog pulling a piece of string with a piece of meat tied to the other end will understand that the meat will follow the motion of the string, just as a man would understand. Inference from a general proposition to the particular instance is required neither in the case of the man nor in that of the dog.

It will help to make clear the nature of perceptual intelligence, if we consider briefly a theory of the way animals learn by experience, which has been put forward by Thorndike, who, in his eagerness to reject the operation of free ideas, has run to the opposite extreme and almost denied the presence of intelligence altogether. He assumes, indeed, that the animal begins with conation and attention to its situation. But he holds that the only result of learning by experience is to supplant this original intelligence by purely unintelligent motor associations such that when a certain sense-impression occurs a certain group of muscles is innervated in a certain way. He thus leaves no place for such factors as acquirement and revival of meaning. He even goes so far as to deny to the animal all anticipation of the experiences which will accompany the movement itself—those due to muscle,

joint, and tendon sensations, or to the sight of the moving limb. These, in his view, are experienced only when they come; they are in no way referred to beforehand.

The whole position seems quite untenable. Hobhouse has forcibly urged against it the fact that what the animals acquire through experience is not merely a tendency to execute a certain movement on the occurrence of a certain sense-experience, but rather the tendency to bring about a certain perceptible effect by whatever means is in their power. A cat, for instance, which has learned to escape from confinement by pulling a loop down with its paws, may on the next occasion use its teeth instead of its paws. If the loop has been raised it may climb or jump up before pulling. If it fails in one way it may try another.

In the second place, the processes in human beings which Thorndike himself adduces as being of a similar nature do not at all conform to this account of them. "The tennis player," he urges, "does not feel 'This ball coming at this angle and with this speed is similar in angle but not in speed to that other ball of an hour ago, therefore I will hit it in a similar way.' He simply feels an impulse from the sense-impression. . . . No tennis player's stream of thought is filled with free-floating representations of any of the tens of thousands of sense-impressions of movements he has seen and made in the tennis court. Yet there is consciousness enough at the time, keen consciousness of the sense-impressions, impulses, feelings, of one's bodily acts. So with animals. There is consciousness enough, but of this kind."[1]

This is an excellent example of perceptual activity developed through experience, and the results of learning by experience in animals are, no doubt, essentially similar. But can we reduce what the tennis player has acquired by experience to mere associations between certain impressions and certain movements? Obviously not. Thorndike's analysis may hold good for cases in which motor processes have been so fixed and organised through frequent repetition under uni-

[1] Thorndike, *Psychological Review*, Monograph Supplement, No. 8, p. 84.

formly recurrent conditions as to become automatic, so that they can take place independently of attention. But the tennis player cannot go on playing while his mind is engrossed in other subjects. On the contrary his attention must be constantly on the alert to discern the acquired meaning of his sense-impressions and of their relatively novel variations so as to pre-adjust his actions accordingly.

Finally, Thorndike himself notes a difficulty in his explanation for which he finds no solution. This is connected with the question: How does the pleasure of success 'stamp in' certain modes of behaviour and the disagreeableness of failure 'stamp out' others? On his view, of course, the only condition of the motor associations being formed is that the movement should occur together with the sense-impression or in close succession to it. This condition being fulfilled, the only function of success and failure is to strengthen or weaken the association thus generated. But, as Thorndike points out, the satisfaction of success arises only in the last stage of the whole process, when the animal emerges from its cage and enjoys food and freedom in the open air. How, then, can it work backwards, over what is sometimes a considerable interval, so as to reinforce motor associations acquired at an earlier stage while the animal was still grappling with its problem inside the enclosure?

Thorndike, as I have said, regards this as a real and serious difficulty. But it is no difficulty to us. The unity and continuity of interest which binds a sequence of distinct acts into a single action has its counterpart on the side or retentiveness in the formation of a cumulative disposition. On the first occurrence of the process the traces left by priof phases persist in and contribute to determine succeeding phases. They unite in a single cumulative disposition. When the activity is repeated, whatever stimulus prompts it re-excites the total cumulative disposition left behind by its previous occurrence. The cumulative disposition has been modified in the anterior experience, and accordingly the re-aroused activity takes a correspondingly modified course as a whole. This is the process which we have described as 'revival of acquired meaning.' Without this there can be

no learning by past experience; and intelligent learning by experience may be due to it alone.

4. Reproduction in Perceptual Process. — In purely perceptual process, the only forms of reproduction are (1) Revival of acquired meaning, (2) Complication, and (3) Revival of general states of nervous excitement and their concomitant organic sensations.

(1) *Revival of acquired meaning* is the most primary and essential. It is grounded in the very nature of perceptual process considered as appetitive activity. The whole process, in so far as it is one and continuous, leaves behind it a cumulative disposition. Hence, when it is repeated, it is modified as a whole from the outset.

(2) *Complication* is a process for which there are probably special pre-arrangements in the original constitution of the nervous system. It consists in modification of the quality and increase of the complexity of certain sensations by association with other kinds of sensation in past experience. It mainly takes place between sensations belonging to different senses such as sight and touch. In looking at a hard object, our visual experience is different from that which we have in looking at a soft object, and the difference is due to the corresponding tactile experiences.

(3) *The revival of general states of nervous excitement and their concomitant organic sensations* is of especial importance in connection with emotion. A dog which as been whipped will whine and display signs of fear and distress at the sight of the lash. The original pain-sensations produced a diffused nervous excitement, which gave rise to a general disturbance of organic functions, and to organic sensations. The sight of the whip revives an analogous nervous and bodily excitement and with it analogous experiences.

5. Explicit Ideas Accompanying Perceptual Process.—So far we have treated perception and perceptual process in their pure form. We have distinguished them sharply from explicit ideas. But in the actual mental life of man they run into one another, so that we do not usually find pure perceptual processes, but rather what we may call perceptual processes

not absolutely, but only *a potiori*. The same is also true to some extent of the higher animals. Explicit ideas may accompany a process without interfering with its fundamentally perceptual nature. The explicit ideas may fulfil a function essentially analogous to that fulfilled by perception, and not any function which by its very nature requires the presence of such ideas.

This happens when the only office discharged by significant mental imagery is to prompt or guide the execution of an action, and not to lay out the plan of an action beforehand in the form of a train of thought. The operative ideas are then explicit but still tied. They are not set free for form a train of thought independent of perception. Independently of previous experience squirrels gnaw at nuts, and by reaching their contents satisfy their congenital craving without any mental image of the kernel inside. Suppose that on a future occasion they start with this mental image, the character of the process is not essentially altered. The image of the kernel inside now only contributes to prompt and guide the action, just as the mere perception of the nut prompted and guided it before.

Separate images may be especially useful and even necessary in this way, when the activity is comparatively complicated, and undetermined by definite congenital impulses. Take for instance the case of a monkey imitating a train of actions which it has seen performed by a man—those concerned in shaving, for instance. Possibly percepts would alone suffice in such a case. The sight of the razor might prompt the act of sharpening it, and the act of sharpening it might next prompt the lathering, and so on. But certainly it is easier to understand the action if we suppose that in different phases of its progress some mental image of the behaviour of the man arises in the mind of the monkey, and helps to guide it.

It would seem that in animals explicit ideas, so far as they exist[1] at all, are isolated and, so to speak, sporadic. They

[1] There is room for difference of opinion on this point. Personally, I do not think that there is much evidence for the presence of ideal images in the animal mind, except in the case of the more intelligent monkeys and perhaps of elephants.

do not as a rule give rise to further ideas following each other in a train. Their function is rather to guide the development of motor activity as percepts guide it.

In our own mental life, free ideas are almost constantly present, so that purely perceptual activity is comparatively exceptional. But it certainly takes place. If I have once been bitten by a dog, and meet the same dog on another occasion, I do not need to summon up in my mind a mental image of being bitten again in order to take practical measures of an intelligent kind.

The vast interval which separates human achievements, so far as they depend on human intelligence, from animal achievements, so far as they depend on animal intelligence, is connected with the distinction between perceptual and ideational process. Animal activities are, in the main, either purely perceptual, or, in so far as they involve ideas, these ideas only serve to prompt and guide an action in its actual execution.[1] On the other hand, man constructs 'in his head,' by means of trains of ideas, schemes of action before he begins to carry them out. He is thus capable of overcoming difficulties in advance. He can cross a bridge ideally before he comes to it actually.

6. Impulsive Character of Perceptual Process.—The stream of consciousness consists of successive trains of mental activity each having its own internal continuity of interest, but relatively disconnected with each other. It must be noted, however, that in the case of normal human beings the disconnection of the successive segments is only relative, not absolute. The successive segments of the conscious stream have also some degree of continuity with each other.

Perceptual activity has this internal unity and continuity. But where conscious life is mainly perceptual, the several trains of activity are relatively isolated and disconnected with each other. They do not unite to form a continuous system, such as is implied in the conception of a person. We must deny personality to animals. They are in the main creatures

[1] There may be exceptions to this rule, but the general statement is broadly true.

of impulse. The word 'impulse' is properly applied to any conative tendency, so far as it operates by its own isolated intensity, apart from its relation to a general system of motives. Action on impulse is thus contrasted with action which results from reflection or deliberation. In deliberation a man, instead of following out the impulse arising from the circumstances of the present moment, brings the contemplated course of action into relation with the total system of his mental life, past and future. In the passage from more primitive to higher forms of conative activity there is a transition from these relatively isolated impulsive trains of action to more persistent trains guided by a complex system of dispositional factors which not only harmonise what would otherwise be conflicting tendencies, but also involve memory and foresight.

In the higher forms of conative activity which may be called volitional, there is an appeal from the self of the present moment to the total self. If the strength of the momentary impulse determine action without giving time for deliberation, regret or remorse is likely to follow. When the momentary impulse has ceased to dominate consciousness, the memory of the past action may come into conflict with the more general tendencies which give unity and consistency to a life as a whole. Regret or remorse of this kind is impossible on the purely perceptual plane; simply because on the perceptual plane there is no unified system of tendencies with which the isolated impulse could collide; there is no personal self including in one whole past, present, and future experience. It is futile to punish a dog for an action which he did a week ago.

Thus the purely perceptual consciousness is compact of relatively detached impulses. The end attained in one perceptual process does not constitute a step towards the attainment of further ends. The several processes, each having its own internal unity and continuity, are disconnected with each other much as games are disconnected with each other. We do not assume the result of one game at chess or rubber at whist as the starting-point of the succeeding game. Each game starts completely afresh on its own account. It

is true that the skill of the player is increased by practice, but this also holds good of trains of perceptual activity, and makes the analogy more perfect.

Summing up, we may say that on the perceptual plane there is no single continuous self contrasted with a single continuous world. The concept of the self as a whole, uniting present, past, and future phases, and of the world as a single coherent system of things and processes, are ideal constructions, built up gradually in the course of human development. The ideal construction of self and of the world is comparatively the rudimentary in the lower races of mankind, and it never can be complete. On the purely perceptual plane it has not even begun.

Between the two extremes of purely impulsive action and action guided by the developed idea of the self there are many intermediate grades. Conative unity may exist in varying degrees. The mental life of such men as Leibniz, or Comte, or Bismarck, or Newton, forms a far more systematic unity than that of the man in the street. The mental life of the civilised man is, in general, more completely unified than that of the savage; and the mental life of man has a unity which is not found in the animal. But some kind and degree of conative continuity must be present, wherever there is anything which can be called 'mental development' or 'learning by experience.' Where there is no conscious striving there can be no self-fulfilment and self-development of conscious striving. Hence we may say that unity of consciousness as constituted by continuity of interest is at once an indispensable starting-point and a progressive achievement of mental evolution in the strict sense, of that kind of development which is peculiar to conscious beings as such.

CHAPTER II.

INSTINCT.

1. Introductory.—Among the facts first to attract attention when we study the behaviour of the lower animals is the extraordinary capacity of many creatures to perform complicated actions which, if performed by us, would call for considerable forethought and intelligence as well as previous practice and the utilisation of past experience. But there are sufficient grounds for asserting that neither the past experience nor the kind of intelligence which we should employ are at the animal's disposal. Moreover, these actions differ in certain important ways from those which depend on the developed forms of intelligence. They are performed with approximate uniformity by all members of the species, and a similar uniformity is to be observed in successive performances of the same individual. Moreover, while the types of behaviour in question have presumably had their origin under conditions in which they would be useful, they tend to persist unmodified when circumstances have so changed as to render them inappropriate. Behaviour of this kind is generally admitted to be 'instinctive.' Instances of instinctive behaviour in this sense fall within daily experience, and others less familiar have been so frequently described that it will be unnecessary to consider more than a few examples in order to indicate the nature of the problems that arise.

We may broadly classify the instinctive actions of animals according to the function they fulfil in the general scheme of animal life.[1] We may distinguish (*a*) those connected with the procuring of food; (*b*) those connected with defence or protection; (*c*) those connected with the care of offspring; (*d*) those connected with the relation of the sexes.

Each of these may include a number of more special processes—the procuring of food often includes: (1) the

[1] This classification is due to Schneider, *Der thierische Wille.*

search for prey or other nutriment; (2) lying in wait; (3) pursuit; (4) springing on prey; (5) seizure of prey; (6) securing it when seized. Besides these main divisions there are special modes of procedure found in some animals, such as throwing out a bait, or constructing traps, or driving the victims from their hiding places by frightening them.

Some animals lie in wait without preliminary search, and seize their prey only when it comes within reach, either by merely extending some part of the body or by a spring. Lizards and frogs, for the most part, do not pursue their prey even when they catch sight of it. They follow it with their eyes, and quietly waiting till it is within reach, seize it by shooting out the tongue, head, or feet, or pounce upon it with a sudden leap.

Lying in wait is often accompanied by other special activities which serve to conceal the watcher, to attract the prey, or to ensnare it. Spiders, for example, construct webs as snares. According to Darwin,[1] the large *Epeira*, when a big insect is caught, makes its web revolve rapidly by a dexterous movement, and at the same time emits a band of threads from its spinnerets which soon envelops the prey in a cocoon-like case. It then examines its victim, gives the fatal bite and, retreating, patiently waits till the poison has taken effect.

Certain crabs disguise themselves past recognition by a covering of sea-weed or other suitable material before lying in wait. Schneider stripped one of its disguise and found its back and limbs covered with short thick bristly hairs hooked at the end. He then placed it in a basin of water containing sea-weeds. The crab drew towards it a small bundle of these, held it with the left claw, and broke a portion off with the right. Then he took hold of the bundle with one claw, raised it slowly to his forehead, placed it there and moved it to and fro till it became fastened to his hooked hairs. He then pulled at it again, as if to see if it were firmly placed. After this, he took up another bundle and repeated the performance until forehead, back, and limbs were all thickly covered.

[1] *Voyage of the "Beagle."*

Many animals may be said to stalk their prey, approaching it stealthily and using cover. The cat's hunting of birds is a familiar example. Crabs, according to Schneider, behave in a similar way.

Instinctive activities of a protective or defensive character assume many special forms, such as: crouching in presence of an enemy; flight and hiding; fighting; burrowing in a suitable place; construction of dwellings, sometimes with chambers and passages; watchfulness in coming out of shelter or hiding place; examination of whatever appears strange or unfamiliar; imitation of an enemy by gestures or noises.

We may here especially refer to the constructive activity of animals in making burrows and nests. The trap-door spider makes a tube in the earth with a door at the entrance. Minute spiders of this species, probably not long out of the egg, make correspondingly minute holes with correspondingly minute doors, gradually enlarging their dwellings as they themselves increase in size. If an enemy endeavours to open the trap-door, the spider frequently seizes hold of its internal surface and, applying her legs to the walls of the tube, forcibly resists the entry of the intruder. Ants and termites construct more or less elaborate subterranean dwellings, hollowing out chambers and galleries in the sod. "The wood-ant piles up a heap of leaves, twigs, and other vegetable refuse so arranged as to form an orderly series of galleries."[1] Beavers construct dams. But the most familiar example is the nest-building of birds, which may serve as a typical instance of instinctive behaviour.

The congenitally determined activities connected with the care of offspring are exceedingly manifold and varied. They include the deposition of eggs in suitable places and other arrangements for their security, nest-building, incubation, shifting eggs and pupae from place to place as varying circumstances require, feeding the young and keeping them clean, hiding of eggs or young by covering them up, by taking them in the mouth or between the feathers or under the wings.

We may select for illustration the case of the deposition of eggs in suitable places so as to arrange for their security.

[1] *Encyclopaedia Britannica*, Vol. II., p. 86.

In most insects, the whole care of offspring consists in depositing eggs in such a place and manner as to provide beforehand for the future life of the larva, its food, safety, and transition to the pupa state. These results are, of course, in no case ends aimed at by the mother-insect herself. She has no opportunity of learning about them by experience or otherwise. She knows nothing of what is going to happen after deposition of the eggs, and the needs and habits of the larvae are quite different from her own. It is not she who provides for their future, but nature, which uses her as an instrument to that end.

There is a beetle which sets about laying its eggs in the following manner. The male and female having found a mass of dung, detach a bit from it and make this into a ball with their legs. Then one of the beetles grasps the ball in front and the other behind; one pulls with its hind legs, the other pushes with its fore legs. In this way they roll the ball along until they find soft earth. Here they dig a deep hole. The female lays an egg in the ball of dung. The next step is to roll the ball into the hole. Finally they fill up the hole again and leave it.

Besides the specialised modes of behaviour which can be brought under these heads, there are more simple and general activities which also have an instinctive character. "By the patient study of the behaviour of young birds, such as chicks, pheasants, ducklings, and moorhens, it can be readily ascertained that such modes of activity as running, swimming, diving, preening the down, scratching the ground, with the characteristic attitudes expressive of fear and anger are so far instinctive as to be definite on their first occurrence."[1] They are from the outset definite enough to be serviceable without requiring to be learned by experience or imitation. The same holds good for adjustment of the organs of sense such as are involved in looking and listening.

2. The Purely Biological View of Instinct.—It is in part possible to give an account of the facts relating to the instinctive movements of animals without introducing psychological

[1] Lloyd Morgan, *British Journal of Psychology*, Vol. II., Pt. 3.

conditions at all. But even in biological works psychological concepts are often tacitly or explicitly introduced. Darwin, for example, writes of instincts in the following way: "An action, which we ourselves should require experience to enable us to perform when performed by an animal, more especially by a very young one, without any experience, and when performed by many individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive."[1]

Here, it will be noted, two of the features singled out involve an explicit reference to mind; and the history of thought concerning instinct, subsequent to Darwin, embraces two broadly contrasted tendencies. On the one hand there has been the attempt to render the concept strictly biological, and on the other there has been the tendency to re-express the facts in psychological terms, and to explore the mental characteristics of instinctive process to which the above definition draws attention.

The biological treatment is necessarily restricted to the study of instinctive movements. These may be regarded merely as special forms of vital adaptation in general, and explained by the same principles which are held by the biologist to account in general for the congenital characters by which the various species of plants and animals are pre-adapted to maintain the life of the individual and the race. It belongs to the innate constitution of a spider that it should spin a web; but it also belongs to its innate constitution that it should possess spinnerets. Both the spinnerets and the aptitude for using them are complex arrangements for the preservation of the spider's existence, and that of the species to which it belongs. Neither is acquired by anything which the spider does.

Darwin, in his *Voyage of the Beagle*, mentions a land-crab which opens cocoa-nuts. "The crab begins by tearing the husk fibre by fibre, and always from that end under which the three eye-holes are situated; when this is completed, the crab commences hammering with its heavy claws on one of the eye-holes till an opening is made." "I think" says

[1] *Origin of Species*, Chap. VII.

Darwin, " this is as curious a case of instinct as ever I heard of, and likewise of adaptation in structure between two objects apparently so remote as a crab and a cocoa-nut tree." Here instinct and structural adaptation are distinguished. The distinction is not, however, fundamental for biology. The crab has a congenital equipment in the way of claws, etc., for dealing with cocoa-nuts in the way described. But it has also a nervous system which is as much part of its bodily structure as its claws. It is because this nervous system has a certain inherited constitution that the animal is capable of performing certain complex series of movements when appropriate conditions occur.

Instinct, considered in this light, distinctively consists in a special pre-adaptation of the nervous system congenitally determined so as to give rise to special bodily actions in response to appropriate stimuli. These actions are in general conducive to the preservation of the individual and of its race, but there is of course no prevision of such ends. If we ask why instinctive movements are thus pre-adapted to subserve remote ends to which the individual animal itself is blind, we must look for the answer in the general theories by which biologists account for the origin of adaptive arrangements in the various species of plants and animals.

The fact that we are here dealing especially with pre-adaptations of the structure of the nervous system makes no essential difference. Whatever principles, such as natural selection and heredity, will account for a sparrow being congenitally equipped with wings adapted for flying, will also account for its having the connate modification of nervous structure for executing the requisite movements, without needing to acquire them by practice.

Instinctive endowment is, in this respect, merely one form of vital adaptation, among others, to be explained in the same way as the ingenious arrangements found in orchids and other flowers for cross-fertilisation by insects, or the construction of the eye as an optical instrument, or the complex combination of processes through which food is digested or the blood supplied with oxygen. Structure and function, from this point of view, conform to the same laws.

Earlier writers were in the habit of insisting on the complete uniformity of instinctive behaviour in all members of a species, and on its uniform transmission from generation to generation. We shall see presently that instinctive conduct is to a large extent modified by experience. But besides this we have also to recognise the occurrence of congenital variations. The connate constitution of the nervous system is no more fixed and invariable in different individuals than their other bodily organs. Each conforms to the general type, but each does so in its own special way. Thus ants of the same species conform in the tendance of their eggs and larvae to the same general type of behaviour. But within the same nest a careful observer is able to detect manifold more or less conspicuous differences in the conduct of individual ants, differences, so to speak, due to individual character. Similar variations are also to be found in the nest-building of birds. Variability of this kind is essential to the Darwinian theory of the origin of species, because "some degree of variation in instincts, . . . and the inheritance of such variations, are indispensable for the action of natural selection."[1]

This is the right point of view from which to deal with the biological purposefulness of instinctive movements, with their adaptation as means to the fulfilment of ends in the general scheme of animal life, which are entirely beyond the ken of the individual who performs them.

3. The Psychological Factor as Indispensable to Instinct.—We have just seen that some features of instinctive behaviour in animals are to be accounted for, in the same way as other facts of vital adaptation, by such principles as heredity, congenital variation, and natural selection. But this point of view is inadequate because it fails to mark off what is essentially distinctive of instinct as compared with other modes of vital adaptation. It is not enough to say that instinct is especially a connate disposition of the nervous system as distinguished from other parts of the body structure. For this would include reflex actions.

[1] *Origin of Species*, Chap. VII.

Now biologists who tend to ignore the importance of psychological factors also tend to regard as unessential the distinction between reflex actions and instinctive movements. They propose to define instinct as consisting in complex combination of reflexes. This position is natural when the problem is approached in a purely biological way. But scrutiny of the facts from the psychological point of view shows that it is quite indefensible. Reflex action is of a nature fundamentally different from instinctive conduct. The difference is that instinctive conduct does, and reflex action does not, presuppose the co-operation of intelligent consciousness, including under this head interest, attention, variation of behaviour according as its results are satisfactory or unsatisfactory, and the power of learning by experience.

Reflex movements occur in response to a stimulus which frequently also gives rise to a vivid sensation with strong affective tone. But they may also occur without any distinctively appreciable sensation. Further, when the sensation *is* present, there is no reason for regarding it as a factor generating or influencing the reflex process itself. It is rather a collateral result of the stimulus, serving merely to arouse attention to the reflex act and to the conditions under which it occurs so as to give occasion to further activity which is not of the reflex type. The obtrusive sensation accompanying a sneeze, for example, does not determine the movement of sneezing, bur rather such further action as the attempt to suppress this or the turning of the head aside or the use of a handkerchief.

But instinctive conduct is related to sense-impressions in a fundamentally different way. The course of the instinctive activity is throughout guided by and adjusted to complex and variable combinations of different sense impressions. This is plain in such instances as the behaviour of dung-beetles in depositing their eggs, of the cat hunting a mouse or playing with a ball of worsted, of the bird building, of the spider spinning a web, and of an ant dragging a load to its nest. Now, in our own experience, the guidance of motor processes in their varying phases and stages by complex and changing groups of sense-impressions is found in two cases. It is found

in the highest degree in actions which involve attentive consciousness; it is also, though to a much more limited extent, found in routine processes for which the nervous system has been previously educated through attentive activity so that they become capable of occurring without attention or with a minimum of attention.

To which of these types is the instinctive behaviour of animals most akin? There is no difficulty in answering this question. Instinctive movements from the outset bring into play whatever mental activity the animal may be capable of. They do not go on while the animal is pre-engaged with something else. Either they fully occupy attentive consciousness, or consciousness is not concerned with them at all. The last alternative seems *prima facie* improbable and further consideration justifies us in dismissing it altogether.

In the first place the whole behaviour of the animal throughout the course of an instinctive activity, even on its first occurrence, shows all the outward characteristics of attentive process. It is marked by adaptation of the sense organs for certain stimuli rather than others, and is throughout pervaded by the attitude of waiting, watching, and searching for future impressions. In this respect, it is sharply contrasted with the mere reflex. The reflex reaction occurs when the stimulus is applied as a loaded pistol goes off when the trigger is pulled. It is not prepared for by previous activity. Until the appropriate stimulus occurs the animal remains passive. On the other hand, the bird gathering materials for its nest, ants tending eggs and larvae, a cat or a crab lying in wait for prey, take the initiative, so to speak, and go out to meet coming impressions. Thus the successive parts of a complex instinctive process, instead. of appearing to the observer as a mere sequence of separate reactions each evoked by its own separate stimulus, irresistibly suggest conative unity pervading and connecting them as stages or phases in the development of one continued action. The cat's procedure, for example, in hunting a bird, from its first prowling in pursuit of prey until the final killing of the bird, seems throughout its course to consist of successive steps linked together by continuity of attention depending on one pervading

appetition which finds satisfaction only in carrying out the process to its final result.

This view is further confirmed by another feature of instinctive behaviour. We find in it clear evidence of what Lloyd Morgan calls "persistency with varied effort;" where a certain mode of action fails to have a certain effect, the activity is renewed again and again under relatively novel forms until success is reached. A dung-beetle rolling its dung-ball along the sand finds itself in a hollow, the sides of which are too steep for the ball to be pushed up from below. The beetle accordingly butts down the sand at one side "so as to produce an inclined plane of much less angle."[1] In investigating the cell-making instinct of the hive-bee, Darwin found examples of this persistency with variation of behaviour. "It was really curious to note in cases of difficulty, as when two pieces of comb met at an angle, how often the bees would pull down and re-build in different ways the same cell, sometimes recurring to a shape they had at first rejected."[2]

There is a species of solitary wasp—*Ammophila*—which in completing its nest blocks up the entrance with earth. In doing this the procedure adopted varies much in its details for different individuals. One wasp, which performed the work in a particularly elaborate way, finally "scampered around hunting for some fitting object to crown the whole. First she tried to drag a withered leaf to the spot, but the long stem stuck in the ground and embarrassed her. Relinquishing this, she ran along a branch of the plant under which she was working, and leaning over picked up from the ground below a good sized stone, but the effort was too much for her. . . . She then started to bring a large lump of earth, but this evidently did not come up to her ideal, for she dropped it after a moment, and seizing another dry leaf, carried it directly to the spot and placed it directly over the seat."[3]

Such behaviour as this shows clearly that instinct does not consist merely in a congenital arrangement through which a

[1] Lloyd Morgan, *Animal Life and Intelligence*, p. 458, as quoted by Myers, *British Journal of Psychology*, Vol. III., Pt, 3, p. 214.
[2] *Origin of Species*, Chap. VII.
[3] Peckham, *Instincts and Habits of Solitary Wasps*.

certain stimulus elicits certain movements. What it essentially involves is rather an impulse which requires for its satisfaction the doing of something in the sense of achieving a certain perceptible result. If the given situation at once evokes the movements required to produce this result, there is no renewal of effort with variation of procedure. Otherwise what we can only call fresh attempts are made involving more or less novelty of adjustment. To some extent the nature of the new adjustments may be provided for by the inherited constitution of the nervous system. But this explanation seems plainly inadequate to cover all the relevant facts. We must also recognise that modes of action are brought into play which have been learnt in the course of previous experience.

This brings us to the final consideration which, taken in conjunction with the others already mentioned, justifies the position that instinctive activity essentially involves intelligent consciousness. Animals in their instinctive behaviour show the capacity of profiting by the lessons of previous experience. This does not mean merely that their mode of procedure is modified on repetition; for this might be explicable without supposing intelligent adaptation. The point is rather that it becomes modified in special ways. It becomes more discriminative and specialised, and it is also generalised by being transferred through association to new conditions which do not originally evoke it.

The series of actions by which animals provide themselves with food is initially determined by their inherited constitution. But they learn by experience to search for it in the special places where they have previously found it in greatest abundance, and to neglect those which have proved barren. It is also to a large extent by actual experiment that they learn to distinguish between different kinds of food as more or less agreeable so as to prefer what best suits their taste. The young chick, untaught by previous experience, pecks instinctively at all small objects. It is only through trial that it learns to distinguish between what is food and what is not and between what is nice and what is nasty. "The inherited tendency of the chick is to peck—'to peck at everything not too large.' But experience very rapidly teaches that it is

pleasant to peck at some things, such as yolk of egg, or cabbage moth caterpillars—and very unpleasant to peck at others, such as cinnabar caterpillars or bits of orange peel. The tendency to peck at one sort of object is accordingly confirmed. The tendency to peck at others is inhibited. . . . The instinctive tendency is regulated, narrowed, and defined, as it becomes a habit in which experience has played its part."[1]

In this way instinctive activities become gradually more specialised and discriminative. But experience also operates in another way. It brings about the extension of instinctive modes of behaviour to new circumstances so that they occur in response to conditions which would not otherwise evoke them. Reactions are thus acquired to which there is no intitial tendency. There is nothing in the inherited constitution of crows or other birds to prompt them to follow a plough. They learn to do so because they have found by experience that where the plough goes there is an abundant supply of food. "The sight of a man or the sound of a human voice cannot under ordinary circumstances stimulate a wild animal that does not prey upon man to expect food or prepare to receive it. But if the same animal is caught and kept in captivity, it will soon" respond in the appropriate way not only to the sight of its food but to the sight of the keeper who feeds it. "Fish who are accustomed to be fed, will come to the surface and be ready to snap as soon as anyone approaches the tank."[2]

The following example, given by Lloyd Morgan, may be taken as typical: "A moorhen chick, for whose benefit we had dug up worms with a spade, and which, standing by, jumped on the first turned sod and seized every wriggling speck which caught his keen eye, would run from some distance to me as soon as I took hold of the spade."[3] Such instances, which are of very frequent occurrence, show that objects, at first unconnected with an instinctive impulse, may come to arouse it through their acquired meaning as reproduced by association.

[1] Hobhouse, *Mind in Evolution*, p. 87, summarising Lloyd Morgan, *Habit and Instinct*, pp. 40-2. [2] *Ibid.*, p. 96.
[3] *Habit and Instinct*, p. 148, quoted also by Hobhouse.

Now it may seem, at first sight, that something similar also takes place in the case of purely reflex action. The mere threat of tickling has the same effect as the reality for some persons. But further analysis shows that there is an important distinction. The person who has a fit of laughing on the mere threat of tickling behaves as he would do if he were being actually tickled. He does not merely make preadjustments preparatory for dealing with the actual stimulus when it shall arrive. The moorhen chick, on the contrary, when it saw Lloyd Morgan with his spade, did not begin at once to snap with its beak at worms which were not there. The instinctive impulse was aroused, but it expressed itself in a form intelligently adjusted to the special circumstances. It took the form of running towards the man with the spade as a preparatory step in the total activity of procuring food.

At this point we must raise an important question of theory. It is generally admitted that, so far as instinctive activity is developed and modified under the influence of experience, it becomes intelligent. But it is also commonly held that it is originally unintelligent. On this view, there can be no intelligence on the first performance but only on its subsequent repetition. The assumption is that there can be no prevision, no kind of reference to the future, except on the basis of prior experience. Hence instinctive action must in the first instance be entirely blind, and therefore unintelligent; for intelligence involves some cognisance of an end pursued.

On the other hand, after previous experience of results more or less foresight becomes possible. "In this condition an impulse acted out may be said to be acted out, in part at least, *for the sake* of the results. . . . An insect that lays her eggs in a place where she never sees them hatched must always do so 'blindly'; but a hen who has already hatched a brood can hardly be assumed to sit with perfect blindness on her second nest. The hen's idea of the chickens would probably encourage her to sit; a rat's memory, on the other hand, of a former escape from a trap would neutralise his impulse to take a bait from anything which reminded him of the trap."[1]

[1] James, *Principles of Psychology*, Vol. II., p. 390.

It is a grave objection to this theory that it gives no sufficient answer to the question: what takes place when the process of learning by experience is actually going on? According to the theory, intelligence first comes into being only when the instinctive action is repeated on a new occasion with adaptive variation of behaviour determined by past experience. But it is not on the subsequent occasion that the animal first learns the lesson. It is only then that it begins to *profit* by what it has learned. But this presupposes that the actual learning by experience has already been achieved. The state of having already learned, as shown by change of behaviour in subsequent situations otherwise similar, presupposes the learning itself at the time when the original performance was taking place.

It follows that, if learning by experience is itself an intelligent process, the intelligence involved in instinctive activity cannot be purely an after-effect of learning by experience. To assert this is to assert that intelligence first arises as a consequence of previous intelligence. Now, if we set aside the special case of the original performance of instinctive movements, all else that we know seems to show that learning by experience is conditioned by attention and continuity of interest leading to the formation of appropriate dispositions and associations and so to acquirement of meaning, etc. There is therefore a strong presumption that this will also hold good in the case of instinctive activities.

It may be said that this is only a presumption and needs to be tested by relevant facts. But the opposite view that instinctive activity must, at the outset, be completely blind is also a presumption of the same kind. As we shall see, it has been taken to be self-evident without sufficient examination. If we turn from such *a priori* arguments to actual behaviour of animals we find that the evidence very strongly confirms the hypothesis of original intelligence.

As I have already shown, animals in their instinctive actions do actually behave, from the outset, as if they were continuously interested in the development of what is for them one and the same situation or course of events. They actually behave as if they were continuously attentive, looking

forward beyond the immediately present experience in preparation for what is to come. They apparently watch, wait, search, are on the alert. They also behave exactly as if they appreciated a difference between relative success and failure, trying again when a certain perceptible result is not attained and varying their procedure in so far as it has been unsuccessful. All these characters are found in the first nest-building of birds as well as in the second; they are also found in courses of conduct which occur only once in the lifetime of the animals.

It seems clear that instinctive behaviour would be regarded as originally intelligent were it not for the assumed self-evidence of the proposition that intelligent action implies prevision of results which is possible only through previous experience. We must therefore examine this position.

4. The 'Blindness' of Instinct.—An action is 'blind' inasmuch as it leads to results which are not in any way aimed at or anticipated by the agent. Now all actions, whether of men or animals, have unforeseen consequences. Hence they are all partially blind. But failure to foresee some results is quite compatible with the power to foresee others. Blindness in one direction must not therefore be taken, without special reasons, as evidence for blindness in other directions. We must not assume that because a bird in its nest-building has not in view the laying of eggs and the rearing of its future brood, it therefore has no aim at all. It may be pursuing a proximate end, though it is blind to more remote consequences which appear to the onlooker as ends fulfilled by its action.

The special question which here concerns us is whether even such proximate ends can be sought after by an animal, apart from experience of the results of similar behaviour on previous occasions. It is, in the first place, important to notice that, even in the first performance of an instinctive act, the influence of previous experience is by no means altogether excluded.

"To my mind," says Myers, "it is certain that on the occasion of the chick's first peck or the duckling's first swim, the bird is dimly, of course very dimly, conscious of the way in which it is about to act. I believe this because no organism

can ever execute a new movement which does not involve other movements that have been performed previously. . . . When a chick first attempts to peck, many of the muscles then called into action must have been contracted before. Thus the feeling of activity arising on the occasion of a chick's first peck is not altogether a new one. It is related as each of our own experiences is related to past experiences. And the very vague awareness of results which is associated with those previous feelings of activity gives the chick a vague awareness of the result of its first peck, before it has actually performed it."[1]

Myers seems here to claim too little rather than too much for the possible influence of previous experience in the first performance of an instinctive action. In many cases, of course, it will yield only a very rudimentary awareness of results. But in others it may be much more definite. It may indeed be quite definite. The movements of flight and concealment on the part of a bird when it first sees a hawk may be movements which it has frequently executed before, so that it has a full anticipation of their perceptible results. Yet the performance of just these movements when a hawk is seen for the first time is congenitally determined, and does not depend on previous experience; it is therefore, to this extent, the first expression of a special instinct. It is so because the occurrence of this special mode of behaviour in this special situation is not due to learning by experience in past situations of like nature. Its instinctive character is therefore independent of the previous performance of similar actions in cases where hawks have been absent. It is even independent of the question how far the ability to execute the movements themselves is primarily innate or acquired.

The conditions under which solitary wasps finally close up the entrance to their nests seem to be very largely of this nature. They have, probably, had experience in the past of the sort of procedure required to stop a hole, so that they may be said to know how to do it. What has to be accounted for by a special instinct is that the members of the species

[1] *Op. cit.*, Vol. III., Pt. 3.

regularly stop this particular hole under particular circumstances and that they do so independently of any previous experience of satisfactory consequences from behaving in this way under the special conditions.

Past experience, then, is a contributory factor in the first performance of all instinctive actions except the very earliest; and in some cases it may be a very important factor, sufficing to give quite definite anticipation of immediate results. None the less it is far from fully explaining all the relevant facts. If all intelligence be supposed due to previous experience of results, then the degree of intelligence must in every case be proportional to the relative amount of such prior preparation. But it is plain that this is not so. Selective attention, continuity of attention, persistency with varied effort, pervade the whole course of activity in the nest-building of birds in a way which cannot be accounted for by the relatively insignificant part in the process which is all that we can assign to previous experience of results. It is the whole specialised system of movements in their co-ordination and co-adjustment which appears to require the control of interest and attention, not merely such partial constituents of it as may happen to have occurred previously either in isolation or in other contexts. Moreover, the hypothesis of Myers, taken by itself, leaves untouched our original difficulty. If all intelligence is an after-effect due to prior learning by experience, we have no satisfactory account of the original processes in which the lesson is first learned.

We are therefore driven to the conclusion that instinctive activities have an intelligent character which is not wholly traceable to previous experience. But how is this possible? In answering this question we have first to fix the kind and degree of intelligence which the conditions of the case require us to assume. It seems sufficient to postulate (1) attention selective and prospective, making possible the guidance of motor activity by complex and variable groups of sensory data; (2) appreciation of relative success and failure, making possible persistency with varied effort.

Selective attention depends upon interest, and there is no question that interest is congenitally determined indepen-

dently of prior experience. It is owing to a connate predisposition that the hawk, for example, concerns itself with small birds and their movements rather than with cows, horses, grass, or flowers. The interest consists in the instinctive impulse with connected affective tone and emotional excitement. The question is whether this impulse is initially a conation in the sense of being directed to an end which can be regarded as pursued by the animal itself. This depends on the nature and conditions of the prospective attitude of attention as expressed in watching, waiting, or searching. If watching or waiting presupposes definite anticipation of what is coming, such as can only be derived from prior experience on similar occasions, it follows that apart from prior experience the instinctive impulse must be entirely blind.

But there is no sufficient reason for assuming this. The prospective attitude of mind may consist merely in looking for further development of the actual situation without forestalling the special nature of the development. For this, it is only necessary to assume an awareness of the present situation as transitional—as something which not merely is but is to be. Such rudimentary reference to the future is not wholly indeterminate; it is specific inasmuch as it is concerned with the further development of a specific situation and, more particularly, of certain selected factors within it. It is vague inasmuch as the animal has no clue to the particular nature of the changes which are to take place. The important point is that the situation is apprehended as alterable. This is enough to make conation possible. For when what is actually present is apprehended as alterable, it is possible to want it altered in such a way as to satisfy the felt impulse.

Thus, in the first performance of an instinctive action, there will not be a purely blind restlessness, but a rudimentary conation or active tendency directed towards an end which is an end for the animal itself, and does not merely appear as if it were so to the external observer. It is true indeed that the animal will initially have no anticipation of the special means by which its end is attainable, or the special form which it will assume when attained. Only experience of results can yield definite prevision of this kind; and in typical cases of

animal instinct the requisite experiences are first obtained in the execution of movements provided for in the inherited constitution of the nervous system. Nature educates the animal by thus supplying it, from the outset, with the appropriate data from which it has to learn.

In the light of the foregoing discussion, it is easy to account for the instinctive appreciation of relative success and failure as shown in persistency with varied effort. We have here only one case of the general principle that in the pursuit of ends the subject has to learn more or less by actual trial what it is that he really wants and does not want. The instinctive impulse requires for its fulfilment a course of behaviour leading, step by step, to certain perceptible results. But at any stage of the process the effect produced may be other than what is needed to satisfy the congenital interest. When this happens the perceived result will become a centre of dissatisfaction, and renewed attempts will be made to get some other instead of it.

A solitary wasp, for instance, which stores spiders in her nest, often finds difficulty in getting them through the hole at the entrance. This leads to persistent effort with varying adjustment of behaviour. In one instance the wasp managed to get the spider "past the entrance, but it stuck in the gallery, and after working at it in that position for a time she brought it out, subjected the legs to a severe squeezing, and tried again. It was still a very bad fit, but by turning it about and pulling at it, she succeeded in getting it in."[1]

5. Instinct as a Psychical Fact.—Instinctive behaviour is essentially conditioned by intelligent consciousness. The question which we have now to consider is how far this psychical factor is a part of the instinct as well as a condition of its expression. Of course the general capacity for attention, emotion, and learning by experience is not itself instinctive. To assert this would be to deprive the term 'instinct' of all distinctive meaning. We must here impose the same kind of limitation as in the case of motor activity.

[1] Peckham, quoted by Hobhouse, *op. cit.*, p. 69.

It is not the general capacity for performing movements which is instinctive. What is ascribed to instinct is rather the fact that under certain special circumstances a certain special train of movements is executed independently of previous learning by experience, so that it has to be referred to the connate constitution of the nervous system. In some cases, the aptitude for making the appropriate movements is itself more or less completely congenital. In others, the aptitude for executing the movements may have been in a greater or less degree acquired in the course of past motor process; but their being performed in this or that special situation is instinctive because it is not traceable to previous experience of satisfactory results following similar behaviour in like circumstances.

The same principle is to be applied to psychical states and processes. The general capacity for being interested and attending is not an instinct. But where we find a specific form of emotional excitement aroused in an animal at the first presentation of some special object, or wherever there is a specific tendency for attention to be directed upon it, or the arousal of specific and determinate forms of conation with regard to it, such interest may properly be called instinctive. It is instinctive because it is only through a connate disposition that it is elicited in response to this particular object rather than to others. Thus, it is instinct when the kitten occupies itself with a dangling ball of worsted in preference to other things which happen to be present at the same time, or when an animal shows anger or fear in the presence of its natural enemies, though it has never seen them before.

In general the innate capacity to perform a special train of movements co-exists with a propensity to employ this capacity when specific objects are presented. Moreover, in such cases there is usually a congenital disposition in virtue of which these objects are readily singled out from their environment as distinct and separate things. The human face with its various expressions evokes responsive interest in the child more readily than many other objects of very much less complexity. There are specific tendencies to approach, examine, or handle some objects and to avoid and reject others. Where there is

nothing in the past experience of the child to explain these special tendencies, and where they cannot be referred to the general tendency to be interested, we are justified in regarding these modes of mental activity as well as the resulting bodily movements as instinctive.

The definition of instinct with the most complete and thoroughgoing recognition of the psychical constituents of instinctive disposition is that proposed by McDougall. By this writer an instinct is defined as " an innate disposition which determines the organism to perceive (to pay attention to) any object of a certain class, and to experience in its presence a certain emotional excitement and an impulse to action which finds expression in a specific mode of behaviour in relation to that object."[1]

As embracing the cognitive, the affective, and the conative phases of mental process, as well as referring to specific movements, this definition is certainly sufficiently comprehensive, and instincts will be found to differ widely in respect of the degree to which each of these constituents is involved. Where there are highly specific and complex propensities to movement the cognitive disposition may be meagre, and in only a few cases is the emotional disposition at all highly specialised. The impulse to walk emerges at a certain stage of development without presupposing any very distinctive object of cognition, and the emotional excitement is of the kind which accompanies new motor achievements in general.

Moreover, specific forms of emotional excitement need have no invariable accompaniment—except, of course, the emotional expressions themselves. When fear is excited various special activities may ensue, and many of these are not specific to fear. We may, therefore, regard the proposed definition as primarily applicable to the more complex and highly organised instinctive dispositions, in comparison with which most of the special instincts are more or less defective.

Instinctive dispositions would seem in general to involve a variable number of component impulsive tendencies, sometimes simultaneously aroused, sometimes as alternative modes

[1] *An Outline of Psychology*, p. 110.

of expression, and sometimes in series or cycles. The perfection of such a disposition will depend in part upon the complexity of its constituents, more particularly perhaps upon the number of alternative tendencies embraced, for on this adaptability depends. Constituent members of the system will vary in the extent to which native predisposition requires to be improved by practice. In general, what is central and fundamental would appear to be nearly perfect from birth, while subsidiary and preparatory tendencies leave considerable scope for improvement. In the complex cycle of breeding and rearing the young, the essential components are automatic almost to the point of being reflex. The selection of material for the nest, the search for food, and skill in securing the prey improve with experience.

The power of learning by experience must also be regarded as instinctive if and so far as, owing to connate dispositions, it exists in a special degree for some kinds of experience rather than for others. In general, an animal learns much more rapidly and accurately along the lines of its instinctive interest than in other directions. Dogs and cats develop and perfect their own natural activities in hunting, fighting, etc., much more easily than they acquire the ' unnatural ' trick in which they are drilled for exhibition at shows.

The importance of this factor varies with different species according as their congenitally determined behaviour is more or less adequately adapted from the outset to the conditions of their existence without need for further modification through experience of results. In general, the lower we descend in the scale of animal life, the more restricted is the range of learning by experience; and the higher we rise, the more extended and varied is the field for acquired adjustments of behaviour.

Thus, insects have relatively little to learn, because their instinctive movements are initially pre-adapted in a very definite and specialised way to definite specialised exigencies of their life history. On the other hand, the instinctive procedure of dogs and apes is originally, for the most part, far less adequately adapted to their needs. Hence they have more to acquire by experimental activity, and in consequence

the specialised capacity for learning what is useful to them is a proportionately more important part of their congenital equipment.

The special power of learning by experience in certain directions is, of course, in part dependent on connately determined interest. But it also involves a special capacity of retentiveness for certain special experiences connected with instinctive activities.

6. Instinct in Human Beings.—To what extent we are to recognise the presence of instincts in human beings depends on the way in which we choose to define the term 'instinct.' In animal behaviour we have noted a variety of congenital factors all of which may enter into the constitution of instinctive conduct. But some of these factors may be clearly present, while others are completely or almost completely absent. It then becomes a question what factors we shall treat as essential and what as inessential.

Animals frequently possess, as part of their instinctive equipment, the power of executing specialised and complex movements for which they are unprepared or quite inadequately prepared by previous practice. In general, these movements are performed in a manner sufficiently definite to be useful from the outset. Thus the first flight of the swallow is "good enough to preserve the little bird from falling to the ground and running the risk of destruction the first time it leaves the nest."[1] The first flight of the sparrow and some other birds approaches still more nearly that of the mature bird.

Now the congenital equipment of human beings, as measured by such ready-made motor aptitude, seems to be very scanty. Walking, for example, has mainly to be acquired by a process of trial and failure; the only rudiment of it which seems to be primary is the tendency to an alternating movement of the legs when the child is held so that his feet touch the ground. Biting an object placed in the mouth, clasping and carrying to the mouth, crawling, the making of articulate sounds, and

[1] Lloyd Morgan, *op. cit.*, p. 225.

the expression of emotion by crying, smiling, frowning, etc., are also due to connate dispositions. But this almost exhausts the list of movements which are congenitally definite in human beings so as to be serviceable from the outset in a fashion comparable to the flight of the swallow.

On the other hand, if we consider as a mark of instinct, not congenital aptitudes for executing movements, but congenital dispositions leading to certain appropriate modes of behaviour under certain special conditions, the range of human instinct is much wider. The movements of flight and concealment are, in the main, acquired. But the tendency to perform them in the presence of an alarming object is by no means wholly due to learning by experience. "As soon as the child can run, his fear expresses itself in concealment following on flight; and the many adult persons who seek refuge from the strange noises of dark nights, or from a thunderstorm, by covering their heads with the bed-clothes, and who find a quite irrational comfort in so doing, illustrate the persistence of the tendency."[1]

If, finally, we disregard as unessential original dispositions for making definite movements under special conditions, and agree to apply the term 'instinct' wherever we find innately specialised interest, attention, and power of learning by experience in certain directions rather than others, it is clear that the instinctive endowment of human beings is far more varied and complex than that of animals. The whole development of human minds has its root in connate tendencies of this sort and is inexplicable apart from them.

It is clear that if we insist upon the condition that to be instinctive an action must be perfectly performed apart from practice and prior experience, the term 'instinct' will be hardly applicable at all to the activities of man, and it will be unduly restricted in its application to the behaviour of the lower animals. On the other hand, if we include as instinctive every action in any way based upon or faciliated by innate disposition, the term will be so indefinitely comprehensive as to be wholly useless. For the most intelligent actions and most

[1] McDougall, *Social Psychology*, p. 53.

painfully acquired abilities are to some extent conditioned by special predispositions.

In prescribing reasonable limits to the application of the term, one restriction may be imposed at the outset. In reviewing the ways in which primitive impulsive tendencies may be modified we found that a specific tendency may come to be attached to new objects, and that the same object may come to evoke a new response.[1] Among the most fundamental of these modifications are those which consist in the response being evoked as memory or idea or in the response itself consisting in a train of ideas instead of overt movements.

Now, however true it may be that a vengeful act which results from the memory of past injury is derivative from an instinct, yet an action so aroused is not instinctive. The same applies to the modified response. Merely to plot revenge in imagination is not an instinctive act. Nor is overt behaviour itself properly described as instinctive so far as it is guided or controlled by the presence of free ideas. In other words, however much we include within instinctive process it must be primarily restricted to activity at the perceptual level. Can we go further, and distinguish instinctive from non-instinctive actions within the perceptual level?

The same general principles would seem to permit us to exclude fundamental changes in behaviour at the perceptual level. If fear is aroused by lightning only because of frequent co-presentation with thunder, we can hardly say that the fear of lightning is instinctive. Similarly, in gross changes of behaviour in the face of danger, conduct ceases to be instinctive. The difficulty arises chiefly in connection with the simpler modifications, such as mere facilitation. The problem springs from the fact that the same series of changes in behaviour may be brought about in two entirely different ways. Progressive improvement in the response may be due either to practice or to normal growth. The simplest example is that of bodily strength. There is continuous improvement in the child's successive attempts to lift relatively heavy objects with its hands. The improvement is in part due to the development

[1] Cf. Bk. I., Chap. IV.

of muscles and the formation of neural connections brought about by practice, but it is also in part due to the growth which is independent of specific forms of exercise.

An analogous distinction must be drawn in all cases of facilitation. It is only so far as development in ability and propensity is to be attributed to increasing maturity that the modified as well as the original activity can be described as instinctive. It is carried beyond the merely instinctive level so far as there is trial and error involving intelligent appreciation of success and failure.

In human beings what is congenital is certainly not less than what is congenital in the lower animals, but it is masked by the considerably greater capacity for the acquisition of new modes of expressions and by individual variability.

Perhaps the most striking instances of connate interest and aptitude for learning are to be found in the peculiar gifts of exceptional persons and more especially of those whom we call men of genius. "If Mozart, instead of playing the pianoforte at three years old with wonderfully little practice, had played a tune with no practice at all,"[1] he would have displayed an instinctive capacity analogous to that shown in the first flight of a young sparrow. But his actual performance was due to a specific congenital endowment which we may, if we so choose, call an instinct. Owing to the native bent of his mind he had an absorbing and unflagging interest in music and an altogether exceptional power of rapid, accurate, and tenacious learning by experience in this direction. The like holds for Newton in relation to mathematics, for Darwin in relation to natural history, and for Giotto in relation to drawing. Similar special endowments, though far less in degree, are of course very commonly found in more ordinary persons. One boy takes to the study of mathematics like a duck to water, whereas another can scarcely get beyond the multiplication table.

Turning to such tendencies of this type as are broadly characteristic of human beings in general rather than of special individuals, we may consider first those which are

[1] Darwin, *Origin of Species*, p. 188 (Oxford World Classics).

mainly confined in their operation to the period of childhood and subserve the acquirement of powers which are the common possession of normal adults. All normal children have to learn, by a more or less prolonged process of active experiment, to stand erect, to walk, to run, to climb, to grasp at an object with definite aim, to throw missiles, and to utter the various articulate sounds used by those about them. They are not prepared for these activities by congenital dispositions yielding definite movements serviceable from the outset. But when the season for their acquisition arises, they show a special interest in them as expressed in continuous attention and persistence with varied effort; they also show special aptitude for learning by experience.

The general innate propensities and capacities which are not limited to childhood but pervade in various degrees the mental life of all or most adults require more accurate examination and analysis than they have yet received.

CHAPTER III.

IMITATION.

1. **Introductory.**—Imitation is a process of very great importance for the development of mental life in both men and animals. In its more complex forms, it presupposes trains of ideas; but in its essential features it is present and operative at the perceptual level. It is largely through imitation that the results of the experience of one generation are transmitted to the next, so as to form the basis for further development. Where trains of ideas play a relatively unimportant part, as in the case of animals, imitation may be said to be the sole form of social tradition. In the case of human beings, the thought of past generations is embodied in language, institutions, machinery, and the like. This distinctively human tradition presupposes trains of ideas in past generations, which so mould the environment of a new generation, that in apprehending and adapting itself to this environment it must re-think the old trains of thought. Tradition of this kind is not found in animal life, because the animal mind does not proceed by way of trains of ideas. None the less, the more intelligent animals depend largely on tradition. This tradition consists essentially in imitation by the young of the actions of their parents, or of other members of the community in which they are born. The same directly imitative process, though it is very far from forming the whole of social tradition in human beings, forms a very important part.

2. **The Imitative Impulse.**—We must distinguish between ability to imitate and impulse to imitate. We may be already fully able to perform an action, and the sight of it as performed by another may merely prompt us to reproduce it. But the sight of an act performed by another may also have an educational influence; it may not only stimulate us to do what we

are already able to do without its aid; it may also enable us to do what we could not do without having an example to follow. When one man sees others dancing, his own feet may become restless and he may be carried away by the impulse to join them. But he may not have anything to learn from them. He may be a better dancer than any of them to begin with. He is simply prompted to do on this particular occasion what he is already quite capable of doing. The case is different with the child's early imitation of the words spoken by his elders. The result at first very imperfectly corresponds to the model, and success is attained only by repeated trials.

In very many instances there is learning by imitation with little or no direct impulse to imitate. The imitative process is enacted not for its own sake but for the sake of some ulterior end. Thus if I am learning billiards and someone shows me by his own example how to make a particular stroke, it is not his example which in the first instance prompts me to the action. He merely shows the way to do what I already desire to do.[1]

We have then first to discuss the nature of the imitative impulse—the impulse to perform an action which arises from the perception of it as performed by another. This impulse is an affair of attentive consciousness. As such it must be distinguished from merely automatic imitation. Automatic imitation is of two kinds. It may be due to habitual association as when the cough of one man sets another coughing. Or again, it may be due to the general habit of doing as others do when there is no special motive to the contrary. This habit is constantly operative in human society. It seems to have manifold sources. I may here mention three:

(1) It is easier simply to follow the current mode of procedure than to be continually striking out new lines of action for ourselves. Thus the habit of following suit constitutes an enormous economy of time and trouble.

(2) It is generally disagreeable to attract attention by singularity and to disturb others by aimless novelty.

[1] So far as this is capable of being taught, and does not depend on 'practice.'

(3) We learn by experience that what others do is very often based on good reasons, and that deviation from it is likely to be disadvantageous.

Such conditions as these lead men to form the settled habit of doing as others do, where they feel no special interest in attending to a matter for themselves and forming an independent judgment.

The imitative impulse, in distinction from such mere routine repetition, is a conation which seeks satisfaction in the imitative process itself. Imitation affects primarily a communication of ends, not a transference of specific actions. When we see a crowd running we experience an impulse to join in its activity. But we do not necessarily run. We may mount a bicycle or board a vehicle going in the required direction. If we are led by imitation to sign a petition we sign our own name, not the name of the man we imitate. The imitation of an action in detail only occurs either if it seems the means to the end for us as well as for those we imitate, or if the performance of the action is itself the end.

The perception of an action prompts us to reproduce it when and so far as it excites interest or is at least intimately connected with what does excite interest. Further, the interest must be of such a nature that it is more fully gratified by partially or wholly repeating the interesting action. Thus imitation is a special development of attention. Attention is always striving after a more vivid, more definite, and more complete apprehension of its object. Imitation is a way in which this endeavour may gratify itself when the interest in the object is of a certain kind. It is obvious that we do not try to imitate all manner of actions without distinction, merely because they take place under our eyes. What is familiar and commonplace, or what for any other reason is unexciting and insipid, fails to stir us to re-enact it. It is otherwise with what is strikingly novel or in any way impressive, so that our attention dwells on it with relish or fascination.

It is of course not true that whatever act fixes attention prompts to imitation. This is only the case where imitation helps attention, where it is in fact a special development of

attention. This is so when interest is directly concentrated on the activity itself for its own sake rather than for the sake of its possible consequences and the like ulterior motives. But it is not necessary that the act in itself should be interesting; in a most important class of cases the interest centres not directly in the external act imitated, but in something else with which this act is so intimately connected as virtually to form a part of it. Thus there is a tendency not only to imitate interesting acts, but also the acts of interesting persons. Dogs often imitate their masters. Men are apt to imitate the gestures and modes of speech of those who excite their admiration or affection or some other personal interest. Children imitate their parents, or their leaders in the playground. Even the mannerisms and tricks of speech of a great man are often unconsciously copied by those who regard him as a hero. In such instances the primary interest is in the whole personality of the model; but this is more vividly and distinctly brought before consciousness by reproducing his external peculiarities.[1]

Our result then is that interest in an action prompts to imitation in proportion to its intensity, provided the interest is of a kind which will be gratified or sustained by imitative activity. But here we must make a distinction. The interest may be either primary or acquired through previous experience. The imitative impulse in young animals and children is to a large extent independent of previous experience. It depends on congenital tendencies. A young duck brought up by a hen among chickens imitates its social environment only in a limited degree. Where there is an instinctive tendency towards a certain form of action, the action is interesting when another performs it, so that the imitative impulse comes into play.

In general, an action is imitated only when there is an independent tendency to perform it or something like it. We tend not to imitate actions which are out of harmony with the rest of our nature. Hence imitation is not regarded by

[1] Of course the society in which we live is always interesting to us. Hence the tendency to acquire a provincial accent when we are constantly associating with people who have it.

common sense as involving any remission of individual responsibility. "If your elder brother had put his head in the fire would you have done so, too"? is the common reply to small offenders who plead example as an excuse for their misdemeanours.

On account of this dependence of the imitative impulse, among other reasons, recent writers such as McDougall have rightly refused to recognise a distinct 'instinct of imitation.' It cannot only be regarded as instinctive in the very general sense of being dependent upon some kind of cogenital disposition. So far as it is instinctive it not only prompts the action, but also determines more or less its special character. The child has a congenital tendency to utter articulate sounds; but the special character of the sounds it utters is largely determined by the sounds it hears from the persons who surround it. The same is true of the song of birds.

But sometimes imitation seems only to supply an occasional impulse, and does not in the first instance create the power of performing an action or appreciably modify its character. As an example in which the presence of a model simply stimulates an activity and does not modify it, we may take the repetition of a danger-cry by young birds when they hear others utter it. The danger-cry itself is undoubtedly instinctive. Any disagreeable or disturbing experience will elicit it from a young chicken which has not heard it before. Its effect on birds who hear it is also instinctive. When a parent bird utters a cry, a chick which is yet in the egg may suddenly cease in its endeavour to pierce the shell and become motionless. In just the same instinctive way, the sound of the alarm-note uttered by one bird prompts another to repeat it, so that the alarm may be communicated to a whole group. It is mainly in this manner that birds and other animals learn to avoid dangers which at first they had disregarded. The sight of a man with a gun on a previously desert island may evoke no alarm in its feathered inhabitants; but after a few experiences of the fatal consequences connected with a man so armed, the birds in general will become shy. Those who have actually been disturbed or wounded by the gun have

uttered the alarm note; this has thrown yet others into a state of alarm, and they also utter the alarm-note; these, when they again see a man, utter the alarm-note, although they have never experienced any harm from human beings.

3. Learning by Imitation.—Let us now turn to the other side of the question. Let us consider the case in which the power of performing an action is acquired in and by the process of imitation itself. Here there is a general rule which is obvious when once it is pointed out. As the impulse to imitate is conditioned by some independent tendency, so our power of imitating the activity of another is proportioned to our pre-existing power of performing the same general kind of action independently.[1] For instance, one who is devoid of musical faculty has practically no power of imitating the violin playing of a Kreisler. Imitation may develop and improve a power which already exists, but it cannot create it. Consider the child beginning for the first time to write in a copybook. He learns by imitation; but it is only because he has already some rudimentary ability to make simple figures that the imitative process can get a start. At the outset, his performance is very unlike the model set before him. Gradually he improves; increased power of independent production gives step by step increased power of imitation, until he approaches too closely the limits of his capacity in this direction to make any further progress of an appreciable kind.

But this is an incomplete account of the matter. The power of learning by imitation is part of the general power of learning by experience; it involves mental plasticity. An animal which starts life with congenital tendencies and aptitudes of a fixed and stereotyped kind, so that they admit of but little modification in the course of individual development, has correspondingly little power of learning by imitation.

Among animals, monkeys have the greatest plasticity and the greatest aptitude for imitation. They are incessantly

[1] Thorndike's animals, referred to in Chap. I. of this Book, failed to imitate actions so strange and unfamiliar to them as the pressure of buttons, etc.

active in all kinds of ways, and they are in a very high degree capable of learning by experience. Thus, when admitted to the company of human beings, they will sometimes spontaneously learn to imitate the use of knives, forks, cups, plates, etc. In general, the more intelligent monkeys have a wider and more varied sphere of activity than other animals. They are incessantly trying to do things, experimenting in all sorts of ways, and learning rapidly by the success or failure of their attempts. The wide range of their activity involves a wide range of interest. They attend to all kinds of things without any directly practical aim; and the imitative impulse is, as we have seen, a special develpment of this form of attention. Their readiest way of bringing before their consciousness vividly and distinctly an action which interests them is to re-enact it themselves.

Of course at higher levels of mental development the imitative impulse is far less conspicuous because impulsive activity in general is checked and overruled by activity organised in a unified system.[1] Civilised men imitate not so much because of immediate interest in the action imitated as with a view to the attainment of desirable results. As experience widens, the pure imitative impulse becomes combined with other motives to imitation and is to a large extent supplanted by them. To begin with, the young child imitates the sounds uttered by those around it merely for the sake of the imitative activity itself. But as it becomes acquainted with the value of words as means of social intercourse a new motive is added. Every new word now means for it a possible acquisition of new knowledge and power. When the adult learns to speak a foreign language it is this kind of ulterior motive which is usually predominant. The mere process of imitating the sounds he hears may be a dull and disagreeable task.

It should also be noted that the general habit of imitating, which leads us to follow suit, when there is no reason to the contrary, is only in part an outcome of the imitative impulse. It is mainly due to ulterior motives which we have already mentioned.

[1] See Bk. III., Pt. I., Chap. I., § 6.

CHAPTER IV.

EMOTIONS.

1. General Characteristics.—If we ask the question, What is an emotion? the first answer that occurs to common sense is a list of specific emotions—fear, anger, hope, suspense, jealousy, and the like. When we push the inquiry further, and ask what character these states have in common which leads us to apply the same name 'emotion' to all of them, we find psychologists giving various and inconsistent answers. According to some, emotion is essentially a kind of sensation, due to general organic disturbance. According to others, it consists in the revival by association of past pleasures and pains. According to others, it is a tendency to behave in a particular way, and must be regarded as a mode of conative consciousness. The best course for us to pursue in view of this disagreement, is to take certain typical emotions, and to attempt to fix characteristics distinctive of them and common to them in all their manifestations.

(1) There is one prominent fact about emotion which confronts us at the outset: its wide range. From the lower forms of perceptual consciousness up to the higher forms of ideational and conceptual activity, the same typical kinds of emotion are everywhere present. Anger may arise in connection with the pain of a wound or the smart of a blow. The wounded lion bites at sticks and stones and at its own wounds. The cat will become angry if you interfere with its kittens. A child will become angry if you take away its toy. A man will become angry if you fail to understand his argument, or if you unfavourably criticise his book. A saint may also be angry *qua* saint, as St. Paul was angry with the foolish Galatians.

It follows from this wide distribution of emotion over different stages of mental development that we must be very

careful to avoid giving too limited a definition of its specific forms. Bain for instance, seems to err in this direction when he says that anger " contains an impulse knowingly to inflict suffering upon another sentient being, and a positive gratification in the fact of suffering inflicted."[1] This would only apply to a somewhat developed stage of free ideal activity; and even then it would not cover such cases as St. Paul's anger with the Galatians.

(2) Closely connected with the wide distribution of emotion is the varied nature of the conditions that arouse it. Any kind of thwarting or opposition may excite anger. Any kind of danger may excite fear. You may produce anger in a dog by disturbing it while eating, or by interfering with its young, or by pulling its tail. It is a certain general kind of situation, not a specific class of objects, which excites a certain kind of emotion.

The behaviour in which emotion finds expression is correspondingly general in its character. It is not an adaptation to the specific nature of this or that specific object, but a general mode of action adapted to a certain kind of situation. The behaviour of the angry dog is generically the same, however the anger is excited. It adopts the same bodily attitude, shows its teeth, growls, attempts to bite, and the like.

(3) There are two sources of emotional states which it is important to distinguish. Emotions may arise in connection with definite perceptions or ideas, as when good news excites joy; on the other hand, they may be primarily conditioned by organic changes, such as those which follow the use of alcohol or other drugs.

A man's temper varies with the state of his health. The organic changes may operate in one or both of two ways. They may directly change the condition of the nervous system. They may also, by altering the general state of the body, alter the nature of the impulses received by the central nervous system from the internal organs. Owing to the diffusive nature of organic sensations, this occasions a general change in the state of the nervous system, which on the psychological

[1] *Mental and Moral Science*, p. 261.

side is experienced as an 'emotional mood.' An emotional mood is not quite the same thing as an emotion properly so called. An emotion properly so called must be felt in relation to some definite object; to be angry we must be angry about something. But the general state of irritation due, let us say, to a sleepless night, has not, as such, any definite object. As we shall see under (4), it tends to find objects for itself, and it may pass from one object to another, giving rise to a series of emotions of a similar nature.

In general, the occurrence of a definite emotion tends to leave behind it an emotional mood akin to it.

(4) An emotional mood, whatever may be its primary origin, tends to persist when once it is aroused, and to fasten upon any object which presents itself. Ill-temper or gloomy depression or hilarity may originate in the first instance in the use of drugs; but when these moods are once in existence they create objects for themselves. A man who gets up in the morning in a bad temper, due to want of sleep or similar causes, is apt to be irritated by almost everything that occurs; though in another mood the same incidents would be received with complacency. The cook angered by her mistress will box the ears of the scullion. A herd of cattle, enraged by the sight of a comrade in distress, will vent their fury on their unfortunate companion; the reason being simply that he is the only object on which their attention is fixed. Their excitement must find an outlet; and in the absence of any other definite channel for it, it discharges itself on the injured animal.

"It is sometimes seen in dogs, when three or four or five are met together, that if one suddenly utters a howl or cry of pain, when no man is near it and no cause apparent, the others run to it, and seeing nothing, turn round and attack each other."[1] So it is dangerous to approach the males of many species of animals in breeding time, when their angry passions are aroused by sexual rivalry. An emotion or emotional mood involves a certain general trend or direction of activity, which particularises itself in whatever way it can, according to circumstances.

[1] Hudson, *The Naturalist in La Plata*, Chap. XXII.

(5) The fifth feature of emotion is what we may call its parasitical character. So far as emotions are excited by general situations, and not merely by general organic changes, they are usually secondary phenomena, and presuppose the existence of more specific tendencies. This is true of all but the simplest and most primitive emotional states. The anger produced in a dog by taking away its bone presupposes the specific appetite for food. The anger produced in it by interfering with its young presupposes the specific tendency to guard and tend its offspring. So the presence of a rival who interferes with its wooing causes anger because of the pre-existence of the sexual impulse.

(6) In all the more intense phases of emotion, organic sensations form an important constituent of the total state of consciousness. This is true whether the emotion has been primarily introduced by organic changes, or whether it has in the first instance arisen in connection with definite perceptions or ideas. This fact has been made the basis of a general theory, according to which the essential nature of the emotional consciousness consists in sensations arising from change in the internal organs of the body, including both viscera and muscles.

2. The Theory of William James.—The general theory of emotion to which we have just referred has met with much favour and has been much discussed. It is at least as old as Descartes, but is now specially connected with the name of William James, who advocated its claims with great force and eloquence.[1] Since its first publication it has been to some extent modified both by James himself and by his followers. But we cannot do better than quote one of his earlier statements of the view that emotion is simply organic sensation and nothing else.

"I now proceed to urge the vital point of my whole theory, which is this: *If we fancy some strong emotion, and then try to*

[1] The essentials of this theory were independently put forward by Lange, of Copenhagen, at the same time as they were advanced by James. Hence the theory is often referred to as the 'James-Lange' theory.

abstract from our consciousness of it all the feelings of its bodily symptoms, we find we have nothing left behind, no 'mind-stuff' out of which the emotion can be constituted, and that a cold and neutral state of intellectual perception is all that remains. . . . What kind of an emotion of fear would be left if the feeling neither of quickened heartbeats nor of shallow breathing, neither of trembling lips nor of weakened limbs, neither of goose-flesh nor of visceral stirrings, were present, it is quite impossible for me to think. Can one fancy the state of rage and picture no ebullition in the chest, no flushing of the face, no dilatation of the nostrils, no clenching of the teeth, no impulse to vigorous action, but in their stead limp muscles, calm breathing, and a placid face? The present writer, for one, certainly cannot. The rage is as completely evaporated as the sensation of its so-called manifestations, and the only thing that can possibly be supposed to take its place is some cold-blooded and dispassionate judicial sentence, confined entirely to the intellectual realm, to the effect that a certain person or persons merit chastisement for their sins."

"The more closely I scrutinise my states, the more persuaded I become that whatever moods, affections, and passions I have are in very truth constituted by, and made up of, those bodily changes which we ordinarily call their expression or consequence; and the more it seems to me that if I were to become corporeally anaesthetic, I should be excluded from the life of the affections, harsh and tender alike, and drag out an existence of merely cognitive or intellectual form."[1]

This passage is certainly eloquent, but it lacks logical stringency. It does not follow that because *A* is necessarily and essentially connected with *B*, that *A* and *B* are identical. A stone cannot fall into water without making ripples, but the ripples are not the stone. A line cannot have length without direction, but length and direction are not the same. There is no smoke without fire, but smoke is one thing and fire another. So it may be impossible for emotion to exist without expressing itself; but it does not therefore follow that the sense-experiences due to the expression constitute the

[1] *Principles of Psychology*, Vol. II., pp. 451-3.

whole emotion. Even supposing James's thesis to be true, it is evident that we cannot invert it. Certainly not all organic sensation is emotion; hunger and stomach-ache are not emotional experiences. To complete the theory, therefore, it is necessary to distinguish the kinds of organic reaction which produce emotion from those which do not.

So far as we can gather James's view on this special point from his own statement, it would seem that he connects emotion with diffused disturbance affecting many organs. But all organic disturbances are diffused in this way. The experience of a cold douche, or of being shampooed after a Turkish bath, ought on this theory to be emotional experiences.

When we explicitly raise the question—what precisely distinguishes the diffuse excitement in emotion from such diffuse disturbances as are present in all organic sensations?—two of the general characteristics of emotion previously noted contribute to the answer.

In the first place, emotions are directed upon an object. This we have found to be the characteristic of all affective states in virtue of which they are most clearly distinguished from sensations, and emotions would seem to involve a specific affective component. This is not only true of emotional upheavals which are aroused by the object to which they are in turn directed; it is also true of emotional moods aroused by physiological processes—such as those due to drugs—of which we may be unaware. Whenever we are cross, and for whatever reason, we find something to be cross with, and whenever we are frightened there is something of which we are afraid.[1] This direction upon an object is inconceivable in a purely sensory experience. It is therefore a fact which is difficult to reconcile with any purely sensationalist analysis of emotion.

In the second place we have noted that emotions possess a parasitical character. This in itself is not incompatible with James's theory. The 'organic reverberation' which accompanies all external perceptions might also be described as parasitical. But emotion depends upon other experiences in

[1] It is not that we are first afraid and then later find an object. As soon as we are afraid we fear that 'something is going to happen.' Later we discover or imagine *what* it is.

an entirely different way. It depends upon prior conation. It is not enough to say that the organic disturbance arises in the first instance in a mechanical way. On this theory there are certain innate or acquired physiological prearrangements owing to which certain visual or other perceptions set up organic disturbances. Such a view is irreconcilable with the facts. Emotions accompanied by marked organic disturbances are not occasioned merely by the perception of certain objects. They are occasioned only by occurrences which powerfully thwart or further instinctive or acquired conative dispositions. A man does not feel fear merely because he sees a bear, but because his life is threatened, and " all that a man has will he give for his life."

The theory of James ignores this essential relation of the circumstances which produce emotion to pre-existing conative tendencies. According to this theory, it is the mere sight of a kitten being removed which excites anger in the mother-cat. Parental affection has nothing to do with it. But obviously the interference with parental instinct is a most essential constituent of the emotional state.

It must further be noted that emotional experience is itself in part impulsive. Consider the special case in which a hungry dog is angered by an attempt to snatch away his bone. There is in the first place the active impulse to satisfy the demands of hunger. The attempted interference arouses not only an affective attitude directed upon the intruder. It involves a new specific impulse of an aggressive nature. We may apply the test which James himself suggests, but this time we will endeavour to fancy the state of rage with every sensation he suggests—those derived from the ebullition of the chest, from the flushing of the face, the dilation of the nostrils, the clenching of teeth, etc., but *without* any felt impulse to action, without any desire to inflict injury or pain. We have admitted all that James consistently demands,[1] but we do not describe what would be recognised as anger. In all natural attempts to describe a specific emotion we tend

[1] His actual demands, however, are not quite consistent. In the passage quoted he refers to 'impulses to vigorous action' as though these were themselves sensations.

to do so by reference to some central impulse. To experience anger is to be impelled to strike, to be embarrassed is to wish to 'sink through the floor.' Apart from such specific impulses the different emotions are very much alike. Certainly it is difficult to distinguish them by reference to sensations.

This criticism, however, leaves untouched the fact with which James starts. We cannot imagine what an emotion would be like apart from the organic sensations which it includes. Even in faint and transient emotional experiences the organic element appears normally to be present. It accompanies a slight touch of irritation or a slight tinge of contempt, as it accompanies intense disdain or wild fury.[1] The difference seems to be one only of degree. But in admitting that organic sensation is a factor normally present in the constitution of those states which we call emotional, we do not admit that it is the sole factor. It is, in fact, a complex experience involving sensory, affective and conative factors, and if any of these were absent the experience would not be emotional. Where the emotion arises primarily in connection with percepts and ideas it is connected with the furtherance or hindrance in special ways of prior conative tendencies, and itself constitutes in part a tendency secondary to these.

In so far as emotion has its first source in organic conditions set up by drugs or ill-health, the case for James seems stronger. But even here while the origin of the emotion is different, the emotional experience is itself the same. The same conative and affective attitudes are aroused, though the objects fastened upon are, so to speak, accidental. Moreover, even the reference to prior conation is not absent. Whenever we are awake we are active in the pursuit of ends, and every conative tendency, however desultory in character, provides occasion for emotional experience. Under normal conditions minor hindrances and obstructions are met with good humour and patience, but under the special condition of latent emotional

[1] Of course overt expressional movements, or other bodily changes visible to the external observer, may be absent in slight, and sometimes even in intense emotions. But what is important is not this overt expression, but internal organic changes, affecting, for example, the circulation and respiration.

excitement due to organic conditions these trivial incidents become the occasion of an ' unreasonable ' emotional upheaval. The effect of these conditions may be not so much to introduce emotion when it would otherwise be absent as to facilitate its arousal to an abnormal degree but in a normal way.

What we have conceded to James is that normally organic sensations enter as contributory factors, though in very varying degrees, into all emotional states. But it does not follow that this is an absolutely indispensable condition. The only way of deciding this question is by considering pathological and other cases in which the required bodily sensibility has been absent. The physiological evidence, however, is insufficient to decide the issue. Sherrington, it is true, " found that it was possible to operate on a dog in such a way as to render it impossible for visceral changes to send impulses to the brain, and yet to maintain the animal in a fair state of health, and he observed that a dog in this condition exhibited most of the symptoms of emotion when appropriate means were taken to excite its instincts."[1] But the facts observed were precisely such as James would have himself predicted. He would have expected the dog to manifest emotion, but not to feel it. Whether the dog did experience emotion we cannot of course decide.

The fundamental difficulty with regard to the physiological evidence in general is our almost complete ignorance of the physiological process correlated with affective and conative experience. Most of what we know with regard to the concomitants of specific modes of experience relates to sensory process, but we have always to bear in mind that organic disturbances may affect the nervous system in other ways than through the receptive organs, and that some phases of experience may be connected with secondary neural processes which supervene upon sensory stimulation.

The researches of Cannon[2] and others have thrown considerably more light upon the organic conditions of emotion, but contribute little to the special issue here raised. But to a considerable extent they at least bear out the view that

[1] McDougall, *Physiological Psychology*, p. 113.
[2] *Bodily Changes in Pain, Hunger, Fear, and Rage.* New York, 1915.

what is central in emotion is conative tendency. In general these organic changes are all of the nature of specific adjustments of the bodily organs in a way that facilitates the progress of the central emotive tendency. The distinctive work of Cannon has been to show how the coarser muscular adjustments are supplemented by the activity of glands which, by discharging certain substances into the blood stream, enable other organs to work with higher efficiency.

3. Ultimate Qualitative Differences.—Emotion in its various specific forms involves sensations, it involves specific conative tendencies, but it also involves specific kinds of feeling which cannot be explained away as resultants or complications of more simple elements. When we have said that a specific emotion is characterised by a certain trend or direction of activity, that it is accompanied by certain kinds of organic sensation, that it is pleasant or painful, and the like, though all this may be true, it is not exhaustive. Each specific kind of emotion has also something in it peculiar and undefinable. It is a unique kind of feeling-attitude towards an object. As James observed: "There are infinite shades and tones in the various emotional excitements which are as distinct as sensations of colour are." Besides its own specific quality of feeling, an emotion has no doubt also a feeling-tone of pleasure or pain. But its peculiar colouring cannot be resolved into mere pleasantness or unpleasantness. It stands out as a fact unique and irreducible.

4. The Interconnections of the Emotions.—From the foregoing discussion it will be evident that in dealing with such emotions as fear and anger we are concerned with tendencies of the type previously described as secondary.[1] They depend upon pre-existent impulse which is actually in progress at the time at which the emotion is aroused. Whenever we are intently trying to reach a certain goal, whatever the goal may be, we tend to be angry when thwarted or obstructed, to 'feel worried' when we are baffled, and to experience delight so far as we are successful.

[1] Cf. Bk. I., Chap. V., § 10.

Shand has drawn attention to four emotional tendencies which in this way have particularly intimate connections with one another: joy, sorrow, anger, and fear.

Before the emergence of these specific emotions it is possible to observe even in the lower animals various modifications of conative process in the face of various forms of failure or success. So far as action is successful there is an intensification and reinforcement of activity with the same general direction. So far as the efforts are thwarted, apart from harm or injury being experienced, there is an intensification of activity combined with variation of means. Serious or dangerous obstruction induces caution; and with varying degrees of danger or failure there are roughly corresponding degrees of inhibition and arrest of action. At the level of recognisable perceptual experience these secondary tendencies would appear to correspond to the distinctive emotions to which we have referred. Joy and anger involve the invigoration of activity, while sorrow and fear, at least in many of their forms, tend to depress or inhibit mental and motor process. Sorrow, more particularly in the extremity of despair, involves the cessation of effort and the inhibition of activity as a whole. It is seen in its purest form when failure is beyond repair.

Anger and fear are in part responses to degrees and kinds of difficulty short of those entailing absolute failure, and in part responses to specific excitants. They are to a large extent alternative modes of response and in certain situations it is impossible to predict which is likely to arise. The issue depends not so much upon differences in the external situation as in differences of mood or of predisposition. In general, however, anger tends to be aroused when there is obstruction of impulse which is independently aggressive, while fear is more likely to subserve an attitude of defence. Perhaps it might be said that anger is primarily the adjunct of appetitive tendencies, while fear is more closely connected with some primary aversion. But to all such generalisations there are obvious exceptions. Moreover, both tendencies are organised in relation to quite specific objects and situations.

Actual bodily pain produced by wounds, when sufficiently intense, is accompanied by the same kind of impotent excite-

ment, the same kind of disablement of bodily and mental activity which is characteristic of fright. Wild efforts to escape, laboured breathing, palpitation, trembling, etc., are expressions of actual bodily pain as well as of strong fear.

Again, a loud noise for which we are unprepared startles us with momentary alarm. Many people cannot help being scared by a reverberating peal of thunder, though they know that it is harmless. Of course much depends on the nervous organisation or on its state at a given time. It is extremely easy to startle a hare or a rabbit. Even a slight noise will give us a disagreeable shock of alarm if we are half-asleep. In some pathological states the patient is liable to be frightened by almost anything. Fledgelings shrink down in the nest when a strange animal or object suddenly approaches, though they may show no uneasiness when their deadliest enemy approaches them unobtrusively as snakes do. "A piece of paper blown suddenly by the wind is as great an object of terror to a young bird as a buzzard sweeping down with death in its talons."[1] The sudden approach of an object, the abrupt occurrence of an intense sensation, stimulate to action: there is a demand for practical adjustment to the obstrusive experience. At the same time its very suddenness or intensity disconcert and startle, so that efficient reaction is impossible.

This is the more conspicuously so, where the impression is not only sudden but unfamiliar. Mere unfamiliarity or strangeness, apart from suddenness or exceptional intensity, suffices to cause fear even in a violent form. The young gorilla brought home by the members of the Loango expedition much disliked strange noises. "Thunder, the rain falling on the sky-light, and especially the long-drawn note of a pipe or trumpet threw him into such agitation as to cause a sudden affection of the digestive organs, and it became expedient to keep him at a distance."[2] The kind of unfamiliarity which so disturbed the gorilla consisted apparently in mere novelty.

Unfamiliarity may, as I have said, consist in mere novelty. But there is another kind of unfamiliarity which involves not

[1] Hudson, *op. cit.*, Chap. V.

[2] Hartmann, *Anthropoid Apes*, p. 265; quoted by James, *op. cit.*, Vol. II., p. 417 (note).

only novelty but direct conflict with ordinary experience. Strangeness of this sort may cause profound alarm. An experience may be so discordant with the normal course of events as utterly to check and disorder the process of conscious life and destroy the possibility of effective adjustment. In the case of human beings the fright caused by a ghostly apparition is a good illustration. This is not so much due to any definite or indefinite anticipation of positive evil as to the utterly abnormal character of the experience. It lies so wholly outside the circle of ordinary events, and is so completely opposed to the conditions of ordinary experience, that it destroys all presence of mind. It stimulates intensely by its strangeness, and at the same time, owing to this very strangeness, all lines of activity, theoretical and practical, are obstructed.

It is instructive to contrast this overwhelming terror in the supposed presence of a ghostly apparition with the predominantly agreeable experience of reading or listening to a tale of marvel. The actual fact obtrudes itself as actual, and demands immediate practical adjustment to it, and yet by its very nature makes such adjustment impossible. Where this practical need is not felt, the free play of imagination liberated from the trammels of ordinary experience may be a source of delight.

Animals are capable of analogous experiences. James gives a good example.[1] A dog was frightened into a sort of epileptic fit by a bone being drawn across the floor by a thread which he did not see. As James remarks, any man's heart would stop beating, if he perceived his chair sliding unassisted across the floor.

Anger is most frequently aroused by the thwarting of some primary impulse, and is less intimately bound up with the perception of specific things. Nevertheless it tends to be aroused more easily by obstruction from living agents, or by accidents for which living agents can be held responsible. It is not so generally roused by impersonal forces or by inanimate objects except where these admit of personification.

[1] *Ibid.*, p. 420.

But there are cases in which it is aroused even by simple percepts. The smart of a wound whether received in the heat of combat or caused by the unskilful use of a hammer will tend to infuriate.

Belt supplies an interesting illustration from insect life. Speaking of leaf-cutting ants he says: "The effect of a little corrosive sublimate sprinkled on one of their paths in dry weather is to make them mad and exterminate one another. . . . In a couple of hours, round balls of the ants will be found all biting each other; and numerous individuals will be seen bitten in two, while others have lost their legs or antennae."[1] As an example of a sensory stimulus other than physical pain, the sight of a red rag to a bull has become proverbial.

5. Sentiments and Emotional Dispositions.—The interconnection of emotional tendencies provides one important condition of the development of the complex system of tendencies to which the term 'sentiment' in a technical sense has come to be applied. But a sentiment is not an actual experience: it is a complex emotional disposition.

An emotion is always an actual state of consciousness; an emotional disposition is a persistent tendency to feel a certain kind of emotion in the presence of a certain object. Thus the cat, after having its tail frequently pulled by a child, has a permanent tendency to feel angry whenever the child approaches it. We have pointed out that the original conditions of emotion are rather certain general kinds of situation than specific persons or things. But in the course of experience they come to be connected with specific persons or things, as the anger of the cat comes to be connected with the approach of the child who pulls its tail. In this way emotional dispositions are formed which manifest themselves in the form of actual emotion on appropriate occasions.

An emotional disposition is not the same thing as an emotional mood. The mood is an actual affection of consciousness; but the disposition persists when neither the mood nor the emotion itself is being felt. Such words as liking and

[1] *The Naturalist in Nicaragua*, p. 79.

disliking, hate and love, indicate emotional dispositions rather than actual emotions. We say that the cat dislikes the child, meaning, not that it is actually feeling angry with the child at the moment, but that it has a permanent tendency to feel the emotion of anger whenever it sees the child in its neighbourhood. Dispositions to experience a variety of emotions in relation to some specific object constitute a sentiment when there is some persistent primary tendency in relation to that object.

A sentiment is sometimes defined as an organisation of emotional dispositions around some central idea. This statement, however, requires modification in two ways. In the first place we must recognise the existence of sentiments at the perceptual level of mental life. For a cat to acquire a permanent antagonism to the child who teases it, it is not necessary for it to have any idea of its tormentor in his absence. It is sufficient if its apprehension is simply of the perceptual kind involving recognition and acquired meaning.

It is also necessary to add that the sentiment consists not so much in the organisation of emotional dispositions around an object perceived or thought of, as in the organisation of these dispositions in the service of some primary tendency of a persistent kind. In the parental sentiment there is the primary tendency to secure the well-being of the child. So far as this tendency is successful joy is experienced; when it is opposed anger is aroused, when its success is endangered fear is experienced, and when it fails sorrow supervenes.

The general character of these complex dispositions vary with the nature of the primary impulse. If the primary tendency is to amass a collection of postage stamps, the secondary tendencies will not be quite the same as if a fundamental instinct were involved. This is partly due to the fact that different primary tendencies organise somewhat different secondary systems. Anxiety may be felt for the security of the collection, but hardly primitive fear. It is also partly due to the fact that in actual experience the primary may blend with the secondary impulses in various subtle ways. On the basis of such differences we may distinguish sentiments proper from hobbies and interests.

CHAPTER V.

AFFECTIVE TONE AND PERCEPTUAL PROCESS.

1. **Introductory.**—Feeling, while analytically a distinct mode of consciousness, admits even less of independent treatment than does cognition or conation. In the diffuse and vague experiences of being pleased or irritable, feeling appears to be almost objectless and hardly to be discriminated from organic sensation. On the other hand, when what we experience is a distinctive affective attitude directed upon a specific and restricted object, feeling arises in close connection with and dependence upon conative activity. We have therefore to consider more precisely the relations of feeling both to sensation and to conative activity, at the perceptual level of mental life.

2. **Affective Tone and Common Sensibility.**—The neural basis of affective tone is exceedingly obscure. There is no evidence that the peculiar qualities of the feelings depend upon special receptors or neural paths as do the qualitative attributes of sensation. On the contrary marked feeling-tone may arise in connection with stimulation of every kind. It is plausible to suppose that pleasure and displeasure do not depend upon the activity of special organs, but arise in connection with certain variations in organic or neural process as a whole. Nevertheless feeling-tone is connected in a particularly intimate way with organic sensations, and the pleasures and pains of organic sensations are of fundamental and all-pervading importance in our mental life.

Normally, these sensations are fused in a total mass of experience, which can only be very partially analysed into its components by attentive scrutiny. The membranes which line our internal organs are generally supplied by sensory nerves, which, from all parts of the body, are perpetually

conducting a multitude of impressions to the central nervous system. On the resultant effect of these impulses, and on direct affection of the nervous system by organic conditions, it depends whether at any moment we feel well or ill, cross or complacent.

By the nature of our organic sensations in the morning we can often predict whether the day's experiences are going to be agreeable or disagreeable. The feeling-tone of common sensibility determines in large measure the feeling-tone of more special experiences in the way of sensations, perceptions, and ideas. An incident which might be pleasant or but slightly disagreeable if we were feeling fresh and 'fit,' is apt to be intensely disagreeable if our organic functions are out of order. This is too well-known a fact to need extended illustration. Smells and tastes which are agreeable to the healthy person may be highly unpleasant to the invalid. After a full meal, food which was previously delicious may become almost nauseous: even the idea of it may be unpleasant. The very thought of smoking a pipe in certain states of body may be repellent to persons who usually enjoy the use of tobacco. The profound alteration of organic conditions which accompanies pregnancy produces curious 'longings' and repugnances for articles of food.

It thus appears that organic conditions directly or indirectly influence the whole state of the central nervous system. Besides receiving sensory impressions from the internal organs, the central nervous system is also directly affected by general organic conditions, and in particular by the character and amount of the blood-supply which flows to it. This factor may contribute to determine the general nature of experience as pleasant or unpleasant. Its relative importance as compared with the more indirect effect of sensory impressions upon the internal organs is difficult to estimate. The neural processes connected with special sensations are more definitely restricted and localised. The experiences due to common sensibility are diffusive in their character. They give to the nervous system a certain general predisposition, and on the psychical side produce a certain general mood or temper.

By reflective scrutiny it is possible, as we have said, to detect special components of the total complex of organic sensation, such as those due to the heart-beat, and respiration, and the shiverings of cold or glows of warmth arising from contraction or dilation of the blood-vessels at the surface of the body. But there are occasions when no special effort of attention is required to detect an organic sensation. The experiences immediately due to a toothache, to a colic, to muscular cramp, to a burn, a bruise, or a blow, usually compel attention, whatever other interests may compete with them. When one organic sensation detaches itself from the mass of common sensibility, it is apt to be overwhelmingly obtrusive. Such intense experiences are much more often painful than pleasant; but they also occur in agreeable phases. In general, the satisfaction of organic cravings, such as hunger and thirst, may be intensely agreeable. The peculiarly disagreeable character of most organic sensations which are intense enough to detach themselves from the general mass, is marked by the usage of popular language which applies to them in a restricted and distinctive sense the word 'pains.'

A bitter taste or a discord may be disagreeable, but it is not usually called a pain. On the other hand, we currently speak of the pains of hunger, of scalding or burning, or of toothache. The reason is that the main importance of such experiences lies in their affective tone. They have comparatively little value for cognitive consciousness. They contribute comparatively little to the discrimination of the qualities of external bodies; and they yield only more or less vague information about the condition of our own bodies. When we have received a wound, we have to look at it to find out its precise character, and the proper mode of treating it. The pain-sensation itself does not yield definite knowledge.

It must be noted that those sensations which are in popular language called, by a distinctive application of the word, 'pains,' have other characteristics besides their mere unpleasantness. The affective tone does not exist in abstract purity: it is always the affective tone of some sensation having a more or less determinate character of its own. It is through the character of the accompanying sensation that we are able to

distinguish different kinds of organic pain or pleasure. Thus we discriminate from each other stinging, piercing, gnawing, crushing, beating, shooting, burning, and innumerable other kinds of pain. Hence it is possible to compare pain-sensations in respects other than the intensity of their painfulness. The points of agreement and difference are to a large extent to be found in the temporal and local distribution of the constituents of a complex experience. Local distribution is marked by such terms as 'pricking,' 'shooting.' Temporal sequence and rhythmic alternation are marked by such terms as 'throbbing,' 'beating,' and the like.

These differentiating qualities which we use in describing the varieties of pain-sensation have usually little cognitive value of any other kind. So far as cognitive consciousness is concerned, their main function is fulfilled in enabling us to detect and express the difference between one kind of pain and another. It is therefore natural that in naming them we should apply to all indifferently the common word 'pain.' But it is better to speak of pain-sensations than of pains, in order to indicate that something besides mere unpleasantness is involved. Markedly analogous experiences may also occur without any intensely disagreable feeling-tone. A slight burn may retain much of the peculiar prickly, pungent quality of the original sensation when the painfulness has almost or quite disappeared. So it is possible occasionally to detect the peculiar throb characteristic of a toothache, and the tenderness of the gum, when the acutely disagreeable phase of the experience has passed away or has not yet arrived. Hunger is usually unpleasant, but sometimes the beginning of it does not appear to be so.

So far we have referred only to those distinctive features which serve us in describing the difference between one pain-sensation and another. But there are undoubtedly other differences which seem incapable of analysis and description. This follows from the diffusive nature of organic sensations. The particular sensation which we regard as painful may have its origin in a burn or a wound in a particular part of the skin, or in a diseased condition of the membrane of the stomach or bowels. The specific nature of the experience will therefore

be in part determined by the character of this primary sensation. But the disturbance set up by the localised impression tends to involve more or less the whole nervous system, and to overflow the whole organism. The diffused effect on the nervous system may be marked by some peculiarity in the experience. Certainly, the impressions which arise from the changed conditions of the organism as a whole must modify the total experience in an important degree. But these elements are not easily expressed in definite language. They can, as people say, be felt but not described.

Organic pains and pleasures in extreme degrees of intensity reduce to a minimum cognitive process in general. In having a tooth drawn, our consciousness seems to consist in a single thrill of mere sensation. Attention to definite objects ceases: we cannot be said to attend even to the sensation itself, except in the vaguest way. We do not take note of its peculiar qualities, we simply experience it. The distinction between subject and object is for the moment more or less obscured. It remains true that the experience has a peculiar quality which might be analysed and described by a demon which had taken possession of us and was watching our mental processes. But no approach to such analysis and description is possible to us until the experience is over, and we can calmly regard it in retrospect.

3. Affective Tone and the Special Sensations.—We now turn to consider the special sensations of sight, sound, smell, taste, touch, and temperature. The affective tone of these sensations varies, first, with their intensity, secondly, with their duration, and thirdly, with their quality.

(1) Many of them in a low grade of intensity appear to be virtually neutral. All of them acquire appreciable affective value as their intensity becomes increased. Some of them are unpleasant even when they are weak. All of them become unpleasant when intensified beyond a certain point. Before reaching this point they nearly all have an agreeable phase; after reaching this point they continue to be more and more disagreeable as intensity increases. It is a matter of dispute whether there is any sensation which is constantly disagreeable

in whatever phase of intensity it appears. It is always possible to urge that though a sensation is generally disagreeable, it might be agreeable if it could be made weak enough.

As an example of a pleasant phase of an experience which everybody would regard as absolutely disagreeable from its very quality, we may quote the following incident from Marshall: "I remember well once having been aroused from serious thought in a railway carriage by a delicious odour, and the words 'What a delightful perfume!' were actually formed in thought. Almost immediately the smell changed to disagreeableness with growing intensity, and there appeared evident the intensely disagreeable smell emitted by a polecat which had been killed by the train."[1]

We may formulate the general rule for the relation of intensity and affective tone as follows. A sensation must reach a certain minimum of intensity in order to have an appreciable feeling-tone. Further rise in intensity of sensation is accompanied by a rise in intensity of feeling-tone. If the sensation is initially unpleasant, its unpleasantness continues to increase as the sensation is intensified. If it is initially pleasant, the pleasantness increases to a certain maximum, at which it remains roughly constant until the intensity of the sensation is increased beyond a certain limit. When this limit is passed, the pleasantness decreases, and finally passes into unpleasantness.[2]

The nature of the transition from pleasantness to unpleasantness requires further elucidation. An unpleasant element appears to enter into the experience even while the original sensation continues to be in itself agreeable. This is sometimes distinctly traceable to other definitely assignable sensations, which are superadded to the primary one. Thus, at a certain pitch of intensity, warmth may continue to be still agreeable in itself, although it is accompanied by a distinctly disagreeable sensation of a prickly or pungent character, probably due to stimulation of heat-spots as distinguished from warmth-spots in the part of the skin affected. So a

[1] *Pain, Pleasure, and Aesthetics*, p. 288.
[2] See Lehmann, *Die Hauptgesetze des menschlichen Gefühlslebens*, p. 181.

bright light may continue to give pleasure when it is so intense that the effort to accommodate the eye to it is unpleasant.

But there are other cases in which it is much more difficult to assign definitely the source of the collateral unpleasantness. However intense sweetness may be, it scarcely seems to become in its own intrinsic nature disagreeable. At the same time, it may excite strong disgust, which seems to be connected with accompanying organic sensations not easy to analyse or describe.

(2) The dependence of feeling-tone on duration varies in nature according as the sensation is continuously maintained or repeated intermittently. The following is the general formula for variations of feeling-tone with the continuous persistence of the sensation in time. The feeling-tone increases in intensity to a maximum. If the sensation is pleasant, it continues for some time at this maximum, and then gradually becomes less agreeable, and in the end distinctly disagreeable. If the sensation is initially unpleasant, the maximum persists for a much longer period than in the case of agreeable sensations. After this, the unpleasantness may become fainter, but it never passes into pleasantness, and it is always liable to reappear at intervals in more intense phases.

The same remarks which we made about the transition from pleasantness to unpleasantness with rise in intensity apply to the same transition as dependent on continuous persistence in time. Here also collateral elements of a disagreeable kind are introduced into the experience before the primary sensation becomes in itself unpleasant. The illustrations of the bright colour and of the sweet taste may be transferred, *mutatis mutandis*, to the case of duration. A boy eating sugar-plums, if he continues to indulge himself beyond a certain point, has disagreeable sensations distinctly traceable to the stomach and other internal organs, while the sweetness itself remains sufficiently agreeable to tempt him to go on eating. But even apart from such definitely assignable collateral accompaniments, there may be a surfeit of sweetness, though sweetness remains in itself an agreeable taste. Doubtless this is due to some general organic effect hard to define by introspective analysis. Sometimes the disagreeable-

ness is simply due to tedium; if we gaze at a bright colour too long we feel bored because of the suspension of other activities, although the colour continues to be pleasing.

The case in which the sensation is repeated intermittently is in many ways analogous to that in which it persists continuously. If the repetition is too frequent, a pleasant sensation tends to become less pleasant, and often becomes unpleasant. Unpleasant sensations by frequent repetition often, but by no means always, become less unpleasant. They may even become virtually neutral or even actually pleasant. Perhaps the best instance of a disagreeable sensation becoming agreeable by repetition is the 'acquired taste' for olives.

When a pleasant sensation by repetition does not lose its pleasantness and become disgusting, and when an initially unpleasant sensation has become more or less pleasant by repetition, its absence from consciousness will at certain moments give rise to a craving for it. The craving of the smoker for tobacco, of the olive-eater for olives, or of the drinker for his bitter beer, are cases in point. The effect is especially noticeable when originally unpleasant sensations have become pleasant by repetition. The nervous system has adapted itself to certain modes of excitation returning at certain intervals, and their absence produces a disturbance of neural equilibrium. If a person is in the habit of using tobacco only at fixed times in the day, the craving is apt to arise exclusively at these times. The omission of a customary 'after-breakfast' pipe may trouble the smoker in the early morning, but the craving may pass away and not recur during the day.

(3) We have seen that there are probably some sensations which are disagreeable in all phases of intensity. Others become disagreeable at a very low intensity. In the case of others, such as sweetness, it is not quite certain that they ever become intrinsically disagreeable, even when they are most intense. It follows that quality of sensation is a most important factor in determining affective tone. We can do little to explain in detail why one quality as such is predominantly agreeable and another predominantly disagreeable. We shall have to consider certain theories on this matter in

connection with the general problem of the relation of feeling to conation. For the present we may merely note the fact and one important qualification.

We have been considering both sensations and their attributes in relative isolation. The reservation to be noted is that feeling is never referable simply to such units independently, nor can the feeling-tone of a concrete act of perception be regarded merely as the summed resultant of the feelings arising from particular sensations or their separate attributes. A sensation is always experienced in a context, and contributes to feeling-tone in different ways and degrees, according to the nature of the whole of which it forms a part. Strictly, all that we can do is to determine the variations in feeling which follow a given change in a certain determinate whole. But to say that this or that change in feeling arises with this or that change in sensory quality does not mean that the difference was due to the quality alone. In another context the same sensation would produce different affective results. A patch of colour which is unpleasing against a neutral ground may contribute to the pleasure derived from a certain pattern.

4. Surplus Excitation.—One important and probably invariable part of the context of particular sensory impressions is that which is based upon what has been called 'surplus excitation.' "If one is listening to a series of sounds, or looking intently at some object, the feeling of 'distraction' caused by being spoken to in a whisper, or lightly touched," is comparable with sharp physical pain.[1] The whisper or the light touch may be in no way disagreeable in themselves; they may be virtually neutral; but they set up a general nervous and bodily disturbance, correlated with a general mental disturbance, of an intensely unpleasant character. A similar shock is experienced when, in the process of going to sleep, we are startled by some sudden sound, which need not be especially loud. There is in such cases a diffused excitement of the nervous system, produced by the sensation, and superadded to that special excitement which is immediately correlated with the existence of the sensation.

[1] Ladd, *Descriptive Psychology*, p. 199.

This surplus excitation is by no means confined to such exceptional experiences as that of being startled. On the contrary, all sensations which have a distinctly appreciable feeling-tone appear to have a more or less diffusive character. In this respect, the difference between the organic sensation produced by a wound, and the special sensation produced by a bright light, is only one of degree.[1]

To some extent this statement may be directly verified by introspection. Wherever feeling-tone is sufficiently intense, we can detect a diffused bodily and mental excitement, and concomitant change in our organic sensations. An intensely bitter taste may give rise to a cold shiver; the piercing scream of a railway whistle disturbs thought and perception, and is felt over the whole organism. A delicious taste may not only tickle the palate, but "set the whole man a-gog"; the strong pleasure or displeasure sometimes produced by stroking, tickling, or rubbing, is not immediately due to the quality and intensity of the tactile sensations themselves, but to the surplus excitement they produce. We mentioned previously that sensations in themselves agreeable may in their general effect be unpleasing, and we found that the collateral unpleasantness can only in part be accounted for by the concomitance of definitely assignable and describable experiences. But surplus excitation, with consequent modification of common sensibility, adequately explains these subtle and evasive affections of consciousness.

It is largely from this point of view that we have to account for what we are accustomed to call different 'kinds' of pleasant or painful feeling. There are not varieties of pleasantness or unpleasantness as there are varieties of colour or sound. The distinctions we here make are ultimately referable to qualitative differences in the concomitant sensations. But the agreeableness or disagreeableness of the sensations of special senses, such as colours or tones or tastes or smells, have peculiar characteristics of this kind which are not traceable to the

[1] Hence there is no sharply marked line of demarcation between pain-sensation and the disagreeableness of special sensations. When unpleasant organic accompaniments become prominent, pain-sensation arises.

nature of the special sensations themselves, but to attendant experiences due to surplus excitation.

In this way we are able to account for the seeming qualitative diversity of the affective tone of different sensations which agree in being either pleasant or unpleasant. "*The way we feel*," says Ladd, "is not by any means precisely the same for all equally pleasurable or equally painful tastes and smells. Some agreeable sweet odours are described as 'heavy,' and others as having an 'enlivening' or 'spicy' quality."[1] Compare, for instance, the heliotrope and the Japanese lily. The strong organic effect which may be produced by a powerful odour is shown by its sometimes causing highly susceptible persons to faint. "Pleasant coolness is 'refreshing': pleasant warmth is 'cherishing.' . . . Musicians have always attached different distinct kinds of feeling to different musical instruments," and "to different keys and chords. . . . The 'grave' feeling belonging to the bass register is different otherwise than in mere quantity of pleasure-pain from the 'stirring' of the tenor."[2] These various experiences tend to induce certain moods having affinity with distinctive emotions. The same is true in a less degree of colours. "Bright light and mellow light produce differences in the character of the equally pleasurable feeling which may result."[3] Goethe contrasts the "cheerfulness" of a view as seen through yellow glass with its "mournfulness" as seen through blue glass.

These differences in affective tone cannot be reduced to the mere difference between pleasantness and unpleasantness; and they cannot be identified with the qualitative differences between the sensible qualities which occupy attention, and which are said to be pleasant or unpleasant. We must refer them to a more or less diffused excitement of the nervous system with its organic consequences, and the resulting modifications of common sensibility.

Experimental evidence shows that the stimuli which arouse sensations also produce widespread changes throughout the organism as a whole, and that these organic reverberations

[1] *Ibid.*, p. 184. [2] *Ibid.*, p. 185. [3] *Ibid.*

are in general more marked when the sensations are strongly suffused with affective tone. If we measure the changes in the volume of a limb, in respiratory movement, in circulation, or in the resistance offered to the passage of an electric current through the body, we find that affective experiences are generally accompanied by marked disturbances in a variety of bodily processes. There are distinct indications that the kind of changes in some cases vary according as the feeling is one of pleasure or displeasure. The facts are extremely complex and difficult to interpret, and we are not justified in concluding that the organic changes provide the principal causal conditions of affective tone. There is little doubt however that they contribute in some measure to the total affective state.

There thus appear to be three factors which may contribute to determine affective tone: (1) The sensation itself; (2) The diffused excitement of the nervous system which it may produce; (3) The effect of this diffused excitation on the organism by the consequent alterations of common sensibility which arise from the altered state of the internal organs. All three factors probably contribute to the result in varying degrees according to circumstances. But, as we shall see, there is much to suggest that it is not sensory change in itself or sensory change alone which determines affective tone, but sensory change as involved in the development of conative process.

5. Affective Tone and Organic Welfare.—Most psychologists support the general thesis that the processes corresponding to agreeable sensation promote organic welfare, and that those corresponding to disagreeable sensation are injurious. Stated more definitely, this means that agreeable process contributes to efficient discharge of function in the organs which it affects, and that disagreeable process disables the organs it affects.

There are two senses in which the general proposition can be understood. The meaning may be that on the whole and in the long run a pleasant experience contributes to the welfare of the organism. The proposition understood in this sense no doubt holds good as a general rule, but it is a rule which has

many exceptions. Any race of animals which should as a rule be pleased by conditions injurious to them and pained by conditions beneficial to them, would certainly perish in the struggle for existence. But to preserve the species in the struggle for existence, it is not necessary that pleasure should infallibly and universally coincide with *ultimate* benefit, and that displeasure should infallibly and universally coincide with *ultimate* injury. Hence we find that many things may be agreeable which are injurious, and that inversely many poisons are palatable. Intoxication is bad for the health; but it may be conducive to a temporary or restricted kind of efficiency of mental process and therefore pleasant.

If we are to establish a universal law, we must consider only the immediate vital activity at the moment in which the pleasant or painful sensation occurs. Sugar of lead has a sweet taste, which is pleasing at the moment; this pleasing taste may in itself be favourable to vital activity, although the substance which occasions it, when introduced into the blood, acts as a deadly poison. Similarly, a bitter drug which is disagreeable to the taste may have a beneficial medicinal effect. The beneficial effect is not due to the disagreeable bitterness, but to subsequent effects entirely disconnected with the original experience.

The case of intoxication by alcohol is different. Here the very process which is correlated with pleasure involves a disablement of the central nervous system. The efficiency of the intoxicated person, both for thinking and acting, is impaired. But this kind of exception may also be explained away. The intoxicated person is disabled from accurate methodical thinking, and from precise and delicate coordination of movement with a view to an end. But in general he makes no serious or strenuous attempts to fulfil these functions. If he does make serious efforts of the kind, he finds them very disagreeable. On the other hand, the loose and varied flow of ideas which accompanies the pleasing phases of intoxication is much more free and expansive than in a state of perfect sobriety. We all know that champagne promotes conversation having a certain kind of brilliancy: and we all know that the opinions expressed and the arguments used are

not likely to bear examination in sober moments. Even when there is no varied flow of ideas, even when a man persists in reiterating the same thing over and over again, his pleasure is connected with the fact that the point he is urging presents itself to him with peculiar vividness and intensity. Thus it appears that in the pleasing stages of intoxication a man is disabled from certain higher forms of mental function; but he does not have disagreeable feelings, simply because conscious activity in these directions is suspended. On the other hand, the kind of conscious activity which continues to go on is not impaired, but intensified, and he consequently feels pleasure.

In this last example, we have referred especially to process in the central nervous system. Pleasure and pain are states of consciousness, and consciousness is immediately correlated with neural process. Hence, the question which really concerns us is whether disagreeable processes are essentially connected with obstruction or disablement of conscious and correlated nervous activity, and agreeable processes with the free and unobstructed flow of such activity.

If we state the question in the above form it seems that the answer must be distinctly affirmative. Disagreeable sensations, in proportion to their intensity, obstruct and disturb mental process and the motor activities which, for their effective discharge, require conscious guidance. Everybody knows how difficult it is to think or act efficiently with a toothache or a headache, even though the desire to do so is strong. It is not merely that the painful sensations divert attention; this is also true of pleasant sensations of similar intensity. The point is that the disagreeable sensations positively disorder and enfeeble thought and action, when the endeavour is made to think or act. Of course, if the disagreeableness arising from this or that special sensation is faint, and if the total state of consciousness is, on the whole, agreeably toned in spite of the presence of this or that disagreeable item, the obstruction to mental activity may not be appreciable. But in principle it seems a safe generalisation that agreeable experience is favourable, and disagreeable experience is unfavourable, to the effective discharge of mental functions.

6. **Affective Tone and Conative Tendency.**—Some pleasures of sense are dependent on pre-existing conations. There are sense-cravings connected with the primary organic needs, such as the need for food and drink; and the gratification of these cravings is a source of sensory pleasure. Similarly, the induced cravings for tobacco and alcohol, which recur of themselves at intervals, give a pleasure when they are appeased which is quite distinguishable from the pleasure immediately due to the stimulus apart from the craving for it.

Every pleasing and every painful experience at the time at which it is actually taking place has a conative aspect. In so far as the experience is pleasing, there is a tendency to maintain and develop it by whatever means may be found effective, until its pleasure-giving capacity is exhausted, or is overpowered by the intermixture of unpleasing elements. In so far as the experience is unpleasant, there is a tendency to discontinue it by whatever means may be found effective. Thus, on the level of sensation, agreeable affective tone corresponds to the positive phase of conation, and disagreeable with the negative. The pleasant experience is coincident with a conative tendency which requires for its satisfaction the continuance of the experience. The unpleasant experience is coincident with a conative tendency which requires for its satisfaction the discontinuance of the experience. While pleasure lasts, conation is being satisfied; it is working itself out. When satiety is reached, it has been satisfied; it *has* worked itself out and reached its termination.

Until satiety is reached, there is always a tendency for the process to go on. If the pleasing sensory process is discontinued or obstructed before satiety is reached, the conation continues and is intensified; to the tendency to continue the pleasing sensation there is added the tendency to get rid of the unpleasing state due to its interruption. The original conative tendency, which was in process of being gratified, is transformed into a thwarted craving. Suddenly snatch away the bottle from the baby who is complacently sucking it, and you will have a picture of the situation referred to. The reverse of all this holds good of disagreeable experiences. To

discontinue them, however abruptly, is to give satisfaction and not dissatisfaction. Their continuance always thwarts and never appeases the conative tendency which is essentially connected with their existence.

It should be carefully noted that we distinguish between ultimate satisfaction and the process of becoming satisfied. Ultimate satisfaction is attained only when satiety is reached—only when the subject has had enough of the pleasant experience, so that, if it were still maintained, it would cease to please him. Pleasure is found in the process of becoming satisfied, not in its completion. Its completion is its termination, and therefore the termination of its affective tone.

Any pleasing sense-experience, when it has once taken place, may, on subsequent occasions, give rise to a conation, when its conditions are only partially repeated, as when the object with which it is connected is perceived, or the corresponding idea is reproduced. The impulses and desires thus occasioned have both agreeable and disagreeable phases. They are for the most part agreeable when gratification comes quickly, or is anticipated with confidence. They are disagreeable when gratification is long withheld, especially if it be withheld in a tantalising way, so as to produce disappointment or a series of disappointments. The experience is also apt to be more or less disagreeable when anticipation is not confident, but doubtful and hesitating.

7. General Theory.—Whatever conditions further and favour conation in the attainment of its end, yield pleasure. Whatever conditions obstruct conation in the attainment of its end, are sources of displeasure. This is the widest generalisation which we can frame, from a purely psychological point of view, as regards the conditions of pleasure and displeasure respectively. Its application to the affective tone of sensation is already contained in the last section. A pleasing sense-experience operates as a positive factor satisfying the conative tendency which is essentially connected with it. On the contrary, an unpleasing sense-experience operates as a positive factor thwarting the conative tendency essentially connected with it.

This is at the best only a vague explanation of sensory pleasure-pain. Moreover, it can be regarded as being an explanation only on one assumption. If it is supposed that, first, pleasure exists, and that, subsequently to its occurrence, the conative tendency arises as a consequence, it is a logical circle to explain the pleasure by reference to the conation. But, as a matter of fact, there seems to be no reason whatever for supposing that feeling-tone and conation are separated in time. From the very beginning they appear to coincide. From the very beginning a pleasing process is a process which tends to maintain itself.

We may perhaps hope to attain a more definite insight into the ultimate conditions which determine the feeling-tone of sensation from the physiological side. But from that side we have not at present any direct knowledge of the nervous processes involved. We can only frame hypotheses to cover the psychological data.

If we attempt to translate into physiological language the general relations of pleasure and displeasure respectively to conative tendencies, perhaps the best result we can obtain is the following. Conation in general appears to correspond to a disturbance of nervous equilibrium, and its completed satisfaction to a restoration of equilibrium. The conditions of displeasure not only disturb nervous equilibrium, but also, so long as they continue, obstruct the processes by which it tends to be restored. On the other hand, the continuance of the conditions of pleasure is a factor positively operative in the restoration of equilibrium.

It is evident that even if this view of the case be granted, there is still abundant room for further speculation as to the precise nature of the physiological processes corresponding to pleasure and displeasure respectively. The most favoured theories of the kind connect these opposite affective tones with the relations of wear and repair in the nervous system. Explanations based on this general principle assume many different forms; our ignorance of the exact nature of the complex chemical processes involved in assimilation and dissimilation of tissue, and of their connection with functional activity and repose, leaves much room for speculation. The

simplest form of statement is that when wear outruns repair the experience is displeasing, and that when repair outruns wear the experience is pleasing. On this view, however, it is difficult to account for the fact that pleasures may be exhausting.

Marshall propounded an interesting theory which lays great stress on the building up of tissue during periods of functional repose. Pleasure, according to him, depends upon a surplus of stored energy acquired during the inaction of the organ. Where this surplus does not exist or has been consumed, the corresponding experience will be virtually neutral, so long as repair keeps pace with wear in the course of functional activity. If wear outruns repair, the corresponding experience is unpleasant.

There is much to be said in favour of this view, and Marshall has said it with great clearness and force. Fatigue is in general a source of disagreeable, and freshness of agreeable, experience. Of course, the fatigue or the freshness must be that of the special tissues engaged in the functional activity. "After the quiet of the night-hours the bird-song, as we awake, is more than usually pleasurable; the rested eye sees beauty in all colours. The rubbing, at our morning bath, of the skin, which has not during the night felt the normal friction of our clothing; the flavour of some special food to which we have been accustomed, but which has not lately been tasted—all are pleasurable."[1] A pleasant sensation, when too long continued, will become unpleasant, because the stored surplus is used up. What is a surplus relatively to one intensity of stimulation, will not be a surplus relatively to a higher intensity; hence by gradually increasing the intensity of a stimulus, we pass from pleasant to unpleasant phases of an experience.

The theory accounts for many relevant facts. But it presents grave difficulties, if we attempt to base on it the whole explanation of the feeling-tone of sensation; and in my opinion it presents insuperable difficulties if we attempt to cover by its means all the pleasures and pains of perceptual

[1] *Pain, Pleasure, and Aesthetics*, p. 200.

and ideational activity. At present, however, we are concerned only with sensation.

One obvious objection arises from the dependence of feeling-tone on quality as well as quantity of sensation. Why should some sensations be unpleasant at a very low intensity, and others be pleasing even at a very high intensity? Why should a comparatively small degree of bitterness or acidity be disagreeable, while a comparatively high degree of sweetness is agreeable?

Marshall replies that there is a great variation in storage capacity, in the case of different sensation-processes. This explanation is probable enough in some cases. Where a function recurs with great frequency and regularity, and without much variation of intensity, as respiration does, we should not expect any large storage of energy. On the other hand, where stimuli occur irregularly, and with great variations of intensity, the organism can only provide against them by storing up a surplus in advance. But there are a large number of instances in which no such explanation appears applicable. Why should the same person dislike the smallest trace of vanilla, and keenly enjoy cloves or cinnamon? Why should the same person enjoy beef and hate mutton? To account for such differences by variation in storage capacity seems forced.

A more important difficulty is connected with the conception of a surplus. How are we to fix what is, and what is not, surplus energy? Marshall says that there is a pleasure-giving surplus "whenever the energy involved in the reaction to a stimulus is greater than the energy which the stimulus habitually calls forth," and that pain is experienced "whenever the physical action which determines the 'sensation' is so related to the supply of nutriment to its organ that the energy involved in the reaction to the stimulus is less in amount than the energy which the stimulus habitually calls forth."[1] There is ambiguity in this statement. The effect produced by a stimulus varies with its intensity; when Marshall speaks of "the stimulus," does he mean the same kind of stimulus in the same degree of intensity, or the same kind of stimulus

[1] *Ibid.*, pp. 204-5.

in varying degrees of intensity? If he means to include varying degrees of intensity, his case obviously breaks down altogether; for when a stimulus is unusually intense it is often unpleasant, although the effect which it produces is greater, and not less, than that which we are accustomed to.

On the other hand, if he means the same stimulus in the same degree of intensity, only a comparatively small group of facts is available for verifying his hypothesis. The instances in which the same kind and intensity of stimulus yields alternately pleasure and pain to the same person are relatively infrequent. The best example, perhaps, is the gradual decrease of pleasure when a pleasing stimulus is prolonged. Here not merely the affective tone, but the experience itself, appears to become fainter; but it is by no means so clear that it continues to remain fainter when it becomes positively disagreeable. Unpleasant experiences may be continued for a very long time indeed before they show any appreciable diminution of unpleasantness; and while they continue, it cannot be said that the effect of the stimulus is smaller than its habitual effect. When abatement of pain begins, the effect of the stimulus is smaller, the total experience becoming fainter. On Marshall's view we should expect, as an accompaniment of the diminishing effect of the stimulus, an increase and not an abatement of painfulness.

This leads up to another objection; the intensity of unpleasantness appears to be, in general, proportioned to the intensity of the unpleasant experience. If Marshall were right in affirming that unpleasant stimulation produces a smaller effect than pleasant stimulation, we should expect all unpleasantness to be very much fainter than we actually find it to be.

We have discussed Marshall's views because they form a very favourable example of the theory which traces pleasure-pain to wear and repair of nervous tissue. In general we may conclude that a large part of the explanation, at least for sense pleasure and pain, may be found on these lines. But no theory framed on these lines has been so formulated as to cover the whole ground successfully even for sensation, and they are all beset by special difficulties.

After all, it is not, *a priori*, likely that merely quantitative conditions will be found adequate to account for the facts. Considering the great complexity of the chemical processes in organic tissues in interaction with the blood-supply, there may be all kinds of qualitative as well as quantitative variations. For instance, the accumulation of waste-products in the blood may be a very important factor. It is possible that what takes place in repose and restores the freshness of organs is rather the removal of these waste products than the actual building up of tissues. There are considerations which tend to show that the building up of tissues takes place mainly during functional activity rather than during functional repose. We know that tissues suffer atrophy or degeneration if they are long disused. We merely refer to this point in order to show how speculative and insecure, in the present state of our knowledge, hypotheses of this kind are.

8. Affective Tone of Perceptual Process.—The feeling-tone of perception is determined by various conditions. We have already discussed some of them; but we may now more broadly distinguish the pleasure or displeasure which is directly due in the first instance to the perceptual process at the time of its occurrence, and that which arises from preformed associations.

Whatever obstructs or disables perceptual process at the time of its occurrence is disagreeable; whatever favours or furthers it is agreeable. Here it is important to distinguish two sides of perceptual activity: (1) the apprehension of objects, or mere play of attention detached from practical interest; (2) the performance of actions which are guided by attention, but are mainly prompted by practical motives.

9. Affective Tone of Attention.—The conditions of pleasure-pain in the mere process of attending, as such, have been well stated by Ward: "There is pleasure in proportion as a maximum of subjective activity or attention is effectively exercised, and pain in proportion as such effective attention is frustrated by restraints, distractions, shocks, or incomplete and faulty adaptations, or fails of exercise owing to the

narrowness of the field of consciousness and the slowness and smallness of its changes."[1]

The monotonous continuance or repetition of the same kind of sensations, after their interest is exhausted, involves a restriction of mental activity which may be highly disagreeable, as in travelling along a road where the scenery is uniform in character, and the villages all similar and similarly situated. A certain amount of variety is necessary for the free play of attention. Where this is lacking, the mind will strive to find objects to exercise its activity upon, and fail disagreeably. On the other hand, a too rapid succession of varying external impressions may be equally unpleasing. The mind, while pre-occupied with one object, is interrupted by the obtrusion of another and yet another, so that attention is being perpetually warped. This gives rise to the pain of distraction, which may also occur when disconnected objects simultaneously claim attention, so that it cannot be efficiently exercised by any one of them.

In attending to the same complex object, pleasure or displeasure may arise from the relation of its parts, which may or may not be adapted to what Kant calls "our faculty of knowing." Where the apprehension of the whole prepares and facilitates the apprehension of the parts, where the apprehension of one part prepares and facilitates the apprehension of another, and where the apprehension of the parts prepares and facilitates the apprehension of the whole, the total activity is pleasant, if it has a sufficiently varied field for its exercise. On the other hand, where at one stage of the process the mind is prepared for a certain kind of continuation and meets with another for which it is not pre-adjusted, the activity is unpleasant.

As examples we may refer to "the pleasurableness of a rhythmic succession of sounds or movements, of symmetrical forms and curved outlines, of gentle *crescendi* and *diminuendi* in sound, and of gradual variations of shade in colour; or the painfulness of flickering lights . . . false time, false steps, false quantities, and the like. In all these, whenever the

[1] *Psychological Principles*, p. 262.

result is pleasurable, attention can be readily accommodated —is, so to say, economically meted out; and whenever the result is painful, attention is surprised, balked, wasted."[1] To understand this, we must remember the essentially prospective nature of the attentive process. It is always a pre-adjustment for what is coming, and the pre-adjustment varies in its specific nature according to circumstances. If what actually occurs is that for which a specific pre-adjustment has been made, the mental activity proceeds smoothly and successfully without waste of energy. If on the other hand what actually occurs does not fit in with the pre-adjustment, there is a shock of disappointment and a waste of energy.

The simultaneous and successive co-ordination of movements directed towards one end involves delicate adjustment of innumerable motor impulses. Each of these must have a certain intensity, duration, and rapidity, and they must accompany and succeed each other in a certain order. In general, failure in adjustment, disturbing the activity as a whole and rendering it inefficient, is unpleasant. The peculiar experience of losing one's balance is a good illustration. Part of the unpleasantness of extreme fatigue lies in the muscular tremblings and convulsive jerks to which it gives rise. On the other hand, ease and certainty of adjustment in performing complex movements is a source of pleasure when the movements have not become so habitual as to lose feeling-tone. A free and easy flow of delicately adjusted movements is pleasurable, as such. The pleasures of play for children and young animals are largely of this kind. Compare the mental state of a dog in its struggle to keep standing on its hind legs with that of the same dog in its natural gambols, its mock-fights with its companions, and the like.

There are certain general conditions which contribute to easy and effective motor adjustment. Among these perhaps the most important is rhythm. In rhythmic movements the same adjustment is repeated at regular intervals, so that it is possible to prepare for it beforehand. In this way waste of

[1] Ward, *Psychological Principles*, p. 255.

energy is avoided, and the maximum of efficiency is attained. All workmen who have to repeat a movement again and again, as in striking with a hammer, or hauling on a rope, fall into a regular rhythm. Concurrence in rhythm between two distinct and simultaneous processes greatly facilitates both. Each process is not only facilitated by its own rhythm, but also by that of the other, and the result is often intensely agreeable. The best instances are dancing and marching to music.[1]

The pleasure or displeasure experienced in observing movement on the part of other persons or things partly depends on the same conditions as those which determine the feeling-tone of our own motor activities. In discussing imitation, we saw that actions which by their intrinsic interest attract attention produce in the observer a nascent tendency to repeat them himself. This tendency is present, even when it does not issue in overt imitation. The sight of external movement occasions an incipient stirring of corresponding activity in the subject who is attending to it. This motor revival forms an integral part of the perceptual complex, not of course a distinct idea. The conditions of pleasure and displeasure which apply to motor process in general, apply also to the reproduced motor process involved in attending to a moving object. When it takes place with special ease and facility and fineness of adjustment, we call the external movement that excites it 'graceful.'

But it is not merely the perception of movement that involves the revival of motor activity on the part of the subject. A slender column supporting an apparently disproportionate weight has a disagreeable effect on the spectator. It is as if he himself were supporting a burden to which he is not equal. The mere thought of Atlas bearing up the heavens on his shoulders makes one uncomfortable. The pleasing or unpleasing effect of geometrical forms is also to a large extent due to the motor activity involved in perceiving them. In part, this motor activity consists in actual movements, such as

[1] Rhythmic activity also produces a diffused excitement of an agreeable kind which intensifies the effect of other pleasure-giving conditions. Thus the rhythm of verse intensifies the effect of poetic ideas and sentiments.

those of the eye following an outline; but in a great measure it arises from our mode of apprehending lines and surfaces as if they were in themselves active. We speak of a column 'raising itself' into the air; of a path 'winding'; and so on. Language of this kind marks a fundamental feature of perceptual process. The direction of lines and surfaces is apprehended as if it were a direction which the lines and surfaces themselves actively take and maintain. Hence, in apprehending them there is a sympathetic revival of motor activity in us, which may be pleasing or unpleasing.[1] When the geometrical outline is so irregular in its course as to defeat pre-adjustments on our part, and to demand abrupt changes for which we are unprepared, it is disagreeable.

Of course, if the figure is too simple, it will be almost neutral in feeling-tone, but when it is at once complex and graceful, it may give rise to considerable pleasure. Marked displeasure occurs when sufficient regularity is present to create a pre-adjustment which other conditions disappoint. The experience is also unpleasant when, owing to the simplicity or monotonous repetition of the object, attention is not sufficiently occupied. In this case an active tendency is thwarted because it does not find adequate material for its exercise. Of course, what is too simple or too complex for one person may not be too simple or too complex for another.

10. Success and Defeat as Determining Pleasure and Pain.—Everybody knows that it is unpleasant to be defeated in an endeavour by adverse external circumstances, and that circumstances which facilitate the attainment of the end of an activity are for that reason pleasing. The cat is displeased when the mouse escapes it; the golf-player is displeased when he digs up the turf instead of hitting his ball; the sportsman is displeased when he misses his bird.

An analysis of such cases is unnecessary. We need only insist on their importance for the general theory of pleasure-pain. The very fact that they are obvious and familiar makes them important. If we can reduce other instances in

[1] This view is developed in full detail in Lipps, *Raumästhetik und geometrisch-optische Täuschungen.*

which the conditions of the feeling-tone are less obvious to the same general principle, we may fairly claim to have given an explanation.

It should be noted that the physiological theory which refers all pleasure-pain to relations of wear and repair in nervous tissue can scarcely be made to apply here. We are pleased when we hit a nail on the head and displeased when we miss it. There seems to be no reason whatever for supposing that in the one case surplus-stored energy is being used up, and in the other not. One would suppose that whatever surplus existed would be common to both.

11. Affective Tone due to Preformed Associations.—Acquirement of meaning, complication, and associative re-excitement of organic sensation play an extremely important part in determining the affective tone of perception. "The cawing of a rook . . . in itself, is certainly not agreeable. This sound, in the case of those who have lived in the country in early life, and enjoyed its scenes and its adventures, is well known to become a particularly agreeable one. . . . The explanation is that this particular sound, having been heard again and again among surroundings . . . which have a marked accompaniment of pleasure, . . . produces a faint re-excitation of the many currents of enjoyment which accompanied these."[1]

To take a simpler instance, the sight of a delicious fruit may give pleasure more because of previous experiences of taste than because of its appearance to the eye. It is important to note that in such cases it is not merely the feeling-tone, the abstract pleasantness or painfulness which is revived. The feeling-tone of the present perception is determined by previous experience only because the perception itself in its cognitive and conative aspect has been modified and developed by this experience. The acquired feeling-tone of the cawing of rooks is the feeling-tone of its acquired meaning. It re-excites a total disposition left behind by previous perceptual experience, and this is the source of its pleasantness. Probably the re-excitement of organic sensations also plays an important

[1] Sully, *The Human Mind*, Vol. II., p. 78.

part in this instance. In other instances it is very prominent. The sight of food disgusting to the taste may produce actual nausea. The sight of a drawn sword produced in James I a highly unpleasant organic disturbance. The mere sight of another person sucking a lemon makes some people vividly experience the corresponding organic sensations which may be to them highly disagreeable.

12. **Pleasure, Pain, and Emotion.**—Some emotions are almost invariably pleasant, others almost invariably unpleasant; grief, for instance, is disagreeable, and joy agreeable. Fear is almost constantly disagreeable, but in other emotions the feeling-tone is much more variable. The complexity of the relations between feeling-tone and emotion arises in part from the fact that emotions in their conative aspect are secondary tendencies, and in part from the fact that both primary and secondary tendencies may be independently successful or unsuccessful. The general principle is, as we have seen, that the obstruction of any tendency is unpleasant and its successful operation pleasurable. But while primary and secondary tendencies maintain their distinctive characters and ends, the feeling-tone of the one blends with that of the other.

Joy is invariably pleasant on account of the success which engenders it. Sorrow essentially involves the thwarting of the primary impulse, but the tender reminiscence of a beloved object to which the secondary tendency gives rise may be pleasurable, and the pleasure may outweigh the primary pain. Anger involves a vigorous reinforcement of activity, and so far as this is successful the experience may be distinctly agreeable. Baffled and impotent rage on the other hand is unpleasant. Fear is unpleasant inasmuch as it lacks the self-confidence of anger. Being purely defensive, it initially presupposes a partial sacrifice on the part of the primary impulse; but a successful escape from danger may be pleasant. In the modified form in which these emotions enter into play or imaginative activity they tend to be more frequently pleasant, for the conditions of their satisfaction are more completely realised. Similar considerations apply to the relations of feeling-tone to instinctive processes.

BOOK III.

PART. II.—GROWTH OF THE PERCEPTION OF THE EXTERNAL WORLD.

CHAPTER I.

NATURE OF THE PROBLEM AND ITS PRESUPPOSITIONS.

1. The Meaning of the 'Physical,' 'Material,' and 'External' World.—These terms are frequently used as if they were synonymous. But closer examination shows that each of them tends to have distinctive implications of its own.

By the 'physical' world we mean a system of things which, however they may otherwise be qualified, must at least have the primary qualities of extension, shape, relative position, and motion. The parts of this system are conceived as actually existing, persisting, changing, and interacting with each other independently of sensation and other experiences of the individuals who are cognisant of it. It is especially to be noted that independent reality is for us inseparably connected with independent action involving what we call physical force or energy. We hold the objects of dreams as physically unreal because they are not operative, independently of their appearance to us, in determining the course of events, as they would be if they were physically real. From the same point of view we can understand why the primary qualities have a peculiar physical importance. Size, shape, relative position, distance, and motion supply the general conditions determining the way the parts of the extended world act on each other.

The term 'material' may be used simply in distinction from 'mental.' It then includes all that is signified by 'physical' and more besides. It is in this comprehensive sense that the

term 'material world' is to be understood in the title of this section. But there is a narrower sense in which matter is contrasted not with mind but with force or energy and in general with the dynamic aspect of what we call the material world in the wider sense. When we thus leave out of account the dynamical aspect there remains as properly material the nature of material objects so far as our knowledge of them depends on sense-experience. Apart from the extensity of sense we should not know what is meant by a thing being extended. Apart from colour sensa we should not know what is meant by a thing being coloured. From this point of view there is no fundamental difference between the primary qualities and the secondary. So far as perception merely depends on actual sense experience at the time, a thing is perceived as blue or sweet in the same way as it is perceived as triangular or moving. Besides the self-determined characters of independently real physical objects, the material world in its distinctly material aspect comprehends also the sensa themselves as they come and go and pass through various changes in individual experience. There is indeed a theory advocated by Berkeley and J. S. Mill according to which the material world is simply reducible to an order of actual and possible sensations.

"I see" says Mill, "a piece of white paper on a table. I go into another room. . . . But though I have ceased to see it; I am persuaded that the paper is still there. I no longer have the sensations which it gave me, but I believe that . . . when I again go into the room I shall again have them; and further, that there has been no intervening moment in which this would not have been the case."[1]

According to Mill, the world of what we take to be independently real physical things and events consists only of such possibilities of sensations related to each other in a systematic order. It is not here the place to discuss whether as a metaphysical theory, this view is tenable or not.[2] The business of the psychologist is to give an account of the view

[1] *Examination of Hamilton*, p. 228.
[2] I hold that it is certainly untenable.

which is presupposed in ordinary thought and conduct. Now apart from philosophical theories, we take the piece of white paper in Mill's illustration to persist as a reality and not merely as an unrealised possibility. Unless we thus believe in it as actually existing when unperceived, we have no ground for believing in the possibility of the sensations which would constitute its sensible appearance if we were perceiving it. None the less the actual and possible sensible appearances of the paper, though they are distinct from its physical existence and nature, do enter into the common-sense conception of it as a material object. In general, Mill's description of the material world as a systematic order of actual and possible sensations is from the standpoint of common sense true as far as it goes; but, since it excludes independent physical reality, it is essentially incomplete.

In order to give a definite and useful sense to the term 'external object' we must determine to what it is supposed to be external. We may safely say that it is in some sense external to the self which is cognisant of it. What for me is an external object is so because I am aware of it as outside me. But this cannot mean that it is outside my mind. Anything can be outside the mind in the metaphysical sense of not being perceived or thought of. But the 'external object' *is* perceived and thought of. Hence it is not external to the mind. But the self, as we are aware of it in self-consciousness, is not merely the mind, but the mind and body in one. The self as engaged in listening, handling, pushing, hauling, eating, is an embodied self, and is known as such. Such activity can neither exist nor be apprehended as existing except as one side of a complex situation within which the self as embodied is distinguished from and related to other bodies which are therefore called 'external' objects.[1] Our knowledge of the material world seems to begin with this complex situation in however rudimentary a form: its development from more primitive to more advanced stages depends, in the first instance, on transactions in which the embodied

[1] This point, among others, is amplified in the "Note on the Perception of Physical Objects," which has been added to the present chapter, see p. 422.

self and the external object are in various ways active and passive relatively to each other. The process is two-sided; knowledge of the external object progressing in correlation with knowledge of the bodily character of the embodied self.

It is important that the same body which is thus internally perceived is also externally perceived—as when we look at or touch our own hands. But even as an external object it differs for the percipient from all others inasmuch as it is constantly present as a persistent nucleus while surrounding things appear and disappear.

Science tends to regard the bodies of men and animals merely as external objects. Yet it would seem in view of modern theories of relativity that it cannot entirely succeed in doing so; for these are based on the fact that all measurement is relative to the position of the individual observer.

In what follows it should be understood that when I speak of 'the material world' or of 'material objects' without special emphasis on the term 'material,' I mean to include what is distinctly meant by the terms 'physical' and 'external.'

2. The Psychological Problem.—What we are attempting is a descriptive analysis of the process through which knowledge of the material world in all the essential aspects of its being passes from more primitive to more developed stages. What we are emphatically *not* attempting is to show how such knowledge is or might be generated from a prior experience in which it is not present. No metaphysical question is raised concerning the real existence of the material world, or the real existence of physical objects. On the contrary, so far as this question is concerned, the position of Psychology ought to be the same as that which is presupposed in ordinary thought and conduct and in the procedure of the other sciences. There are indeed metaphysical theories which either deny the real existence of physical things, or hold that as they really are in themselves they differ in their fundamental nature from what they appear to us to be. But whether such theories are tenable or not, we need not trouble ourselves about them here. The reason is that they cannot seriously claim to be considered at all, except on one condition. They must be shown to be essen-

tially equivalent for practical purposes to the view on which we proceed in daily life and in science. Hence there is no need to consider them at all except in Metaphysics.[1]

Though the psychologist need not and ought not to start from metaphysical assumptions in his descriptive analysis, descriptive analysis itself leads up in the long run to metaphysical problems. It brings us face to face with questions which, so far as they are answerable, cannot be answered merely by examining the course of individual experience, but demand an inquiry into the nature of the universe of being as a whole and into the place of individual experience within it. Such inquiries are of the utmost interest and importance. But they are not properly psychological. The results reached by the psychologist, unless they are shown to be incorrect from the psychological standpoint, form part of the data from which the ontological inquiry must start. Hence the psychologist cannot be expected to regard his results as mistaken merely because they are found to be incompatible with this or that ontological doctrine—materialism, subjective idealism, behaviourism, or any other.

3. The Activity-Factor and the Sense-Factor.—It will be found as we proceed that the development of our knowledge of the material world depends on two main conditions in the most intimate union and interdependence. These may be called the 'sense-factor' and the 'activity-factor.' The activity-factor is essentially involved in our apprehension of the independent reality of physical objects and their qualities. What is independently real is independently active and passive. Even in the primary perceptual situation the percipient is aware of his own body and of the external object as distinct physical existences only in being aware of them as active and passive relatively to each other. By the sense-factor is meant the actually experienced sensa which enter as essentially independent into sense-perception. What we have to consider is the part played by this actual sense-

[1] Even in Metaphysics they seem to me indefensible, the common-sense view may be inadequate, but it is not essentially untrue.

experience in the perception of physical objects as having material character, size, shape, colour, sweetness, etc.

The first point to be noticed is that the sensum and the character of the physical object are not identical. Otherwise the moon would be really smaller than the penny I hold in my hand; in double vision of a candle flame, there would really be two candle flames as there are really two actually experienced sensa. Nor can we identify the sensum with what we may call the perceptual appearance—with what the physical object *seems* to be to the percipient in the act of perceiving it. In the case of double vision there *seem* to be two candle flames, and if we trusted merely to the present perception we should believe that there really were two. But there is really only one; though there seem to be two. On the contrary it cannot be said that there only seem to be two sensa. There really are two which actually exist in being actually experienced. Again, if the sensum were identical with the perceptual appearance, every difference and variation in the sensum would be a difference and variation in the physical object as we perceive it, and inversely. But this is far from being universally true. The visual sensum, for example, increases very greatly in size as we approach things seen, and decreases as we recede from them; but within certain limits of distance there is no marked increase or decrease in the seeming size of things seen; and even beyond these limits the increase or decrease is not proportionate to the variation in the sensum.

Though the relevant sensum is distinct from the perceptual appearance, we do not commonly notice the difference. We notice it only when there is special occasion and motive for doing so, as when we recognise a perceptual appearance as illusory. What we are immediately cognisant of in seeing a tree, for example, includes both constituents, both the visual sensum, and the shape and colour of the tree, both the perceptual appearance and what we may call the sensible appearance. But ordinarily we do not discriminate them. We are aware of both undiscriminatingly in being aware of the whole percept into which they enter. Hence the plain man is equally shocked when he is told that what he directly

perceives in sense-perception is only his own sensations, and when he is told that what he directly perceives is something thought of and not actually perceived at all. The trap is that the material characters of the physical object are present only to thought; but the thought must, so to speak, have a foothold in sense-experience, and be more or less determined by the nature of present sensations in seeing, touching, hearing, etc.

In what way does present sensation determine the nature or what seems to the percipient to be the nature of the physical object? In what way does the sensible appearance determine the perceptual appearance? Here we may lay down a general principle. The more nearly we approach a state of things in which the present sensation is the sole operative condition, the more does the nature of the physical object as apprehended by the percipient approximate to the nature of the sensa which he experiences in perceiving it, so that differences and variations in the sensible appearance are matched by corresponding differences and variations in the perceptual appearance.

Under the conditions of certain experiments intended to test the local sensibility of the skin, the subject is called on, as far as possible, to estimate the size of a thing or distance between two compass points merely through the present sensations which arise in the moment of contact. It is then found that the seeming size or seeming distance of the compass points varies greatly according to the part affected. In other words, the perceptual appearance is assimilated to the present sensation and varies as this varies. But the present sensation, though always essential, is never the sole condition. It is relatively more important in the more primitive stages of mental development. As sense-perception becomes more accurate and trustworthy, other conditions come into play. These are all connected with the process of correlating different perceptual appearances with each other in a coherent system such as makes possible anticipation of the course of events and successful action. This process reaches its highest and more complex development in ideal construction and more especially in science. But it begins at the perceptual level.

As regards terminology, we may say that the sense-factor determines for us the material nature of the physical object. We may also say that the sense-factor presents the material nature of the physical object, in that it introduces it or makes it present to thought. Or again, we may say that it is through sensation that we know the physical object in its material aspect. On the general question of knowing immediately, and not by inference, real existence which is not actually experienced in the act of knowing it, it will be sufficient here to refer to the analogous case of memory. After feeling cold I now feel hot, and remember having felt cold. The two feelings are incompatible, so that they cannot be actually experienced together. Yet in having the later I know of the earlier immediately and not inferentially. But in knowing it I do not actually experience it. Hence it can be present only to thought, in the sense in which thought is contrasted with immediate experience.

But the analogy between sense-perception and remembrance of the past, as such, goes further than this. We have seen that the total percept includes not only physical objects but present sensations; similarly what we are cognisant of in remembering is not merely past experience but present experience as continued from the past, as the past is continued into the present. Again, the distinction between what is actually experienced and what is not, is not as a rule explicitly recognised either in sense-perception or in memory-knowledge. It emerges clearly only in reflective analysis. Finally, remembrance, though fundamentally trustworthy, may in detail be inaccurate in various ways and degrees; the same holds for sense-perception.

4. Original and Acquired Meaning.—The physical world, as we now apprehend it, consists of a multiplicity of particular items connected in the unity of a single system. We have therefore to distinguish (1) what is original from what is acquired in the apprehension of particulars in this or that perception, (2) what is original in the apprehension of the unity of the whole—the context within which the particular items have to take their place.

With the sense-factor we have already dealt in the last section. What we have there said might be otherwise expressed by saying that present sensation originally 'means' for the percipient corresponding characters of the physical object. But original meaning does not enter only into the constitution of each percept taken singly. It is also presupposed in correlating different perceptual data with each other within the unity of a physical world, and concurrently modifying and correcting the perceptual appearances with which we start. The single percept is not apprehended as self-contained in isolated independence. It has an original meaning beyond its own existence inasmuch as it is related to a context, which, so far as it is not determinately known, is known indeterminately as the object of possible inquiry. Apart from original meaning in this sense no satisfactory account of acquired memory can be given. But this requires more detailed explanation.

What we have to explain is not merely the apprehension of external objects considered separately as items relatively detached, but also their interconnection as parts of one world. We have, therefore, to determine whether the unity of the external world can be accounted for merely as due to acquired meaning, or whether, on the contrary, there is some apprehension of it, however rudimentary, from the outset.

Here it is important to remind ourselves that sensations are felt at any moment only as parts of one total sense-experience. As Ward puts it, "At any given moment we have a certain whole of presentations, a 'field of consciousness' psychologically one and continuous; at the next we have not an entirely new field but a partial change within the old."[1] The entire complex of sensations simultaneously experienced contributes to our apprehension of the total present situation; and this or that special item within it is singled out only by selective attention under the guidance of special interests. Hence James is probably not far wrong when he speaks of the earliest awareness of the infant as having for its object only "a blooming buzzing confusion."

[1] *Psychological Principles*, p. 77.

But this merely sensuous unity is not sufficient for our purpose. It is not sufficient, because the growth of the knowledge of external reality constantly involves the breaking up of this original sense-given unity into a plurality of relatively separate data and the recombination of these data in new ways. "Out of the variety of impressions simultaneously presented we do not instantly group together all the sounds and all the colours, all the touches and all the smells. But, dividing what is given together, we single out a certain sound or smell and regard that along with a certain colour and feel, similarly singled out as belonging to what we call one thing.... There is nothing in its first experience to tell the infant that the song of the bird does *not* inhere in the hawthorn whence the notes proceed, but that the fragrance of the mayflower does."[1] There is, we may add, nothing in its first experience to tell the infant that the extension which he sees when he looks at his rattle is identical with the extention which he feels when he touches it.

It is through such separation and recombination of the original data of sense that the knowledge of an external world gradually develops. Now the question is whether in this process the mind initially apprehends each particular connection as it comes—living, so to speak, from hand to mouth; or whether, on the contrary, it starts with some germinal apprehension of the unity of the world, sufficient to enable it, when occasion arises, to expect and seek for connections not yet disclosed. It would seem that only the second alternative is psychologically tenable. If we are to secure ourselves against the fallacy of explanation in a circle, we must assume from the outset something answering, in however vague a form, to our developed consciousness of the world as a unity—a system within which all parts are in various ways connected with each other.

Further, from the outset this embryo awareness of unity has various aspects answering to the fundamentally diverse kinds of relation given in sense-perception. Among these aspects we may single out for special consideration the rudi-

[1] *Ibid*, p. 164.

mentary forms of what the developed consciousness recognises as spatial unity, temporal unity, causal unity, and the unity of different attributes as belonging to the same thing. Such forms of unity may be called 'categories.' Categories are universal principles of relation holding either for all knowable objects or for all of a certain kind. Our position is that such categories belong even to rudimentary perceptual consciousness as a condition of its further development.

5. Spatial Unity.—At our present level of mental development, spatial unity means that all extended bodies are extended in one and the same space, which is definitely contrasted as a whole with particular extensions as its parts. When we perceive, imagine, or conceive any particular extension, we think of it as continued beyond itself, so as to be an inseparable portion of the one all-embracing space. Its termination is a boundary in which it meets space beyond it. Further, whenever we think of two extensions which are separate in the sense of not meeting in a common boundary, we think of them as mediately connected by some intervening stretch of space, and as having some definite position, distance, and direction relatively to each other. Every 'here' is connected in this way with every 'there.'

Now we cannot, of course, attribute to the undeveloped consciousness the full and articulate consciousness of the unity of space which we possess ourselves. None the less if we are to advance securely in our psychological explanations, it would seem that an embryo form of it must be present from the outset as the condition of further growth. We have, at least, to assume that even at the perceptual level, when a thing is apprehended as extended, its extension is not thought of as self-complete and self-contained, but as continued beyond itself; also that, when and so far as the mind arrives at a stage in which two separate extended things are thought of together, they will be thought of as connected by intervening space.

The apprehension of space as tri-dimensional is directly bound up with the category of spatial unity. If we consider the extensity of visual or tactual sensations, as such, we find in them only an order of coexistence in two dimensions. They

have not any immediately-experienced thickness. Further, if they had immediately-experienced thickness, this would avail us little, because it would stand in no direct relation to the filling of tri-dimensional space by external objects. We only touch the surface of things, not what lies beneath the surface. The same is true of sight; inasmuch as we see through anything we do not see the thing itself. Hence, many psychologists have found a difficulty in explaining how it is that we constantly and universally apprehend the external world and every part of it as extended in three dimensions.

The only adequate solution of this problem seems to lie in recognising that from the outset the apprehension of a third dimension is involved in the apprehension of surfaces. Only superficial extension is directly perceived in such a way that its parts are given together, so that their distinction and relation can be discerned within the whole to which they belong. But any given surface is thought of as prolonged beyond itself; and it is not only thought of as prolonged into a further surface but also into extension which is not superficial. The further development of the perception of a third dimension will thus depend on the detailed development of our apprehension of the varying shape of surfaces and their varying position, direction, and distance relatively to each other. For all such relations will be interpreted as relations of surfaces and parts of surfaces within a third dimension, analogous to the relations of lines within a surface.

6. Temporal Unity.—What we assume under this head is that any particular duration or change is, from the outset, apprehended, however vaguely, as having a 'before' and 'after.' In early stages of mental development, owing to the dominance of direct practical interest, the mind is preoccupied with continuation into the future rather than the past. Such reference to the future seems involved even in the most rudimentary forms of the attention-process as indicated by the behaviour of animals and children. Even the most primitive attention is essentially prospective; it is a waiting or watching, a being on the alert for what is to come. The given situation has for it a transitional character; it is not

something which merely is, but something which is to be. Only on this condition is there a possibility of apprehending it as alterable or of wanting it altered in however vague a way. In other words, the reference to the future must be as primitive as conative consciousness.

It would also seem to be a primary condition of the possibility of learning to adjust future behaviour to the lessons furnished by past experience. Reproduction and association, taken merely by themselves, account for the renewed apprehension of what has been apprehended before; but they do not of themselves explain the emergence of any really new knowledge.

Thus, if *B* has once been perceived as succeeding *A*, when on a subsequent occasion *A* is perceived again, then in the absence of any primary reference to the future, the utmost that can result is that *A* will be thought of as having been followed by *B*, not as about to be followed by *B*. *B* never has in any way been thought of as belonging to the future and therefore association cannot recall it as belonging to the future. On the other hand, if in perceiving *A* the mind looked onward to a further development of the present situation, *B* when it came would be identified with this anticipated development. It would initially be apprehended as something future relatively to *A*. Hence the possibility of its being reproduced in this same relation to *A*.

7. **Unity of Attributes in the Same Subject.**—Our present thought and perception is always concerned with propositions either asserted or merely supposed; and there is no proposition which does not involve directly or indirectly the distinction and relation of attributes and a subject to which attributes belong. We cannot stir a step without such forms as are expressed in language by '*S* is *P*' or 'if *S* is *P*,' or '*S* is *P* or *Q*.' Implicitly or explicitly our mental procedure always involves some distinction between things and their nature, between 'that' and 'what.'

Is it possible for the psychologist to go back to a primitive stage of conscious life for which there is no rudiment of this category and then proceed to show how it can arise through

the extension of experience in accordance with known psychological laws and conditions? It is at least safe to say that no one has yet succeeded in this undertaking or indeed set about it with any clear and adequate recognition of the nature of the problem.

We may therefore assume that the primary datum of perception is something regarded as qualified by an attribute, the nature of the attribute being initially determined for thought by the nature of the sensation through which it is perceived. Further, this relation of subject and attribute does not merely enter into the constitution of separate particular data. It is rather a fundamental principle of unity preparing the mind to look for attributes which are not yet given. This is plainly so for the developed consciousness.

As Hume points out, the idea of substance is essentially the idea of a principle of union. "Thus our idea of gold may at first be a yellow colour, weight, malleableness, fusibility; but upon the discovery of its solubility in *aqua regia* we join that to the other qualities. . . . The principle of union, being regarded as the principal part of the complex idea, gives entrance to whatever quality afterwards occurs, and is equally comprehended by it, as are the others which were first presented."[1]

To show that this principle of union is an original category, we have to lay stress on a point ignored or denied by Hume. We are here dealing with an altogether unique sort of unity. It cannot consist, as Hume supposes, in such relations as those of contiguity and causation. I always find my house in the immediate neighbourhood of another house; but I do not therefore regard the two houses as attributes of the same subject or one of them as an attribute of the other. I may indeed regard them as parts of the same whole. But, to adopt a distinction from Hobbes, the parts of a thing are not therefore parts of the nature of the thing. Head, shoulders, arms, and the like are parts of a man; his figure, motion, weight, size, and the like are parts of his nature. Only the parts of the nature of a thing have that unique form

[1] *Treatise of Human Nature*, Bk. I., Pt. I., Sect. VI.

of unity which cannot be otherwise described in ordinary language than by saying that they are attributes of the same thing.

When once it is granted that this form of unity is original and not derivative and also that it works as a principle of union determining the progressive combination of new attributes with those previously given, it becomes clear that its function as principle of union must also be original and not derivative. From the outset a given attribute or given attributes are implicitly apprehended as parts of the nature of a thing and not as its whole nature, so that the mind is prepared to look for further attributes whenever occasion arises and interest prompts it to do so.

The only alternative is to suppose that the new attributes are merely found to be combined with the old, without any principle of anticipation. But if we inquire how this mere finding, this blind stumbling on new combinations, takes place, it seems very difficult to supply any intelligible account. For, strictly speaking, the union of distinct attributes in the same material thing is never given as a mere datum of particular experience, except in cases where the relevant sense-experiences are inseparably blended, as colour-quality and extensity are blended in visual sensation. Apart from such cases, all that is given in the way of particular data consists in relations of coexistence and sequence and concomitant variation.

Thus I may perceive something as white and also at the same time something as sweet-scented. But this is quite different from apprehending what is white as identical with what is sweet-scented. A baby, when it looks at its rattle, is aware of something having extended colour; when it feels its rattle it is aware of something having extended hardness and roughness. But it is a further step to group the colour and the hardness together as qualities of the same thing and to come to regard the extension of the colour as identical with the extension of the hardness. What particular experiences supply consists in guiding clues which require to be interpreted as meaning the union of different attributes in the same thing: and for this there must be some principle working implicitly

and, so to speak, underground, which leads the mind to construe them in the way required.

The full strength of this position from the psychological point of view becomes evident when we take account of a fact which ought never for a moment to be lost sight of in discussing questions of this sort. I mean the fact that even in its most primitive stages, whether in animal or human life, learning by experience is really learning by experiment. It involves throughout subjective initiative, trial and failure, and persistency with varied effort. The condition of finding is seeking. Now seeking always presupposes some pre-notion of what is sought. As mental development advances such anticipation becomes progressively more full and definite. But if we are not quite gratuitously to place an impassable gap between earlier and later stages we must assume that it is present, in however indeterminate a way, from the beginning.

It should be noted that there are two ways in which this category contributes to the development of the knowledge of physical objects. Firstly, what we take to be the same thing may seem to have incompatible characters in different perceptual appearances. When this happens we have to regard one of the perceptual appearances as illusory, and if we attempt to explain the illusion we can do so only by distinguishing between sensations and physical things—a distinction which we should not otherwise have recognised.

When I sit in a railway carriage at a station and look at a passing train, my own train seems to be moving. But when I glance at the platform or station building it is seen to be at rest. Taken by themselves there is no reason for regarding one of these seemings as deceptive rather than the other. It is only because one of them alone fits into the general context of my experience that I accept it as real and regard the other as illusory. But whence does the illusion arise? I answer by saying that it occurs because I am looking at a passing train and my visual sensations in looking at it are like those which I should experience if my own train were in motion. I thus distinguish between my sense-experiences and the physical object both as it really is and as it seems to me in sense-perception.

The second case also involves incompatibility of attributes, but more indirectly. When we have learned to ascribe to a thing different perceptible characters *a*, *b*, *c*, *d*, so that given *a* we presume that the others are present, another kind of illusion arises. What seems to the eye to be sugar is not really sugar if the taste is salt instead of sweet. What seems to the eye to be a man is not really so if it vanishes through a wall or casts no shadow.

8. Causal Unity.—What has been already said of the other categories holds also in principle for causal connection. Unless we assume from the outset that the primitive mind treats a perceived change which challenges its interest and attention, not as something self-existent in isolation, but as something conditioned by and conditioning other changes, it seems hopeless to attempt to show how this causal point of view could have arisen through any extension of knowlege in accordance with ascertained psychological laws and conditions. The only plausible suggestion is that it may have grown up through habitual association due to frequently repeated perception of similar sequences, for example, the frequent perception that the placing of my hand in the fire is followed by a burn.

But here we have the old fallacy of supposing that retentiveness gives rise of itself to fresh knowledge instead of merely preserving for future use knowledge already otherwise acquired. As Hume has pointed out with the greatest clearness and vigour, "from the mere repetition of any past impression even to infinity, there never will arise any new original idea . . .; and the number of impressions has in this case no more effect than if we confined ourselves to one only."[1]

[1] Hume, *op. cit.*, Bk. I., Pt. III., Sect. VI. As regards Hume's own view that the notion of causal connection may arise, not through the development of knowledge concerning the changes themselves supposed to be causally connected, but through a peculiar effect produced by customary repetition in the mind itself, I say nothing, because this doctrine does not appear to have been seriously maintained by any later philosopher and because, in the end, it seems to have failed to satisfy even Hume himself.

It might, indeed, be maintained that such customary repetition, though it does not itself account for the genesis of the category of causality, is yet an antecedent condition without which it does not actually emerge as a factor in the mental life. Even if this were true, the apprehension of causal relations would still be original in the sense which we have defined. It would not become operative until certain experiences had first been acquired, but these experiences would not account for it in accordance with known psychological laws. There is, however, good reason for denying that customary repetition is even required to furnish a first occasion or opporutnity for the first emergence of the apprehension of causal relations. For, as we have already insisted, the process of learning by experience is from the beginning experimental. Perceptual process involves throughout motor activity directed towards the fulfilment of practical interests in such a way that subsequent behaviour is continually adapted in accordance with the satisfactory or unsatisfactory results of previous behaviour in similar situations.

It is only through this practical initiative that customary expectations are in the first instance formed. Regularities are only found because they are sought. But it is in the seeking that the category of causal unity is primarily involved. The having learned by experience is a subsequent result which presupposes the previous process of learning; and the learning takes place only where there is attention, which is essentially a prospective attitude.

Consider the dog or cat in Thorndike's experiments previously quoted. The animal is confined in a box, with food outside. It can only escape by turning a wooden button, pulling a loop, or pressing down a lever. It struggles to escape in all kinds of ways, squeezing and biting and clawing. Ineffective modes of action are discontinued and give place to others, which in their turn are discontinued if they prove fruitless. If in this way the animal does accidentally work the mechanism, it is likely to do it sooner when again put into the box. Thus in repeated experiments "all the squeezings and bitings and clawings which do not hit the vital point of the mechanism . . . get stamped out, while the particular

impulse which made the successful clawing or biting gets stamped in," until it alone is executed.

This gradual adaptation of means for the attainment of ends involves in a rudimentary way the category of causality. It involves the distinction between efficiency and inefficiency. It is the starting-point and presupposition of all subsequent developments of thought which proceed according to this category.

But we must notice the essential difference which separates the merely perceptual category from that of ideational and conceptual thought. The perceptual category is always purely and immediately practical in its operation. It is a constitutive form of thought only because it is a constitutive form of action. The theoretical question Why? has no existence for the merely perceptual consciousness. It does not and cannot inquire why it is that a certain cause produces a certain effect. It does not and cannot endeavour to explain, to analyse conditions so as to present a cause as also a reason. It does not compare different modes of procedure or different groups of circumstances, so as to contradistinguish the precise points in which they agree from those in which they disagree, and in this way to explain why a certain result should follow in one case and a different result in another case. Causality in this sense can only exist where there are trains of free ideas, and the development of the ideational consciousnsness in this direction is a development of conceptual thinking—of explicit generalisation.

NOTE ON THE PERCEPTION OF PHYSICAL OBJECTS.

The following note will appeal only to those students of Psychology who are interested in the philosophical questions which this subject raises.

I have said in the text that we are primarily aware of our own bodies in the experience of being active in such processes as looking, handling, motor effort, walking, eating, etc. To explain this further I must begin by considering the meaning of the terms 'active' and 'activity.' The main point is that

there is no such thing as *mere* activity. Activity is rather an abstract character which belongs in varying degrees to all sorts of actions. But by itself it cannot be a concrete action. The reason is that an action is an active *process*, and that activity by itself is not a process at all. Every concrete process involves specific factors, phases, and stages whose nature is not at all determined by calling the process active or passive. What I assert is that the action of the self in looking, handling, grasping, etc., whatever else it may be, is at least a bodily process, and that the experience of it is primarily and primitively a bodily experience. It is the experience of an embodied self.

But, if it is a bodily experience, it must in some way essentially involve sensation. What account are we to give of the part played by the sense-factor?

In the first place, why should not purely sensory as distinct from bodily changes of themselves give specific character to our actions? The answer to this question is contained in the phrase 'the passivity of sense.' We feel ourselves active in altering or trying to alter our sense-experience or in maintaining it unaltered. But in actually experiencing those changes in the sensory continuum which we call particular sensations or sense-impressions, we feel ourselves wholly passive. I may be active in putting my hand into a fire; but the resulting experience of being burnt is something which happens to me, it is no part of my action. In contrast to my active endeavour to escape I feel myself passive in it. We can also exclude another alternative. The sensory change, abstractly considered, is not indeed my action. None the less it might be an active process falling within my immediate sense-experience. This would be so if and so far as previous change in the sensory continuum tended to issue in further change. But experience gives the lie to this suggested possibility. No such active tendency is discernible within the content of actual sense-experience. On the contrary, each sense-impression is *in this respect* loose and separate from all others. Each has an invasive or irruptive character such that, if we are to account for it at all, we must do so by tracing it to conditions which lie not within but beyond sense-experience. Each, indepen-

dently of the others, "strikes in," as Hume would say, with "a certain force and liveliness."

In this situation what ought to happen? Have we any cogent reason for predicting *a priori* that the subject will refer his sense-impressions to unknown causes, or to a mind other than his own, or simply take them as they come without reference to anything beyond them? Such dogmatic assertions concerning what *ought* to happen seem quite unwarrantable. No one has an independent knowledge of the nature of the mind and of the universe and of their relation to each other such as to justify him in thus laying down the law on what ought to take place, in advance of relevant evidence of what does actually take place.

The problem is rather to find a hypothesis which will best cover what we take to be the facts concerning the way we know physical objects and especially the way in which this knowledge develops from rudimentary beginnings and varies with variable conditions. The only hypothesis which I find workable is that the subject primarily and directly apprehends change within his actual sense-experience as the continuation of a process which he does not actually experience. This implies that he knows his own sensory continuum only as a partial phase of a wider whole with which it is continuous in existence, and therefore fundamentally akin in nature. We may call the partial phase which is actually experienced the 'field of sensible appearance,' and what lies beyond it the 'field of physical existence.' The two fields are so far of a piece in nature as to make it possible that a continuous process should partially fall within one and partially within the other.

This I take to be the primitive basis of our knowledge of the physical world. Its further development, as I have said in the text, is to be found in the correlation of diverse perceptual data in a coherent system.

I have assumed in the text that the primary perception of physical existence includes awareness at once of the embodied self and the external object, each passive and active in relation to the other, as essentially co-ordinate partners in one total situation. What difference and connection on the side of sense primarily determine the perception of the difference and

connection of the body of the percipient and bodies external to it? The difference is not wholly or mainly between particular sensa. It is rather between abstract characters or aspects of the same particular sensa; and it is just because this is so that there is not only difference but internal and essential union.

In the first place, certain characters of our sense-impressions remain constant however the sense-impressions may otherwise vary. Such are, for instance, the local signs of the eye and the ear, and all features of sense-experience which depend permanently on the sense-organ or part of the sense-organ affected, and not on the variable way in which it is stimulated. Characters which are in this way constant, whether what we touch is velvet or steel, or what we see is fire or snow, directly determine perception of the percipient's body and only indirectly contribute to the perception of external objects. They determine perception of the hand as touching, or of the eye as seeing, rather than of the thing touched or seen. It is for this reason that without perceiving or imagining my own retina as an external object, I can distinguish between seeing with one part of it and with another—for example, between seeing with the centre and out of the corner of the eye.

In the second place, all the sense-impressions which are most important for the perception of external objects have a double aspect inasmuch as in their coming and going and other variations they are partly dependent in regular ways on our subjective initiative and partly independent of it. So far as they depend in uniform and orderly ways on our subjective initiative, they primarily determine perception of our own bodily processes; so far as they are independent, they determine perception of external objects. This point has been sufficiently illustrated in the text. I would only add here that, strictly speaking, there are no sense-impressions which depend *merely* on our subjective initiative. Even in our free movements there is always sense-experience, if less intense, due, for example, to the weight of our limbs or to the ground we walk on. We feel ourselves free in such movements because the resistance is comparatively slight and of so familiar a kind that we automatically adjust ourselves to it without making a special effort.

We have finally to take account, not of different aspects of the same sensations, but of a peculiar class of sensations, which, though they blend in a most intimate way with all others are none the less distinct from them. I refer to modifications of organic sensibility. These do not begin and cease or change in any regular way in dependence on our active movements. We cannot by merely turning our head get rid of a headache, nor can we dismiss the sting of a nettle by withdrawing our hand. The reason is that organic sensa persist independently of varying relations of our sense-organs to external stimuli. Owing to their relative constancy amid the coming and going of other sense-impressions, organic sensa mainly determine perception of the states of the body and contribute only in a very vague and rudimentary way to the perception of external objects.

In conclusion, I turn to a question concerning activity on which it is important that there should be no misunderstanding. We know ourselves as active and passive immediately and not through inference. And if this were not so we could not know anything else as active and passive. But in the strict sense of immediate experience in which it means actual experience, we do not immediately experience our own actions. Direction to an end or to the fulfilment of an interest does indeed involve an actual experience of an altogether unique kind, without which there could be no distinction between success and failure, and therefore no activity on the part of the self. But this is only an abstract ingredient in action or active endeavour. The concrete process involves factors and stages which are not actually experienced. What I have been maintaining is that these, being sense-determined, are bodily, and that therefore our immediate awareness of ourselves as active implies awareness of our bodily existence.

CHAPTER II.

SPECIAL PROBLEMS OF PERCEPTION.

1. Introductory.—The whole question of the detailed development of the perception of an external world is highly complex and intricate, and there are many points connected with it which are still obscure. We may, however, here select certain fundamental problems which appear capable of being treated in a more or less satisfactory way. (1) How is it that certain portions of matter come to be singled out and marked off from each other and from their surroundings as separate things? (2) How, in particular, does the experient come to distinguish his own body from objects in his environment? (3) How does the distinction arise between the 'real' nature of the object so singled out and its varying sensible appearances? (4) What is the nature and what are the stages of the process through which the perception of spatial extension grows in distinctness and complexity? (5) How are initially separate data of different senses or of the same sense correlated with each other as attributes of the same thing?

These developments of perpetual consciousness really proceed coincidently and interdependently. They constantly condition each other; advance in one direction makes possible and is made possible by advance in others. But since we cannot say everything at once, we must take them separately for purposes of exposition. It is, however, to be borne in mind that in dealing with each we are presupposing the others to be going on at the same time.

2. The Singling out of Separate Things.—Our sensuous experience, at any moment, together with its acquired meaning, yields the apprehension of a certain total situation, a certain portion of the external world. But this total situation is normally broken up into those distinct centres of unity which we call 'separate things.' Thus, while sitting in my

study, within the whole which is sensuously presented to me I can distinguish certain complex units as relatively independent—the pen I am holding, the desk I am writing at, this or that book, a match-box, a piece of blotting-paper, etc. This distinction by no means coincides with that between different portions of matter. Two portions of matter are distinct from each other when they occupy distinct portions of space. But each separate thing contains in this sense distinct portions of matter which are not distinguished as separate things. A pane of glass is apprehended by me as a separate thing, but the parts into which it would be broken up if someone were to smash it to shivers are not so apprehended.

A separate thing in all but the earliest stages of mental life is apprehended as combining within its unity a number of different attributes apprehended through different senses. We shall have to show subsequently how this synthesis of attributes takes place. But this is not part of our immediate problem. What we are here immediately concerned with is the distinction of separate things from their environment and from each other, rather than their internal complexity as involving a union of different attributes.

The latter problem essentially refers to the correlation of the sensible qualities presented to separate senses, sight with hearing and touch, and so forth. The simpler problem with which we are here concerned arises even within the domain of a single sense. Within the visual field some items are joined together as parts of a single thing and separated from others as parts of different things. A succession of sounds may be apprehended as a pattern involving distinctive units of various grades of complexity.

In the process of conjoining spatio-temporal units to constitute individual things and in disjoining them to form distinct things, two groups of factors would seem to be operative. There are firstly the objective properties of the units themselves, and secondly the subjective factors connected with the direction of conation.

Under the head of objective factors we may note those previously referred to as conditions of prominence. The very notion of 'singling out' implies such prominence. There are,

however, various stages in which things of differing degrees of complexity attain to individual prominence. There is firstly the relatively simple case in which a homogeneous unit stands out against its ground as the moon stands out against the sky. Again, there is the case in which a number of such units, though individually distinguishable, are 'taken together' as forming a single thing against a similar ground. The distinction between the thing which is singled out and its ground would seem to be universal. There is no occasion on which the presented field appears to consist entirely of individual things. While reference to an objective reality is by no means lacking in the apprehension of a ground, this 'ground' is not perceived as a 'thing.' In perception 'thinghood' is not contrasted with nothingness but with what is taken merely as a ground.

For a distinction to be drawn between two things or between a single thing and its ground a spatial or temporal difference is essential. It is a necessary condition of two portions of matter being different things that they should occupy distinct portions of space.

But this is not a sufficient condition. In the first instance things are distinguished by qualitative contrast. Distinct but adjacent portions of matter tend to be treated as a single thing so far as they are similar in quality. Conversely, qualitative contrast makes for separation. Intensive differences may serve the same purpose.

An important case of contrast is that which arises in connection with movement. Objects which move in unison are treated as a single thing, while an object which moves independently is singled out as a separate thing. Similarity or diversity of movement will often outweigh qualitative diversity or similarity. This unification, however, does not depend exclusively upon movement. A stationary group upon an unchanging background may, in spite of the qualitative diversity of its components, be recognised as a separate thing. Here the most important factor is the presence of form.

Simple homogeneous units possess formal elements as well as qualities, and awareness of these elements of form is perhaps

never wholly absent. But the perception of the formal character of a relatively simple unit has comparatively little influence on its being detached from its ground as a separate thing. Complex units, on the other hand, are not apprehended at all except in so far as their form is perfectly distinct. We can see an individual star without clearly discerning its shape, but a constellation such as Orion or the Great Bear is not apprehended at all apart from the apprehension of a shape.

The enumeration of the specific factors which determine which of the many forms objectively present will be singled out as individual things is a question of detailed investigation. It will suffice here to indicate certain general considerations.

Elements of form, as we have previously noted, must be accepted as primary data. There is no question of their having emerged from the development of an originally formless confusion, nor have they been 'imposed by the mind' upon what would otherwise have appeared simply as 'material.' We can only raise such questions as: Why should *this* rather than *that* complex whole be perceived under such and such conditions? What are the stages in the development of the perception of form? The perception of forms cannot be explained solely by reference to retention. The effect of retention consists primarily in facilitating the renewed perception of what has been previously perceived. It does not account for the original perception. It does, however, exert a selective influence. We cannot perceive at any given moment all that there is to be perceived. Hence on account of retention a given thing may be singled out more readily because it has been singled out before. Moreover, increasing familiarity with one kind of complex whole may facilitate the perception of another still more complex form. In this way the expansion of the span of apprehension involves not only an increase in the number of items simultaneously perceived but also the apprehension of increasingly complex wholes.

A fact of the greatest importance in connection with the perception of complex things is that the perception of any particular form of synthesis is not determined simply by the nature of the elements which enter into its constitution, but

is in large measure conditioned by the nature of its context. This is most clearly seen in the familiar puzzle pictures and ambiguous figures. So far as any particular feature is 'used' in perceiving a given complex so far is it debarred from use in the simultaneous apprehension of another.

Considerable light is thrown upon the factors involved in the perception of individual things by the cases in which there is failure to distinguish an object which might be expected to appear. Such cases are afforded by the adaptive marking and coloration of animals and by artificial forms of camouflage. Clearly, where qualitative or intensive difference from the ground is lacking, a motionless object will not be discriminated. More important, however, are the cases in which distinctions within the whole object cause it to be broken up into a number of separate items which may appear as single things or be severally conjoined with other objects in the background. In this way conspicuous forms of marking may serve the purpose of concealment even more completely than uniform coloration.

Objective factors, however, are rarely, if ever, found to be operative in total isolation. The world is mapped out into a plurality of relatively independent units each of which is detached from its surroundings by its separateness and unity of interest. This interest is ordinarily of a practical kind; and the further we trace back the course of human development the more exclusively practical it becomes. It is true that for our highly complex consciousness the form of 'thinghood' has become very variable and fluctuating in its application.

In more primitive stages of mental development, human interests are at once more exclusively practical in their nature and more limited in their range and less fluctuating. Hence for primitive man the division of the external world into separate units called things is more fixed and absolute. But the limit in this direction is reached in the perceptual consciousness. Animals distinguish from its environment and treat as a separate thing whatever portion of matter appeals to their peculiar instincts and affords occasion for their characteristic modes of activity. Thus what is a separate thing for one animal is not so for another. The interests of

each species are to a very large extent determined by the connate predispositions which belong to it like other specific characters. What possesses unity and distinctness of interest to an ant is nothing to a cat, and so on.

At higher levels the interest may be more theoretical, and the change in interest will involve a change in the way the object is perceived. A stone is a single thing to a boy about to fling it at another boy. To the geologist examining its structure it may be several distinct things. It is nearly always possible mentally to break up what appears as one object into parts, each of which has an identity and distinctness of its own. But we only do so in so far as the interest of the moment leads us to do it. The relativity and variability of our apprehension of 'thinghood' depends on this fluctuation of interest.

In general, however, the division of the world into separate things is determined by more or less permanent and common interests of a practical nature. This may even be the case in the relatively artificial examples afforded by geometrical designs. Here, however, the interest involved does not arise from specific dispositions of the instinctive type, but from the more general conative tendencies pervading mental activity of all sorts. Thus so far as we are attending at all, and for whatever reason, we are trying to perceive and remember as much as we can for a given output of effort. The perception of certain forms enables us to 'take in' very much more than would otherwise be possible. Similarly, the characteristic fluctuation in the perception of relatively meaningless patterns may, in part, be due to the inherent tendency in attention to pass to something new.

3. Awareness of the Body.—The individual percipient is aware of his own body in two ways. He may become aware of it through vision or touch in the same way as he becomes cognisant of other things; but in addition he is acquainted with it in a way in which he is acquainted with nothing else. The latter mode of cognition is involved in feeling hot or cold, hungry or fatigued, or in feeling the dead weight of the limbs in unimpeded motion or in rest. This direct awareness of the

body may be described as 'internal' perception, in contrast with the 'external' perception through which we become aware of other things.

Now, in the data of internal perception the body of the percipient is presented in a way which fulfils from the first and in the highest degree all the requirements for its being singled out as a separate thing.

Consider, first, the objective conditions. The complex of sensations actual or obtainable at will which yield awareness of the body, the body-complex as we may call it, is alone continually experienced, while other sensations come and go. This happens, for instance, whenever the percipient moves from place to place. Thus the body of the percipient forms the persistent spatial centre in the shifting situations which he apprehends from time to time. Further, the members of the body may move relatively to each other or otherwise suffer perceptible change with little or no perceptible change in their surroundings. Conversely, change in other sensations may take place independently of change in the body-complex. Finally, the body-complex is partly constituted by a peculiar class of sensations, the organic, which remain blended in the original unity of sensuous experience instead of being broken up into a plurality of separate data and reconstructed in new combinations, like the sensations of the special senses, such as sight and hearing. These organic sensations form a central core, so that whatever other sensations blend with them are therefore included in the body-complex.

The importance of this is shown by certain cases of hypochondria. "If, as sometimes happens in serious nervous affections, the whole body or any part of it should lose common-sensibility, the whole body or that part of it is at once regarded as strange and even as hostile."[1]

It would be a mistake, however, to suppose that internal perception of the body is conditioned only by the organic and motor sensations previously referred to. In sight and touch there is internal as well as external perception, but the two processes are blended in a particularly intimate way.

[1] Ward, *Psychological Principles*, p. 364.

The visual field, for example, is diversified in two ways. On the one hand our visual sensations vary to a great extent simply in accordance with the nature of the object seen, and not in accordance with what we ourselves may do. But not all variation and difference are of this nature. There are differences which correspond to differences in the organ of perception irrespective of the nature of the object seen. This is illustrated by the increasing haziness of objects as we pass from the centre to the margin of vision. In the same way we find that whatever the contents of the visual field may be, the field itself is apprehended as approximately round. In this there are presented the limits of the sensitive surface of the organ of vision, not the limits of external things.

Touch manifests the same two forms of diversification. There are variations and differences due to the character of the object touched, and variations and differences due to the nature of the sensitive organ engaged in exploration. Each part of the sensitive surface has its own persistent local character, its own 'local sign,' and its own discriminative capacity.

While every form of sense-experience probably involves both internal and external perception, the different senses vary considerably in the extent to which they are employed for the development of knowledge of the self and for the development of knowledge of external things. In organic sensation we approximate to pure internal perception; in vision and hearing we are mainly concerned with the perception of external things. The limiting case perhaps is that of sound, but the hearing of a sound is never entirely without the presence of characteristics which enable us to locate the affected organ as in the region of the ear rather than elsewhere.

Turning to the subjective factors which are operative in the singling out of the body as a separate thing it is obvious that the body of the percipient is to him an object of peculiar and continual interest. His interest in other percepts constantly includes interest in their relation to his body and especially in their position, distance, and direction relatively to it as a spatial centre. His motor activity needs continually to be adjusted to such relations and their changes, the purpose

of such movements being to bring near to his body the things for which there is appetite, and to remove from it those from which there is aversion.

The body, besides being thus the spatial centre from which the position, distance, and direction of other perceived objects are reckoned, is also most intimately and directly connected with the subjective life of feeling and will; so intimately that the awareness of self is primarily inclusive of the body so as to be the awareness of the embodied self. The pleasures and pains connected with organic sensation in early stages of development form almost the whole affective aspect of consciousness, and to the end they remain of the greatest importance, playing a large part even in the higher emotions. But the pleasures and pains of organic sensation, like the painfulness of a bruise or of hunger and thirst, or the pleasure of eating and drinking, arise in connection with perceived states and changes of the percipient's own organism and exist or at least persist independently of the variable environment.

Equally important is the unique relation of the body to the will. The only sensations over which the individual possesses or can acquire habitual and uniform control, so as to initiate, modify, or discontinue them at will, belong to the body-complex. They are all concomitants of his own unimpeded movements or of the contact of one part of the body with another. The voluntary initiation of change in other things or in their appearance to the senses is indirect and conditional.

Now it is a general principle that we normally apprehend as belonging to our own activity those means or instruments which are fully under our control instead of regarding them as belonging to the things acted on. In writing, so long as the pen does not splutter or make blots or otherwise assert its independence, I apprehend its movement as part of my own action—the action of writing. Again, in riding a bicycle, as long as the machine is completely under my guidance I regard its behaviour as my own behaviour. I naturally say that *I* go down a street or turn a corner; I do not say that I make the bicycle do so. On the other hand, if it gets out of control it becomes sharply contrasted with my own action.

On this principle, the motor and other sensations which occur uniformly and directly whenever the subject is interested in having them are not normally discriminated from the conations which condition them. Conative consciousness and its results are to this extent blended in the single complex experience of motor activity. This means that awareness of the body and its behaviour is included in awareness of the self and its doings.

Thus the growth of the distinction between the body of the percipient as a thing separate from other things coincides with the growth of the distinction between the embodied self and other parts of matter as spatially external to it and independent of it. This, again, makes possible another distinction of great importance—that between the qualities of things and their varying sensible appearances.

4. Distinction between the Real and the Merely Apparent Properties of Things.—In our account of the primary datum of sense-perception we began with the postulate that not only is sensation primarily apprehended as a phase of something which is not merely immediately experienced, but also that every difference and variation in sensuous experience means for the percipient difference and variation in the presented thing. This may seem to exclude the possibility of the same object or at any rate the same attribute of the same object presenting different appearances to sense without itself undergoing change. Yet this variability in the sensible appearance of the same thing and of the same attribute of the same thing is a familiar fact.

Water which feels hot to one hand may feel lukewarm to the other. Colour-sensations vary with the varying illumination, with the state of the retina and with other conditions apart from any corresponding variation in the thing seen. The same unvarying extension is very differently presented to touch and to sight; for touch, again, it varies with the part of the skin brought into contact with the object; and for sight with the part of the retina stimulated as well as with varying perspectives due to the varying positions of the spectator.

We may consider first the changes in sensible appearance which arise in connection with the percipient's own activity. An object appears to increase in size when it does so in fact, provided it remains at a constant distance from the observer. But it also appears to undergo the same increase in size either when it approaches the percipient or when the percipient approaches it. In the first two cases there is a real change in the object in respect either of size or of motion, while in the third case the change is merely apparent.

In drawing this distinction, the percipient is guided by the implicit use of the category of causality, attention being directed to the conditions of the change. Primarily there is the fundamental distinction between changes in sensation which arise in accordance with the experient's own initiative and those which arise in an independent way. This, as we have seen, is an essential condition of drawing the distinction between the bodily self and external or independent things. If all sensations were equally independent or equally dependent no such distinction would arise. We may imagine a sentient being for whom all impressions were directly obtainable at will. A certain mode of sniffing would always yield the smell of roses, a certain movement of the eye would always yield the sight of roses and so forth. Similarly, we may suppose that the taste of food or drink would be obtained merely by going through the motions of eating and drinking as in the banquet of the Barmecide in the *Arabian Nights*. Obviously for such a creature the distinction between the self and the external world would not exist. Such a being would be a complete world in itself.

This case is not so far removed from our normal experience as it at first might seem to be. We cannot sharply divide our sense-experiences into two groups, one *wholly* dependent on our own initiative, the other *wholly* independent. Most if not all of our sensations vary to some extent with our own activity. So far as this is the case, the changes are regarded as real changes in the self or treated as merely apparent changes in the external object. When the change is independent, however, it will be treated as a real change in the external object, not as a change in the self.

We may first consider the case of free or unimpeded motor activity. If I walk towards a thing, keeping it in view, my visual sensations change, as they would change if I had remained still and the thing itself had moved towards me or increased in size. If again I reverse my movement and recede from the object, I obtain the same series of changing appearances in reverse order; and this happens as often as I repeat or reverse the course of my motor activity. So, if I pass my hand to and fro in the same uniform way over the surface of a table, I regularly get the same series of touch-sensations, now in one order and now in the opposite order.

Such changes, inasmuch as they are initiated, continued, discontinued, reversed, accelerated, or retarded by corresponding variations of my own free motor activity and perceived variations in the position of my body or its parts, are apprehended as conditioned merely by change in me as an embodied self and not by change in the thing perceived. So far as the thing perceived is concerned, they are regarded, not as real changes, but only as changes of sensible appearance. On the contrary, when similar changes occur apart from corresponding free movements on my part, I tend normally to apprehend them as involving real change in the thing perceived and not merely change in its sensible appearance.

Let us now turn to the case of impeded movement or movement against resistance. Here we have to disabuse our minds at the outset of the vague notion that there is some peculiarity in the nature of the sense-experiences involved which makes them the vehicle of a special revelation of external reality. The essential points to be considered are as follows: (1) the body of the percipient or part of it is in perceptible contact with something; (2) movement or the continuation of a movement already begun takes place only when what it is in contact with moves together with it in the same direction; (3) this occurs, if it occurs at all, only when the will to move has been followed by a certain degree of intensity and complexity in a complex of touch-sensations and muscle, joint, and tendon sensations.

What we have to show is that the displacement of the thing which offers resistance must be apprehended as real,

and not merely as a change in sensible appearance. This depends, in the first place, on the variability of the amount and direction of effort required in different cases. What lies within the free control of the agent is only the making of efforts in a certain direction and in a certain order. The result is relatively independent of this initiative. It varies with the thing which he pushes or pulls or otherwise attempts to manipulate.

But, besides this, there is another condition even more important. The perceptible changes which follow effort against resistance persist independently of the embodied self and its free movements. Unlike mere variations of sensible appearance, they cannot, in any constant or uniform way, be continued, discontinued, reversed and renewed merely by continuance, discontinuance, reversal and repetition of the movements by which they are initiated. If I push a cup lying on a table away from me, I cannot merely by withdrawing my hand make it appear again in its original position. If I push it off the edge of the table it falls and breaks; the change which I initiate is continued into further change after my action has ceased and the final result persists for my perception independently of my movements. It persists as a condition to which my motor activity must adjust itself in order to be effective in subsequently producing other changes in the sensible appearance or in the independent reality of external objects.

In part, perceptible changes follow constantly and uniformly on the free movement of our bodies; in part, they follow on movements involving various degrees and directions of effort against resistance. But they also very frequently take place in the absence of any initiative on our part, as when an object in the visual field shifts its position relatively to others while our head, eyes, and body remain at rest. In accordance with our general principle such alterations will be taken as real and not merely as alterations in sensible appearance.

But besides this mark of their independent reality, there is another which assumes increasing importance with the growth and gradual organisation of knowledge. The implicit operation of the causal category will lead the mind to seek for the

conditions and consequences of such changes, whenever they are sufficiently interesting; and inasmuch as the conditions and consequences are not to be found in the motor activity of the percipient, they will be looked for in obvious changes taking place in other things external to his body. They will thus come to be referred to a causal system of their own contrasted with that to which mere change in sensible appearance is due.

On the other hand, though this system excludes mere change in sensible appearance, it will include the perceived results of resisted motor activity which we have called the manipulation of objects. For the relations between the body of the percipient and other things involved in the overcoming of resistance by effort are similar to the relations involved in the interaction of external objects with each other. If I push a billiard ball, the ball rolls; but it also rolls when another moving billiard ball comes into contact with it. Further, the consequences following motor activity against resistance are constantly apprehended as continued into further changes due to the interaction of outside things with each other. If I push the first of a row of bricks, this, in falling, similarly pushes the second, and so on.

In general, real changes have presuppositions and consequences radically different from mere changes in sensible appearance; and we constantly use this causal difference as a criterion for distinguishing between the two. To use Kant's illustration, when I glance from the top of a house to the bottom, the various parts of the house from above downwards are successively perceived; but I do not, therefore, regard them as successively coming into existence. One reason of this is that it is a pre-condition of the top existing that it should be supported by what is below it; otherwise it would fall.[1]

[1] Plainly Kant, in his laboured 'proof' of the principle of causality, is throughout thinking of the distinction between real succession and succession in sensible appearance. He fails, however, to recognise that merely apparent successions have causal connections of their own. He fails also to recognise that the whole problem arises only when we are considering what I call 'a separate thing,' in detachment from other things and its surroundings.

The criterion afforded by the possibility of referring changes in sensory experience to ourselves rather than to external things is not universally applicable. This accounts only in part for the distinction between real and apparent change. The distinction arises in cases other than those in which the change is due to motion. Water may appear warm to one hand and cool to the other. The difference is due to some difference in the body of the percipient, not to any difference in the external object. The same applies to changes in coloration due to abnormal conditions of the eye.

In general, changes can be referred to the body of the percipient only when the determining organic condition is independently known. In the illusions under consideration the same sensory experience presents both the external object and the organ of perception, but in such a way that the two factors do not admit of discrimination. The special condition prevailing in the eye of one who is suffering from jaundice can be directly known only in looking at external things. If jaundice could be produced at will, or if the condition of the eye were manifested to touch, discrimination would be possible.

In such cases the chief principle which enables the distinction to be drawn is that changes in sensible appearance are taken as real so far as they receive the support and corroboration of the senses as a whole. So far as the testimony of one sense is isolated and in conflict with the rest it tends to be disregarded or dismissed as an illusion.

Corroboration varies in degree, and the resultant perceptual judgment admits of progressive refinement and correction. Sometimes the divergent testimony of the senses fails to issue in a clear distinction between the merely apparent and the real. There remains a simple conflict of appearances of which none has a better claim to acceptance than any other. This is the case as between the estimates of the two hands with reference to the temperature of the water. But such situations are normally the occasion of further exploration, the aim of which is to obtain additional evidence as to the character of the presented object. This additional evidence is not always found on the purely perceptual plane. The

final judgment will depend upon various forms of measurement and inference.

The apparent bend in an oar immersed in water provides an example of an illusion of a somewhat different type. Here, it is to be noted, the change in sensation means a real change in the external world as contrasted with the merely apparent changes due to processes in the body of the percipient. It is not, however, a change in that particular portion of matter singled out as an *oar*. The special sensations involved depend not only upon the physical object singled out for attention together with the organ of vision itself, but depend in addition upon the nature of the media through which the object is seen. The problem here is not to distinguish change in sensation due to bodily process from change due to external objects, but to distinguish between two external things.

In drawing this distinction no new principle is involved. We are guided by the testimony of the senses as a whole, and by the principles in accordance with which we attempt to apprehend the world as a single coherent whole.

So far as attention is restricted to the visual datum in isolation, the distinction is not drawn at all. We experience an illusion. But in the course of practical experiment, two lines of development enable the percipient to understand how the illusion comes about, and to distinguish two objects in the external situation.

In the first place, the nature of the central object of attention comes to be determined by the testimony of the senses as a whole. The oar out of water is straight to vision and touch alike. When immersed in the water practical activity is more successful on the assumption that it has not changed. So far the experiences involved in tactile exploration receive corroboration, while the testimony of vision stands alone.

But *pari passu* there is a second line of cognitive development in which new objects come to be known, and to these the illusory appearances can properly be referred. So far as a medium is transparent the changes it undergoes and the properties it possesses are presented to vision only as changes in other things. But the perception of the medium is not restricted to vision. In passing the finger down the oar, the

point at which the apparent bend occurs coincides with the point of contact with a separate thing. The water itself comes to be clearly distinguished as another object, and when disturbed by the hand, further changes occur in the visual datum. It is in this connection that touch—and the non-projicient senses generally—possess a certain advantage over vision. Touch has its own illusions, and in many ways it reveals much less than sight, but it is relatively free[1] from the illusion due to an intervening medium. It is also generally useful for detecting the presence of such media.

The way in which the distinction between real and merely apparent properties of objects comes to be drawn can thus be broadly summarised as follows. It depends upon the use of the two closely connected categories of 'thinghood' and causality. The same change in sensible appearance may arise in various ways and be due to various conditions which at first are not separately discriminated. So far as attention is restricted to the unitary data of a single sense no distinction of this kind is possible. But attention is not so restricted. When the change in one sensory experience is concomitant with change in another, the two tend to be jointly referred to a single thing. When there is a departure from this concomitance the change is referred to a distinct factor in the total situation. Through the mutually corroborative testimony of the separate senses the separate factors come to be discerned.

There are thus two complementary processes through which the primitive reference beyond sensation becomes an awareness of an articulate system of things. On the one hand parallel changes in different departments of sense involve converging reference to a single thing. When, on the other hand, the parallel is incomplete or inexact, there is divergence of reference from the unitary sensation to distinct and separate things. In this way what at first is illusion is often a stage in the growth of discriminative awareness. What at first is only confusedly apprehended as a distortion of something else, later may come to be known as a wholly separate thing.

[1] Relatively, not absolutely. To the blind man exploring his path with a stick, touch is a projicient sense, and illusion analogous to those due to a transparent medium are at least in theory possible.

This development may continue until the changes in an indivisible sensation becomes the means of our cognisance of a complex causal chain. Some of the variations in immediate experience are unambiguously referred to the central object of perception, some to the external medium, and some to the bodily self or the organs of perception. A movement in the visual sensory field, for example, sometimes means movement in the object perceived; sometimes it is understood as movement of the mirror from which the object is reflected; sometimes, again, as movement on the part of the percipient himself. When the conditions of discrimination are absent the result is an illusion which fails to be apprehended as such.

Clear discrimination of all the relevant conditions is not attained on the purely perceptual plane. The process of corroboration and interpretation is continued on the plane of reflective thought, where inference and scientific method are consciously employed to correct and supplement the relatively incoherent data of sense.

5. Correlation of Different Sensible Qualities as belonging to the Same Thing.—The most essential conditions for dealing with this problem have already been referred to in treating of the distinction between sensible appearance and external reality, and will receive more detailed exemplification in connection with spatial perception. Here, however, we may note two kinds of cases of correlation which require to be distinguished. There is, first of all, the correlation of the types of qualities which cannot exist apart, such as, for example, shape and size, colour and extension. Contrasted with these there are the cases in which the correlation arises between qualities between which no necessary connection is involved. An object cannot be coloured without being extended. On the other hand, there is no essential reason why that which is coloured should be a source of noise. As Ward remarks, "there is nothing in the first experience to tell the infant that the song of the bird does *not* inhere in the hawthorn whence the notes proceed, and that the fragrance of the mayflower does."[1]

[1] *Ibid.*, p. 164.

Where there is some necessary connection this is given in the unitary sensation. Intensity and quality are given in the isolated sound in such a way that it is known that neither could be present without the other. This constitutes a *prima facie* ground for reference of the two attributes to a single physical thing. But this, we have seen, may prove to be an illusion. Looking at a sheet of writing paper through blue spectacles there appears to be a single object which is both blue in colour and rectangular in shape. Later experience shows that two distinct objects are involved. What is blue turns out also to be round, and what is rectangular proves to be white. But from the outset it is clear that what is coloured must have some or other shape, and if the apparent shape does not, in fact, belong to what is really blue, some other shape, which does belong to it, remains to be found; similarly some other object remains to be discovered to which the illusory shape belongs.

The case is somewhat different when we turn to the correlation of sensory qualities which appear to have no necessary connection with one another. Why do we refer the odour, sound, and heat to the body we see at a certain distance from us? Here the main condition lies in concomitant variation. The corresponding sensations increase as we approach the object, diminish as we recede from it, and reach a maximum when we are close enough to touch it. The distant train looks small and the sound it makes is faint. As it approaches both its apparent size and the intensity of its sound pass through corresponding variation. If the boiler bursts there is a corresponding discontinuity in visual and auditory change.

Besides these conditions we must also take account of the causal interaction of things with our own bodies when we overcome resistance by effort, and the analogous causal relations of things with each other. Changes which affect a group of qualities together, either as regards their spatial relations or otherwise, tend to be regarded as changes in the qualities of the same thing. When a piece of paper comes in contact with a flame and burns, the resulting change affects permanently its appearance to all our senses. It also makes

a similar difference to the further changes which it is capable of undergoing or producing. It will not, for instance, burn again as it did before.

Attention to interactions involving real alteration as distinguished from mere variation of sensible appearance, yields the apprehension of a most important class of attributes, those which have been called by Locke active and passive powers. These consist in modes in which certain bodies can be counted on to behave when brought into certain relations with other bodies. Wax, for example, melts and clay hardens in contact with fire.

6. Hallucinations.—Are there any appearances which cannot be referred to anything at all? In the illusions so far considered, what is merely apparent is later referred to something else as real. The apparent movement of an external object means a real motion on the part of some intervening medium, or on the part of the percipient's body. The apparent blueness of the paper really belongs to the spectacles. The oar is not bent, but there is a real bend in the line through which the waves of light from the oar are transmitted to the eye. But in the case of dreams and hallucinations and certain other illusions, nothing, it might seem, is present to the mind but mere appearances devoid of objective reference in any form.

In this connection it is important to distinguish the hallucination proper from the simpler illusions.

In the case of pure illusion the senses are in a normal state and are affected in a normal way by something actually present; but the resulting impressions, either owing to inveterate association or to some other cause, suggest the presence of something of a different nature. This happens, for instance, when a wax figure is taken for a living man, or a dummy book for a real one, or an empty egg-shell for an egg with the usual contents. Similarly, when in a stereoscope two flat drawings appear as a single solid figure, the sensations experienced are produced in a normal way, but their habitual associations suggest an object different from that which is actually present.

In hallucination, on the contrary, the impressional experience is due wholly or in part to an exceptional state of the sense-organs themselves or of their nervous connections. Thus in *delirium tremens* a man appears to 'see rats' or 'see snakes' because he has impressions similar to those which he would have if he actually perceived rats or snakes, and because the acquired meaning of these impressions is vividly and irresistibly suggested by habitual association. But in contrast with cases of illusion, the impressions themselves are not due merely to a stimulus affecting the retina in a normal way: they are due instead partly or wholly to an abnormal state of the nervous system induced by alcoholic poisoning. The result is that kind of erroneous perception which is called hallucination.

A perception may be partly an illusion, and partly an hallucination. Thus we may appear to see a man, when what is perceived is really a suit of clothes. The special nature of the sensations experienced may be due partly to the suit of clothes, and partly to an exceptional state of the visual apparatus; so far as the sensations which arise in a normal manner from the external stimulus are wrongly interpreted, there is illusion; so far as other sensations due to an abnormal condition of the retina or nervous system enter into the experience, there is hallucination. It may happen in such a case that no other sensations are present except those which the suit of clothes would normally produce: and that the error lies wholly in a wrong interpretation. When this is so, the illusion is a pure illusion without any element of hallucination.

It is not necessary that all the ordinary characteristics of impressional experience should be present in hallucinations. Dreams partake of the nature of hallucinations in so far as the dreamer appears to see and hear what does not really exist in the external world. But it sometimes happens that these dream-experiences are indistinct and lack impressional intensity; and in general they are without that dependence on motor activity which marks percepts. Their impressional character is mainly due to their independence of subjective activity—the discontinuity and abruptness of the mode of

their emergence into consciousness. We are passive in relation to them in the same way in which we are passive in relation to actual objects present to the senses. Probably the hallucinations produced by suggestion in hypnotised subjects are of a similar kind.

The conditions of hallucination include certain variations in the nature and distribution of the blood-supply within the brain and pathological affection of the brain-substance. The blood may contain poisonous materials, such as alcohol, opium, ether, chloroform, and the like, which have an irritant effect on the nervous system. In sleep, owing to lowered respiration, the blood becomes charged with carbonic acid, which may have an exciting effect on the sensory areas of the brain.

Many hallucinations are the conjoint effect of the peculiar state of the nervous system and of the operation of normal stimuli on the sense-organs. So far as this is so, hallucinations assume in part the character of illusions. This holds to a large extent for dream-experiences. A slight pain in the ribs makes the sleeper dream of a stab from a dagger or of the bite of a dog. Contact with a cold body may give rise to the dream of a corpse. The excitement of the retina by internal conditions plays in some cases a very important part in constituting dream-pictures. On this subject we may quote the interesting experiences of Ladd.

"Almost without exception, when I am able to recall the visual images of my dream and to observe the character of the retinal field quickly enough to compare the two, the schemata of the luminous and coloured retinal phantasms afford the undoubted clue to the origin of the things just seen in my dream-life."[1] By long practice Ladd had acquired the uncommon power of dropping gradually into a dreaming sleep and then suddenly awaking with his attention fixed on the comparison of his dream-picture with the experiences of light and colour due to the internal processes of the retina, which in his case were peculiarly brilliant and varied.

"The most elaborate visual dreams . . .," he continues, ". . . may originate in intraorganic retinal excitement. Per-

[1] *Mind*, N.S., Vol. I., p. 301.

haps a harder problem could not be given to my experiments to solve than the following: How can one be made by such excitement to see a printed page of words clearly spread out before one in a dream? . . . But I have several times verily caught my dreaming automaton in the feat of having just performed this transformation. On waking from a dream, in which I had distinctly seen lines of printed letters forming words and sentences, and had been engaged in reading these lines by sight, I have clearly detected the character of that retinal field which had originated such an extraordinary hallucination. The minute light and dark spots, which the activity of the rods and cones occasions, had arranged themselves in parallel lines extending across the retinal field."[1]

Pure illusions are illusions in which no element of hallucination is present. The impressions made on the senses of the observer may give rise to just the same sensations as they would normally produce, and yet the things and processes apparently perceived may not actually exist or take place. It is mainly this pure illusion, unmixed with hallucination, which is exemplified in the tricks of ventriloquists and conjurers. When a juggler swallows a sword merely in appearance, the sensory impressions made on the eye of a spectator are very much the same as if the juggler had swallowed the sword in actual fact. For this reason, pure illusions may be shared by a great number of persons simultaneously. On the other hand, collective hallucinations, though their existence is guaranteed by the Psychical Research Society, are of rare occurrence, and stand in much need of explanation.

From the nature of the distinction between illusion and hallucination it is clear that the problem of mere appearances arises in its most crucial form in regard to hallucinations. When the drunkard sees pink rats it is difficult to know what is presented to him. Certainly there is no pink physical object present to his senses. The case is one in which any objective reference which is present must relate to the conditions of sensation within the percipient's body. Still we cannot say that he is really perceiving either his bodily organs or the

[1] *Ibid.*, p. 302.

specific poisons which may in fact be responsible for the experience. Strictly there is no perception of an external object or of an organ except when it is recognised as such; and the essential conditions of recognition are lacking.

But while it is not perceived as such, we may truly say that the sensation here, as in more normal cases, is something incomplete and exists only in indivisible connection with other things. But what its connections are, or what it is which appears in this experience, is so imperfectly apprehended that the immediate perceptual judgment is inevitably a delusion.

Developed awareness of the body and its states depends not only upon the direct correlations of the separate data of internal perception, but also upon the correlation of internal and external perception. Under the conditions of hallucination, neither of the modes of correlation is possible. We may say, nevertheless, that in such experiences we have the rudiments of potential internal perception, though the data so afforded are hardly likely to be employed for the purpose of extending awareness of the self.[1]

[1] They are nevertheless data for the psychologist. The principle of parallelism, which, as we have seen, is ultimately a parallelism of internal and external perception, leads us to suspect the occurrence of processes which are not accessible to direct external investigation. It is only on the basis of this principle that we presume these processes at all.

CHAPTER III.

SPATIAL PERCEPTION: (1) TACTUAL.

1. Nature and Conditions of the Problem.—We have to inquire how spatial perception develops from vague and imperfect to more definite and perfect forms. The conditions of this problem are indicated by the results of an analysis of what is involved in the spatial extension of the external world as perceived and imagined and as ordinarily conceived by the developed consciousness. Such analysis reveals on the one hand a formal constituent consisting in a certain relational order of co-existence in the way of position, distance, direction. On the other hand, it is plain that spatial extension involves more than this relational order; it presupposes also something which is ordered; it presupposes items which are connected with each other in relations of position, distance, and direction—terms between which these relations subsist. The purely relational order is found apart from extension.

Thus when we sing a tune each of the successive notes has certain temporal positions, and those that are not immediately successive have a certain temporal distance relatively to each other; there is also the distinction of temporal direction from what precedes to what succeeds. So with numerical series: 12 comes between 10 and 20 at a definite place in the numerical order, its direction relatively to 20 is contrasted with its direction relatively to 10, and it is nearer to 10 than it is to 20. If we take into account fractions, surds, and other kinds of number recognised by mathematicians, there is no relation of position, distance, or direction, whether in space or time, which is not matched by a strictly analogous numerical relation.

A similar relational order is found in merely qualitative series such as those in which colours may be arranged. For instance, in the series of intermediate gradations connecting pure blue and pure green, any blue-green or green-blue has a definite position, and a definite distance from other blue-greens or green-blues. If we select the interval between one

blue-green and another as a unit, we may measure the distance between any positions in the scale in terms of this unit. But this series of qualitative gradations is not a line in space: it does not depend on the juxtaposition of the colours, but only on their differences and likenesses as revealed to attentive comparison. It may be represented as a line in space, but only by analogy. In itself, it has no distinctly spatial character. What fixes the position of any special colour in the series is its own intrinsic quality.

It would seem, therefore, that the distinctive character of spatial order depends on the peculiar nature of the terms which are connected by spatial relation—of the parts of an extended whole. What is the distinctive character? For certain purposes, it might be sufficient to say that spatial order is distinctively an order of co-existing terms as such. But this is certainly not enough from the psychological point of view. As psychologists we are concerned with conditions through which in the first instance an order of co-existence is perceived, not with the way in which it may ultimately come to be abstractly conceived by the metaphysician or mathematician.

Approaching the question in this way, we find that the definite apprehension of an order of co-existence, as such, arises and develops only in connection with that particular aspect of sense-experience which we have called 'extensity,' and more especially the extensity of sight and touch. Two sounds or a sound and a smell may be presented as co-existent in the sense of being simultaneous; but taken by themselves, apart from association with experiences of touch and sight, they are not apprehended as spatially juxtaposed or separated by a perceived spatial interval or as having perceived spatial direction and distance relatively to each other. Such relations can only be perceived or imagined, except perhaps in a very rudimentary way, when the external object is determined for us as an extensive whole by the extensity of the same sensation through which we apprehend it.

Further, it is characteristic of perceived and imagined extension that its parts do not require to be distinguished from each other by any difference except a spatial difference,

a difference belonging to them only inasmuch as they are parts of an extended whole and not for any other reason. The parts of a visible surface are locally distinguishable from each other, however uniformly similar they may be in colour. The same holds for a surface as touched, however similar it may be throughout as regards roughness and smoothness. The local distinction depends on the ultimate difference between simultaneous sensations which we have named a difference in local sign. Extensity is nothing but the continuous repetition or diffusion of local sign difference.

Where simultaneous sensations of similar quality are not held apart by a difference of local sign they are not distinguishable from each other. Two stimuli which occurring separately would yield tone-sensations of identical pitch and timbre, produce, when they are strictly simultaneous, a single sensation of the same pitch and timbre, though of greater intensity. The perception of mere difference in place with similarity in all other respects occurs only in sensations having extensity.

The sensory order of position, direction, and distance by means of which we perceive spatial relations in the external world is, therefore, primarily a relational order connecting the distinguishable parts of an extensive experience—a local sign continuum. But it is equally clear that mere extensity is not of itself sufficient to yield the explicit apprehension of such relations between its parts. First touch the tip of the tongue and then the back of the neck with the square end of a match. The resulting sensations are in both cases extensive and through both of them we are aware of contact with an extended surface. But with the tip of the tongue the sensation is such that we perceive a surface as of a definite shape. For the back of the neck it is shapeless. Organic sensations have more or less extensity; they are more or less diffuse or restricted. But we have little or no apprehension of their shape or of the relative position and direction of their parts.

Such facts might be explained by distinguishing between cruder and finer forms of extensity. The cruder form which belongs, for example, to organic sensation, it may be said, exhibits only vague diffuseness without definite order, whereas

the finer belonging especially to epicritic touch and to sight-sensation does exhibit such an order. This distinction is probably valid if it be taken to mean that some kinds of extensity are, and others are not, intrinsically capable of exhibiting the sort of relational grouping which we are considering. But the available evidence is strongly against the view that even the finer forms of extensity are of themselves sufficient to account for the perception of relative position, distance, and direction apart from the co-operation of other factors. This is shown by the ascertained conditions of the perception of apartness in the case of skin-sensation—the discrimination of two skin-sensations as the limits of a felt interval interposed between them.

Head's experiment of cutting through the sensory nerve fibres supplying the skin of his forearm indicated that the perception of apartness is possible only for epicritic and not for 'protopathic' or deep sensibility. But even epicritic sensibility cannot be sufficient by itself. For it fails to yield the perception of apartness when the limb to which it belongs has lost sensibility to muscle, joint, and tendon sensations. As far as regards the eye, we cannot appeal to such direct experimental and pathological evidence; but here also there are considerations which show unmistakably that the apprehension of relational order within visual appearance is very largely, if not entirely, due to the co-operation of other factors than mere extensity.

If with one eye I look partly at the floor and partly at the wall of the room in which I am sitting, the visual appearance of the floor has for my perception a direction strongly contrasted with that of the wall. But it seems impossible to account for this difference of direction merely by reference to peculiarities in the extensive character of the retinal sensations which I receive in seeing floor and wall. Wall and floor both affect my eye through the light which they reflect. But the resulting groups of impressions due to the light proceeding from the floor and its parts, those which proceed partly from floor and partly from wall, and those which proceed from the wall alone, are spread out side by side on the surface of the retina in essentially the same way.

Similarly, when with either one eye or two I look at objects situated in the far distance, there is nothing in the nature of the retinal sensation received at the moment which can of itself account for the apprehension of the lines and surfaces as directed towards or away from the observer. There are no variations of retinal sensibility sufficient of themselves to account for the definite apprehension of the manifold varieties of solid figure.

The same lesson is taught by the effect of perspective and shading and similar conditions in paintings, drawings, and photographs. These factors owe their whole efficiency to their acquired meaning: and yet relative positions and directions of lines and surfaces, as thus suggested, obscure and displace for our apprehension what we call their real relation on the flat surface. Lines which are really divergent appear as parallel and lines which are parallel appear as divergent, so that it is often difficult or impossible to determine what their actual relation is without resorting to measurement.

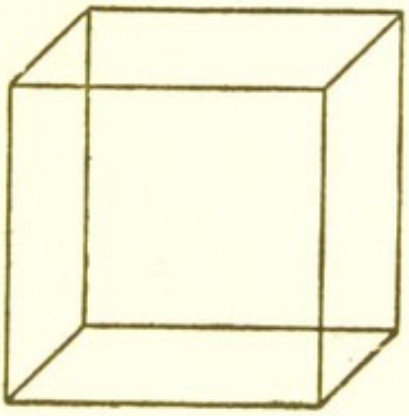


Fig. 1.

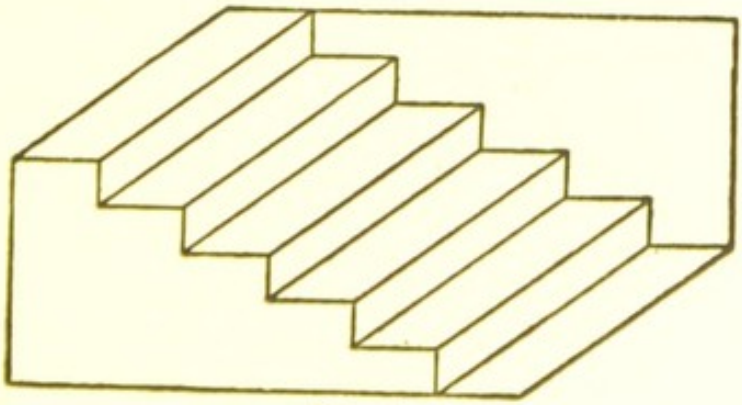


Fig. 2.

Cases of ambiguous figures are especially instructive. By an ambiguous figure I mean one which can be perceived alternatively in different ways. Thus Figure 1 may be perceived at one time as having its highest line nearer the spectator and at another as having it further away than the bottom line. Similarly Figure 2 may be seen either as an

overhanging cornice or as an ascending flight of steps. According as one or other alternative prevails, the whole visual appearance is shot through with different lines of direction. Yet there is no difference in the extensity of the visual sensations immediately due to the way in which the retina is stimulated.

Considerations of this kind, which might be multiplied indefinitely, show that, in very many instances at least, the definite relational order of visual sensations as regards position, direction, and distance cannot be explained merely by reference to visual extensity, but presupposes also the co-operation of other factors. If we also take into account the proved inadequacy of mere extensity for tactual sensation, we seem justified in adopting as a provisional hypothesis the view that in all cases relational order is not an affair of mere extensity. The verification of this hypothesis will, of course, depend on our success in working it out in detailed consistency so as to account for the facts.

Mere extensity, then, whether crude or epicritic yields only a vague apprehension of the extension of bodies. It only in part supplies the conditions of the perception of definite position, distance, direction, and shape. The difference between the tactual experiences, according as a square surface or a circular surface presses on the skin, does not of itself account for the apprehension of the one as circular and the other as square. Such various modifications of extensity are indeed ultimately necessary for perception of shape; but they are not by themselves adequate, because they do not give definite apprehension of spatial order. For this we must also have recourse to some factor distinct from bare extensity. This factor must show definite serial arrangement in the way of position and distance. It must also be so intimately connected with experiences of extensity that the definite arrangements which belong to it may be transferred to them: for it is not enough to have a pure experience of extensity externally conjoined with another experience showing a definite order of positions and distances and directions. Position and distance and direction must come to be apprehended as a relational order of the extensive whole itself.

As regards the general nature of this factor there is no room for doubt. It can consist only in experiences in the way of movement. But the word 'movement' is here ambiguous. It may refer to motion-sensations belonging properly to touch or sight. Such motion-sensations occur when a touch-sensation progressively shifts its local sign within the general field of touch-sensation, or a visual sensation shifts its local sign within the general field of visual sensation, as, for example, when a fly creeps over the skin or a flying bird crosses the field of view.

But the reference may also be to the muscle, tendon, and joint sensations which accompany the varying positions of the limbs. These are called motor sensations because they arise in dependence on the changing states of the apparatus by which the body and its parts are set in motion. Only part of the motor sensations have a distinct claim to be regarded as essentially akin to motion-sensations—those which arise through the joints sliding over one another. Both motor and motion-sensations play an important part. But of the two, the visual and tactual motion-experiences ought probably to be regarded as one of more fundamental significance in the first development of the apprehension of spatial order.

In any movement of the limbs or of the body as a whole, a series of varying sensations arises, due to the changing conditions of muscles, joints, and tendons. Following Ward, we may symbolise such a series as P_1 P_2 P_3 P_4. "P_1 cannot be presented along with P_2 and from P_4 it is impossible to reach P_1 again save through P_3 and P_2"[1] or through some other determinate motor series. These motor experiences have therefore a definite arrangement. P_2 lies between P_1 and P_3. P_2 and P_3 constitute a distance separating and connecting P_1 and P_4.

Further, if the movement is not merely made in free space, but explores the contours of some object, there is another concomitant and corresponding series having definite arrangement. Suppose the instrument of exploration is the hand. As the finger-tips pass from one part of the object to another,

[1] *Psychological Principles*, p. 150.

there is a continuously successive series of tactile experiences having a definite order, and varying concomitantly with the sensations arising from muscle, joint, and tendon. If the object explored is part of the cutaneous surface of the body itself, there is still another definitely ordered series. As the finger-tip passes along the palm of the other hand, the contact is felt not only in the finger but in the hand explored. The successive stimulation of the parts of the hand yields a succession of local sign experiences which occur in a fixed order and correspond to the succession of motor experiences. All these series have a definite arrangement of positions and distances: but the arrangement is not spatial. It is purely an order of time-sequence. Simultaneous spatial relations can only be perceived when the definite order is apprehended as the order of the parts of an extensive quantum as simultaneously presented.

It is essential to the possibility of this that the experience of extensity and the experience of active movement should enter as co-operative factors into a process having unity and continuity of interest. A process having unity and continuity of interest leaves behind it as a whole a total disposition —a disposition to which each and all of its component factors in their conjoint interaction have contributed. This cumulative disposition is re-excited as a whole when the process is repeated in part. In this way the factors which enter into the process may become profoundly modified by their previously apprehended relations, so that each separately assumes a character which it has acquired from its connection with the others. It comes to mean or stand for the others and to be modified by complication with them.

When an extensive experience has thus an acquired meaning due to its previous connection with a system of active movements, the extensive experience has become a perception of ordered extensity and therefore of ordered extension. If, on clasping an object in the hand, you know at once how to make a systematic exploration of its parts, so that you will have nothing to learn by actually executing exploring movements, then you have an adequate perception of its shape and other spatial determinations. If, on the other hand,

mere contact with the object does not fully supply precise and definite guidance to the movements of exploration, the spatial perception is *pro tanto* inadequate. When the perception is adequate, any two local signs or any group of local signs prompts at once the appropriate movements for passing from part to part of the object. Extensity which has thus acquired meaning is no longer mere extensity, but a continuous complex of positions and distances. Just as the passive touch acquires in this way a properly spatial significance, so the active touch, which is at first a purely successive series, also acquires a spatial character. As the finger-tips pass over an object, the successive tactile experiences do not present themselves as merely a time-sequence. They become for consciousness the successive presentation of a whole of coexistent parts.

If we inquire what the appetitive processes are into which extensity and active movement enter as co-operative factors, we may answer by referring to all the primitive activities by which the ends of animal life are secured. Such practical activity can be effective only in so far as active movement is delicately adjusted to the shape, size, distance, etc., of objects. The guiding clues to such motor adjustment can be found only in touch- and sight-experiences. But just in so far as the touch- or sight-experiences either originally possess or subsequently acquire the power of guiding active movement, they are or become perceptions of spatial order.

We have now at once to explain and to justify these general statements by an account of the special conditions by which the development of (1) the tactual, and (2) the visual, perception of spatial order is determined.

2. Spatial Perception of the Blind.—The existence of blind persons enables us to study touch-space dissevered from sight-space. But it is essential for this that the blind persons should either be blind from their birth, or have lost their sight in the first years of their life.[1] Those who have become

[1] The facts adduced in this section are largely due to Heller's most valuable *Studien zur Blinden-Psychologie* in the *Philosophische Studien*, Bd. XI., pp. 226, 406, 531.

blind in their fourth year translate their tactile impressions into visual imagery as we ourselves do in the dark.

It must be understood that the observations and experiments on which we rely are all made on blind persons who have already acquired considerable experience. Their spatial perception is therefore at the outset developed in some measure. What we can observe therefore is only the process by which greater precision and accuracy are acquired. It is fortunate for psychological purposes that spatial perception by touch frequently does not reach full maturity with nearly the same rapidity as spatial perception by sight. Hence even in the adult blind, it is possible to observe it in the process of growth.

The chief instrument used by the blind in perceiving the shape and size of objects is the hand, or rather the two hands. These are used in a twofold way. (1) The hand, either open or closed, may touch simultaneously the parts of the object. This may be called 'passive touch,' because it does not involve active movement from one part of an object to another. It may also be called 'synthetic touch,' because it yields a total simultaneous impression of all or many parts of the object. (2) A portion of the hand, such as the finger-tips, may explore the parts and contours of the object by gradually moving over them. This may be called 'active touch,' because it essentially consists in active movement. It may also be called 'analytic touch,' because it analyses or breaks up into a series of successive impressions what synthetic touch presents as a simultaneous whole. Now the main lesson that we learn from study of the blind is that development in the definiteness of the perception of spatial order is essentially due to the intimate union and co-operation of synthetic and analytic touch.

The first question with which we have to deal is—What information concerning shape and other spatial determinations is conveyed by synthetic touch apart from analytic? Of course, we cannot bring synthetic touch into play in absolute severanace from analytic, for we are considering persons who have already had considerable experience in the exploration of objects and especially of their own bodies. In the case of simple and familiar things which they have already

often explored by active touch, they can at once recognise shape, size, etc., by merely passive contact. But when objects are presented to them with which they are quite unfamiliar, it is found that for precise apprehension analytic touch must be combined with synthetic. Synthetic touch alone, without the aid of previous experience, yields at the most a general and schematic total impression. For instance, they can tell whether the object is round or angular, and whether it is regular or irregular. But for more precise determination of its shape, analytic movements are required.

It is particularly noteworthy that the blind are almost incapable of confining themselves to purely synthetic touch when the object is at all unfamiliar. Involuntary twitchings of the hand occur which they find it difficult or impossible to suppress.

In the active exploration of objects there is a great difference in the method of procedure in different persons, and in different stages of development of the same person. The more highly the spatial perception has been developed, the more systematic and appropriate are the movements and their combination. At the highest stage the blind use a plan of procedure identical in its main features in different individuals. This is sometimes acquired in early childhood where the conditions are favourable. If the blind have to work with their hands, they always acquire the power of apprehending simple spatial relations. On the other hand, adults of otherwise good intelligence, who have not been compelled to acquire control over objects by pressure of practical needs, often show great helplessness, and do not appear to have any interest in spatial relations. In such cases, a special education of perceptual activity is required for adequate apprehension of the shape of objects. As education advances, the blind person becomes more and more capable of determining the size and shape of objects presented to him. At the same time, his active movements of exploration show a more and more systematic and purposeful character.

In higher stages of development the process of analytic touch takes a form such as the following. One hand holds the object in position, and turns it so that it may be con-

veniently explored by the other. Finger and thumb are the instruments of exploration, and they are used simultaneously. The finger glides along one contour of the object, and the thumb along an opposite contour. The varying distance of finger and thumb, as they proceed from their starting-point, measures and determines the distance and direction of the boundary lines. If finger and thumb retain the same relative position, the boundary lines are parallel; if they move apart, the boundary lines are divergent; if they approach each other, the boundary lines are convergent.

When in this process of analytic exploration the object is pushed backwards till it touches the surface of the hand, analytic touch passes into syhthetic. The two hands sometimes interchange functions, and at intervals synthetic touch intervenes, the object being clasped and pressed. As a rule, synthetic touch comes first, and introduces analytic. All active exploration is brought into connection with the total presentation of the object, as it exists for passive touch. The more practised a blind person is in the apprehension of the configuration of bodies, the more rapid and sketchy are the active movements necessary for adequate perception. Indeed, all the facts show that neither active nor passive touch alone suffices. The perception of spatial order is a product of their union and interaction.

This co-operation of synthetic and analytic touch is possible only for objects small enough to be taken in the hand, or at least in both hands. Larger objects cannot be apprehended as a whole by synthetic touch. Active movement, it would seem, must in these cases be the main resource. But this is not quite true. The blind person can often measure the dimensions of the object by the dimensions of his own body, comparing, for instance, its height with his own height.[1] The significance of analytic touch as applied to larger objects depends upon the significance which it has acquired in co-operation with synthetic touch. Some blind persons are unable to acquire precise spatial apprehension of those objects which cannot be immediately clasped by the hand. This

[1] We shall presently have to consider the conditions under which the spatial relations of the body itself come to be presented to us.

inability manifests itself in their movements of active touch, which are for the most part limited to the discovery of some striking and distinctive feature of the object which can serve as a sign of it.

But it is often possible to induce these persons to undertake a systematic exploration of larger objects in the way of active movement, by putting before them models of these objects on a reduced scale. They are thus prompted to compare originals and copies. Afterwards they freely apply the system of movements thus acquired to all objects which require and admit of them. As in the active exploration of small objects the convergence and divergence of thumb and finger play a prominent part, so in the exploration of larger objects the convergence and divergence of the two arms is of the greatest value. There is a link of connection between these two methods, inasmuch as it is possible to use either of the two methods for smaller objects. A thing may either be taken between the opposing thumb and finger-tip or between the opposing fingers of the two hands.

So far, we have dealt with the exploration of comparatively limited spaces. We have kept within what may be called the 'touch-horizon.' This is very much more restricted than the visual horizon. Its utmost limit is the space that can be embraced by the outstretched arms. Larger spaces than these can be explored only by locomotion of the whole body, in which extension previously presented is completely left behind. We thus have a series of fragmentary sensations. For fully precise spatial apprehension these must be gathered together into a single simultaneously presented whole.

It is conceivable that this might be effected by mental images of the parts not immediately perceived. To a certain extent the blind may actually proceed in this way. But they can do so only by reproducing the whole on a reduced scale. The scale of their imagination is limited by the range of their actual perception. The same is true of those who can see. We cannot mentally visualise a spatial expanse larger than the field of view as given in actual perception.[1] If we are to

[1] Of course we can think of such an expanse, although we cannot picture it.

include in the purely mental field of view objects beyond the range of actual vision, we must make a schematic representation of them on a reduced scale. Those who are confined to the sense of touch may follow an analogous plan; but their power in this respect varies with the individual, and is in any case very much more restricted than that of persons who can see.

We must not, however, suppose that where the apprehension of the parts of a spatial whole becomes purely successive, the parts themselves are presented as successive, so as to transform a spatial perception into a temporal perception. On the contrary, the movements of exploration have already acquired a spatial significance through the experiences obtained within the limits of the touch-horizon. Hence the parts of the spatial whole which successively present themselves are apprehended as related in the way of coexistence, although they cannot be simultaneously presented.

Similarly, in walking along a road for ten miles, a person who can see, has a number of successive fields of view which cannot be simultaneously presented either actually or ideally. But he does not apprehend these fields of view as forming a time series: he apprehends them as successively presented parts of a coexistent whole. The reason for this will become clearer in the sequel.

3. Localisation and Projection.—For the developed consciousness skin-sensations have a double function. On the one hand, they inform us of the extension of the surface of our own body and of the shape and the relative position, direction, and distance of its parts. So far as this is the case, skin-sensations are said to be localised. On the other hand, they inform us of the shape and the relative position, direction, and distance of bodies external to our own. So far as they do this, they are said to be projected.

The terms projection and localisation have become established by usage. But they are apt to mislead. For they tend to suggest that we begin by referring skin-sensations to the skin itself as their seat, and that in afterwards referring them to things outside our body we undo this original connec-

tion and, so to speak, throw them outwards. That this is a fallacy is sufficiently indicated by the parallel cases of visual and joint sensations. Visual sensations are not originally localised in the retina. Further, they never come to be localised in the body like tactual sensations because for this a special system of experiences is required which in their case is absent.

The distinction between localisation and projection is a distinction of acquired meanings and not an original datum of tactual perception. Projection distinctively and primarily depends on the system of experiences connected with the active movements whereby we explore the surface of things external to our own bodies, as when I pass my hand over the surface of a table; also, in a less degree, on the motion of outside things over the surface of our bodies while we remain relatively passive, as when a fly creeps over my cheek. Localisation distinctively and primarily depends on active movements by which one surface of the percipient's body explores another, as when I pass my hand over the surface of my arm or my legs rub against each other.

The processes through which localisation and projection develop are distinct; but they are by no means isolated. On the contrary they continually condition and support each other, each advance in localisation making possible further advance in projection and inversely. In particular, the progress of localisation is of the highest importance for the full development of projection.

4. Projection.—Let us first consider projection apart from localisation as it might proceed if the skin, like the retina, were incapable of exploring itself. I lay the palm of my hand on the surface of a table. In so doing, I experience an extensive complex of sensations, emphatically different from any I should be experiencing if my hand were not pressing against such a surface and also emphatically different from those I should be experiencing if my hand were in contact with my own body. Since such a complex possesses extensity, it will, of itself, yield a crude awareness of extension, independently of acquired meaning and complication.

But the perception of apartness, shape, and definite spatial order requires to be otherwise explained. How does it arise in the first instance? Suppose that I move my hand over the surface of the table. Part of what happens is that new tactual sensations gradually emerge and at the same time others cease. This is a point to which we shall presently recur. But, besides this, sensations previously experienced continuously shift their local signs. For example, a touch-sensation, having originally the local sign distinctively dependent on contact with the tip of the middle finger, comes to have the local sign distinctively dependent on contact with some part of the ball of the thumb, and in the process of transition successively acquires a series of intermediate local signs.

Any tactual sensations within the extensive whole may in this way, by means of appropriate movements, progressively shift their local signs so as to acquire those originally belonging to any others within the same extensive complex. Here, then, we have precisely that awareness of mutual relation between extensity and motion which is required for the growth of the perception of apartness, direction, and distance —of a rudimentary spatial order.

So far, I have considered only skin-sensations—an extensive tactual field and changes of local sign within this field. But movements of active exploration also involve, besides the motion which is merely an affair of cutaneous sensibility, corresponding series of motor experiences due to muscle, joint, and tendon. Of these, the joint-sensations at least are akin to touch proper, and change as a limb moves in a way akin to the shifting of the local signs of tactual sensation.

The motor sensations in general, and more especially the joint-sensations, render very important help in giving definite awareness of apartness, position, distance, and direction within the extensive field of tactual experience and therefore within the extension of the external object. At the same time they become complicated with the tactual experiences so as to acquire a meaning which persistently clings to them even when the corresponding series of skin sensations is absent. They come to mean, even when they occur by themselves, extension, position, distance, and direction. Thus, when my

hand passes over the surface of the table and beyond it so that experiences due to contact with it cease, I am still aware of space traversed, though in this case of empty as distinguished from filled space.

This seems fully accounted for by two conditions: (1) the category of spatial unity which leads the mind to apprehend any given bit of extension as only a bit, and therefore as having a continuation beyond itself; (2) the meaning acquired by motor sensations through their union with tactual extensity and tactual motion.

I have, for the sake of clearness, referred only to one simple and primitive example of the mode in which the perception of spatial order may be acquired. But of course the same essential conditions may be varied in endless ways and endlessly repeated in each of them. In particular the alternate interchange of passive or synthetic contact with a surface as a whole and the successive exploration of its parts one after another is of the greatest importance in all but the earliest stages of development. After touching a surface, as a whole, with the palm of my hand, I may raise my hand so as to leave only the tip of one finger in contact with it, and then I may explore one by one with this finger the parts which I had previously touched all together; or I may first touch it as a whole with one hand, then explore in detail with the fingers of the other, and so on. In such processes, the variations of sense-experience due to free movements are referred to sensible appearance only; hence the surface of the external object is throughout identified as the same.

Besides the continuous shifting of the local signs, active exploration of the surface of a body also involves the progressive incoming of new sensations together with the disappearance of those previously experienced. If, as Berkeley supposed, we were aware only of the sensuous experiences without reference to anything else, the result of this would be merely an apprehension of a temporal sequence of sense-experiences, not of an order of coexistence. It would not convey the perception of the parts successively touched as persisting and coexisting in contrast to the transience of the sensations as they begin and cease.

That in fact we do apprehend in this way the ordered co-existence of the enduring parts of the external object is due to the following conditions. (1) Sense-experience originally means the existence of connected physical things, and the relational order of sense-experience means a relational order of those things. (2) The kind of motor activity by which we pass from one part of a surface to another, inasmuch as it does not involve the overcoming of resistance by effort, is regarded as determining change in sensible appearance rather than change in the thing perceived. (3) The emergence and disappearance are gradual: we have, for instance, to begin with the simultaneous group *a*, *b*, *c*, *d*, *e*, *f*, then *b*, *c*, *d*, *e*, *f*, *g*, then *c*, *d*, *e*, *f*, *g*, *h*, etc. (4) The category of spatial unity is throughout operative, leading the percipient to look beyond any given bit of extension for its further continuation.

As regards the perception of a third dimension, we have already noted that, though this is primary, it differs radically in nature from the perception of surfaces. So far as it is primary, it is inseparably bound up with the apprehension of spatial unity. We are initially aware of it inasmuch as we are aware of surfaces as being only surfaces—boundaries of solid extension. We are aware of any bit of surface not merely as continued beyond itself superficially, but also as continued into a third dimension. This is the germ from which the perception gradually grows. Further development depends on increasingly definite and detailed apprehension of the relative position and direction of different surfaces and of their varying shape as flat or as curved in various ways.

This development, so far as it is connected only with exploration of outside things and not with the spatial apprehension of the percipient's own body, is essentially dependent on motor sensations and their acquired meaning. If I pass my hand over the surface of the table to its edge and then beyond it so that contact with the table ceases, I am still aware of the extension previously perceived as continued in empty space. But there is an indefinite variety of alternative continuations according as my hand moves in various possible ways. Thus the edge of the table comes to be apprehended as a common

boundary of many diverging surfaces, all of which have a common continuation on the surface of the table.

Again, motor series differ in marked ways according to the shape of the surface explored, according as this is flat or spherical, concave or convex. All such differences as they emerge are interpreted with reference to a third dimension on the analogy of the relation of limiting lines within a surface to the superficial extension which they bound. As, for instance, a circle is enclosed by its circumference, so a spherical surface encloses a sphere.

Apart from muscle, joint, and tendon sensations, there are also highly important differences in the feel of different kinds of surfaces. But these variations of merely tactual sensibility do not of themselves suffice to yield awareness of shape and direction in the third dimension. They only come to do so through meaning acquired by them in connection with motor sensations. There are marked differences of tactual sensation according as my finger tip presses the level surface of a table or its edge or the round surface of a billiard ball. But the difference arises merely from the varying distribution of intensity of pressure. When I press a level surface, resulting touch-sensations are of approximately equal intensity. When I press the surface of a billiard ball, the extensive complex of tactual sensation has a central part of maximum intensity round which other sensations gradually decrease in intensity. Such variations will not of themselves originally suffice to give the apprehension of the shape of surfaces. But they come to do so by association with experiences of active movement, much as varying distributions of light and shade come to signify for the eye variations of solid figure in things seen.

5. Localisation.—All the conditions operative in the exploration of outside things are also operative in the exploration of the percipient's own body. But other factors also come into play, and these are of the utmost importance. In the first place, there is the doubling of sensation due to the fact that when one part of the skin comes into contact with another, both surfaces are sensitive. There are thus for every such contact two extensive sensations which appear, disappear,

and persist together, and vary in intensity concomitantly with each other.

The consequences of these double-contact sensations are immensely important as regards acquirement of meaning. Each of the two groups of tactual experiences acquires spatial meaning, as it would in the exploration of things outside the percipient's own body. All that we have said in dealing with projection applies here also. But, besides this, the associations which each would acquire separately are through their constant union permanently communicated to the other as well.

If the right hand alone were sensitive and the left insensitive then tactual exploration of the left by the right would yield only perception of the extension and spatial order of the left; the sense-experiences connected with the right hand would not thereby come to yield perception of its own extension and spatial order; nor could this be supplied by the left since the necessary sensations would be absent; for the same reason, the left hand could not come to feel its own extension and spatial relations. But owing to double-contact experiences, the mutual exploration of the two hands gives an essentially different result. The skin-sensations connected with each come to mean not only the extension and spatial relations of the other, but also its own. Further, the spatial awareness of the surface of the skin itself, due to its own sensations, persists, however these sensations may be excited. When once acquired it accompanies the sensations due to contact with things outside the body.

It depends on circumstances whether we attend especially to the spatial relations of the thing touched or to those of the skin which touches it. When the body touched is relatively interesting as requiring practical adjustment or for any other reason, projection predominates over localisation. When, on the contrary, it does not demand practical adjustment and is of too uniform and familiar a character to excite interest through its comparative novelty, localisation predominates over projection. We do not, for instance, usually take notice of contact with our own clothes or with the surrounding air, even when we move through it. Indeed, we usually treat the surrounding air as if it were empty space.

In the case of organic skin sensations such as those due to a blow, localisation is emphatic, though it is also accompanied by distinct projection at the moment when the sensation arises through the action of an external body.

To understand the full significance of this awareness, which we have by way of skin-sensation, of the extension and spatial order of the surface of our own bodies, we must take another point into account. The whole sensitive surface of the skin is normally the source of sense-experiences, apart from what we ordinarily call contact with external bodies. This is in part due to unnoticed contacts which escape attention through their uniformity and familiarity—those with slight currents of air or with our clothes. It is also in part due to inter-organic conditions, such as the circulation of the blood.[1]

Whatever may be the operative conditions, it is at least true that we have only to attend to any special area of the cutaneous surface in order to detect the presence of touch, temperature, and organic sensations. Many of these are comparatively feeble; but others are emphatic, like the organic sensations of itching or tickling, or those which persist as the after-effect of a bruise or a burn. Marked after-sensations also frequently follow the motion of an external body over the skin in the path which it has traversed.

This continuous presence of a total extensive field of skin sensation gives rise to a combination of passive or synthetic with active or analytic touch which is not found in exploration of bodies external to the precipient's own organism. In the case of external bodies, active exploration of the parts of a whole, and simultaneous contact with the whole, cannot co-exist; so that synthetic and analytic touch can only come into play alternately. But when the finger-tip passes over a surface of the skin, we have not merely a series of successive touches, but also a persistent field of cutaneous sensation corresponding to the whole of the surface explored.

[1] Perhaps we ought to assume that, as in the case of the eye, apart from stimulation by light, there is visual sensation, due probably to central, not to retinal conditions, so there are touch-sensations, due to similar conditions, apart from external stimulation.

By continual exploration of the body in various directions, this background of synthetic touch acquires a spatial significance. There thus arises a direct sense-perception of the configuration of the body and its parts which is always with us, whatever other spatial perception we may or may not have at any moment. This primitive awareness of the spatial qualities of our own body is of great importance as a preparation for the perception of spatial relations in external bodies. Owing to it, both synthetic and analytic touch as applied to external bodies have a spatial significance which they would not otherwise possess.

6. Influence of Localisation on Projection.—This aid and reinforcement which projection derives from localisation assumes manifold forms too numerous to discuss in detail. It will be enough to refer to some points of cardinal importance.

Consider the act of grasping an object between finger and thumb. When the object grasped is a part of our own organism, such as the hand or the leg, the skin surface which lies between the contact of the thumb and the contact of the finger is itself the seat of cutaneous sensation which has acquired spatial significance. Thus the interval between finger and thumb is directly perceived as an extended whole by synthetic touch. The extension is greater or less according as the thumb and finger are more or less widely apart. Hence, when an external body is taken between finger and thumb, the interval between them and the variations in the amount of this interval are already perceived as a spatial interval having varying degrees; and this must contribute to give greater definiteness and precision to the perception of spatial distance in the thing touched.

Further, when one part of the skin comes in contact with another, the area touched is apprehended as part of a wider area surrounding it; or rather of two wider areas surrounding it. For instance, when the palm of one hand is laid upon the palm of the other, the area of contact is apprehended both as a portion of the total surface of the right hand and arm, and as a portion of the total surface of the left hand and arm. When the palm of the hand is applied to an external object,

the area of contact is immediately perceived by synthetic touch as part of the total surface of the hand and arm. It is not directly apprehended by synthetic touch as only a portion of the surface of the external body. But previous experience of the kind in which one hand is laid on the other, must constitute a certain preparation for regarding the area of contact as a portion not only of the body surface, but of the surface of the object touched; and it must therefore help to give significance to the active movements by which other parts of the external object are explored.

Measurement by superposition has its psychological beginning in localisation and the union of localisation and projection. To be aware of superposition is to be aware of two surfaces as spatially related in such a way that there is no distance between them. Now the distance of a surface outside us from the surface of our body is roughly measured by the series of motor sensations required to give certain touch-sensations. When the touch-sensations occur the continuance of free movement occasions their disappearance. Hence at the time of their occurrence the surface of the external thing is apprehended as being at no distance from the surface of the skin touching it. But this presupposes that through the same extensive group of tactual sensations we have at once a perception of the surface touched and of the skin touching it as coincident with one another.

The fact that it is the self-same sensations which yield the apprehension of both surfaces as separated by no distance accounts for their being apprehended as identical in size. Thus when I place my hand on the table I am at once aware of the extent of surface touched as equal to that of the surface of the hand touching it. When one part of the skin is in contact with another, there are two groups of sensations each of which yields perception of both surfaces, and of both surfaces as having no distance between them. Such measurement by superposition enables us to allow for the variation of extensity for different areas of the skin, so that we refer this to sensible appearance rather than to external reality.

It is plain that the perception of spatial relations in the third dimension is immensely helped by our perpetual aware-

ness of the surface of our own body and the spatial order of its parts. Out of the endless ways in which this takes place we may select a few by way of illustration.

When my hand presses the surface of an external body the resulting sensations yield at once the awareness of the surface of the body touched and of the surface of the hand, with no intervening distance. If, now, I raise my hand, I am aware of the separation of the two surfaces with a greater or less distance between them marked by motor sensation. But this distance, inasmuch as it is a distance between different surfaces in contrast to a distance between parts of the same surface, must be apprehended as an interval in the third dimension, an interval of solid space. The same holds good for the contact and separation of areas of my own skin, except that in this case I continue throughout the process to have a separate perception through appropriate sensations of both surfaces.

When my hand is partially closed, so that the thumb is touching the index finger, I perceive each surface directly, each through its own sensations, and also through those of the other. If I now separate finger and thumb, I still have a perception, through actually present sensation, of both; and I am aware of their surfaces as separated by an intervening tract of tri-dimensional space, greater or less according to the motor sensations which accompany the movement. In this way, each group of muscle, joint, and tendon sensations which I may experience at any moment comes to mean for me a certain relative position and distance of finger and thumb.

Let us now suppose that finger and thumb hold between them a marble or ball or other solid body. Then the distance between them as determined through motor sensations means the distance between the opposite surfaces of the thing which they grasp. Again, suppose that we stretch out a hand so as to touch something in front of us; the distance of what is touched is measured by our awareness of the length of the outstretched arm; it is an arm's length away. Finally, the extension and shape of our body as a whole and of each of its members can only be apprehended as extension and shape in the third dimension. It is a surface returning on itself so as to form a closed figure. But a surface returning on itself so as to form

a closed figure can only be apprehended as bounding off a solid space enclosed within it from a solid space surrounding it. This perception of our body as solid is also made more vivid by the extensity of organic and motor sensations which yield the vague apprehension of surfaces inside it.

7. Congenital Dispositions for Spatial Perception.—It is clear that to a very large extent the apprehension of a spatial order in the way of position, distance, direction and shape arises, as we have described, through a progressive union of extensity with motion-experiences and motor experiences. It may, however, still be questioned whether it is entirely to be explained in this way. All that we can say is that apart from definite evidence to the contrary we have a right to assume that the same principle which covers the facts so far as we can trace them also applies when direct means of testing fail.

But it does not follow, even if we assume that all perception of spatial order is acquired, that it must therefore be acquired entirely by each individual percipient for himself. It has frequently been maintained, especially by Herbert Spencer, that the individual starts his own development with an initial equipment due to the inherited dispositions formed through the experience of his ancestors. On this view, retentiveness operates in the transition from generation to generation, in a way essentially analogous to that in which it works in the development of the single individual. The hypothesis is attractive. But from the biological point of view it is doubtful whether we are justified in assuming the "hereditary transmission of acquired characters"—characters acquired by an individual in the course of his own life history.

It may be that the parent organism transmits to its descendants only such characters as belong to it at birth, and not those special modifications which it acquires for itself. Ancestral experiences may not be retained and revived in subsequent generations as an earlier experience is retained and revived in subsequent experiences of the same individual.

None the less, there is no doubt that congenital predispositions do play a most important part in the growth of spatial perception. The development depends on the union of

extensive experience with active movements. But we have seen, in discussing instinct, that animals are born with a congenital equipment which leads them to perform more or less complex and definite series of movements under appropriate conditions without having to learn them by experience, and that they are born with a strong impulse to such motor activities which again does not need to be acquired by previous experience of consequences. The chick, for instance, in emerging from its shell, pecks at suitable objects. This does not necessarily imply that it is aware, from the beginning, of the distance, situation, and direction of the objects. But the experiences which accompany instinctive actions of this kind are just those which are required for the acquirement of the perception of spatial order. Nature intervening at the outset, supplies the animal with appropriate material for learning the needful lesson; it also supplies a special interest and a special power of retentiveness.

These last factors are of peculiar importance for the higher animals, and, above all, for human beings. The congenital preparation in human beings does not usually take the form of ready-made and precise adaptation for complex series of movements. What we find in a rudimentary form in them is more of the nature of general tendencies to certain kinds of motor activity, like walking, running, articulate utterance, and a peculiar ability for learning to perform such movements in varying special ways. This ability includes a special capacity for being interested in certain directions, and a special power of retentiveness in the same directions.

It is because of such specialised interest and retentiveness that learning by experience is so very rapid and its results so permanent in the first years of childhood.[1] There seem however to be, besides, certain eye-movements which are congenitally definite.

[1] It should be noted that what is congenital in the human being does not necessarily appear in the new-born infant. The nervous system of the new-born infant is very far from being fully grown. Much comes to it by mere physiological growth as distinguished from learning by experience. The same is also to some extent true of the new-born dog and other higher animals, though the growth in this case is much more rapid.

CHAPTER IV.

SPATIAL PERCEPTION: (2) VISUAL.

1. General.—There is no difference in principle between the process by which the visual perception of space is developed, and that by which the tactual perception is developed. Both depend on a combination of analysis and synthesis. Active sight corresponds to active touch, and passive sight to passive touch. There is however this important difference, that, in the case of sight, synthesis and analysis are much more intimately combined. They are for the most part simultaneous rather than successive. We have in the eye an expanded surface sensitive to light, but near the centre of this surface there is one spot in which visual sensation is peculiarly delicate and distinct. Thus there is at any moment of vision a general field of view seen by the eye as a whole, and a limited area within it seen with peculiar clearness and distinctness by the central spot, called from its colour the yellow spot. Within the yellow spot there is a pit or depression called the *fovea centralis*, and here discrimination is most delicate of all.

Now, active sight consists in movements of the eye which successively bring the outlying parts of the field of view within the area of distinct vision. A certain amount and direction of movement is required in order that a stimulation situated in a given position in an outlying part of the retina may be transferred to the yellow spot. Thus by a highly organised system of definite movements the eye is perpetually passing to and fro over the field of vision, bringing its parts successively into the area of distinct vision. The development of spatial perception, as dependent on sight, is coincident with the perfecting of these movements, and of others connected with the co-operation of the two eyes.

Though the visual and tactual perception of space depend on essentially similar conditions, there are specific peculiarities

in the case of sight which require separate treatment. In the first place, visual perception of space cannot be adequately discussed unless we take into account its relation to the tactual experiences which arise in the actual manipulation of objects. The spatial perception is throughout its development determined by practical interest. The object of perception is ultimately always *real* extension, figure and magnitude; but these are much more directly and accurately revealed in tactual experience than in visual. Variations of the visual experience are constantly occurring, which imply no variations in the size, figure, and position of the objects seen, but only variations in the position of the body or eyes of the observer.

In the second place, the eye has means of perceiving the third dimension which are denied to touch. This arises from the fact that the eye is stimulated by objects at a distance from the body.

2. Advantages and Disadvantages of Sight as Compared with Touch.—Sight as a means of spatial perception has the following disadvantages as compared with touch.

(1) The conditions of localisation as distinguished from projection are absent in the case of the retina. One part of the retina cannot explore another so as to get double visual sensations comparable to double-contact sensations. Hence light and colour-sensations never yield any perception of the extension of the retina itself, its shape, or the spatial arrangement of its parts.

(2) The surface of the retina is not in direct contact with things seen. Hence there is great and incessant variation of visual appearance for things of the same size and shape according to their varying distance and direction from the eye and the varying conditions of illumination. Whatever makes a difference to the light on its way from the thing perceived to the eye makes a difference to the resulting sensation.

(3) The movements of the eye are restricted; it turns upward and downward or to right and left, and in intermediate directions; but it cannot move away from the head as the hand can move away from the trunk. This deficiency is

of course partially compensated by movements of the body as a whole or by backward and forward movements of the head.

(4) The motor apparatus for the eye has no joints and therefore its movements are not accompanied by joint sensations. Hence, apart from retinal experience itself, they are mainly appreciated by the tactual sensations due to the rolling of the eyeball in its socket. The evidence seems to show that discrimination by this means alone is relatively vague and inaccurate. Finer discernment depends on sensibility to changes in the local sign of visual sensations as the eye moves.

On the other hand, sight has the following advantages over touch:

(1) *Comprehensiveness.*—The field of view has a vastly greater range than that of touch, inasmuch as it usually includes sensations from a vastly more extended portion of the external world.

(2) *Greater Delicacy.*—Visual sensibility is more finely differentiated than tactual sensibility.

(3) The use of two eyes yields a peculiar system of local signs of great importance for the distinction of the positions of objects before and behind that point of the field of view which is most distinctly seen at any moment. These local signs are due to the local sign fusion which takes place when a sensation belonging to one eye coalesces with a sensation belonging to the other in a single sensation without local distinction.

(4) In the case of the eye there are many and various sensible appearances which through constant association come to signify spatial relations, although they do not directly and essentially contribute to the process through which such relations are first apprehended—the distribution of light and shade and geometrical perspective are examples.

Balancing advantages against disadvantages we may say generally:

(*a*) The disabilities of sight render it incapable of developing an adequate spatial perception independently of touch and movements of tactual exploration; also in the end the data of sight are tested in cases of doubt by those of touch. Spatial

perception starts from and is ultimately referred to a tactual base.

(*b*) On the other hand, as visual perception develops, it yields an apprehension of spatial relations far wider in range and more delicately discriminative than is possible for touch alone.

The problems which require discussion in the case of sight are mainly connected with the perception of spatial relations in the third dimension. But we shall first deal with the relative parts played by sight and touch in the perception of the directions, up and down, right and left.

3. Distinction of Up and Down and of Right and Left.—It is a well-known fact that the image formed on the retina by the light proceeding from the things we see is inverted. Rays from the lower part of the object fall on the upper part of the retina and inversely; rays from the right side of the object fall on the left side of the retina and inversely. Yet visual appearances are not perceived as upside down or with their left side on the right and right side on the left. The reason is that the distinction of right and left and of up and down is primarily due to tactual exploration and is for the eye an acquired meaning. It is true that the directions which we name in this way are distinguishable through visual experience and eye movements. As the eye turns upwards or downwards, retinal impressions progressively shift their position in opposite ways with correspondingly contrasted series of changes of local sign of visual sensation. This is enough to yield the apprehension of two contrasted directions. But it does not of itself account for these directions being felt as upward and downward; and the same holds for the distinction of right and left.

It has been suggested that one direction is felt as upward because we have to move the eyeball upward in order to obtain the required series of local sign changes and that for the like reason the opposite direction is felt as downward. But this view was refuted by a very interesting experiment, carried out by Stratten,[1] as follows:

[1] *Psychological Review*, Vol. III., No. 6, Vol. IV., Nos. 4, 5.

By wearing glasses suitably constructed he obtained retinal images for his whole field of view which were not inverted. In other words, his visual sensations were such as they would have been if all visible objects had been turned round through an angle of 180°. The result was at first bewilderment and almost total inability to adjust himself and his actions to his environment, except in so far as he succeeded by an effort of memory in recalling the usual appearance of familiar objects. Their actual appearance seemed to him dreamlike. He was aware of it as mere sensible appearance in contrast with external reality. But he gradually learned to guide his movements directly in relation to his novel experience and so to correlate and harmonise the data of sight and touch. So far as he succeeded in doing this without effort and sense of strangeness, he ceased to apprehend the new visual appearances as inverted. He felt as if he were looking upward when he moved his eyeballs downward, and he felt as if he were looking to the right when he moved his eyeballs to the left.

The whole experiment shows that the distinction between up and down, as such, and that between right and left, as such, primarily belong to touch and are for the eye acquired meanings. This may prepare us for finding in other cases that what now seems to be directly seen really presupposes the co-operation of vision with tactual exploration.

4. Secondary Means of Spatial Perception by the Eye.—Setting aside, for the moment, the peculiar system of local signs due to the conjoint use of two eyes, the visual sensations produced by things seen at different distances do not vary as regards extensity in any other way than those produced by things at the same distance. In both cases there is the same kind of difference in the size and outline of the retinal impressions. Further, the eye cannot move out of its socket away from the body. With a reservation, to be noted presently, connected with the use of two eyes, the eye movement from near to far is the same as the eye-movement from lower to higher. How are these initial disabilities overcome so as to yield the apprehension of spatial relation in the third dimension which we have even when we use only one eye? As a first

step towards answering this question we may begin by noticing the manifold secondary means of spatial perception which are plainly from their very nature due to acquired association only.

There are, as I have already indicated, highly complex and multiform conditions which play a most important part in our developed visual apprehension of spatial order, but which cannot be regarded as original factors directly and essentially contributing to it. So far as spatial perception has already developed in other ways they suggest it through association, but they are not presupposed in its first acquisition.

Among these secondary conditions we may especially note the following:

(*a*) The varying magnitude of visual appearances. When we know or are by any motive led to assume that the thing seen has really a certain fixed size, the variable bigness of its visual appearance comes through association to convey the perception of varying distance from the body of the percipient. The larger the visual appearance the nearer the thing; the smaller the visual appearance the farther away the thing. If we look at a man through the wrong end of a field glass the visual appearance is diminished in size, and as an immediate consequence the man looks just as if he were at a great distance. It is just as if we actually saw a man at this distance.

To appreciate the full importance of this condition, we must remember that all the objects within the field of view and the different parts of the same object produce retinal impressions varying in extent in a systematic and regular way according to their distance from the eye. The imitation of this systematic diminution of size with increasing distance is in the hands of the artist a most potent means of producing stereoscopic effect. Where the varying distance of an object is fixed by other means, the extent of the retinal impression mainly determines perception of magnitude.

This is well seen in the case of after-images. "Produce an after-image of the sun and look at your finger-tip; it will be smaller than your nail. Project it on the table, and it will be as big as a strawberry; on the wall, as large as a plate; on yonder mountain, bigger than a house. And yet it is an

unchanged retinal impression."[1] An actual thing producing a retinal excitation of the same extent would vary in size according to its distance. Hence the imaginary thing suggested by the after-image appears of different sizes, when it is perceived at different distances. But the actual retinal excitation is in all cases the same.

(*b*) Certain solid figures of a familiar type present characteristic and easily recognisable visual appearances and, especially, characteristic relations of their boundary lines. Such characteristic outlines come through association to suggest corresponding solid shapes.

(*c*) The distribution of light and shade. The mode in which light is intercepted varies with the shape of the solid object on which it falls. The distribution of light and shade among the parts of the object itself is also determined by its shape. Thus the play of light and shade is exactly opposite in the case of a hollow mask and a projecting face. This 'modelling,' as it is called by the artist, takes the most subtle gradations, according to the various minute hollows and elevations in the surface of an object, as for instance in the folds of drapery. Besides this, what is called the 'cast-shadow'—the shadow thrown by an object as a whole—plays a very important part. "Objects in a landscape stand out much better in morning and evening light when strong and distinct cast-shadows are thrown, than in noonday light."[2]

(*d*) Vividness, distinctness, and modifications of colouring. The brigher is the visual appearance, and the more sharply and minutely its details are distinguished, the nearer it appears, in the absence of counteracting conditions. As I gaze from my window across the sea towards a strip of coast on the other side of the bay, I find that on a clear day this looks much nearer than when the air is misty. Similarly, persons leaving the foggy climate of England for the clear atmosphere of the Swiss Alps or the Arctic regions find themselves greatly underestimating distances.

Differences of colouring may have a like effect. If two mountains are seen in the distance, and one appears bluish,

[1] James, *Principles of Psychology*, Vol. II., p. 231.
[2] Sully, *The Human Mind*, Vol. I., p. 252.

and the other green, the green is perceived as nearer. The green of the vegetation is visible only at a certain distance; at a greater distance it gives place to a blue tint derived from the intervening air.

(*e*) Another condition is connected with the changes of local sign of visual sensations which accompany movements of the eyes or head. This change is more rapid in proportion to the nearness of the thing seen. In travelling by rail, the nearest objects seem to fly past us with great rapidity; those further away move more slowly; and the most distant appear by contrast to be moving the other way in the same direction as the train. In general, the varying rapidity of the displacement of visual appearance as the eyes, head or body move has come to signify varying distance from the percipient.

(*f*) Varying accommodation of the lens of the eye. The nearer the object, the more convex must the surface of the lens be, if a distinct image is to be focussed on the retina; and the more remote the object, the flatter must it be. If the lens is too convex or too flat, what are called ' circles of diffusion ' occur on the retina, and the image is indistinct. Thus, in fixing the eye successively on more and more distant points of a line, the lens will be accommodated at any moment for the point looked at and yield a distinct image of this. Points nearer or more remote will produce progressively more indistinct and diffused impressions, the greater their distance from the fixation-point. As the glance moves to and fro along the line, the indistinct becomes progressively distinct, and *vice versa*. This helps the perception of position and distance in the third dimension. The adjustment of the lens depends upon a muscle which by its contraction slackens a ligament to which the lens is attached. When the ligament is slackened, the lens, owing to its own elasticity, bulges and becomes more convex. There are motor sensations accompanying this process of motor accommodation.

These associative conditions do not themselves enter into the constitution of the perception of depth, but are able to reproduce it when it has once been formed by other means. It is frequently said that they are signs which the mind interprets. Such phrases are permissible only if we are care-

ful to explain the nature of the signs and of their interpretation. Usually when we speak of interpreting a sign, it is implied that the sign is itself distinctly and separately noticed, and that the interpretation is an additional and distinct act of thought. But this is not the case with the perceptual signs which we have been discussing. They themselves are in the main ignored, and only their meaning is attended to. They have no independent existence for consciousness apart from their meaning. The meaning being inseparably one with the sensations that are its signs, has the immediacy, the obstrusiveness, and the fixity of impressional experience.

The association works by reviving, not free or explicit, but tied or implicit ideas. When we look at a man through the wrong end of a field-glass, we do not first notice that the visual appearance is small, and then proceed by a separate step to entertain the suggested idea of his being far away. Rather we see him as if he were far away from the outset. It is only through reflective analysis that we infer his apparent remoteness to be something suggested by association and not an original datum of perception.

Though such associative factors do not directly contribute to the first development of the perception of spatial relations in the third dimension, yet in all but the earliest stages they indirectly play a very important part. They do so because they enable us to retain, recall, and utilise the results of previous development.

5. Primary Monocular Perception of Shape and Distance in the Third Dimension.—Though our perception of spatial relations in the third dimension is decidedly less precise and accurate with one eye than with two, yet it is plainly of the same nature. There must, therefore, be some way of accounting for it without reference to the special conditions of binocular vision.

Berkeley was the first writer to advocate a theory according to which all spatial perception of shape and distance in the third dimension is entirely due to tactual and motor experience, so that the eye only supplies secondary signs of the kind which we have just enumerated. This theory contains an essential

truth. The tactual perception of extension does play a great and indispensable part in modifying and, so to speak, 'moulding' the visual perception. But it is quite wrong to regard sight, even in monocular vision, as supplying nothing but merely secondary signs, such as the distribution of light and shade.

According to Berkeley, when we perceive a thing as at a distance from the eye, our apprehension of its distance is primarily due merely to the tactual and motor experiences which we have had in the past in walking up to things so as to come in contact with them. The results of these past experiences are, he says, suggested by such secondary associative conditions as distinctness, light, and shade, size of visual appearance, etc.; and this constitutes the perception of "outness" by the eye.

A very important point is here omitted. The experience of going towards a visible object so as to get contact with it includes, together with tactual and motor sensations, a concomitant and corresponding series of visual sensations in such a way that the distinction between extension as felt and extension as seen comes to be interpreted as a distinction only of sensible appearance and not of external reality. Through this constant and intimate union, the spatial order and direction in the third dimension, which originally belong only to the tactual-motor series, are acquired by the visual series also. Thus the field of visual sensation itself becomes grouped and ordered so that some parts of it are perceived as directed outward, others to right and left, others in intermediate directions.

Extension as revealed to sight depends primarily for its value on its intimate correlation with extension as revealed to touch. There is between them a unity of practical interest, in which the tactual element plays the dominant part. In practice, they are perpetually combined. In exploring a thing by touch, the eye follows the motion of the hand. In so far as sight comes first, it is constantly followed by touch, and is useful only in so far as it guides touch. Now this intimate union cannot exist without mutual modification, and since the tactual experience more directly reveals real extension, the modification of the visual experience will be

the more profound. To explain what we mean by this modification, let us consider its influence in the formation of mental images. A man handles an object in the dark. As he explores the outlines of the object, he at the same time constructs a visual image of it. The visual image is throughout determined by tactual experience. With each feature of tactual extension there is correlated a corresponding feature of visual extension. The visual image is throughout moulded by the touch.

Now we are here concerned, not with visual imagery, but with visual perception; not with free, but with tied ideas. What we say is that owing to the frequent and intimate union of tactual with visual perceptions, visual perception, when it exists without tactual perception, will be moulded by previous tactual experiences, much as the visual image of an object in the dark is moulded by a present tactual experience. This is only a special application of the general principle which underlies the whole development of the perception of space. In the development of the tactual perception of space, passive or synthetic touch acquires a certain serial order and arrangement of parts from its connection with active and analytic touch. In like manner, the visual perception of extension acquires a certain order and arrangement of its parts from its connection with the tactual perception of extension. It would thus appear that though the eye had no independent means of apprehending those relations of surfaces and lines which presuppose the third dimension, it would none the less become capable of apprehending them in some degree through its intimate practical union with touch. The whole process is a case of complication.

There is still, however, a gap in our explanation. When and so far as the visual experience exists before the tactual, as when we look along the surface of the ground, stretching away from us, without actually walking over it, or when we see a cube or sphere without touching it, how do previous tactual experiences come into play so as to determine the perceived order and direction of sight-sensations? Obviously there must be, in each special case, distinctive peculiarities in the visual experience itself to suggest them. But there is no

difficulty here. We have already indicated what these distinctive peculiarities are. They consists in all those variable features of visual sensations which we have brought under the head of secondary associative factors—varying size of visual appearance, distribution of light and shade, distinctness and indistinctness, recognition of familiar outlines, difference in rapidity of displacement of visual appearances as the eyes, head, or body move, accommodation of lens, and other conditions of a similar nature.

The results of the previous co-operation of sight and touch are, so to speak, deposited in the keeping of these secondary factors so as to be recalled and utilised as occasion requires.

We have now given an account of the conditions of spatial perception which would be operative if we had only one eye. But the use of two makes it decidedly more precise and adequate. Further, even our apprehension of spatial relations with one eye alone is no doubt helped in ordinary cases through associations formed in binocular vision. It has even been maintained that the monocular perception of solid figure and of varying distance in an outward direction mainly depends on such associations. But, as we have shown, this is an unnecessary hypothesis; and it seems to be sufficiently refuted by cases of persons who for many years or virtually for their whole lives have depended on one eye alone.

6. Binocular Perception.—Whenever we look at a point so as to bring it within the area of most distinct vision for both eyes, we receive from it two impressions, one affecting each eye. But the result is a single presentation of the object. This is so because similar impressions fall on corresponding points of the two retinas. The two points of most distinct vision constituted by the *foveae centrales*, or central pits, correspond to each other in this way, so that light-impressions falling on them give rise to the vision of a single object. Other points of the two retinas also correspond when they are symmetrically situated with reference to the central pit.[1] In general, the left half of one eye corresponds to the left half of the other,

[1] This statement is not quite exact; but the correction required is unimportant for our general exposition.

and the right half to the right half. Thus a point in the left half of one eye will correspond to a point in the left half of the other when both have the same situation relatively to the centre of distinct vision.

If the retina of one eye could be applied to the retina of the other, so as to superimpose the nasal half of each on the temporal half of the other, their points of contact would be, roughly speaking, corresponding points. Single vision normally occurs when corresponding points are stimulated in a similar way. But it also occurs when the points thus stimulated do not exactly correspond, but when the deviation from correspondence, or 'disparateness,' as it is called, is small. When this happens there is a single sensation, but it appears as lying behind or before that area of the field of visual sensation which is most distinctly presented. When the disparateness between the points affected is relatively great, double vision may result.

If a finger is held between the eyes and an object, and if we then fix our eyes on the object so as to bring it into the centre of distinct vision, we see the finger doubled. The greater the distance between the finger and the object, the wider apart are the two images of the finger. If the right eye is closed, the left image disappears; if the left eye is closed, the right image disappears. This is crossed disparation.

If now, instead of fixing our gaze on the object, we fix it on the finger, the finger is seen as single, and the object as double. The greater the distance between finger and object the wider apart are the two images. When the right eye is closed, the right image disappears. When the left eye is closed, the left image disappears. This is uncrossed disparation.

The experiment succeeds with most people, but not with everyone. There are some few who can hardly be brought to see things double at all. But even these, if their vision is really normal, will in all probability be able to see a double image of such a bright object as a lighted candle. The special conditions of the experiment are that the eye should be fixed on one object, and the attention fixed on another, either beyond it or in front of it. Apart from these special conditions, it would appear that double images are not ordinarily noticed by normal persons. When the eyes are moving in a

free and natural way from object to object, and attention is concentrated only on what is seen in the area of distinct vision, double images are not discerned.

It should be carefully noted that when vision is distinctly doubled, the distance of the two images from the object which is distinctly seen is vaguely apprehended. We may see it now at one distance and now at another, either arbitrarily, or in consequence of some casual suggestion. So far as the distance is precisely apprehended, our perception of it may be referred to other conditions than the disparate position of the two impressions on the retinas of the two eyes. It would seem that this disparateness either yields a precise perception of distance, or a double image, but not both at once.

The same facts are well illustrated by the stereoscope. In looking through this instrument there is set before each eye only a surface and not a solid figure. It is not the same surface which is set before both eyes, but a separate one before each. On these surfaces there is outlined a drawing of the same solid object, but the one surface presents it as seen from a point of view to the left, the other from a point of view to the right. The one figure represents the solid object as seen by the right eye, the other as seen by the left, when both are fixed on it. The result is the presentation, not of two superficial delineations, but of one solid object. The reason is, that when the two eyes are respectively fixed on corresponding parts of the two outlines, other parts of the field of view produce disparate impressions on the retina, just as they would do in looking at the same point of the actual object. The further they lie behind or before this point in the actual object, the more disparately situated are the impressions they produce, and the same is the case in looking through the stereoscope.

The solid effect in the stereoscope is greatest when the eyes are allowed to move freely from one point to another. But it is also unmistakably present when the illumination by which the two pictures are seen is so transient as not to allow time for movements of the eyes. Of course, as the eyes fixate one point after another in the apparently solid object, retinal impressions which have been previously disparate

come to affect corresponding points, and those which previously affected corresponding points become disparate. The appearance of solidity is more distinct and impressive, the fewer are the double images discerned. Old and practised experimenters, who concentrate their attention with the view of finding double images, become in time unable to obtain the stereoscopic effect. They see only a flat surface.

Now there is a theory which would regard the above statement as a complete account of the binocular perception of solid figures. Distance from the area of distinct vision, behind or before it, is supposed to find its full and ultimate explanation in the disparateness of the position of like impressions on the two retinas, the degree of distance corresponding to the degree of disparateness. This view seems plausible if we consider visual perception in its fully developed form. It does not appear that any other conditions can be operative when the two slides of the stereoscope are lit by a momentary illumination which allows no time for movements of the eyes. But when movements of the eyes are thus excluded, the stereoscopic effect is comparatively dim and imperfect. It must also be borne in mind that when in ordinary vision we steadily fixate a single point in the field of view, and attend to objects before or behind it, we obtain double images rather than a perception of distance from the point fixated. These facts point to active exploration by movements of the eye as an important factor in the perception of the third dimension.

An even more powerful reason for introducing this factor is the general analogy of the way in which the spatial perception develops. The apprehension of tactual space develops through a co-operation of active and passive touch. What we know about children, and about persons blind from early infancy who have recovered their sight by an operation, shows that the same is true of sight. In a case of operation for congenital cataract,[1] a boy could not count even as few as two objects by means of passive sight, although he had learnt

[1] Uhthoff, *Sehenlernen blindgeborener und später mit Erfolg operierter Menschen*, in *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Bd. XIV., Heft 3 und 4.

to count by means of touch. When two objects were placed before him, and he was called on to say how many they were, using sight alone, he could do so only by fixing his eyes on each of them in turn. At the outset, it was necessary for him to point to each of them successively with the finger. Pointing without touching was sufficient. At a later stage he was able to count merely by fixing his glance on each object in turn. This he did at first not by movements of the eye, but by lateral movements of the head. It was not till much later that he learnt to count a number of objects at a single glance.

In all cases of this kind, the perception of distance in the third dimension develops very gradually. At the outset, the patient appears to have only the analogies of his tactual experience to guide him.

We may then assume that active as well as passive vision is required for the development of the perception of the third dimension. In principle, this development takes place in a way precisely analogous to the development of the perception of space in general. When the eyes are fixed on any point in the field of view, those parts of the field which lie behind or before this point are perceived by means of disparate retinal impressions. If and so far as the disparateness does not give rise to double images, it gives rise to a peculiar modification of visual sensation, varying concomitantly with the nature and degree of the disparateness. Thus there are differences in the passive sensibility of the retina corresponding minutely with the varying distances of other objects from the object which is at any moment fixated by the two eyes. Thus we are given in the way of synthetic or passive sensibility the material for the perception of the third dimension.

But this synthetic and passive experience cannot acquire spatial order in which its parts become positions separated and connected by distances, except when active sight successively explores the data simultaneously given to passive sight. Active sight takes the form of increasing or decreasing convergence of the two eyes. When the eyes are turned inwards, so that the lines of vision[1] converge, objects nearer than the

[1] The line of vision is an imaginary straight line connecting the *fovea* and any point to which the gaze is directed.

point fixed by the eyes, which have for that reason previously produced disparate retinal impressions, come to produce impressions on corresponding points. Decreasing convergence has the same effect for objects lying beyond the point originally fixated. This process is perpetually going on in every moment of waking life; and it is perpetually required for practical adjustment to the environment.

Hence the two co-operative factors, active or analytic and passive or synthetic vision, must combine to form a total disposition, which is excited as a whole by each of them. In this way each acquires spatial significance which it would not have in isolation from the other. The peculiar qualitative differences due to varying disparateness of the retinal impressions become perceptions of relative distance from the point on which the eyes are fixed, and the combined movement of the two eyes becomes for consciousness a movement over a tract of space.

In this way we may account for the perception of relative distance from the visual sensation which is most distinct at any moment. But the question still remains, How is the distance of the fixation-point itself determined? In the first place, by all the factors which are operative for one eye. But besides this, whatever determines the relative distance of other points from the fixation-point must also determine the relative distance of the fixation-point from these other points. Thus all objects intervening between the body and the eye contribute to fix the absolute distance from the body of the point distinctly seen.

There is also another factor operative in a greater or less degree—the sensations due to the varying positions of the eyes themselves. There are no joint-sensations because the muscles of the eye do not work on joints. But this defect is to some extent compensated by the tactile experiences due to the movement of the eye in its socket; and muscular sensations proper are probably contributory factors. Thus the varying degree of convergence will be marked by varying tactual and motor sensations in the eyes. These will also help to mark varying direction and extent of movement. But it should not be forgotten that the movements of the

eyes, whether in the way of convergence or otherwise, are optical as well as motor experiences. They are accompanied by displacement of impressions on the retina. In converging movements, disparate impressions are in process of becoming correspondent, and *vice versa*. It has been shown by Hering and others that this purely optical process admits of greater delicacy of discrimination, and therefore is a more important factor, in our experience of movement and position of the eyes, than the motor sensations of the eyeball.

Binocular local signs, together with movements of increasing and decreasing convergence, give rise to an awareness of the order and direction of visual sensations and therefore of external objects. But are they sufficient, independently of touch, to constitute our normal apprehension of relative nearness and farness from the body of the percipient?

To answer this question we must first remind ourselves of the result reached in the analogous cases of right and left, up and down, as perceived by the eye. There are, as we saw, distinctions of purely visual direction corresponding to these distinctions. But we also found cogent reason for holding that the opposition of visual directions is not felt as the contrast between right and left, up and down, except in so far as the data of sight are correlated and co-ordinated with the data of touch. There is therefore a strong presumption that the same holds for the directions from near to far and from far to near. If physical and physiological conditions were such that movements of increasing instead of decreasing convergence were required for clear vision of objects which for touch are more remote, and if movements of decreasing instead of increasing convergence were required for clear vision of what for touch are nearer objects, the visual direction which is now felt as from near to far would be felt as from far to near, and inversely.

This result is confirmed by other facts which indicate the ultimate subordination of even binocular experience to tactual data and to sight as educated by touch. Where in accordance with the special binocular condition of the perception of solid figure we ought to see a human face in inverted relief, we fail to do so. The normal appearance of the human face obtrudes

itself in spite of the binolcular system of local signs which, if they were effective, would transform its projections into hollows and its hollows into projections. This seems hard to explain if we suppose that the binocular apprehension of the directions from near to far and from far to near, as such, depends only on retinal experiences and the motor sensations of the eyeballs, independently of meaning acquired by association with other visual data and ultimately with tactual data.

Even more important is the fact that the binocular fusion of disparate impressions so as to yield a single sensation is itself to a large extent determined by associative suggestion. It is not true that fusion and non-fusion depend only on anatomical conditions—on the degree of disparateness of the retinal impressions. Retinal impressions equally disparate may or may not fuse. Whatever in accordance with past experience tends to suggest that we are looking at a single thing favours fusion; whatever tends to suggest that we are looking at two things works to prevent fusion. In combining drawings in a stereoscope we may at first see them only as superposed on a flat surface with their component lines remaining distinct. Yet, if we merely add a line tending to suggest a familiar solid figure we obtain the stereoscopic effect.

Further, in certain cases of squinting and in others where the shape of the retinal surface has been altered by disease, the patient begins by seeing double where he had previously seen single, and then gradually learns to see single again. Finding, in constant experience, that his double images really correspond to single things he acquires the habit of fusing them in a single visual sensation. This dependence of binocular fusion on associative suggestion is hard to explain except by assuming that the specially binocular perception of spatial relations does not stand apart by itself, but is conditioned throughout by its correlation with other experiences and ultimately with touch and tactual exploration.

CHAPTER V.

TEMPORAL PERCEPTION.

1. Introductory.—The apprehension of temporal relations, as they exist for human consciousness, is an extremely complex product of mental development. The part played in it by trains of free ideas is of predominant importance. Without such trains there could be no such thing as the definite apprehension of a time-series, having a distinguishable beginning and end, connected by a train of intermediate events, each having its own position in the series determined by its relation to other events which come before and after it. For perceptual consciousness it is evident that time cannot exist in this form. On the other hand, we find in perceptual consciousness those primary experiences on which our developed apprehension of time is ultimately based.

2. Immediate Experience of Time-Transience.—The perception of extension depends ultimately on the extensity of certain immediate sensory experiences. That of time depends also on a certain character of immediate experience. Not, however, on a character confined to certain kinds of sensuous experience, but on one belonging to immediate experience in general. Within our conscious life change and transition are constantly taking place. Sensations wax and wane in distinctness and intensity, and give place to each other; attention is shifting; conation is constantly undergoing vicissitudes of relative success and failure with their affective accompaniments.

Now the bare fact of the existence of such change is in itself irrelevant to the problem of time-perception. The essential point is that the transition involves a peculiar immediate experience which we may call the experience of transience. When we are in the darkness and an electric light is suddenly turned on, it is a quite inadequate account of what takes place in us merely to say that first we have darkness-sensation and

that immediately following this we have light-sensation. It must be added that the transition itself from the one to the other is experienced in a peculiar way. What is experienced is not mere darkness and then light, but darkness passing into light. It is ultimately this transience-experience which conditions the thought or perception of the fact that a change is taking place, whether the change is apprehended as occurring in our own sensations or in external objects.

There could be no awareness of what is expressed in the proposition, 'Experience *b* follows experience *a*,' if there were not also the peculiar experience involved in the passage of *a* into *b*. Without an immediate change-experience, "cognition of change would be impossible for lack of presentative material. The thought of succession in time must be based on the direct experience of time-transience, as the thought of red colour is based on the corresponding sensation. As the perception or idea of colour-quality is impossible to the blind, so the perception or idea of change would be impossible to a being without the change-sentience."[1]

The immediate experience of transience is, as such, confined to the moment in which it is being felt. But the apprehension of an event as an object of thought or perception transcends this limit. It necessarily involves the mental reference to a past and to a future which, just because they are past and future, cannot be immediately experienced at the moment, and the present is apprehended only as related to this before and after—as being the transition from one to the other.

3. Present, Past, and Future.—What we apprehend as past or future is always determined for our thought as future or past relatively to a present. How is the present itself determined? The only possible answer is that it is determined by some character of immediate experience; and the character of immediate experience which fulfils this function is simply its immediacy. The present is fixed inasmuch as it is the moment of actually felt pleasures and pains, desires and emotions, of actually sensed sensations and of images actually

[1] Stout, *Analytic Psychology*, Vol. I., p. 160.

imaged. Whatever is not our actual experience at the moment or not apprehended as being simultaneous with this is referred to the past or future.

This statement, however, requires qualification. It applies only to the present strictly understood as a momentary transition between past and future, a "knife-edge," as James appropriately calls it. But what we usually call the present time includes more than this; it includes more or less of the immediate past, and also perhaps more or less of the immediately anticipated future. The reason is that our power of definitely discriminating the parts of duration is limited, and that even when we could discriminate we are not interested in doing so. Hence we do not single out and, so to speak, divide the momentary present as a separately distinguishable object from all that precedes and follows. Thus when we speak of the present we usually refer to what has been called the 'specious present.' "In short, the practically cognised present is no knife-edge, but a saddle-back with a certain breadth of its own, and from which we look in two directions into time. The unit of composition of our perception of time is a *duration* with a bow and a stern, as it were a rearward- and a forward-looking end."[1]

This specious present includes more or less of the recent past according to variable conditions. It is perhaps smallest in the experiments, previously referred to, in which the subject is called on to estimate very brief intervals. On the perceptual level, it is longer when conation is obstructed or delayed, and shorter when conation proceeds successfully and easily towards the attainment of its end. The present is long to the hungry child or the hungry dog compelled to wait for its food; whereas one present rapidly succeeds another when the child or the dog is enjoying its play.

Distinction between past, present, and future can be apprehended only in a rudimentary way at the perceptual level. But there is, even at this level, what we may call a 'not yet' consciousness and a 'no more' consciousness. The 'not yet' consciousness is contained in the prospective

[1] James, *Principles of Psychology*, Vol. I., p. 609.

attitude of attention—in the pre-adaptation for what is to come which it involves. This 'not yet' consciousness is emphasised when conation is delayed or obstructed, as when the dog is kept waiting for its bone. In this experience not only is the present lengthened, but the contrast between present and future is heightened. The 'no more' consciousness emerges most distinctly when conation is abruptly disappointed or frustrated. The dog in the fable which lets go its actual bone in order to seize the reflected bone in the water, would have this experience in a marked manner.

With the advent of ideal representation the 'no more' and the 'not yet' experiences become much more definite. This must be the case even when ideas occur only as supplements of perceptual process, and not as components of ideational trains. The hungry child seeing preparations for food, may call up a mental picture of itself eating the food. The ideally represented satisfaction stands in sharp contrast with its present impatient hunger. In this case the 'not yet' consciousness assumes a very definite form.

Sully, who gives this example, illustrates the corresponding 'no more' consciousness in the following manner. "A child is watching some interesting object, say the play of the sunbeam on the wall of his nursery. Suddenly the sun is obscured by a cloud and the marvel of the dancing light vanishes. In place of the golden brilliance there now stands the dull commonplace wallpaper. . . . The [ideal] image persists, and attracts the attention by reason of its interestingness. At the same time there is the actual present, the sight of the sunless wall. Here, then, both actual experience of the present and represented experience which is not now, occur simultaneously, and so supply the most favourable conditions for the development of a consciousness of their difference or contrast."[1]

In general, temporal perception is bound up with the process of attention. The primary experience of 'pastness' is involved in the cumulative effect of attention on its own process. The primary experience of 'futureness,' if we may

[1] *The Human Mind*, Vol. I., pp. 320-1.

allow the expression, is involved in the essentially prospective nature of attention. The present is characterised by the actual sensations which serve to guide and determine attention at the moment.

4. Perception of Lapse of Time.—By perception of lapse of time I mean the perception of a state or process at its termination as having had more or less duration. On this point experiments yield interesting results. Two methods are mainly used. Either "a time interval is presented by the experimenter," and the subject has to repeat this interval as correctly as possible; or "two intervals are presented to the subject, who is aksed to determine whether one is longer or shorter than or equal to the other." Each presented interval is bounded by suitable stimuli, for example, electric sparks or momentary sounds.

"By whatever method we proceed," says Myers, "one result . . . seems to stand out very clearly. Short intervals tend to be over-estimated, and long intervals to be under-estimated. Between these there is an indifference interval lying between 700 and 800 thousandths of a second. Intervals shorter than this are over-estimated, those longer are under-estimated." Another general result is that 'filled' intervals appear longer than empty intervals. "When two sound stimuli limit a given interval, and when this interval is compared with an equal interval which instead of being merely limited by is also occupied by sounds, the 'filled' interval appears longer than the empty interval, the error of estimation increasing up to a certain point with the number of sounds filling the interval."[1]

The most essential factor conditioning this immediate awareness of varying degrees of duration is probably to be found in the process of attention with its accompaniments and results. Where and so far as there is continuity of attention, successive experiences are modified by the cumulative effect of retentiveness. This cumulative effect varies in its nature with the amount of time which the process has

[1] Myers, *Textbook of Experimental Psychology*, pp. 297-9.

taken. In this way we can explain why an animal or a human being in preparing for action should be able to wait for the right moment, having no means of determining the right moment except lapse of time. What measures the lapse of time is the cumulative effect of the process of attending. When we are listening to a sound, our experience is different at the end of one minute from what it is at the end of two minutes, although the sound itself may not have altered in quality. This experience is unique in kind, and it certainly does not consist in having the parts of the sound-sensation, as they successively occur, spread out before us in a sort of duration-line or duration-block.

The same explanation applies to what is called 'empty' time. In music, the several notes are separated by temporal intervals. To keep time is to measure these intervals correctly. But it is difficult to say by what means we can measure them, except by the process of expectant attention itself. Certainly it is by no ideal reproduction of a series of events. Of course, empty time is only relatively empty; what is absent from it is the special kind of experience which marks its beginning and end. There are always other experiences going on, especially of a motor and organic kind.

The immediate estimate of lapse of time is most accurate for small intervals.[1] It appears to become progressively less precise as the intervals become larger. If we go for a walk and ask ourselves at any moment how long we have been walking, we can say immediately without any explicit process of calculation that we have been about half-an-hour or about an hour. The limits of error are indeed very wide, but undoubtedly there seems to be *some* power of estimating lapse of time, even for these comparatively long periods. It is not quite a fair test to try this experiment without previous practice. A man may be able to estimate lapse of time with a fair amount of accuracy, and yet not have established an accurate relation between his subjective estimate and time

[1] Many experiments have been made to determine more precisely the conditions on which it depends; but the results obtained are so ambiguous and conflicting, that I have not thought it advisable to trouble the student with them.

as measured by the clock. With practice it is found that a person can tell with a tolerable approach to accuracy and without express calculation when an hour, or two hours, or half-an-hour has elapsed.

The part played by attention in determining this immediate estimate is illustrated by the fact that conditions affecting attention affect it too. When we are bored by monotony, or when we are distracted by a too great variety and rapidity of experience, the duration of time is so to speak magnified. We say that it 'passes very slowly.' When attention is very intensely and disagreeably aroused, as in moments of acute danger, minutes may appear as hours. On the other hand, when attention passes easily from object to object, and is agreeably absorbed by each in turn, time passes rapidly. After an entertaining conversation, we may be astonished to find that the hands of the clock have travelled over so much space.

This contrast holds good only for the immediate estimate of lapse of time due to the cumulative effect of past process. When we ideally recall a period of time, and estimate it by the number and variety of the events which have taken place in it, the period which has been agreeably spent is apt to appear relatively longer, and the period in which we have been bored, shorter. In ideal retrospect, periods, which appeared interminable while they were passing, shrink, as it were; whereas periods that seemed on their actual occurrence to pass rapidly are correspondingly expanded when we review them in the form of a train of ideas.

BOOK IV.

IDEATIONAL AND CONCEPTUAL PROCESS.

CHAPTER I.

TRAINS OF IDEAS.

1. The Twofold Aspect of Ideational Process.—We now pass from perceptual to ideational process—from those trains of mental activity which are prompted and guided by external impressions and directly worked out in bodily movement to those which proceed independently of external stimulation and are worked out 'in the head.' Up to this point we have taken into account free ideas only in so far as they supplement processes which are in their essential character perceptual: we have now to consider processes which reach their end through free ideas succeeding each other in a series independently of actual perception.

Trains of ideas, like trains of perceptual activity, have, in general, a certain unity and continuity of interest. They subserve some end, practical or theoretical. Those transitions in the flow of ideas which show a break in continuity of interest are, in general, transitions from one train to another. It should be noted that the interest which gives unity to a single train may be very slight and evanescent. Thus the train may be no more than a passing thought. It may appear to consist of a single idea; but if it tends to gratify and interest, however evanescent, it may none the less be regarded as a continuous train.

The course of a train of ideas is determined by two distinct groups of conditions. On the one hand it is reproductive, and on the other productive. The material for it must be derived from past experience. But this material is variously

shaped and transformed by the total mental condition existing when the ideal revival takes place. Even when we are interested in reviving past events, as such, preserving as far as possible their original nature and order, yet the mode in which they appear to consciousness is determined by the circumstances of the present, and by all that has taken place since their original occurrence. It is for this reason that on their revival they come before consciousness as past events; whereas on their original occurrence they bore the character of present experiences.

Every train of ideas, then, has both a reproductive and a productive aspect; though the relative dominance of the two aspects may vary indefinitely. We shall first consider the reproductive side of the process, under the head of 'Association of Ideas'; and then the productive, under the head of 'Ideal Construction.'

2. Association of Ideas.—The basis of all associative connection is the concurrence of different sense-experiences in the formation of a single cumulative disposition, which tends to be re-excited as a whole whenever any of the experiences recur which have combined to produce it. If we suppose that two sensations, a and b, have been united in this way so as to form the total disposition $a\beta$, the re-occurrence of an experience similar to a will re-excite $a\beta$. If the reproduction takes the form of mere acquirement of meaning or of complication, the result is a modification of a, which we may represent by a_b. But in ideal reproduction something more takes place. The occurrence of a_b is followed by the separate revival of b_a, as a relatively independent step in the successive flow of mental process.

It must be noted that the tendency is to the revival of the total experience ab. Hence, apart from interfering conditions, b will tend to be revived in the same relation to a as that in which it originally occurred. If in the original experience one object has been apprehended as succeeding another, or as situated on the top of another, or as logically dependent on another, the tendency of the ideal revival will be to represent the object in the same relations. It is evident that these

objective relations may be indefinitely numerous and diverse in nature. Hence it is difficult to base on them a classification of the various forms of association of ideas.[1] As Reid remarks: "Every relation of things has a tendency, more or less, to lead the thought, in a thinking mind, from one to the other."[2] It follows that in classifying the forms of association of ideas we have to consider, not the relation of object *a* to object *b*, but rather the relation of the *apprehension of a* to the *apprehension of b*. Ultimately, all depends on continuity of attention: but this continuity may be direct or indirect, giving rise to two forms of association which are commonly called association by 'contiguity' and by 'similarity.'

3. Different Forms of the Association of Ideas.—(*a*) *Contiguity* (*Continuity of Attention*). The law of Contiguity, as ordinarily understood, may be stated as follows: If *B* has been perceived or thought of together with *A* or immediately after *A*, then, on a future occasion, the perception or idea of *A* will tend to call up the idea of *B*. In other words, the sequence of ideas follows the order in which their objects have been attended to in previous experience. The underlying principle is that mental activity when partially revived tends to repeat itself; it can only repeat itself if its original direction and order are reproduced.

This law, though it is valid, is not sufficiently comprehensive. It covers only a special case of a wider principle. It refers only to temporal continuity instead of continuity of attention in general. It is by no means true that association connects only those objects which occupy attention in immediate succession. This has been clearly shown by many experiments. Ebbinghaus found that after learning by heart a series of disconnected syllables, which we may denote by *A*, *B*, *C*, *D*, etc., it cost him relatively a much shorter time to learn the same series with regular gaps in it, *e.g.* $A \cdot \cdot D \cdot \cdot G \cdot \cdot$, etc. Repetition of the series *A*, *B*, *C*, *D* served to establish associa-

[1] For attempts at classification see Myers, *Textbook of Experimental Psychology*, Ch. XII., and Jung, *Studies in Word Association*.

[2] *Works*, Hamilton's edition, Vol. I., p. 386.

tive links not only between *A* and *B*, *B* and *C*, *C* and *D*, etc., but also between *A* and *D*, *D* and *G*, *G* and *H*, etc.

The same point is more conspicuously illustrated in ordinary experience. In recalling a train of events we usually pass from one salient occurrence to another, leaving out the relatively unimportant details which actually intervened between them. Similarly, in describing an object, I do not mention all the details which I actually observed in the exact order in which I noticed them. On the contrary, I pass from one characteristic and distinctive feature to another, oblivious of much which is not characteristic and distinctive. The dominant interest of the original experience and the dominant interest at the time I recall it determine a selection of items which is by no means tied down by the condition that objects which introduce each other in the train of ideal revival must have been attended to in immediate succession.

The truth is that the most important condition of association is not mere contiguity in the strict sense of temporal continuity of attention, but also continuity of interest. Where continuous interest pervaded the original process, the stronger this was the more selective is the revival apt to be, links being dropped out which are relatively unimportant to the general trend of mental activity. This is well brought out in the special case in which some process having continuity of interest is carried out with interruptions occurring at intervals. If the interruptions are not themselves of a specially interesting kind, we tend to omit them altogether in recalling the main activity. The gaps, so to speak, close up.

It may be asked why in any case we should remember the interruptions, even when they are specially interesting. For where there is interruption, there is not continuity, but rather discontinuity of interest. The answer is that at the moment at which the interruption takes place there is temporal continuity of attention. The interruption is itself an experience which belongs both to the end of one process and to the beginning of the other.

Immediate succession of this sort is not, however, the ultimate condition of association. Ideal revival may and often does proceed by leaps and bounds. But it must be

conceded that the immediacy of the succession does count as a very important factor. Other things equal, the direct transition of attention from *A* to *B* will be repeated in ideal revival, rather than a transition from *A* to *C* which originally took place through the intermediate link *B*. In proportion as the control of a dominant interest is weak and intermittent, the tendency is to repeat the original order exactly, without omissions and inclusive of interruptions. This is well seen in the conversations of feeble-minded persons. Of course the original order will be exactly repeated, where there is an interest in exact repetition, as in learning by heart.

(*b*) *Reproduction of Similars.* It is a fact familiar to all of us that objects remind us of other objects similar to themselves. Ought we, therefore, to recognise resemblance as an independent condition of association distinct from any form of continuity of attention?

We may take as a typical example the case of a portrait calling up the idea of its original. If in the past we have already attended to both original and portrait in relation to each other so as to compare them and to become aware of their likeness, the subsequent recall of one by the other is capable of being explained on the principle of continuity of attention. But so far as this explanation applies we are not really dealing with what is especially distinctive of the recall of similars by similars. This is not dependent on co-presentation in previous experience. The portrait may suggest its original even when it is seen for the first time, so that we cannot have previously perceived or thought of the two in relation to each other. This seems to warrant our treating resemblance as a distinct and independent condition of association.

Before committing ourselves to this conclusion, let us first consider what it would imply. Clearly we must extend it beyond what are ordinarily regarded as cases of recall by resemblance. If we recognise a distinct principle of association by similarity we seem bound to recognise its operation as essentially implied in all revival by association.

Take, for example, the simple instance in which the sound of one letter of the alphabet, *A*, reminds us of the sound of the

next letter, B. On previous occasions we have had a multitude of sound-sensations A_1, A_2, A_3, etc., closely resembling each other. We have also had other sound-sensations B_1, B_2, B_3, etc., also closely resembling each other. Further, A_1 has been connected in past experience with B_1, A_2, with B_2 and so forth. We have now a new sensation A_n which, as it is now experienced for the first time, cannot have been previously connected with any member B_n of the series B_1, B_2, B_3, . . . How then can A_n revive a B_n in the form of an image? Only, it would seem, in a circuitous way. A_n must re-excite the several dispositions formed by A_1, A_2, A_3, etc., so as to evoke corresponding images; this will then be followed by the re-excitement of the several dispositions due to B_1, B_2, B_3, and by the corresponding images.

It is plain that such a theory is hard to reconcile with the facts. When the letter A recalls the letter B we are not normally aware of a multitude of A images, and of another multitude of B images. All that is discernible is the given sensation A_n and the revived image B.

This indicates that we are wrong in assuming a plurality of distinct dispositions corresponding to similar sensations. We must rather assume that there is one and the same disposition for like sensations in so far as they are alike—that so far as retentiveness is concerned resemblance, so far as it extends, is virtually identity. But if we proceed on this principle, we cannot regard similarity as an independent condition of association. For association is a connection of partial dispositions in a complex disposition, so that it cannot exist where there are no distinct dispositions to be connected. When, therefore, we see a portrait, the disposition due to previous experience of the original is already partially re-excited without requiring a further step, depending on association. It is already re-excited in so far as portrait and original really have a common character. The work of association is merely to bring before the mind further characters and relations in which the original differs from the portrait. What is re-produced consists in points of unlikeness, not in points of likeness. But this is possible only because the characteristics in which the original agrees with the portrait

have already been attended to in the past in relation to the characteristics in which it differs. Thus the only ultimate condition is some form of continuity of attention.

None the less the revival of similars is distinguished from other modes of reproduction by important peculiarities. It involves what we may name 'divergent' or cross recall as distinguished from 'serial' recall. In serial recall we attend again to a train of objects *a*, *b*, *c*, *d*, *e*, in the order in which we have previously apprehended them. If now in the course of this process, *c* suggests a similar object *y*, *y* need not have, and very frequently has not, ever before been brought before the mind in connection with *c* or with the original series *a*, *b*, *c*, *d*, of which *c* forms a part. There is thus a cross-transition from one train of ideas to an otherwise disconnected train.

I may have seen a portrait before seeing the original, and I may subsequently recall it as belonging to a series of incidents connected with a visit to the house of its owner. It will be remembered in connection with the room in which it was hung, and what took place in that room, and so forth. But if in the meantime I have met the original, then on seeing or ideally recalling the photograph again, I may be reminded of the original and his history and circumstances. Thus two otherwise disconnected groups of associated ideas will be suddenly brought into relation with each other for the first time.

In this way the revival of similars is a fruitful source of novel combination. It is, as Bain remarked, opposed to routine, leading the mind away from beaten tracks. Another peculiarity of the revival of similars is that the common features on which the revival depends are separately presented twice over, (1) as features of the given object, and (2) as features of that which is reproduced. When a photograph reminds me of its original, the points of likeness which mediate the mental transition are twice presented in different and incompatible contexts. To begin with, they are constituent items of my sensations in looking at the photograph, and again they are constituent items of my sensations in looking at the person photographed.

Serial reproduction as well as reproduction of similars presupposes, for the most part, only partial identity of nature of the given object with one apprehended previously. Smoke reminds one of fire because of preformed associations. This is serial reproduction. But the smoke I now see may have features of its own in which it differs from previous experiences. It may be more voluminous, lighter or darker in colour, and so on. In other words, there need only be similarity, not complete identity. The points of difference do not contribute to bring about the reproduction. The partial identity is alone operative in this. But the specific differences may none the less play a positive part in the process. Though they do not help to bring about reproduction, they modify the nature of what is reproduced. A thin thread of smoke suggests a small fire; a large volume suggests a big fire. Smoke on a moorland and smoke rising from a house in London both suggest fires, but with very important differences. The reproduction is due to their identical character; the difference in what is reproduced is due to their different setting.

Now in the reproduction of similars the points of divergence between the reproducing experience and that which is reproduced play no positive part in determining the reproduction. The partial identity of personal appearance between a man whom I meet casually and the Duke of Wellington calls up in my mind the idea of the Duke. But this idea is not transformed in a special manner by the divergent characters which distinguish the man before me from the victor of Waterloo.

We must, at this point, distinguish between the actual reproduction of similars and the processes which frequently follow on it. When a sensation has called up an image similar to it, the mind may proceed to compare them, and it may make the partial identity which is discernible between them the basis for working out a parallelism in other respects by means of further processes. The relation of an apple to the earth reminds Newton, according to the familiar legend, of the relation of the moon to the earth. But he does not stop here. Fixing attention on the partial identity, he strives to enlarge it by tracing identity in other respects also. This

takes place by trains of thought in which the effect of serial association is profoundly modified but not arrested by the difference of the two.

4. Competition of Divergent Associations. — The same experience may have, and generally has, a great many connections in the way of association. The question naturally arises, why one of these rather than another should be operative on any given occasion. "If the sight of a picture, for example, can recall to me the person whom it resembles, the artist who painted it, the friend who presented it to me, the room in which it formerly was hung, the series of portraits of which it then formed a part, and perhaps many circumstances and events that have been accidentally connected with it, why does it suggest one of these . . . rather than the others?"[1] Stated in symbolic terms, the question is as follows: If *a* has become associated with *b*, *c*, and *d*, severally, why on any given occasion should it recall one of these, *b*, in preference to the others?

Thomas Brown was the first to enumerate a number of special circumstances, depending on the conditions under which the association has been originally formed. The greater and more prolonged the attention given to *a* and *b* and to their connection at the time they became associated, the firmer will be the association, and the stronger the tendency of *a* to recall *b*. Again, the frequency with which *a* and *b* have been previously combined is a very important factor. "It is thus we remember, after reading them three or four times over, the verses which we could not repeat, when we had read them only once."[2] We must also take account of the recency of the association. "Immediately after reading any single line of poetry, we are able to repeat it, though we may have paid no particular attention to it; in a very few minutes, unless when we have paid particular attention to it, we are no longer able to repeat it accurately, and in a very short time we forget it altogether."[3] Lastly, much depends on whether *b* has been

[1] Brown, *Philosophy of the Human Mind*, Vol. II., pp. 271-2.
[2] *Ibid.*, p. 273.
[3] *Ibid.*, p. 274.

associated in a similar way with other objects besides *a*. "The song, which we have never heard but from one person, can scarcely be heard again by us without recalling that person to our memory; but there is obviously much less chance of this particular suggestion, if we have heard the same air and words frequently sung by others."[1]

As Ward remarks, the average Englishman is continually surprised without his umbrella, just because the weather is so changeable that no fixed association can be formed.

The preceding conditions are important. But other equally important factors are to be found, not in the conditions under which associations have been previously formed, but in the total mental state at the time when revival takes place. There is a tendency ideally to re-instate those objects which are relevant to the general trend of mental activity at the moment of recall. The sight of rain will suggest an umbrella if we are intending to go out; otherwise it may only suggest the idea of somebody else getting wet. If our minds are occupied with scientific discussion, the word 'proofs' will suggest one group of ideas; if we are engaged in preparing a book for the press, it will suggest something quite different.

Within the total object which engages our attention, special features which for any reason happen to be peculiarly interesting are more efficacious than others in determining the direction of recall. This is admirably brought out in the following illustration given by James. "After looking at my clock just now [1879] I found myself thinking of a recent resolution in the senate about our legal-tender notes. The clock called up the image of the man who had repaired its gong. He suggested the jeweller's shop where I had last seen him; that shop some shirt studs which I had bought there; they the value of gold and its recent decline; the latter the equal value of greenbacks, and this, naturally, the question of how long they were to last, and of the Bayard proposition."

"Each of these images offered various points of interest. Those which formed the turning points of my thought are easily assigned. The gong was momentarily the most interesting

[1] *Ibid.*

part of the clock, because from having begun with a beautiful tone, it had become discordant and aroused disappointment. But for this the clock might have suggested the friend who gave it to me, or any one of a thousand circumstances connected with clocks. The jeweller's shop suggested the studs, because they alone of all its contents were tinged with the egoistic interest of possession. This interest in the studs, their value, made me single out the material as its chief source, etc., to the end."[1]

5. Ideal Construction.—We have seen in the last section that the total mental state, at the time at which ideal revival takes place, is a most important factor in determining what ideas shall be revived. We have now to add that the ideally revived objects are in various manners and degrees modified and transformed by the conditions under which their reinstatement takes place. They enter into new combinations and acquire new relations, so that they appear under fresh aspects. If in the past the sight of a house has become associated with the ideal representation of a person living in it, whenever I see or think of the house I shall tend to think of the person inside it. Supposing that I see the house on fire, or hear that it is on fire, the ideal representation of the person who lives in it will be transformed by the special circumstances of the case. I shall think of him as in danger of being burnt.

The same transforming influence also comes into play in association of similars. A draper serving at the counter may remind me by his personal appearance of Napoleon; but the special circumstances will tend to make me think of Napoleon in a special way. My mind will dwell on the contrast between the life of the great conqueror and that of the man before me.

In these instances, the object ideally recalled is modified by the relations into which it enters at the time of its recall. In some manner or degree, this always takes place. But there is another kind of transformation which becomes prominent only under special conditions. The ideally revived object may not only be modified by the new relations into

[1] James, *Principles of Psychology*, Vol. I., p. 573.

which it enters; it may require to be modified as a pre-condition of its entering into these relations. The nature of any whole is determined, not merely by the nature of its constituent parts, but also by the form of their combination.

Now suppose that we have two terms *b* and *d* so related as to form a whole *bd*. If the relation which constitutes this whole is to be maintained while one of the constituents is altered, it may be necessary for the other constituent to be changed in a corresponding manner. A familiar illustration is supplied by mathematical ratios. Suppose that we have given the ratio 1 : 4; if 1 be changed into 5, we must change 4 into 20, in order to preserve the same ratio.

Now in ideal revival based on preformed association it may and frequently does happen that the trend of mental activity at the moment requires the relation between the associated terms *b* and *d* to be re-instated. But the given term may be only similar to *b*, not identical in its nature with it. Let us call the given term β; β may so differ from *b* that it can no longer enter into the same relation with *d*, so as to form the same kind of whole. In order to reconstitute the form of combination characteristic of this whole, it may be necessary that the ideal revival should take the form δ instead of *d*.

A simple instance " is supplied by the singing or mental repetition of a tune in a different key from that in which it has been previously heard. The absolute pitch of the notes is determined by the keynote, which may vary. The identity of the tune is preserved by correspondence in the transitions between the notes."[1] To take an example of a very common type, suppose that the sight of a piece of sugar arouses the ideal representation of its sweetness. It is this special piece of sugar as seen by me at this moment which recalls the sweet taste. The special conditions operative at the moment of reproduction enter into and modify process and result. " If the sugar seen is beyond my reach, then the sweetness suggested is a sweetness beyond my reach, though in all my past experiences the sugar may have been easily attainable."[2]

[1] Stout, *Analytic Psychology*, Vol. II., p. 57.
[2] *Ibid.*, pp. 44-5.

"Mr. Lloyd Morgan tells a story of a little boy who 'after gazing intently at a spirited picture of a storm at sea with a ship being struck by lightning, asked, Mother, why doesn't it rumble?' Now, what kind of a rumble was in this case actually suggested to the boy? Was it anything in the nature of a literal reproduction of any thunder-clap which he had ever heard? If he had heard an actual peal of thunder at the moment, this would not have fitted itself in as a natural complement of the painted scene. If his mother had told him that painted lightning could only be accompanied by painted thunder, the answer would in all probability have appeared to him as a satisfactory one."[1]

A little girl, playing with a doll, treats it as if it were a baby. The doll becomes a centre from which a train of associated ideas starts, analogous to those which would be suggested by a living child. But the fact that she has not to deal with a living child, but only with a doll, makes a difference. She puts food to its mouth, but does not expect the food to be swallowed.[2] She would certainly be very much startled if it actually began to cry. The train of ideas connected with babies is reproduced only in analogue.

In these examples, the relations which determine the ideal construction are revived by association. But in other cases, the form of combination is entirely determined by the predominant interest at the moment at which revival takes place; so that objects are brought into relations in which they have never occurred before. If a man is in the mood for making puns, or for drawing epigrammatic contrasts, or for tracing relations of cause and effect, these modes of combination will impose themselves on the objects revived by association, and

[1] *Ibid.*, p. 46.

[2] "Some children, it seems, have a way of putting food on the floor near the doll; others go further, and hold the food long to the doll's mouth; or, insisting on a still more realistic performance, break out some of its teeth, and push the food into the mouth with a pin. Others, again, stopping short of such violent realism, cover the unreality by a dodge, as when one child, after holding the food to the doll's mouth for a while, slipped it down its neck." Sully, article on "Dollatry," *Contemporary Review*, Jan. 1899.

will tend to transform these objects so far as may be necessary to make them fit into the relational scheme.

Differences in the mental constitution of individuals largely consist in differences in the kind of relation in which they are predominantly interested. Some attend by preference to mere relations of contiguity in time and space; others to metaphorical analogy; others to rhetorical contrast; others to logical connection; and the kind of transition which is relatively dominant in the sequence of their ideas varies accordingly. In the mind of a schoolman, the ruling scheme of connection was apt to be the form of the syllogism. In many minds, and especially in those which are saturated with the study of Hegel, a special form of transition is favoured, which consists in a triple movement, passing from a one-sided view of the case to the opposite one-sided view, and then to a more comprehensive view which embraces the two extremes in harmony.

Sometimes the modification needed to adapt the material supplied by association from past experience to its place in a new context takes place in the process of revival itself so that no further readjustment is required. The inveterate punster, for instance, may find himself mispronouncing a word without previously thinking of the right pronunciation or recognising that this requires to be altered for the purpose of the pun. The same holds for the recall of the successive notes of a tune when it is transposed from one key into another.

In the 'inspired' work of genius, as the musical compositions of Mozart, ideas emerge of themselves in a form already adapted to their place in the growing context of ideal construction. But in ordinary thinking, the materials initially supplied by the play of association require, for the most part, to be re-moulded before they can be woven into the relational scheme. A high and smooth-barked tree has to be climbed. To think of steps does not of itself furnish an ideal path to the desired end. They must be steps of a special kind produced in a special way—steps cut successively in the bark by means of a knife, so that those first made may be used in order to make those higher up.

Or, to take an instance of a different kind, the novel writer is ever on the outlook for scenes, incidents, and traits of character which may turn out useful to him in his literary work. He thus stores his mind with materials which the play of association will present to him as they are required. But in actually using them he will in general, have to select and recast them so as to fit them into the development of his story.

A word in conclusion as to the ultimate nature of ideal construction. It is a common-place that the power of the mind to frame for itself new ideas is never creation out of nothing, but always consists, as Locke maintained, in separating and recombining in fresh ways a material already at its disposal. But such words as 'combining' and 'separating' contain metaphors derived from the workmanship of human beings in the material world, the quarrying of stones, the building of houses, the chiselling of statues, and so forth. What is the real nature of the mental processes which are thus metaphorically described? It consists, we may answer, in the transition from the apprehension of the actual to the thought of the possible.

Possibility is essentially bound up with the existence of kinds of classes. Wherever a number of different objects share a common nature but exemplify this common nature each in its own special way, these special determinations are what we call possible alternatives. All the things in this room have shape; but the shape of each is different. The particular shapes are all possible alternative specifications of the common character, shape. In the case supposed, these possible alternatives are also actual and apprehended by me as actual. But the common character is such, and is found by me, when I consider it, to be such, that the range of its alternative variations is not exhausted by the given particular examples or by any others which I can recall from past experience. On the contrary, I find that I am able to bring before my mind other possible variations which I have never perceived and perhaps never shall perceive.

Similarly, human beings in general have height which varies from man to man; but in actual experience the variation is

confined within definite limits. The limits are not, however, imposed by the general character itself or by the shape and proportions of the human body. Hence I can think of a man being a mile high or even picture him with his feet on the ground and his head in the clouds. These examples illustrate the essential nature of all ideal construction. It consists always in the discovery of fresh possibilities, possibilities relative to this or that general condition or conditions.

Viewed in this light, the constructive work of the mind is rather a finding than a making or producing. It is a finding of possibilities which have not been apprehended as actual. It is only on the side of immediate experience that it can be regarded as, in the strict sense, a production of something new. When we imagine a golden mountain, we do not make but discover the shape and size of a mountain as among the possible variations of shape and size in general; similarly, we do not make but discover gold as one of the alternative materials capable of having such size and shape. But if we bring before our minds this possible alternative by means of a mental picture, the mental picture is a relatively new immediate experience. Both it and the mental disposition which it leaves behind are determined by our activity in attending. They are the workmanship of the mind and products of mental construction.

6. Obstructions in the Flow of Ideal Activity.—Ideal activity, like perceptual activity, may be successful or unsuccessful. In so far as it is unsuccessful, it tends, like perceptual activity, to persist with variation of procedure. The tendency is of course proportioned to the strength of the interest involved.

The conditions which obstruct and delay the flow of ideas are of various kinds. The hitch may occur either on the reproductive or on the constructive side of the process. When it occurs on the reproductive side, it is merely what is called a failure to remember; as when we find ourselves unable to recall the name of a person or the title of a book. If we are sufficiently interested, such failure is followed by a more or less prolonged effort to recollect. In this effort we vary our procedure, using all the means which present themselves.

Supposing it is the name of a person we are endeavouring to recall. We try various clues in succession. We fix attention on objects and circumstances connected with the person. We perhaps inquire of a bystander, or look in a book; or go through a list of names on the chance that we may hit on the right one. As in perceptual process, there is persistency with varied effort.

When the hitch occurs on the constructive side, the mental processes which are directed to overcome it may be extremely complex. The guessing of riddles furnishes a good example. We have ideally to reproduce something which shall satisfy all the conditions of the riddle. Certain relations are given, and we have to find another term which shall fit in with these in a harmonious whole. We make trial after trial, we think of this, and then we think of that; but each suggested solution in turn, though it may fulfil part, fails to fulfil all conditions of the problem. Here, too, there is persistency with varied effort, comparable to the varied efforts of Thorndike's cats to escape from their cages. Finally, we may or may not succeed in completing the ideal scheme, by making the right guess.

We may take as another example a case in which the flow of ideas is controlled by the urgency of a practical need. Suppose a man shut up in prison and bent on devising a mode of escape. Let us assume that the main difficulty lies in the height which has to be descended before he can reach the ground. The notion of letting himself down from a height by means of a rope may be familiar to him by past experience: but in this case he has no rope. What he needs, therefore, is something which will take the place of a rope—something which will fit into his ideal scheme as the rope would if he had it. He may proceed to think of various expedients, and he may at last light on the idea of using his sheets and blankets. The first time this suggestion occurs to him, it may not help him out of his difficulty; but it comes nearer to what he wants than anything else he has thought of; therefore his mind tends to dwell on it, and to give it a new shape which will suit his purpose. At last he hits on the idea of tearing up the sheets and twisting them into a rope.

Of course we are supposing that our supposed prisoner has not already heard of this expedient. We may assume that he is the first man who invented it. In this, as in similar instances, association by similarity plays an important part. His own case calls up to the mind of the man analogous cases in which ropes have been used. He then proceeds to work out his own case on parallel lines, so far as the circumstances admit.

CHAPTER II.

MEMORY.

1. Definition of Memory.—Sometimes the word 'memory' is used as synonymous with 'retentiveness' in general. This application of the term is inconveniently wide. It is better to confine it to ideal revival, so far as ideal revival is merely reproductive, and does not involve transformation of what is revived in accordance with present conditions. This reproductive aspect of ideal revival is best exemplified in those cases in which the controlling interest requires the objects of past experiences to be re-instated as far as possible in the order and manner of their original occurrence. Hence the word 'memory' is applied with special appropriateness to these cases.

A witness giving evidence in a law-court is a typical example. His mind is bent on recalling past objects and events, as they actually occurred in his previous experience, omitting the inferences which he has subsequently drawn from them, or is inclined to draw at the present moment. The inferences which he drew from them when they occurred he recalls as far as possible only as inferences, and not as actual percepts.

The witness in a law-court recalls his own personal experiences as far as possible in the same time-relations in which they actually occurred. This may be called 'reminiscence' or 'personal memory'; but there is a large class of cases in which memory is impersonal. What is remembered in these instances is the knowledge acquired by personal experience, and not the particular incidents connected with the process of acquiring it. When a boy first begins to study his Euclid, his natural tendency is to learn the propositions by heart, so as to reproduce the very words of the book. When the process of learning is complete, what remains in his mind may be only the general method of proof. He will to a large extent have forgotten the words of the book, and he will certainly have forgotten much that happened in the process of learning; the

particular occasions on which he sat down with Euclid in hand to learn a proposition; his blunders in attempting to reproduce it, and so on. He will finally tend to recall only what he has an interest in recalling, forgetting what is irrelevant.

The process is quite analogous to the formation of habits of thinking and acting. As in the formation of habit, two distinct conditions are involved: the first is retentiveness; the second lies in the essential nature of conation, according to which conative processes cease, if and so far as their end is attained. This holds good even in learning by rote. In learning by rote the dates of accession and death of the kings of England, a boy will go over them again and again in his book, and will again and again attempt to repeat them; but in the long run he will forget these particular incidents. He will forget his successive attempts to 'commit to memory' and his occasional failures and errors in attempting to reproduce.

2. Good and Bad Memory.—The marks of a good memory, are, (1) The rapidity with which the power of recalling an experience is acquired; (2) The length of time during which the power of remembering lasts without being refreshed; (3) The rapidity of the actual revival; (4) The accuracy of the actual revival. Some persons can learn quickly and easily, but soon forget; others take a long time to learn, but also retain for a long time what they have once learned. Even when memory is retentive, so that what is once learned is not easily forgotten, there may yet be slowness and hesitancy in the actual process of reminiscence.

As a further mark of good memory, we may mention its serviceableness, or in other words the readiness with which it reproduces what is relevant to the prevailing interest of the moment. A memory may be extremely extensive without being in this sense serviceable. Dominie Sampson's mind, for instance, was like " the magazine of a pawnbroker, stowed with good of every description, but so cumbrously piled together, and in such total disorganisation, that the owner can never lay his hands on any one article at the moment he has occasion for it."[1]

[1] *Guy Mannering*, Ch. XXXIX.

Those who cram for examinations often realise this in a painful manner. So long as the questions are straightforward, so that the answers may be taken directly from the books they have used, they may find no difficulty. But as soon as a question is asked which requires them to record their acquired knowledge in a different order and manner from that in which it is given in their textbook, they break down. The materials for an answer may really be contained in what they have learned, and yet they may not be able to recall what is wanted, because the particular question has never been associated in their minds with the particular answer.

The rapidity with which the power of recalling is acquired depends to a large extent on the keenness of the interest attaching to the original experience. Much that attracts attention only transiently and faintly fails to be remembered at all. It is to be noted that we tend to remember, not only what is in itself interesting, but also connected circumstances which may in themselves have little interest. A young child takes little interest in the alphabet for its own sake, but if the letters are made of gingerbread, it is more likely to remember them.

So far as the power of acquiring a memory does not depend on interest, it must be set down to the account of congenital constitution. But native capacity for remembering is, for the most part, connected with native capacity for interest in what is remembered. Mozart, as a boy of fourteen years old, could write down from memory an extremely complex piece of music after having heard it only once; but the musical genius of Mozart caused him to take a most intense and absorbing interest in the actual hearing of music.

Some idiots show remarkable power of memory. They can, for instance, repeat long lists of disconnected words which they have heard only once. Possibly, this is connected with the fact that the range of interest in the idiot is excessively narrow and correspondingly concentrated. Such abnormal power of memory in one specific direction does not involve any increased memory capacity in general. There is probably no general capacity of memory, but only a group of specialised memories. These closely correspond with special interests.

Differences in the length of time during which the power of recall is retained also depend largely on interest. It is to be remarked that the kind of interest which facilitates the acquisition of memory is not necessarily the same as that which is most effective in causing its permanent retention. The barrister learns the facts bearing on a particular case, but rapidly forgets many of them which have only a transient interest, when the case is over. The properly legal aspects of the case, on the contrary, will tend to be retained because he has in them a permanent interest.

Another very important factor in determining duration of the power of recall is the frequency with which the remembered experience has been repeated. A boy learning a passage by heart will go over it again and again until he has thoroughly stamped it in. Differences in the retentiveness of memory which are not traceable either to interest or to frequent repetition must be referred to congenital constitution. Here again it is doubtful how far congenital constitution can favour memory without favouring interest.

The conditions on which serviceableness depends are of a different kind. A man who can readily recall what he needs at the time he needs it is said to have his knowledge well-arranged or organised. The mass of his acquirements may be much smaller than that of another man whose knowledge takes the form of cumbrous and disjointed erudition. Yet his memory may be incomparably more effective both for practical and theoretical purposes, and even for the answering of examination papers.

To understand the distinction we must note that a man may be perfectly able to call something to mind when a certain prompting cue is given, and quite unable to do so in the absence of this cue. I may be quite able to recall a line of verse if I have first heard or recalled the previous lines, but I may be quite unable to recall the same line of verse as a quotation illustrating some point in which I am interested at the moment. The reason is that I never thought of the meaning of this line of verse, or of familiar objects, in connection with this particular point or similar points. It is not necessary that the particular line of verse should have been

thought of in a special connection for it to be recalled in this connection. All that is necessary is that the general kind of relation involved should be more or less familiar to the mind.

I may, for instance, wish to illustrate the fact that in poetic metaphor the connection between the metaphorical expression and the reality which it expresses is often identity in the form of combination of a complex whole rather than identity in the nature of its material constituents. For this purpose I may quote Tennyson's line,

"A doubtful throne is ice in summer seas."

A throne is not in the least like ice, nor the dangers to which it is exposed like the warmth of summer seas. There is only analogy of relation. Now for this line of Tennyson to occur to me as an illustration of my point, it is not necessary that I should have thought of it before in this connection. But it is necessary that I should previously have thought of other similar illustrations. The more I have done this, so as to familiarise myself with this kind of mental transition, the more readily shall I be able both to recall old illustrations and to produce new ones.

Thus we may say that the serviceableness of memory depends on our forming the right kind of associations. The tendency of A to recall B in a certain kind of relation, r, depends on our having previously attended to A and B in this relation, or to things similar to A and B in similar relations.

3. Decay of Memory with Lapse of Time.—Though particular memories last for various periods in different cases and with different persons, yet it is the general law that they tend to die away in course of time if they are not refreshed.

Ebbinghaus conducted numerous experiments with the view of determining the quantitative relation between lapse of time and decay of the power of recall. For this purpose he learnt by heart lists of unmeaning syllables of three letters each; each list contained from twelve to thirty-six syllables. After learning a list so as to be able to repeat it, he allowed an interval of time to intervene before again attempting to recall the syllables. Memory had in the interim become more

or less partial and fragmentary. The point of the experiments was to determine the amount of time required for re-learning the list as compared with the time originally required. This yields a measure of the degree of decay of the mental dispositions, and shows the relation between decay and lapse of time. After an interval of 20 minutes, about 40 per cent. of the original time was required for re-learning, after 64 minutes, about 56 per cent., after 526 minutes, about 65 per cent., after two days, about 72 per cent., and so on. From this we see that, though the amount of decay increases with the lapse of time, yet relatively it is smaller the longer the interval.

4. Variety of Memories.—In ordinary language we speak of a person having a good memory for numbers but a bad one for names, a good memory for places but a bad one for faces, and so on. Theoretically, we must carry this division very much further. As memory consists in the power of ideal revival, there must be a relatively separate memory for every experience ideally revived. There must not only be a separate memory for names, but a separate memory for each particular name.

But ordinary language is undoubtedly right in recognising distinct memories for general departments of experience. Mozart had an extraordinary memory for music; but he may have been very bad at recalling numbers. The most wonderful memory for words may be accompanied by a poor memory for dates and events. These differences are very largely due to congenital constitution. They are closely connected with differences in interest; but there are individual peculiarities which cannot be easily explained in this way.

5. Improvement of Memory by Practice.—It is certainly true that the exercise of memory in a special direction improves it in that direction. By long practice actors come to learn their parts more rapidly and easily. The same is true of clergymen who learn their sermons by heart. These effects of practice appear to be strictly confined to the special kinds of ideal revival which are exercised. A man who improves his memory for words does not thereby improve his memory for places.

There is reason for denying that memory can be directly improved by practice. The power of remembering depends on the kind and degree of attention given to the original experience. It would seem that what is educated by practice is the power of attention, and not the power of recall. James was probably right in maintaining that "all improvement of memory consists in the improvement of one's habitual method of recording facts."[1] It is the power of learning, not the power of retaining, which is increased by practice. "I have," says James, "carefully questioned several mature actors on the point, and all have denied that the practice of learning parts has made any such difference as is alleged. What it has done for them is to improve their power of *studying* a part systematically. Their mind is now full of precedents in the way of intonation, emphasis, gesticulation."[2]

There can be little doubt that James was justified in assigning increased and better directed attention as the ultimate cause of the improvement of memory by practice. The endeavour to remember is an endeavour to attend; and by repeated and prolonged attention to objects, we not only make more permanent the traces which our experience of them leaves behind; we also bring them into relation with other objects, and so multiply the associations which may severally and conjointly contribute to their revival.

On this view, the power of retentiveness is born with each individual as an essential part of his general physiological constitution. It is "a physiological quality, given once for all with his organisation, and which he can never hope to change. It differs no doubt in disease and health; and it is a fact of observation that it is better in fresh and vigorous hours than when we are fagged or ill. . . . But more than this we cannot say."[3]

In order to understand the improvement of memory by practice, we must recur to a point already explained in discussing the revival of similars. Similar experiences, so far as the similarity extends, have the same mental disposition corresponding to them. This is peculiarly clear in association

[1] *Principles of Psychology*, Vol. I., p. 667.
[2] *Ibid.*, p. 664. [3] *Ibid.*

by similarity. One man, by some quality in his personal appearance, may remind me of another; I may not discover, even after careful scrutiny, what the point of resemblance is. It has not formed a separate link of association. Yet the disposition left behind by my experience of the one person has been re-excited by the sight of the other. The dispositions left behind by the two experiences must therefore have some common factor. They must partially interpenetrate. In general, so far as the revival of similars by similars is possible, there must be a partial coincidence of mental dispositions.

The same applies to association by continuity. If β recalls γ because b and c have been associated, the disposition left behind by b must be partially re-excited on the occurrence of β; the dispositions left behind by b and β cannot therefore be absolutely independent.

Just in so far as this interpenetration of mental dispositions exists, the exercise of the memory for certain experiences will improve the memory for analogous experiences. When a man has made a certain amount of progress in the learning of a foreign language, further progress is facilitated, just because he has become familiar with certain general characteristics of the language, which do not need to be learnt over again for every particular case. Of course it does not follow that memory in general is improved by its exercise in this or that particular direction. The progress will only extend to analogous experiences in precise proportion to the degree of analogy. Exercise of the memory in the study of languages will do little to improve it for the retention of chemical formulae.

6. Memory and Past Time.—There is one most important aspect of memory which we have not touched upon. When we remember objects or events, we often apprehend them as having been presented to us in our past experience. This is part of the general question of the origin and development of the ideal representation of time-relations, which will be discussed in the chapters on " The World as Ideal Construction " and " The Self as Ideal Construction."

CHAPTER III.

IDEATION, COMPARISON, AND CONCEPTION.

1. Ideal Pre-arrangement distinguished from Perceptual Pre-adjustment.—Perceptual activity is guided by the actual presence of perceived objects. It is true that perceptual activity constantly involves pre-adjustment of the body and sense-organs for coming impressions. But this pre-adjustment is directly prompted by present or past impressions, and it consists, not in a pre-determination of the future, but merely in an appropriate waiting attitude.

The only means by which the perceptual consciousness can control the course of its experience is through actual bodily movement. But no bodily movement can overleap a period of time. The most agile animal cannot take a spring into the future. But in trains of ideas we can transport ourselves into the future. We can begin by the ideal anticipation of the end, and we can move freely to and fro over the series of links intervening between end and starting point. Thus, if we meet a difficulty midway in the series, we need not provide for that difficulty at the point where it emerges. We may go backward to an earlier stage or even to the beginning, and there make a suitable re-arrangement. It is plain that the process admits of all kinds of variations, and re-adjustments of part to part, which are impossible for perceptual consciousness.

2. Conceptual Analysis and Synthesis. — All ideational activity as compared with perceptual activity involves some kind and degree of generalisation. We have seen that mental images are in general fainter and much less detailed than the corresponding impressions. They lack the determinate particularity of actual sense-experience. But indeterminateness in the image involves indeterminateness in the meaning of the image in so far as expression of the meaning depends merely

on the presence of the image without being otherwise defined and developed. Hence any given mental image taken by itself may be equally capable of representing a great number of diverse objects.

If I think of wealth, I may have in my mind a vague mental picture of a bale of goods: but the same mental image might equally have been present in my mind had I been thinking of a wharf, of commerce, or of a warehouse. Similarly, a bag of sovereigns might stand either for wealth, or a miser, or the Bank of England. The mental picture of a spade might stand either for the act of digging, for a garden, for a navvy, or for a grave-digger.

But the mere indeterminateness of the mental image is very far from explaining the beginnings of general ideas. We give an essentially inadequate view of the generalising function of thought when we dwell exclusively on what it omits. This negative side of the process has for its indispensable correlate a positive side. In any train of thought, we are under the guidance of a controlling interest constructing an ideal whole. Each of the several ideal representations which successively emerge contributes its part to this ideal structure. The details of actual perception which are omitted in the ideal representation are omitted because they will not fit in to our ideal combinations. We can no more use the complete details of actual perception in building up our mental structure than we can use unhewn stones in building a house. But in this account of the matter it is indirectly implied that the indeterminateness of ideal representation is compensated for by another kind of determination. What is vague and indefinite in the several images and their meanings is made relatively definite and complete by the combination of ideas as the train of thought advances. What is wanting in the several ideas is supplemented by their relations to each other in the ideal whole.

Thus we have side by side a process of analysis and one of synthesis. By the process of analysis, the concrete detail of actual sense-perception is broken up, and certain aspects of it selected. In contrast with the concrete totality of perception, these partial aspects have a more or less general or 'conceptual'

character. The analysis may therefore be called 'conceptual analysis,' and the corresponding synthesis, 'conceptual synthesis.' By conceptual synthesis, the partial aspects are recombined into a new whole. Similarly, in building a house, we have first to go to the quarry and detach the single stones from it, afterwards hew them into shape and then build with them a new structure. This may be illustrated by the simple recall of a series of events in the order in which they actually occurred in sense-experience, or of a number of objects in the order in which they were actually presented in space.

The word 'now' and the word 'here' have different meanings from the point of view of sense-perception and of ideal recall. From the point of view of sense-perception the word 'now' always means the actual moment of sensation, and 'here' means the direct presence of an object to our percipient organism, as immediately revealed by the sensation which it produces. But in ideally recalling a series of events in time, or a grouping of objects in space, actual sensation is absent, and can no longer serve as a distinguishing mark of what is now present or what is here present. The individualising details of present perception are to a very large extent absent from the ideal reproduction. The 'now' and the 'here' must therefore be otherwise defined. In fact, they are defined by the combinations into which they enter. They become purely relative terms.

To go back to an old example, suppose that I picture myself as eating my breakfast.[1] I pass in review successive events. I mentally enter the breakfast-room; then sit down at the table; then pour out the tea; then open a newspaper; then help myself to fish, and so on. If I want to represent vividly what took place, I may say 'now' instead of 'then,' and think in the historic present. Now I am entering the breakfast-room, now I am sitting down, now I am pouring

[1] I have supposed this train of ideas to take place by means of a series of visual images. I have done so because the treatment of the function of language is reserved for the next chapter. But as a matter of fact many people would naturally recall a series of past events in the way of verbal description, either as a substitute for, or an accompaniment of, visual imagery. It is the peculiarity of words as mental images that they are indeterminate in their meaning, not in their nature.

out the tea, and so on. Whether I say 'now' or 'then,' obviously what I am doing is to define the temporal position of each event by its relation to others in a series. The word 'now' becomes purely relative in its application. Any part of the series may be regarded as a 'now' in relation to what comes before it and what comes after it. Similarly, by a change in the point of view, any part of the series which was previously regarded as a 'now,' may become a 'then.' It all depends upon our point of departure. If we mentally pass from an earlier part of the train to a later, what was previously a 'now' becomes a 'then,' what was previously future becomes present or past, and so on.

This example is typical. In all trains of ideational thinking, the several parts are made definite and determinate by their relations within the ideal whole which is being constructed. In this way the concrete determinateness of sense-perception is replaced by a new kind of determinateness, that which is due to conceptual synthesis. In this sense we may adapt the dictum of Hegel, that thought passes always from the abstract to the concrete. One abstraction combines with and supplements another, so as to make the whole more and more concrete. The concreteness thus attained is of course different in kind from that of actual perception, and must always fall short of it. But it is at least equally true that the concreteness of actual perception falls short of that which is attained by ideal synthesis. In ideal synthesis there are apprehended distinctions and relations of which in sense-perception we can never become aware. By ideal combination the world comes to be thought of as a unified system of which only a very small part is ever actually present to the senses of an individual percipient. Thus sense-perception is fragmentary as compared with ideal combination, and in this sense is less concrete.

3. Comparison.—"The growing mind, we may suppose, passes beyond mere perception when some striking peculiarity in what is at the moment noticed is a bar to its definite recognition. A deer-stalker, say, is not instantly recognised as a man, because he is crawling on all fours; or a scarecrow looks like one, and yet not like one, for, though it stands on

two legs, it never moves. There is thus a pause and no 'naming': the conflict of ideas—quadruped or biped, clown or boggard—inhibits this step."[1]

Such a comparison is a complex process, involving a series of judgments, such as—"It crawls; It does not move; and the like."[2] There are abundant occasions in animal life which might usefully call into play mental operations of this kind. Whenever things are in appearance different, although they are for practical purposes the same, or whenever they are in appearance similar, although for practical purposes they differ, a problem arises which would be most effectively solved by deliberate comparison. By deliberate comparison I mean a mental confronting of the two objects, and a transition of attention from the one to the other, so as to discover some respect in which similar things differ in spite of their similarity, or in which different things agree in spite of their diversity, and also a fixing of the precise nature of this agreement or difference.

If an unpalatable moth resembles in its markings a palatable moth, a bird will be apt to confuse them, and so meet with disagreeable disappointment. The bird might conceivably attempt to overcome the difficulty by setting a specimen of the disagreeable species side by side with one of the agreeable species, and then, examining them alternately, might consider first one character and then another of each, so as to find out distinguishing differences. Or again, without bringing the two actual objects together, it might examine the one as perceived and the other as ideally represented, and go through the same process. This would be much harder because it would require a strong and persistent effort to keep before the mind a sufficiently accurate idea of the absent object.

Now the supposed case of the bird actually confronting the two objects, alternately scrutinising each, and passing in turn from one characteristic to another, has a strong air of improbability. As a matter of fact, we rarely observe animals behaving in such a manner as to make this interpretation of

[1] Ward, *Psychological Principles*, pp. 305-6.
[2] *Ibid*, p. 306.

their actions necessary or even probable. But if they do not usually compare two objects when both are perceived, it is *a fortiori* unlikely that they should do so when one has to be ideally recalled, for, as we have said, this is the harder task. In fact, we have good reason to re-affirm Locke's dictum that "brutes compare but imperfectly." "It seems to me," he says, "to be the prerogative of human understanding, . . . when it has sufficiently distinguished any ideas, . . . to cast about and consider in what circumstances they are capable to be compared."[1]

We have seen that systematic observation of animals confirms this view. It is the one result most distinctly brought out in Lloyd Morgan's book on *Comparative Psychology*. I may here quote an experiment which he carried out with great care and patience.

Taking with him a dog which had been trained to fetch and carry, he threw a stick into a field surrounded by railings. The dog bounded after the stick, and brought it back in his mouth as far as the railings. But here he was confronted with a difficulty; he could get through himself, but he could not get the stick through. His experience had not taught him that the only way of succeeding was by grasping the end of the stick; instead of this, he tugged now here, now there, in a perfectly uncritical way. If, by accident, he did get hold of the right end of the stick, or if Lloyd Morgan showed him how to proceed, this seemed to yield him no assistance on the repetition of the experiment. He had stumbled on the solution, but could not do the trick again.

This was no casual observation; it was a systematic experiment repeated day after day, and only one of a course of similar experiments. It is evident that the dog here passed from one alternative to another without selective comparison; so that when he hit on the right one or was shown it, he failed to note the points in which it differed from unsuccessful attempts.

Comparison in all but a most rudimentary form involves free ideas. Even when the objects compared are both present

[1] Locke, *Essay Concerning Human Understanding* (Fraser), Vol. I., pp. 204-5.

to the senses, each is scrutinised in turn. For anything more than a vague awareness of resemblance or difference, it is necessary to keep before the mind the ideal representation of the one object in the very act of examining the other. Only in this way can each detail and characteristic in turn be selected for comparison, so as to distinguish the points of difference from the points of agreement. Hence we may attribute the rarity of comparison in animals, in all but its most vague and rudimentary form, to the absence or imperfect development of free ideas.

When the process of deliberate comparison plays an important part in the mental life, it involves a corresponding development in conceptual thinking, in the distinction of the general or universal from the particular. To compare deliberately is always to compare in some special respect. Some theoretical or practical end is to be subserved by the comparison. The difference or agreement to be discovered is not just any difference or agreement, but one with significance for the guidance of conduct or for the solution of a theoretical difficulty. Thus comparison takes place only in regard to the characteristics which happen to be interesting at the moment, other characteristics being disregarded or set aside as unimportant.

Objects in other ways most diverse may yet in a certain respect be compared and found more or less similar, and objects in other ways very similar may be compared in a certain respect and found more or less unlike. Hence, as the process advances, it becomes possible to group objects according to the degrees of their difference or resemblance in this or that respect without taking into account their other attributes. We may arrange musical tones according to the degree of their loudness disregarding their pitch, or according to their pitch disregarding their loudness. In the scale of loudness, sounds most different in pitch might occupy the same position, and sounds of the same pitch widely different positions. A shrill note and a low one may be of equal loudness, and sounds of the same pitch may be of different loudness.

It is evident that in this way what we have called the conceptual analysis of the concrete details of sense-perception

receives a great development. A complex object becomes mentally separated into a plurality of partial aspects, each of which can form a starting-point for a series of comparisons, giving rise to different series of graduated resemblances such as those of pitch and loudness, and objects which are far apart in one series will be close together in another. To each of the different series there corresponds an abstract character or attribute of the object consciously distinguished from other abstract characters or attributes. Thus the category of 'thinghood' assumes a new form in ideational thinking from that which attaches to it in perceptual. The unity of the thing is explicitly distinguished from the plurality of its qualities, and that kind of predication which is embodied in language becomes possible.

The necessity of doing one thing at a time has led us to describe the nature and progress of comparison without reference to the use of language. But in fact the ideational activity which comparison involves could not proceed far unless it were guided and supported by expressive signs—signs directly expressing free ideas and their relations. The nature, function, and origin of these signs is the topic which will occupy us next.

CHAPTER IV.

LANGUAGE AND CONCEPTION.

1. Language as an Instrument of Conceptual Analysis and Synthesis.—In speaking of language, we must remember that what primarily concerns the psychologist is not any special system of external signs such as gestures, articulate sounds, or written characters, but a certain psychical function —a peculiar mode of mental activity. It is a unique and most important characteristic of this function or activity that many minds can co-operate in it as if they constituted a single mind. But the possibility of this co-operative thinking must be grounded in the nature of the mental process as it takes place in the individual mind. I do not mean that the use of language in individual thinking was or could be prior to its use as a means of intercommunication. What I do mean is that the earliest communication concerning objects outside the range of present perception could take place only between minds capable of a certain kind of mental process.

In order that *A* and *B* may interchange ideas, instead of merely pointing to percepts, it is evident that they must start from a previous basis of common experience. It is impossible to discuss Greek particles with a person who does not know a word of Greek. But if communication is to be real and valuable, it must be possible for *A* not merely to convey to *B* what *B* already knows, but also what he does not know. *A* must be able to communicate to *B* something of which *A* has had experience and of which *B* has not had experience. How is this possible?

Let us consider an analogous case. I wish to show someone how to pronounce a word which he has never heard. He is either deaf or at a distance, so that I cannot adopt the simple expedient of pronouncing it myself in his presence. My only resource is to write it down for him in phonetic spelling. I

thus convey to him the new sound by exhibiting it as a combination of sounds with which he is already familiar. I reconstruct it and thus enable him to reconstruct it out of its phonetic elements. In like manner, *A* can communicate a new fact to *B* by reconstructing it out of elements with which *B* has become acquainted in the course of his previous experience. Intercommunication of ideas therefore implies analysis of the objects and processes presented to perception into certain constituents which recur in varying combinations in various particular cases. The use of language involves ideal analysis of objects and processes into common factors and their free reconstruction out of these common factors.

It must not, however, be supposed that these common factors have each a rigid and unalterable nature which remains unchanged in the various combinations into which they enter. They are not like printers' types, which merely change their mode of external juxtaposition without inward modification. On the contrary, the elements which are being continually combined in all kinds of varying ways in spoken or written discourse mutually modify each other. The meaning of a word varies with its context. Paul emphasises this point in his valuable work, *Principles of the History of Languages*. "In sentences like, 'I never laid a hand upon him'; 'John never drew bridle,' the hand referred to is not a hand in general, but my hand, the bridle referred to is not a bridle in general, but that which was held by John. Compare such instances as 'a good point,' 'a point of honour,' 'the bar of an hotel,' 'the bar of justice,' 'the tongue of a woman,' 'the tongue of a balance.'"[1]

The special meaning assumed by a word in a special context or special circumstances may be called its 'occasional' meaning. It is only at a late stage of mental development that an express attempt is made to distinguish an identical and persistent element of meaning pervading the varying occasional significations of a word. When the attempt is made it constitutes an epoch in the history of thought. It is the beginning of definition and of the scientific concept. In popular and pre-

[1] Ch. IV., p. 73. The student should read the whole chapter.

scientific thinking the occasional meaning is the only one which comes to clear consciousness.

It follows from this account of language as a means of communication that words and their combinations express that process of analysis and synthesis which is essentially involved in trains of free ideas. The use of language presupposes the breaking up of the concrete content of actual perception into its partial aspects and constituents, and the recombination of these to form new ideal wholes. The variation of meaning with context is due to the nature of the constructive process. The word calls up only what is relevant to the controlling interest guiding the train of thought.

Conceptual analysis and correlative synthesis would seem from this account of the matter to be a prior condition of the existence of language. In logical strictness this is so, but it is equally true that conceptual thinking could exist only in a most rudimentary and inchoate form apart from the use of some kind of expressive signs. Language is not merely an accompaniment of conceptual activity; it is an instrument essential to its development. It is an appropriate means of fixing attention upon ideally represented objects as distinguished from percepts. It becomes the more necessary the more abstract ideal representation is—in other words, the less it contains of the concrete details of actual sense-perception. The precise mode in which expressive signs serve to fix attention on ideas will be considered later on. Here we content ourselves with provisionally affirming that language in some form is an indispensable tool to think with. Within the mind of the individual thinker it serves to fix attention on his own ideas; in communication with others, it serves to fix the attention of the hearer on the ideally represented objects present to the mind of the speaker.

For illustration of conceptual analysis and synthesis, we may take any sentence or intelligible combination of words. Each word stands for some general aspect of the concrete detail of actual perception—in other words, it stands for what is called a 'universal' or 'concept.' The universals expressed by the several words combine in a unity, each helping to determine and particularise the rest, so as to form an ideal whole.

Take such a sentence as 'Nansen skates.' 'Nansen' is a proper name, and may therefore be supposed to stand for a particular, not for a universal. This is true from a certain point of view. The word 'Nansen' designates a particular human being. But from another point of view it stands for a universal. The individual Nansen is a universal as the unity and connecting identity of his own manifold and varying states, relations, qualities, and activities. Nansen as perceived must be Nansen eating, or Nansen sleeping, or Nansen lecturing, or Nansen skating, or determined in some other specific way. But the word 'Nansen' by itself does not stand for any of these particular determinations rather than others. It stands for Nansen in general. The word 'skates' particularises the universal 'Nansen.' But it does so by means of another universal. Other people skate besides Nansen, in varying manners and in varying times and places. Thus the universal 'skating' not only particularises the universal 'Nansen,' but receives particular determination from it. The skating is not any skating, but the skating of Nansen.

Now if instead of framing the sentence 'Nansen skates,' we actually saw him skating without any inward or outward translation of the experience into words or equivalent signs, there need be no such explicit contradistinction between the agent in general and his particular act, or between the act in general and the particular agent. The psychical function, then, which is involved in the use of language, is conceptual analysis and synthesis. Discourse is the expression of discursive thinking.

We now pass to an old and well-worn problem—that of the origin of language. Of course the question is not capable of what may be called a historical answer. There are no records or remains of remote prehistoric ages which would enable us to state on historical evidence the circumstances under which intercommunication of ideas by means of expressive signs first originated. But we are by no means at a loss on that account. Language actually grows and develops under our eyes, and we can apply the general laws of its growth and development to account for its origin. Besides this, we have in savage races examples of stages of mental development

more rudimentary than our own; and by noting the points in which they differ from us we may obtain a clue to the nature of the differences between ourselves and primitive man.

2. The Motor Element in Ideal Revival.—Perceptual process is penetrated through and through by experiences of movement. Passive sensations serve only to guide and define motor activities. Besides the movements which directly subserve the attainment of practical ends, there are also constantly present the adjustments of the organs of sense involved in attending to percepts. There are the movements of exploration by which touch and sight follow the contours of objects. There are the attitudes of listening for sounds, and sniffing for smells, and the like. Ideal process, being a reproduction of perceptual, tends to reinstate the movements which form an essential part of it. The tendency is stronger in proportion to the vividness and distinctness of the mental imagery. In mentally reproducing the visual appearance of a thing we may mentally follow the outline of it with the eye, and in general we tend to repeat in idea the movements of ocular adjustment.

Similarly, in recalling a sound, we may mentally repeat the attitude of listening, or better still, mentally imitate the movements by which the sound is produced. If it is a sound which we are able more or less successfully to imitate by means of our own vocal organs, we mentally articulate it. Our power in this respect is greatest with the words of ordinary speech, so that when we recall them in the form of mental images, we constantly reproduce the motor process of articulation as well as the mere sound.

This revived motor element has a peculiar importance, because our power of freely controlling, detaining, modifying, and repeating mental images depends in a large measure on our power of controlling their motor constituents or accompaniments. "The reason why revived movement is capable of discharging this special function is that our control over it is analogous to our power of controlling actual movements."[1]

[1] Stout, *Analytic Psychology*, Vol. I., p. 213.

To show that this is so, we have only to point out that the more intimately a given experience is connected with motor processes peculiar to it and distinctive of it, the greater is our command over it in ideal representation, *ceteris paribus*.

A good example is supplied by the articulate sounds of ordinary speech. Let anyone who habitually uses this form of verbal imagery select for mental experimentation any word or sentence; he will find that he has almost as great a control over the internal articulation as over the external. The chief restriction appears to lie in the inability to make the represented sound as loud as the actual sensation; but, apart from this, one may do almost what one likes with it. He may repeat it as often as he chooses with unfailing definiteness precision, and certainty; he may say it rapidly or slowly, with emphasis or without emphasis or with emphasis that varies; he may even invert the order of the sound with as much freedom as in actual utterance. The same holds good with the simpler geometrical figures. We can trace them mentally much as we trace them physically.

Contrast such cases as those of smells, or of organic sensations. Some persons can mentally reproduce odours with great vividness and accuracy; but vivid and accurate reproduction is one thing, and free control is another. We cannot, as in the case of articulate words, pass from one odour to another in a series, with greater or less rapidity, varying the order of successior according to our caprice or convenience. We cannot repeat the same odour as often as we choose with unfailing definiteness, precision, and certainty; we cannot vary its intensity at will as we can the loudness of articulate sounds. So far as we have any power in this respect, it appears to be indirect and depends on the recall of the appearance of odorous objects or of other associated circumstances. We cannot simply take some smell, and in idea freely run up and down the scale of its varying intensities. According to all analogy, we should be able to do this, if we possessed and habitually exercised the power of actually producing the smell, and varying its intensity by our own movements.

It is in the motor elements of the mental image, and in the control which they yield over the image as a whole, that

we have ultimately to look for the origin of expressive signs, or in other words, of language, in the broadest sense of the term. We have said that language is an appropriate means of fixing attention on ideally represented objects, as distinguished from perceived objects. Since the means of controlling ideal representations lies in the motor constituents of mental images, the source of language must be found here or nowhere. The first definite stage in the development of expressive signs is constituted by the tendency of ideas, in so far as they have a motor aspect, to issue in actual movements.

3. **Tendency of Motor Reproduction to Pass into Actual Movement.**—No one did more than Bain to bring into prominence the importance of the motor constituents of ideas, and he has also laid great emphasis on the tendency of ideal movement to pass into actual movement. In the mental revival of experiences of energetic action, "it is" he says, "a notorious circumstance that, if there be much excitement attending the recollection, we can only with great difficulty prevent ourselves from getting up to repeat them. . . . A child cannot describe anything that it was engaged in, without acting it out to the full length that the circumstances will permit. . . . No better example could be furnished than the vocal recollections. When we recall the impression of a word or a sentence, if we do not speak it out, we feel the twitter of the organs just about to come to that point. The articulating parts—the larynx, the tongue, the lips—are all sensibly excited. . . . Some persons of weak or incontinent nerves can hardly think without muttering—they talk to themselves."[1]

"Thinking is restrained speaking or acting."[2] Since Bain first wrote these words, psychological investigation has strongly confirmed their general purport. The tendency of ideas to act themselves out is now a common-place in Psychology. Bain exaggerated the degree in which this tendency is ordinarily realised. The "twitter of the organs of speech about to come to the point" is not a constant feature of inward articulation in all persons. But there is no doubt that it is very

[1] *The Senses and the Intellect*, fourth edition, p. 357. [2] *Ibid.*, p. 358

frequent, and in some people almost invariably present. In what he said about thinking aloud, he rather understated his case; this habit is by no means confined to persons of " weak or incontinent " nerves. It is often found in those who become intensely absorbed in their own trains of thought to the disregard of their social surroundings. Social convention has a great deal to do with the restraint which we ordinarily put on the actual utterance of the thoughts which pass through our minds.

The general theory of the tendency of ideas to pass into movements is as follows. Ideational process is correlated with brain process. The brain is so intimately one with the rest of the organism, that processes in it cannot take place without in some measure overflowing to other parts of the body; and in particular to those parts with which it is most directly connected—the muscles. The whole complex apparatus of efferent nerves creates a functional unity between brain and muscle. This overflow of excitation to the muscles may, and constantly does, take place without the subject being at all aware of it. Thus in thought-reading the place where an object has been hidden is revealed to the thought-reader by slight muscular pressures and twitches unconsciously produced by his guide, who all the time concentrates his attention on the idea of the hidden object and the place where it is to be found.

On the whole, at the level of our present mental development, ideational trains of thought proceed for the most part without any distinct and conspicuous embodiment in actual movement, unless a need arises for communicating them to others. But the conditions are very different in more primitive stages of evolution. Where free ideational activity is just struggling into independent existence, so that it may be regarded as little more than an extension or supplement of perceptual activity, ideas can scarcely fail to pass into overt movements. The more life in general is a life of bodily activity, the more likely is bodily activity to enter into ideal process. Besides this, we must remember that the less developed and habitual are trains of thought, the more difficult they are to sustain; so that whatever means offer

themselves for the furtherance and support of the process will be utilised. But the partial repetition of the ideally represented object by means of actual movements yields a ready and effective means of fixing attention on the object. Hence we may regard the actual expression of ideas by movements as primary, and the absence of such expression as the result of a comparatively high degree of mental development.[1]

But even if we suppose that the tendency to act out an idea does not find distinct realisation in the individual's own private trains of thought, it must do so when occasion arises to communicate with others. Suppose that *A* and *B* are co-operating in some important work. It is *B*'s turn to do something, and *A*'s to wait expectantly. *B* either fails to do what is required of him or does it wrongly. Suppose that *A* has no conventional language to express himself in, or even that he has not used language of any sort until that moment. If he is capable of ideally representing what he wants *B* to do, he can scarcely fail in his impatient eagerness to make movements indicating what is required. It may be sufficient to point to some object actually present. This does not, strictly speaking, involve the use of language. But if he uses a truly imitative gesture or combination of imitative gestures, then in his action is the birth of language. He may, for instance, point to a rope and imitate the act of hauling. The imitation of the act of hauling is simply his own idea of hauling issuing in actual movement. Thus from a psychological point of view the most primitive form of language is the imitative gesture. We shall now proceed to give evidence in favour of this position.

4. Natural Signs.—Some writers appear to assume that all language worthy of the name must consist of conventional signs. Such a view creates unnecessary difficulties. The

[1] "I fancy the main body of the lower classes of Africa think externally instead of internally . . . even when you are sitting alone in the forest you will hear a man or woman coming down the narrow bush path chattering away with such energy and expression that you can hardly believe your eyes when you learn from them that he has no companion." M. H. Kingsley, *West African Studies*.

essential function of language as a means of conceptual analysis and synthesis may be fulfilled by a system of natural signs such as uninstructed deaf-mutes employ and largely devise for themselves. A natural sign bears in its own nature a resemblance to the thing signified, to the mode of using or producing it, or at least to some action, state, or adjunct characteristic of it. Merely demonstrative gestures which stand alone and not as part of a context, expressed or understood, are not to be counted as part of the language of natural signs. It is true that they are signs and that they are natural. But they are not language in the only sense which is relevant; for they are not means of conceptual analysis and synthesis. They consist in acts drawing attention to an object actually present or to be found in a certain direction. But if the object, thus indicated, is pointed to, not for its own sake, but merely as a sign of some absent object which it happens to resemble or with which it has some kind of natural connection, the gesture is a true expression of ideas and therefore belongs to language in the strict sense.

Demonstrative signs also become part of language when they belong to a context. Thus if a man imitates an action and then points to another man, the act of pointing is a sign of gesture-language. For it does not merely draw attention to the man as he presents himself at the moment; on the contrary the presence of the man at the moment is used only as a means of representing something else; it is used as a means of representing the man as performing an action which at the moment he is not performing.

Similarly, the direct expression of emotion cannot be regarded as language. But it is otherwise when the expression of a special emotion is imitated, so as to convey the *idea* of the emotion. Thus if *A* noticing *B* preparing to act in a certain way points to *C* and frowns, this is true language. For *A*'s act is not a direct expression of his own emotion, but only a way of conveying to *B* his idea that *C* will be angry if *B* does not alter his conduct. So, too, the imitation of a characteristic sound made by some animal or thing is not in itself language; it only becomes so when the mimicry is meant to convey the idea of the thing or animal which makes the sound.

Earlier writers on the origin of language were much perplexed by the difficulty of explaining how a convention as to the meaning of words could be established between the different members of a community who were not already in possession of a means of communicating their ideas. This difficulty has been frequently used as an argument for referring the origin of language to a divine revelation. But it disappears if we suppose the natural expression of ideas to be prior to the use of arbitrary signs.

Positive evidence for the primitive nature of natural signs may be drawn from the case of deaf-mutes and savages. A deaf-mute called Kruse, a highly educated man and a distinguished teacher, has left on record an account of the spontaneous origin of natural language in the minds of those who cannot command conventional signs. He says: "What strikes . . . the deaf-mute . . . most, or what makes a distinction to him between one thing and another—such distinctive signs of objects are at once signs by which he knows these objects, and knows them again; they become tokens of things. And while he elaborates the signs he has found for single objects, that is, while he describes their forms for himself in the air, or, imitates them in thought with hands, fingers, and gestures he develops for himself suitable signs to represent ideas, which serve him as a means of fixing ideas of different kinds in his mind and recalling them to his memory. And thus he makes himself a language, the so-called gesture-language; and with the few scanty and imperfect signs, a way for thought is already broken, and with his thought as it now opens out, the language cultivates and forms itself further and further."[1]

According to Schmalz, the more intelligent deaf-mutes form natural signs spontaneously, if they are not altogether neglected by their fellow-men. At first they point to the objects in which they are interested, in order to indicate their wishes. If the objects are not in sight they fetch them or conduct others to them. The deaf-mute points to a dish or a jug and so indicates his desire for what the dish or jug

[1] Quoted by Tylor, *Early History of Mankind.*

contains. "If he wants bread he brings the whole loaf, together with a knife, and he hands both to the person who is to cut a slice for him."

There is not much to distinguish such signs from the demonstrative gestures an intelligent monkey or even a cat may employ. But cases occur in which devices of the kind described are inadequate. "The deaf-mute, it may be, wants a drink of water; he sees neither water nor drinking-glass in the room, so that he cannot point to the one or fetch the other. He takes someone by the hand in order to lead him to the place where the water is. The person to whom the appeal is made refuses to move. The deaf-mute is perplexed and embarrassed. Finally he adopts the device of pointing to his mouth." This is something more than a practical expedient. It is the expression of an explicit idea. But the sign is ambiguous. The person addressed may, through a real or pretended misunderstanding, give the deaf-mute something to eat instead of something to drink. He is thus driven to define his meaning by a combination of gestures —a context of natural signs. He directs his hand towards his mouth again, but now he curves it as if it held a glass, at the same time imitating the act of drinking. "At last he makes himself understood," and "from this time forward, he learns to describe absent objects, and he forms for himself a language of natural signs, at once betokening and producing a distinctively human power of thought."[1]

In a certain degree what has been said of deaf-mutes applies also to ordinary children. "A child's gestures are intelligent long before it has any extensive command of intelligent speech, although very early and persistent attempts are made to instruct it in the use of words, and no such attempts are made to instruct it in the use of gestures."[2] "Missionaries, explorers, and shipwrecked mariners acquire the language of savage races through the medium of natural signs. They point to objects and make gesticulations, at the same time observing what articulate sounds are associated with these

[1] *Ueber die Taubstummen*, pp. 267 *seq.*

[2] Mallery in the Annual Report of the Bureau of Ethnology of the Smithsonian Institute, Vol. I., p. 276.

motions by the persons addressed."[1] Whenever a person is at a loss to express himself by means of words he naturally has recourse to gestures if the subject-matter admits of it. "Without having ever before seen or made one of the signs used by Indians or deaf-mutes, he will soon not only catch the meaning of theirs but produce his own, which they will likewise comprehend."[2]

The primitive character of gesture-language is indicated by its widespread use among savages. This is partly due to the inadequacy of the signs of their conventional language, and partly to the diversities of speech which make the spoken words of neighbouring tribes unintelligible to each other. Travellers have reported the existence of tribes whose oral language is inadequate even for ordinary intercourse. Their evidence has been called in doubt, but apparently without sufficient reason. It is well established that the Bubis of the island of Fernando Po cannot understand each other in the dark. Miss Kingsley in her *Travels in West Africa* told us that among the Fans it was common to propose to go to the fire in order to see what people are saying. But the second reason we have assigned is probably the more important. The fullest development of natural signs is found among the North American Indians, where the diversities of conventional languages within a limited area are very numerous.

The copious use of imitative gestures is almost universal among North American Indians, and it is also widely spread in South America. It must not be supposed that the same signs are everywhere in common use. This is far from being the case. There is no common code. A common code is possible only by convention. It must be fixed by usage. But the vast distance which separates different tribes does not permit of this arbitrary uniformity arising from custom. An imitative gesture delineates the most striking outlines of an object or the most characteristic features of an action. But different individuals and different social groups do not always agree in the selection of these outlines and features. A deer, for instance, may be designated "by various modes of

[1] *Ibid.* [2] *Ibid.*

expressing fleetness, by his gait when not in rapid motion, by the shape of his horns, and sometimes by combinations of several of these characteristics."[1]

Besides this, when a sign has become fixed by usage it may become modified and abbreviated in various ways, as conventional understanding takes the place of self-interpreting pantomime. It might therefore be expected that Indians using one dialect of natural signs would not understand other Indians, using a different dialect. It would appear still less probable that an Indian should on the first encounter understand a deaf-mute or *vice versa*. But in fact it is found that in spite of the diversity of signs mutual understanding is possible to some extent between all who have any expertness in the use of imitative gestures. However special signs may vary, the formative principle remains the same, and this formative principle adapts itself in the most flexible way to varying conditions. A man may understand at once a gesture which he has never seen before. If any one of the more conventional signs is not comprehended, an Indian skilled in the art of imitative suggestion tries new ways of conveying his meaning. It is often sufficient to reproduce in full pantomimic detail a gesture which had first been given in an abbreviated form. If this expedient fail, it is always easy to try other modes of representation.

In one way or another experts in sign-language manage to interchange ideas in the form of long dialogues and narratives without any prior convention. Of course it is assumed that there is a basis for mutual understanding in community of interest and experience.

5. Natural Signs as Instruments of Conceptual Thinking.— Expression by natural signs fulfils the essential function of language as a means of conceptual analysis and synthesis. By it the content of concrete experience is resolved into relatively elementary and general constituents which are freely recombined in new ideal structures. That the signs of gesture-language bring with them an apprehension of the

[1] Mallery, *op. cit.*

general or universal aspects as distinct from the particular and specific details of perceptual experience is plain from their very nature. An imitative gesture can suggest only general characters or features common to a class of objects or actions. The thought it expresses or evokes is only a fragment of a thought and demands completion. It is indeterminate and requires further definition from a context expressed or understood. The context itself consists of other imitative gestures, each expressing a relatively indeterminate universal. Each of these relatively indeterminate universals particularises and defines the others, and is by them particularised and defined. Just as we can illustrate this process by taking at random any intelligible combination of conventional words, so we can illustrate it by taking at random any intelligible combination of imitative gestures. The analogy holds good in another respect also. The natural sign, like the conventional word, becomes modified in meaning in varying contexts and under varying circumstances.

We may illustrate both points simultaneously. An acquaintance of Mallery's once asked the same favour of two savage chiefs successively. Each in replying used the common sign for repletion after eating—" viz. the index and thumb turned towards the body, passed up from the abdomen to the throat; but in the one case being made with a gentle motion and pleasant look, it meant 'I am satisfied,' and granted the request; in the other, made violently, with the accompaniment of a truculent frown, it read, 'I have had enough of that.'" Here the sign used for bodily repletion derives a metaphorical meaning from the context in both cases, and a different meaning in each.

6. Conventional Element in Gesture-Language.—The theory that natural signs are psychologically the most primitive form of language has two advantages. The first of these is that self-interpreting signs arise naturally and spontaneously wherever there is any need for them. The second is that they rapidly tend to become more or less conventional between members of the same community so as to pave the way for a system of purely arbitrary signs.

The imitative gesture tends to become more or less conventional inasmuch as the understanding of it comes to depend, not merely on its own intrinsic value as a self-interpreting sign, but also on its having been employed and understood before. On a first occasion, the sign may occur in circumstances or in a context which leave no doubt as to the meaning; on a subsequent occasion these circumstances or this special context may be absent, so that if the sign were then made for the first time, it would not be understood; nevertheless it may be understood on the second occasion just because it has been understood on the first occasion. "The deaf and dumb teacher in the Berlin institute was named among the children by the action of cutting off the left arm with the edge of the right hand; the reason of this sign was not that there was anything peculiar about his arms, but that he came from Spandau, and it so happened that one of the children had been at Spandau and had seen there a man with one arm."[1] It is evident that this sign might come to be understood and used by members of the institution who knew nothing of its derivation.

One highly important way in which natural signs tend to become relatively conventional is through abbreviation. There is a strong disposition to abbreviate familiar gestures. The mere hint of a movement comes to be substituted for the movement itself. Mallery once observed a Cheyenne Indian attempting to convey the idea of 'old-man'. "He held his right hand forward bent at elbow, fingers and thumbs closed sidewise. This not conveying any sense, he found a long stick, bent his back, and supported his frame in a tottering step by the stick held as was before only imagined.[2]

By processes of this kind, those who employ gesture-language must become familiar with the possibility of a conventional arrangement for the expression of ideas. But the natural system never actually passes in this manner into a conventional system. Its formative principle remains all through essentially that of imitiative representation. The deaf-mute and the Indian rarely lose sight altogether of the

[1] Tylor, *op. cit.* [2] *Op. cit.*

natural connection between sign and signification. A by-stander may be totally unable to detect the meaning of the signs used in conversation, owing to abridgment of natural pantomime. But the deaf-mute, or the savage, is able, if required, to act out in detail his abbreviated gesture. Natural signs may lead up to a conventional language, but they do not develop into one.

7. Origin of Conventional Language.—The language of natural signs is pervaded by the systematic unity of a single formative principle—that of imitation. This gives it so strong and tenacious a hold upon the mind that it can be displaced only by a conventional language which has also a systematic unity of plan. It can never be displaced by a chaotic multiplicity of detached and disconnected signs, each of which has to be separately remembered by an independent mental effort. The human mind could not endure so burdensome a load. The conventional signs which are to displace imitative gestures must therefore form some kind of system, unified by general formative principles.

Now visible gestures are theoretically and practically capable of forming a conventional system. The deaf-mute is sometimes taught a finger-language which is purely conventional. He makes a limited number of easily remembered manual signs, each corresponding to a letter of the alphabet, and by successively combining these he spells out words and sentences. Such a language has a unity of composition which makes it manageable. There is in it a possibility of systematic correspondence between expression and meaning. Where meaning is partially similar, expression may be partially similar; where meaning is modified, expression may be modified in a corresponding manner and degree. But the important point is that the systematic unity of composition belongs in the first instance to articulate speech. The manual alphabet is merely a translation of the oral alphabet. Further, it could have been devised only after articulate utterance had been already analysed into its elementary constituents.

Now a conventional system of manual or other visible movements analogous to the conventional finger-alphabet

could not grow up spontaneously out of a previous system of imitative gestures. We might as well expect an untutored savage to invent the steam-engine or the electric light. A limited and easily manageable set of manual signs is required. But on what principle are the signs to be selected, and on what principle are they to be limited? Oral language had been in use for long ages before its alphabet was discovered. But the invention of a similar system of visible signs would have been incomparably harder than the discovery of the alphabet. The discovery of the alphabet was the discovery of unity of composition in a structure already existing and familiar to mankind. But the independent invention of a visible alphabet would have been not a discovery arising through reflective scrutiny of familiar experience, but a highly artificial creation.

On the other hand, articulate utterance is, as a natural process, characterised by unity of composition. This unity of composition is determined by the structure of the organs of speech. There is no need to invent an alphabet before combining elementary sounds in syllables and words. The alphabetical sounds which form the vital constituents of all speech were, as Ferrier says, "there from the beginning." Undetected, but yet present and operative, they made possible a systematic correspondence between meaning and expression. This correspondence is not indeed of the same kind as that which characterises the imitative gesture. Any isolated imitative gesture has a direct affinity with the thing it represents. The absence of this direct self-interpreting affinity is just what distinguishes the conventional from the natural sign.

None the less, systematic correspondence is possible where there is no direct resemblance. The rise and fall of the mercury in the thermometer corresponds to the rise and fall of temperature, but it does not resemble it. So, apart from all similarity between sounds and what they signify, there may be a correspondence between the relations of sounds and relations of meaning. Where meaning is partially similar, its utterance may be partially similar; where meaning varies more or less in this or that special manner, expression

may vary more or less in a corresponding manner.[1] This we find to be the case in all known languages.

It is here that philological analysis becomes important. In all languages there are traceable certain comparatively elementary phonetic components called roots, expressing primary universals or products of conceptual analysis; and these roots variously modified and entering into various combinations express conceptual synthesis or discursive thinking. They blend and combine in continuous speech just as the corresponding concepts blend and combine in continuous thought. This is possible because of the ultimate unity of composition of the phonetic material, which is resolvable into elementary alphabetic sounds which do not occur in isolation but as parts of an articulate complex.

8. Certain other Theories of the Origin of Speech.—Attempts have been made to explain the origin of language without emphasising the importance of the visible gesture as the starting-point. Three of the important theories of this kind were nicknamed by Max Müller the 'pooh-pooh' the 'bow-wow' and the 'ding-dong' theories. Their more pretentious titles are the 'Interjectional,' the 'Onomatopoeic,' and the 'Pathognomic' theories.

The principle involved in all these theories is essentially the same. They all attempt to trace conventional signs back to natural signs; but they exclude from consideration visible gestures, and confine attention only to vocal signs. It is evident that to mimic the mewing of a cat, in order to convey the idea of that animal, is as much an imitative gesture as going on all fours and humping the back for the same purpose. It is mimicry of this kind on which the 'bow-wow' theory relies for explanation. The same holds good for imitating the cry of fear, in order either to convey the idea of the emotion or of the approach of a dangerous object. This is the sort of expressive sign which is most primitive according to the 'pooh-pooh' theory.

[1] Consider, for instance, the connection of blot, blotter, blotting, and blotting paper, and of write, writer, writing, and writing paper.

The 'ding-dong' theory is more subtle, and it has the distinction of having been vigorously advocated by Steinthal. According to it, specific kinds of objects so affected primitive man as to elicit from him, or to use Max Müller's metaphor, to 'ring out' of him, correspondingly specific utterances. The most primitive words would therefore be phonetic types 'rung out' from the organism of the first man or men when struck with an idea. There is a harmony of sound and sense which does not depend on the imitation of one sound by another. The charm of literary style and especially of poetry consists largely in the subtle affinity between vocal expression and the objects or activities expressed, which may exist apart from any resemblance of sounds to one another.

The word 'zigzag' is a good illustration. The 'zig' goes this way, and the 'zag' goes that way, the tongue itself describing a 'zigzag' course. What philologists call reduplication has often this intrinsic expressiveness—a 'big big man'; a 'wide wide sea'; 'far far away.' Among the Botocudos of Brazil *ouatou* stands for stream, *ouatou-ou-ou-ou* is the sea.

In this metaphorical expressiveness of vocal utterance we may detect under a somewhat deceptive disguise the essential principle of the imitative gesture. Even the disguise is not present in the case of reduplication; here more of the same kind of sound represents more of the same kind of thing. Other instances may look more mysterious. But the mystery to a large extent disappears when we consider that articulate speech consists not merely in articulate sounds, but also in the motor process of articulation.

The tongue actually does go zigzag in uttering the word 'zigzag.' 'Tick-tack' imitates not only the sounds of the clock, but the rhythmic movement of the pendulum by a corresponding movement of the tongue. Even born deaf-mutes use the organs of articulation in this imitative way. Heinicke, as quoted by Tylor, mentions a "deaf-mute, nineteen years old, who had invented many writable words for things." Some of these were arbitrary; but at least two, *mumm* for eating, and *schupt* for drinking, were, as Tylor remarks, an imitation of the movements of the mouth in eating and drink-

ing. In like manner *njan* means to eat in the Negro-English dialect of Surinan, and *njan njan* means food.[1] Thus the 'ding-dong' theory is in its more obvious applications reducible to the general principle of the imitative gesture. That part of it which is not so reducible is of little value as an explanation of the origin of language.

Vague and recondite affinities between sound and sense cannot in the first instance constitute a natural and spontaneous language, because they are not sufficient to make the vocal utterance self-significant or self-interpreting. For this it is not enough that a word should be dimly felt to be appropriate when its application is already known. It is necessary that the sign should be so stamped with the character of the thing signified as to determine its application in a given context and under given circumstances. On the other hand, it must be admitted that when once the meaning of a word has become a matter of convention a general feeling of affinity between sound and sense may operate powerfully in determining the creation and selection of new words.

These and similar theories must all be regarded as part of the general doctrine that natural signs psychologically precede conventional signs. They are true and useful inasmuch as they emphasise the part played by phonetic elements in imitative expression. The imitative use of vocal utterance paves the way for the development of conventional speech. Why conventional language has come to consist almost entirely of phonetic elements we have attempted to explain in the last section. The reason why natural signs have to so large an extent been displaced by conventional signs lies in their superior convenience and power.

9. Advantages of Conventional Language.—The primary and essential procedure of the language of natural signs is to represent things and processes by imitating the broad features of their sensible appearance and especially of their appearance to the eye. But the characters which are capable of being so imitated are of a comparatively low grade of generality or

[1] *Op. cit.*, p. 73.

abstractness. They represent an analysis of perceptual experience into universals and its reconstruction out of these universals. But the universals themselves are very far from being simple and ultimate. They in their turn are intrinsically susceptible of analysis, and constituents thus revealed are again susceptible of further analysis, and so on.

Now the more advanced is this process of dissection, the more helpless is pictorial representation to express the result either within the individual consciousness or in the intercourse of different minds. Hence a mind whose discursive thinking could find expression only in self-interpreting signs, would be incapable of the higher reaches of abstraction. Broadly speaking, natural signs are capable of fixing attention on universals which are constitutive characters of particular objects as presented in perceptual experience; but they can only to a very limited extent fix attention on universals which are constitutive characters of other universals. The thinking which depends on the imitative gesture generates concepts; but it can hardly generate a conceptual system, in which there is an ascending scale of generalisation, passing from species to genus, and from genus to higher genus, and so on through a series of gradations till the highest genus is reached. It seems beyond the unaided powers of the thought which works through natural signs to frame a system of classification.

This impotence of the imitative gesture to express higher universals is easily illustrated. "To make," says Tylor, "is too abstract an idea for the deaf-mute; to show that the tailor makes the coat, or that the carpenter makes the table, he would represent the tailor sewing the coat, and the carpenter sawing and planing the table."[1] According to Schmalz, "The more general determinations of magnitude such as *broad, narrow; long, short; thick, thin; high, low;* cannot be accurately expressed; the most that can be done is to teach the deaf-mute signs which are suitable to the largest proportion of cases."[2]

Often a general concept is capable of pictorial expression; but only in a way which is cumbrous and circuitous when

[1] *Op. cit.* [2] *Op. cit.*, p. 275.

compared with the conventional. A series of imitative gestures may be needed, where a single word would effect the same purpose with greater precision and certainty. Thus an Indian who wished to convey to a deaf-mute that he had travelled in the train, could convey the idea of 'train' only by three successive bits of pantomime, one representing the conception of something covered in, another that of wheels, and the third that of smoke. Now this mode of expression may at first sight appear more analytic than the use of the single word 'train.' It resolves into three universals and reconstructs out of them what the conventional language expresses in its totality by one sign. But we must remember that we could use many signs if there were need for them. If there were occasion to give an analytic description of a railway train, that description could be given with far more fineness, precision, and adequacy in words than in imitative gestures. The conventional language uses one word because one word is enough. The language of imitative gesture uses three separate bits of pantomime because it cannot do with less. It is forced to describe because it cannot directly designate.

Now why is it unable to express by a single appropriate sign the general conception of a 'railway train'? The reason is that the concept of a railway train possesses too high a degree of universality. It gathers up into unity a great multiplicity of special features, functions, and relations. Among these are included some which it would be difficult to express concisely, or even to express at all, in the gesture-language, as for instance the principle or mechanism of its locomotion, its function as a means of communication and traffic, and so on. Now the comprehensive unity which embraces within itself all these particular determinations is not capable of being directly expressed in natural signs, without the aid of convention. Hence in a communication by imitative gestures, where there has been no previous convention, the only course possible is to select certain particular characteristics of the object, which are at once important and easily presented to the eye, and to exhibit as many of them as appear sufficient to enable the intended meaning to be divined.

The same deficiency also makes it difficult to refer to an individual person by a self-expressive sign. The imitative gesture, as such, and apart from convention, is incapable of directly expressing the universality which belongs to the individual and is associated with proper names. The depiction of some special characteristic or peculiarity may or may not be successful in directing attention to the person intended. All depends on context and circumstances. If representation of this or that characteristic proves insufficient, others may be added until understanding is reached, as in the case of the railway train.

CHAPTER V.

THE EXTERNAL WORLD AS IDEAL CONSTRUCTION.

1. Unification of Perceptual Data.—It is the function of free trains of ideas to connect in a continuous whole the detached data of sense-perception occurring in the course of individual experience. The isolated facts of sense-perception are made continuous with each other by interposing between them ideally represented links. The perceived thing reveals itself in actual perception as existing, persisting, and changing independently of the motor activity of the percipient. Its characteristic nature as an externally real object essentially involves this independence of the percipient subject and his changing position in relation to it. But the percipient may not only alter his relative position in regard to it, while he is actually perceiving it; he may also turn aside from it altogether, or remove himself to such a distance that it can no longer affect his senses. As change of position on his part makes no difference to the thing as physical object, so his presence or absence can make no difference to its nature and existence. When, therefore, he ideally represents it, he will represent it as existing, persisting, and changing, although it is no longer perceived. He will represent it as existing, persisting, and changing in the same manner as if he were in its presence and actually observing it.

Herein lies the possibility of extending knowledge of material things and processes far beyond the limits of actual perception so as to construct an ideally represented world of which only detached fragments are actually perceived.

We have now to assign the motives which prompt and guide the process of ideal construction. The first of these is that which constitutes the impulse to all theoretical, as distinguished from practical thinking. It is the endeavour to clear experience from incoherence, contradiction, and ambiguity. Incoherence, contradiction, and ambiguity obstruct the onward

flow of ideas. Where they rise, therefore, the course of mental activity will direct itself to their removal.

Now it is obvious that conflict must continually arise between an object as actually perceived and the same object as ideally represented on the basis of previous perception. A man leaves an object at rest in one place: he returns and finds it in another place: the discrepancy can be removed only by ideally connecting the two experiences by intermediate links representing some mode in which the transference from one place to another may or must have taken place. A fire is left burning brightly; after an interval nothing is found but grey embers. Percept and remembrance must be connected by ideal representation of a fire gradually decaying. Again, the fire which is left burning brightly may after a long interval of time be found still burning as brightly as ever. Here the representation of the fire as gradually decaying collides with the actual percept. It has not gone out. The incoherence may be removed by representing someone as having intervened in the meantime to keep it alive.

Apart from actual conflict between idea and perception, the mere strangeness of an object acts as a theoretical motive for ideal construction. The mere inability to fit it into the general scheme of things impels the subject to trains of thought directed to overcome the difficulty.

Merely theoretical interest, however, is on the whole a factor of secondary importance; and the more primitive the stage of mental development attained, the less important it is. The systematic pursuit of knowledge for its own sake is a late outcome of mental evolution. In early stages of human development thinking is mainly subservient to practical ends, and its impelling motive lies in the pressure of practical needs. Thus the process of ideal interpretation is carried on only so far as it supplies a guide to action. Merely theoretical speculation may and does exist as a sort of amusement: but it is not followed in a serious and strenuous manner.

2. Verification and Re-interpretation.—The primary function of ideal construction is the framing of means for the attainment of practical ends. The ideal combinations which thus arise

are of use only in so far as they are translated into action. The plan which is formed in the head must be put into execution. Now the course of events which takes place in the execution of the plan may or may not conform to the ideal pre-arrangement. When it does so conform, the ideal pre-arrangement is verified by the result. When events fall out otherwise than was anticipated, the ideal pre-arrangement is contradicted by the result. In cases of failure, there is a new impulse to thought. The ideal combinations must be modified until an effective plan is reached. In this way, the process of ideal construction is perpetually finding and utilising new data.

In the original ideal train, there may be a sequence *a*, *b*, *c*, *d*, but the actual sequence of events when the plan is carried into execution may be *a*, *b*, *c*, *q*. This provokes a new process of ideal construction, in which the represented order is *a*, *b*, *c*, *m*, *d*. On trial, this ideally represented sequence is verified. On subsequent occasions, when the practical end is similar, the sequence *c*, *m*, *d* will be substituted for the sequence *c*, *d*, where other relevant conditions are similar. Thus ideal construction subserves practical activity, and in its turn practical activity yields fresh material for ideal construction.

It may happen, of course, that a plan of action sometimes succeeds and sometimes fails, owing to conditions beyond the agent's control and possibly beyond his power to foresee. When this is the case, effective reconstruction of his ideal scheme is not possible, and he must take his chance of success or failure in each particular instance. Again, it may happen that the result depends upon conditions entirely outside the range of his experience, so that his action is quite ineffective. Under such circumstances there will be no cessation of the activity of ideal combination or practical execution, if the interests involved are sufficiently strong. We have an instance of this in modern times in the widespread use of 'quack' medicines. The patient is really helpless, but he tries every means that suggests itself. In more primitive stages of mental development, whole systems of ideas arise in this way, which we from our superior point of view stigmatise as mythology or superstition.

Real insight into physical nature, and effective control over its processes, are acquired in the first instance mainly by mechanical contrivance and mechanical execution. Weaving, basket-work, pottery, building, the construction of tools and weapons, yield in early stages of development a real knowledge of the nature of physical things and a real control over them. In such mechanical operations, ideal analysis and synthesis are accurately translated into real analysis and synthesis, a real separation and recombination of the parts of matter. Thus the constitution of the physical world is learnt by actually taking it to pieces and putting it together again. In general, insight into natural process is in proportion to the degree of development of the mechanical arts.

The knowledge of nature which is embodied in modern science is essentially of the same type. There is, however, one important difference. We now artificially separate and recombine physical conditions for the sake of obtaining knowledge, and not merely for practical purposes. Experiments are now made with a purely theoretical interest, because the love of knowledge for its own sake has become strongly developed.

3. Space as Ideal Construction.—We are unable to perceive, imagine, or draw on paper, any actual line, which can be ascertained to be perfectly straight. None the less, we know clearly what is meant by a perfectly straight line. This is possible, because in ideal construction we can by mental abstraction regard as irrelevant the physical conditions which actually prevent perfect straightness. A drunken man tries to walk straight along a road; but in spite of his efforts his course is more or less conspicuously zigzag. In his own mind, the course he intends to pursue is contrasted with the course he is compelled to pursue against his will. The course he intends to pursue is that which he would pursue apart from certain interfering conditions. It is thus an ideal construction presupposing conceptual analysis.

Now it is possible in this way to disregard and treat as irrelevant all properly physical conditions as contrasted with those conditions which are contained in the very nature of

space, as such. A line, as straight as the nature of space will admit of apart from other interfering conditions, appears to ideal construction as a perfectly straight line. In a similar way the conception of a perfect circle and other perfect figures arises. It is possible to notice degrees of roundness before attaining the explicit concept of a perfect sphere or circle, just as we notice different degrees of bigness, although there neither is nor can be an ideal of perfect bigness. Having had experience of *b*, which is rounder than *a*, we may try to make *c*, which will differ from *b* in degree of roundness as *b* differs from *a*. The obstacles which hinder us in such an attempt are our own deficient skill or the nature of the material we have to deal with. If we abstract from such conditions and consider only the nature of space, we have a concept of perfect roundness.

The starting-point of this development is probably to be found in the attempt to make things as round, as straight, or as square as possible in the process of mechanical construction. In this way there will come to be an ideal roundness, or straightness, or squareness, and these ideals, at first rude, will ultimately pass into the abstract mathematical conceptions with which Euclid has made us familiar.

The conception of the infinity of space has a like origin. Progress from place to place may be arrested by all kinds of physical conditions; but if these be disregarded, and the nature of space alone considered, no reason is discernible why movement from one position to another should have any limit. A spatial limit is the boundary line between one part of space and an adjoining part; it is a limit *in* space, and cannot therefore be a limit *of* space. It is by mental process of the kind described that the transition is made from space as perceived or imaged to space as conceived.

4. Time as Ideal Construction.—The process of ideal construction makes an even greater difference in the case of time than in that of space. We have seen how in an ideally represented time-series the distinction between 'now' and 'then,' or between one 'now' and another, becomes relative, so that according to the point of view we may regard any part of the

series as a 'now,' and what precedes or follows as relatively future or past. But besides this relative antecedence and subsequence, there is also what we may call an absolute 'now' —the moment determined by the immediacy of immediate experience. This forms a starting-point for ideal construction of time-order. What is prior to it is regarded not merely as relatively but as absolutely past; what is subsequent to it is regarded not merely as relatively but as absolutely future. Past and future are still defined only by their relations; but the starting-point from which we define them is not arbitrary but fixed, and fixed not by ideal construction but by actual sensation and feeling.

As Ward has said: "To a being whose experiences never passed through the transitions which ours undergo—first divested of the strength and vividness of impressions, again reinvested with them and brought back from the faint world of ideas—the sharp contrasts of 'now' and 'then,' and all the manifold emotions they occasion, would be quite unknown. . . . In the obligation to wait and work in hope or dread of what is 'still to come' there is much more than time-order."[1]

The apprehension of past and future in this absolute sense presupposes a starting-point in the immediate experience of the moment; and an ideal construction in two directions—on the one hand, of what has preceded, on the other, of what is to follow the actual 'now.' On the whole, anticipation of the future must be regarded as prior in the order of development to reminiscence of the past. For the primary stimulus to ideational activity comes from practical needs; and these are in the first instance concerned with the future. Given a present urgency in the way of hunger or thirst, the primary demand made upon ideational activity is for the devising of means to procure food or drink. It is thus called on to follow out a train of ideas representing the successive links connecting the present state of need with a future state of satisfaction. Trains of ideas representing previous sequences of events will at first be called into play mainly by the need for data derived from the past to use in providing for the

[1] *Psychological Principles*, p. 210.

future. But the grand stimulus to reminiscence is not to be found in dealings with the physical world, but in the personal and social interests which we shall have to discuss under the head of self-consciousness.

There are two characteristics which distinguish the future from the past apart from abstract priority and subsequence. The future is uncertain, or in other words its anticipation may take the form, not of one definitely fixed series of ideal representations, but of a number of alternative lines, which compete with each other for predominance in consciousness. But the past has already taken determinate form; in it one definite alternative has already been realised to the exclusion of others. Besides this, past and future have an altogether different relation to practical activity. The future is something which may be in a greater or less degree determined by the agency of the subject himself; and he must be continually adjusting his actions so as to modify it, if he is to survive and live a tolerable life in the world. But the past is beyond this kind of control. Retrospection can be of use only in supplying data for pre-arranging the future.

So far we have considered only the lapse of time as it appears to the individual subject, or in other words what is sometimes called 'subjective time.' But it is plain that this does not coincide with time as measured by the clock. Shakespeare tells us that time travels "in divers places with divers persons"; Newton tells us that time moves at a constant rate. Shakespeare's time is evidently subjective time, and Newton's objective time. In a position of great difficulty, and danger minutes may appear like hours. Two lovers in the enjoyment of a lovers' conversation may find hours pass like minutes. The subjective estimate of time is more or less different from time as measured by the clock, though normally there is a rough correspondence between them. Objective as distinguished from subjective time is a product of ideal construction. The beginning of the process by which it comes to be conceived is found in the conditions of practical activity.

Lapse of time is often an important factor in the attainment of practical ends. It takes a certain time, for instance, to

travel from one given place to another, or to cook a piece of meat, or for water to boil, or for clay to harden in the sun. Now in practical calculations it will not do to leave the estimate of the lapse of time in such cases to the varying impressions of the individual. The only effective mode of procedure is to find some other process which coincides in its beginning and termination with the process of which the duration is to be measured.

Thus, if the question be, how long it takes to get from one place to another, a sufficient answer may be found by reference to the course of the sun. It will take perhaps from sunrise to sunset of a summer's day; or from sunrise till noon. The efficiency of this mode of procedure depends upon the discovery of uniform standards of measurement. These are best supplied by rhythmic processes which repeat themselves at intervals. If it is found that the duration of events in general can for practical purposes be defined by saying that they take the same time as one or more repetitions of a certain rhythmic process, this process has proved its efficiency as a standard of measurement. The process which we now most commonly use is the movement of the hands of a clock. The movement of the minute-hand, starting from one position and returning to it again, constitutes a fixed period which we call an hour. So the movement over a smaller interval on the dial constitutes another fixed period which we call a minute.

Objective time is thus an ideal construction, and the principle on which it rests is that processes otherwise similar, and taking place under similar conditions, will occupy the same time. Thus if they start simultaneously, they will terminate simultaneously, and so on. Similarly, if two dissimilar processes are found to occupy the same time on one occasion, they will occupy the same time on another occasion, under like conditions.

5. Causality as Ideal Construction.—On the purely perceptual level, there is a tendency to repeat modes of procedure which have proved successful in the past, and to discontinue modes of procedure which have proved unsuccessful. To this extent the category of causality operates in perceptual con-

sciousness. But for the merely perceptual consciousness the question why a given cause produces a given effect can hardly be said to exist. Ideal construction is continually asking this question. It is the very essence of the process by which means are devised for the attainment of practical ends to interpose between the starting-point and its termination a series of ideally represented links, each constituting an indispensable term in a train of causes leading up to the ultimate effect. These practical experiences yield material for interpreting events which take place apart from the agency of the subject. Thus it becomes possible to ask why *A* produces *D*, and to answer by saying that *A* produces *B*, and that *B* produces *C*, and that *C* produces *D*.

So far as this ideal construction is determined by more or less practical experiences such as those connected with mechanical contrivance, it yields a true insight into the nature of physical process. But strong interests of a practical or theoretical kind often create a need for explanation where data for explanation are either altogether insufficient or absent. In such cases the ideal construction will take a form which appears from a higher point of view fanciful and absurd. Why has the robin a red breast? Because cock-sparrow shot it with his bow and arrow. A good example of a simple causal series of this kind is the story of the old woman whose pig would not go over the stile. "As soon as the cat had lapped up the milk, the cat began to kill the rat, the rat began to gnaw the rope, the rope began to hang the butcher, the butcher began to kill the ox, the ox began to drink the water, the water began to quench the fire, the fire began to burn the stick, the stick began to beat the dog, the dog began to bite the pig, the pig in a fright jumped over the stile, and so the old woman got home that night." In savage thought, there are abundant examples of causal explanation which remind us of these nursery fables.

The word 'why' may have another application. In asking why a given effect is produced, the interest may lie in discovering which of a given group of conditions are essential to the result, and which irrelevant. This inquiry naturally arises when the same result follows under circumstances

apparently dissimilar on the whole, or fails to appear under circumstances apparently similar on the whole. To find a cause is here to find points of identity in apparently dissimilar conditions, and of difference in apparently similar conditions.

There is a West African story according to which a hunter took the first hint for weaving nets from contemplating the spider's web. His wife suggested that he might make mats and similar articles in like manner. He tried, but failed to give them shape. Accordingly, he went back to observe the procedure of the spider, so as to note the points of difference between the animal's method and his own. He discovered that the spider started always with a fixed framework and wove its web on that. Going back to his own task, he made for himself a framework by means of sticks and poles, and so succeeded in giving proper shape to the articles he made. He had compared the two modes of procedure, so as to distinguish the points of agreement from the points of difference, and in this way was able to explain why a certain result should follow in the one case, and a different result in the other.

It is by such processes of analytic comparison that universal laws of nature are ultimately discovered, which laws may form the basis of such exact and complicated mechanical contrivances as the steam-engine or the modern aeroplane. In early stages of development, the distinction of the essential part of a cause from the accidental is very crude, and is in the main proportioned to the degree of advancement in the mechanical arts. Arsenic and incantations, according to Voltaire, will kill a flock of sheep. The savage rarely thinks of using the arsenic without the incantations. The medicine man accompanies even surgical operations with all kinds of ceremonials having nothing to do with the result. In Charles Lamb's "Dissertation upon Roast Pig," we have a fanciful exaggeration of this feature of savage thought. Bo-bo discovers the flavour of roast pig by accidentally setting fire to a house. The custom of firing houses in order to roast pigs continued " till in process of time . . . a sage arose, like our Locke, who made a discovery that the flesh of swine, or indeed of any other animal, might be cooked (*burnt*, as they call it)

without the necessity of consuming the whole house to dress it."[1]

The exaggeration in Lamb's story arises from his having chosen a case in which all essential conditions fall within the practical experience and control of the agents interested in the result, so that it would be easy for them to disengage the essential from the accidental. He would scarcely have exaggerated if he had referred to such natural phenomena as disease and death, in which the operative conditions are in the main beyond the control and even beyond the ken of the uncultured mind. Here ideal construction cannot fix upon what is essential; and since the strength of the practical interests concerned demands the discovery of some operative conditions to form a basis of practical procedure, causal efficacy is ascribed to all kinds of circumstances which are in reality totally irrelevant, such as the evil eye, the malignancy of departed spirits, the magical practices of witches, and the like.

On these assumptions, elaborate methods of procedure are based. Such methods are often more or less intermingled with truly curative measures, which prevent the result being wholly a matter of accident. But, on the whole, much more stress is laid on what is irrelevant and inefficient than on what is relevant and efficient. In the treatment of a disease, it is obvious that the cure does not depend merely on drugs, or the like; for the patient may either die or recover when the same drugs are used. Other conditions are therefore imagined which by their very nature cannot come, except in a partial and uncertain way, within the control of the medicine man.

6. **'Thinghood' as Ideal Construction.**—We have seen that for perceptual consciousness whatever has unity and distinctness of interest is a separate thing. Since interest is primarily practical, whatever acts as a whole, and is capable of being acted on as a whole, is one thing. We have seen that conceptual analysis resolves the unity of the thing into its constituent parts, qualities, and relations, and that conceptual synthesis reconstructs it by ideal combination of these constituent parts, qualities, and relations.

[1] *Essays of Elia.*

Very important developments of the process of ideal construction arise out of the connection of the category of separate 'thinghood' with that of causality. These assume two forms. The first line of thought endeavours to give a causal explanation of the nature and unity of the separate thing from the connection and interaction of its parts. The other presupposes the unity and intrinsic nature of the thing as ultimate and, instead of explaining them, uses them as a basis of causal explanation.

The first of these lines of thought takes its point of departure in mechanical contrivance and execution. Inasmuch as a man has himself actually put a piece of mechanism together, so that it may fulfil a certain function, he is able to explain why it fulfils this function, by showing how the parts are combined and act on each other so as to work together in producing a certain result. The same kind of explanation may afterwards be applied to things which he cannot himself construct. He may ideally analyse and combine in a mechanical way what he cannot actually take to pieces and put together again. He may even assume constituent elements which are beyond the reach of actual perception, and by ascribing to them fixed modes of behaviour in relation to each other, he may explain the observed phenomena as the products of their interaction.

Modern theories of atoms and molecules and of the motions of the particles of ether are examples of the highest development attained in this direction. Atomic theories explain the nature and mode of behaviour of perceptible things by assuming as elementary constituents of the physical world " countless atoms, invisible from their minuteness, persistent in their duration, and unchangeable in their properties. These atoms, now coalescing in most manifold fashion, now withdrawing unaltered from these fluctuating combinations, produce by the variety of their positions and motions the different kinds of natural products and their changeful development."[1]

The essential presupposition of such theories is that the elements which they assume as ultimate shall always behave

[1] Lotze, *Microcosmus*, third edition, Vol. I., pp. 31-2.

in virtually the same way in the same circumstances. Their whole nature is supposed to be constituted by their mode of behaviour in relation to each other, and this is invariable. Explanation is more complete and satisfactory the less variety there is in the constitution of the ultimate atoms. It would be most perfect from a mechanical point of view if all natural processes could be explained by the combination and interaction of atoms in themselves homogeneous, so that the resulting variety of material products would be purely due to variety in the way in which identical elements are put together. This mechanical point of view has been applied, to a large extent with success, even to living organisms.

The construction of self-acting machinery has had an important influence in suggesting this line of thought. "Our eyes," says Lotze, "cannot rest repeatedly and continuously on this remarkable borderland of self-acting instruments, which derive their material from Nature, but the form of their operation from human volition, without our whole mode of conceiving Nature being affected by these observations. . . . We know in fact that not from within, by a spontaneous effort at development, but under extraneous compulsion have the combined bodies acquired this admirable play of mutually adjusted states. Far simpler properties and effects belonged in themselves to the particular substances which we combined, varying according to universal laws with the alteration of definite conditions. These invisible forces our mechanical skill has compelled (by the cunning combinations into which it has beguiled that which holds them) to work, under such conditions that their conformity to universal laws must, without any purpose of their own, realise the ends that are our purposes."[1]

Such human contrivances could not but suggest the question whether even animated organisms were not composed partly or wholly in a similar manner, having their origin in "the world's course, which combines the elements sometimes in one way, sometimes in another, and in each of these groups inexorably initiates the system of movements and operations

[1] *Ibid.*, Vol. II., p. 18.

that, according to general laws, corresponds to the actual mode of their connection."[1] As a matter of fact, physiological explanation tends, as far as possible, to take this form.

The mechanical point of view, which has received so vast a development in modern science, sprang from extremely meagre and rudimentary beginnings in primitive thought. The power of mechanical construction and analysis implied in the making of the simple instruments of savages seems almost infinitesimal, if we compare it with our elaborate machinery. It would hardly seem to suggest even the possibility of mechanical explanation of the complex processes and products of nature, and especially of living organisms and their behaviour. Yet the mind of the savage cannot remain at rest, simply ignoring the play of the natural forces which surround him and continually influence his life and activity for good and evil, but especially for evil. In particular, disease and death are phenomena which he cannot neglect. The pressure of practical interests compels him to act and to contrive means of acting. Thus some kind of ideal construction is for him a necessity in order that he may not sit down helpless in face of a vast variety of phenomena which he cannot even think of explaining on mechanical principles.

To him it is simply a familiar fact which requires no explanation, that individual things exist, having distinctive properties and modes of behaviour. It is a familiar fact that such things are composed of parts which act and are acted on together, so that change in one part is accompanied by changes in other parts. All this he does not think of explaining, but presupposes it without question as a basis of explanation. Hence he follows a line of thought which is opposed to the mechanical. Instead of explaining the unity of the whole by the combination and interaction of the parts, he explains the combination and interaction of the parts by the unity of the whole.

He knows that the sole of his foot is part of the same individual unity as the crown of his head; he knows that if a nail runs into the sole of his foot, his mouth utters a cry of

[1] *Ibid.*

pain. But the connection of the two facts by a series of intermediate links of a mechanical kind lies entirely outside the circle of his ideas. He knows nothing of afferent and efferent nerves, or of molecular processes in brain and muscle. When the nail runs into his foot, his organs of speech emit a cry simply because he is one individual being of which both foot and organs of speech are part. The important point is that as this mode of explanation takes no account of mechanical conditions, it is not subject to mechanical limitations. The sympathetic communion between the parts of a whole need not be conditioned by those relations in space and time on which mechanical interaction depends. It is thus possible to represent the sympathetic communion as existing even when the supposed parts of the same individual whole are widely separated in space, so that the familiar conditions of mechanical interaction are absent.

The ideas and the practices of primitive magic and witchcraft depend in a great degree on this enlargement of the conception of individual unity. Disease or death may be produced by operating on the cuttings of a person's hair, or the parings of his nails, or the remains of his food, when the person himself is far away. Hence it is a common custom with savages to bury their nail-parings, hair-cuttings, and so on, so that what happens to these may not by sympathetic communion cause misfortune to them. In like manner, the nature of a whole is often regarded as in some manner present and operative in the part, even when it has been dissevered from the whole, and acquires connection with some other individual. In this way the nature of one thing may be in some measure transferred to another. By wearing a tiger's tooth, a man may make himself brave and fierce; by appropriating the belongings of a deceased person, he may share in that person's skill and good-fortune. Instances of this kind are innumerable, and we shall have to refer to them again in the next chapter.[1]

[1] It should be remarked that the savage view contains a great truth. Its error and crudity lie in *substituting* explanation of the parts by the whole instead of explanation of the whole by the parts. But it is equally one-sided to suppose that merely mechanical explanation can yield the whole truth.

7. Ideal Construction as a Co-operative Process.—Through language, ideal combination becomes a function not of the individual merely, but of a community. It may be confidently asserted that the capacity for ideational thought would be of little use to a solitary animal. Such thinking is essentially a social function. Other animals co-operate in work and play, but only men co-operate in thinking. Where many men are united in striving to realise a common end, each single mind is, so to speak, part of one great collective mind. The ideas occurring to each are communicated to all. What occurs to *A*, to *B*, or to *C* respectively may be valueless: but the ideas of *A*, *B*, *C*, taken in combination, may form a real advance: even in combination they may be futile, yet when they reach the mind of *D*, they may fall on fertile soil and suggest some feasible plan of action or tenable line of thought.

The debt which the individual owes to social intercourse by means of language is twofold. He is placed by it in possession of data which he could never have acquired by his own personal experience. His thinking is based not only on what he himself has seen, heard, and done, but also on what others have seen, heard, and done. In the second place, he receives from others not merely the results of their observations, but the results of their trains of thought. In both ways his debt to his social environment is immense. His debt is not confined merely to interchange of ideas by means of language. Imitation also plays a large part. In doing or attempting to do what others have done before him, he rethinks the thoughts which have passed through their minds; and he also in the same process acquires novel ideas, inasmuch as imitation is rarely, if ever, exact reproduction of that which is imitated. The actions imitated are usually more or less modified and lead to new results in the case of each imitator.

What has been said holds true for the relations of the men of the same generation to each other; but its application to successive generations is even more important. Every child in learning the language of its ancestors assimilates in outline the whole system of ideas, the whole system of conceptual analysis and synthesis, which has been acquired by

the mental and bodily activity of past generations. It acquires knowledge by question and answer, and by a gradual divination of the meaning of words, as used in ordinary conversation, far more than by direct personal experience.

"The words and sentences that fall upon [the ear of a child] and are soon upon his lips, express not so much his subjective experience, as the common experience of his kind which becomes, as it were, an objective rule or measure, to which he shall conform. Why, for example, does a child have no difficulty about the relation of substance and qualities that has given philosophers so much trouble? and why do all children understand or seem to understand it alike, whatever their experience may have been? Why? but because the language put into their mouths, and which they must e'en use, settles the point for them, one and all; involving, as it does, a metaphysical theory which, whether in itself unexceptionable or not, has been found serviceable through all the generations of men."[1] We use our own private experiences "mainly to decipher and verify the ready-made scheme of knowledge that is given to us *en bloc* with the words of our mother-tongue. This scheme is the result of the thinking, less or more conscious, and mainly practical, of all the generations of articulately speaking men, passed on with gradual increase from each to each."[2]

The educational influence of one human generation on another is by no means wholly dependent upon the use of language. The importance of the part played by imitation cannot be exaggerated. What men have learned to do in the past, the child has to learn to do over again in its own individual case. This is only possible in so far as it attends to the behaviour of its elders, and strives to imitate them. As a matter of fact, the period of childhood is mainly occupied in attempting to reproduce the modes of action current in the society to which the child belongs. Even the play of children is penetrated through and through by this imitative character. Children can take the place of their elders in the next genera-

[1] Croom Robertson, *Philosophical Remains*, p. 68.
[2] *Ibid.*, p. 69.

tion only by learning from them those ways of acting which are necessary for the general scheme of social organisation. But in this process they acquire not only bodily dexterities, but also systematic combinations of ideas which they never could have attained by their own unassisted efforts.

Besides this, the material environment of human beings is in a large measure a creation of human thought transmitted from one generation to another. Tools, weapons, utensils, buildings, gardens and cultivated fields, are all products of human intelligence. They are material arrangements embodying in outward and visible form trains of ideas which have passed through human minds. Flowing from human intelligence these objects appeal to human intelligence. The child, in learning their nature and use, re-thinks the thoughts which gave them being. In this way, as much as by the help of language and direct imitation, the ideas of one generation are transmitted to the next to be by it further developed, so that from comparatively small beginnings civilisation may grow like an avalanche ever accumulating and retaining new material as it advances.

Now the lower animals do not in this manner create an environment for themselves by their own intelligence. Bees, ants, nest-building birds, beavers, and other animals with definite constructive tendencies may be said in part to make their own environment. But they do not do so in execution of designs framed by themselves. Their constructions do not embody trains of ideas directed to the attainment of foreseen ends. As their work does not arise from trains of ideas in the first instance, so it does not awaken trains of ideas in the successive generations which repeat the same activities. Each new generation is born with the instinctive aptitudes and propensities of its progenitors and repeats their actions in the same undesigning way.

On the other hand, the work of man, as they arise from ideational thought, so they arouse ideational thought. The same understanding which was needed for their production is needed for their reproduction. Hence the educational influence of an environment moulded by human hands to embody human designs does not affect the animals which

dwell with man. The human intelligence incorporated in the products of human industry is intelligible only to a mind essentially akin to the human mind.

The external world as an ideal construction is a social product. It must therefore be independent of the individual subject in the same manner and degree as social organisation in general is independent of its individual members. There is thus introduced a new factor in the constitution of external reality—the social factor. The ideal combinations which arise in the individual mind can become permanent parts of the ideal structure representing the real world only if they are entertained by other minds also, and so become current in the society to which the individual belongs. Besides the verification of ideal combinations by actual experiment yielding the corresponding perceptual experiences, another kind of verification is required. Social endorsement is necessary. On the other hand, ideal combinations which are generally current in society tend to maintain themselves in the mind of the individual, even though he has never himself verified them, and even though his own personal experience is unfavourable to them rather than otherwise.

Now and then a person is met with who dares to deny that the earth is round; there is nothing in his direct personal experience to show the roundness; on the contrary, so far as he can observe it, it seems to be flat. Now such a person is generally regarded as a 'crank'; he is generally spoken of as a harmless kind of lunatic; and what is more important, he is so spoken of by multitudes of persons who know much less about the matter than himself. The reason is that he is maintaining his own individual ideas against the vast work of ideal construction which has been built up by the co-operative thinking of many generations. It is true that this ideal structure is in process of constant development; and that, as it grows, it rectifies itself, excluding ideal combinations which had previously formed integral parts of it, and receiving into itself others which it had previously rejected. But the earth-flattener does not appear as a representative of this advance: he puts himself forward, or is supposed to do so, merely as an individual setting up his own private thoughts in antagonism

to the social product. The experts who are the accredited representatives of the development of the general system of ideas in this direction scout his pretensions: he therefore figures as an isolated individual appearing in the strength of his own private judgment in opposition to the established social order, and he is accordingly regarded by society much in the same way as a lunatic or criminal, the only difference being that he is considered to be harmless and amusing.

This is a case taken from our own complex society, in which ideal construction is so vast in its extent and so diversified that there is no single person who can hold more than a fragment of it, and its various branches are assigned to the keeping of special guardians. These complex conditions give a certain freedom of play to the individual, which is absent in more simple organisations. In more primitive communities, such as we find among savages, the general stock of ideas is assimilated by each individual, and all are its guardians, though the old men are in this respect more important than the young. Thus the pressure of society upon the individual is incomparably more coercive. Any private rebellion against inherited and accepted tradition would be resented and suppressed with great speed and certainty.

Thus primitive societies are intensely conservative and remarkably unanimous in their modes of thought. Each thinks as the rest think, and dares not persevere in any innovation which does not find general acceptance. Ideal activity is on the whole more occupied in finding reasons to justify tradition, or to explain its apparent inconsistency with actual experience, than in further developing and improving the ideal scheme which has been handed down from generation to generation.

CHAPTER VI.

THE SELF AS IDEALLY APPREHENDED.

1. General Nature of the Self as Ideally Apprehended.—On the perceptual level, the apprehension of the self is not yet disengaged from that of the body. For perceptual consciousness, the boundary between the 'Me' and the 'Not-Me' is drawn at the surface of the skin. The clear and explicit opposition of the feeling, willing, and thinking subject to the material world in general, inclusive of the living organism, is a late outcome of mental development. Even when it has been reached, it is only occasionally present to consciousness —in moments of reflection. In the ordinary language of civilised and educated human beings, including philosophers the word 'I' usually refers to the embodied self, as when we say: "I took a walk," "I trembled with anger," "I hit on this idea while lying in bed."

With the emergence of trains of ideas, the awareness of the self becomes developed in a twofold way. In the first place, there is an ideal enlargement of the self of perceptual consciousness. "We have at this stage not only an intuition of the bodily self doing or suffering here and now, but also memories of what it has been and done under varied circumstances in the past,"[1] ideal anticipations of what it will do or suffer in the future, and thoughts of what it might have done or suffered or may do or suffer in various actual or possible situations. This development does not of itself alter the nature of the self which is apprehended; it only yields an extended view of the self of perceptual consciousness.

But besides this, and in direct connection with it, another development takes place which introduces a fresh and most important constituent into the object of self-consciousness.

[1] Ward, *Psychological Principles*, p. 365.

This comes to include processes of attending, feeling, and willing as concerned with trains of ideas as well as with things present to the senses. It comprehends thought, volitions, and emotions, which proceed independently of direct transaction between the embodied self and its actual environment at the time when they occur. It contains remembrances of past trains of ideas, as when we say: "These reflections passed through my mind"; anticipations of future trains of ideas, as when we say: "I shall think over the matter before deciding"; and also references to possible trains of ideas, as when we say: "If I had known what was going to happen, I should have prepared a suitable plan to meet the emergency."

Apart from the fulfilment of further conditions, the awareness of self at this stage still remains fused with the awareness of the body. But with the growth of ideal processes, there arises an important distinction within the embodied self, the distinction between an inner and an outer self. Trains of ideas frequently proceed without any overt motor activity such as is involved in the observation of surrounding things or in practical dealings with them; and it often happens that the ideally apprehended object diverts attention from external impressions altogether. Hence the self of ideation becomes relatively detached from the embodied self of perceptual process.

On the other hand, it is by no means detached from the perceived body altogether. Intense emotions and desires connected with ideally represented objects, are intimately connected with bodily changes accompanied by impressive organic and motor sensations; and even where these organic and motor sensations are not specially prominent, they are still present in some degree in all trains of ideas. But as they are localised within the body, the self of ideational process is distinguished from that of perceptual process as something internal. "Hence arises a contrast between the inner self which the natural man locates in his *φρήν*, or midriff—the chief seat of these emotional agitations—and the whole visible and tangible body besides."[1]

[1] *Ibid.*, p. 366.

2. The Social Factor in the Development of Self-Consciousness.—We have so far only given a general account of what constitutes the self as ideally apprehended. We have now to consider the special motives which prompt us to attend to this idea, and the constructive processes to which they give rise. These motives are primarily practical, and arise from the relation of different individuals to each other in the same community.

In such a community each individual is even more dependent on his fellows and their conduct than he is on his physical environment. We have seen that even for the power of thinking effectively, and so adjusting his actions to physical conditions, he is dependent on intercourse with others by means of language and otherwise. He must be continually adapting himself to his social environment; and to that end he must study the conditions which determine the conduct of his fellows towards himself and towards each other. He must strive ideally to represent their experiences, the impulses which determine their actions, their emotions, their trains of ideas, and so on. In this way he is led to the ideal construction of their subjective history. Now it is true that other selves are not his own very self, but they are none the less selves, though they are other selves.

Interpretation of the behaviour of others can be founded only on data derived from his own experience of the motives and ideas which prompt and guide his own actions. Thus in the very process of constructing a representation of the subjective experience of others, he must construct a representation of his own subjective experience. He is continually comparing others with himself, noting the points of agreement and difference. Every advance in his knowledge of them is also an advance in his knowledge of himself; and, conversely, every advance in his knowledge of himself is an advance in his knowledge of others. The same result may be reached in a somewhat different way. The individual has not only to consider the attitude of others towards himself, but his own attitude towards them. He must shape his own ways of thinking and acting so as to please them and secure their friendly behaviour towards himself. Thus he is con-

stantly urged to a comparison between what he is and does and what his fellows require of him. In this way he is forced to think about his own thoughts, actions, capabilities, and the like.

In this way the environment of social relationships supplies the prompting motives of an ideal construction, in which the present self appears as a link in a series embracing the remembered past and the expected future. But this is only one part of the function of the social factor. It not only supplies motives for the ideal construction; it also supplies essential material entering into all developed human self-consciousness. The thought of self always involves the thought of manifold and complex relations to other selves. A man's own ideal representation of himself includes the view which he thinks others take of him, the view which he wishes them to take of him, the view which he anticipates they will take of him, or that they would take of him if he acted in certain ways, and so forth.

"The characters, attributes, functions, or other organic constituents of the self commonly extend, from our own point of view, decidedly beyond anything that can be directly presented in any series of our isolated inner experiences, however extended. When one is vain, one's self-consciousness involves the notion that one's self really exists, in some way or other, for the thoughts and estimates of others, and is at least worthy, if not the possessor, of their praise or of their envy. When one feels guilty, one does not and cannot abstract from the conceived presence of one's self in and for the experience of a real or ideal judge of one's guilt. In all such cases the self of self-consciousness thus appears as something that it would not and could not be were there not others in the world to behold, or to estimate it, to be led or otherwise influenced by it, or to appeal to it."

"It is now from such points of view that the self of self-consciousness comes, in the end, to get form as a being who takes himself to have a social position, an office, a profession —in brief, a vast group of functions without which the self would appear to itself to be, relatively speaking, a mere cipher, while these functions are at once regarded as organically joined

to the self, and centred in it, and, nevertheless, are unintelligible unless one goes beyond one's private consciousness, and takes account of the ideas and estimates of other people."[1]

As the idea of one's self essentially involves the idea of varying relations to other selves, it will vary according as its relations vary. In relation to enemies it is a combative self; in relation to superiors it is a submissive, receptive self; in relation to inferiors it is a dominant, controlling self. To quote Royce again: "If I strut about in fancied dignity, my non-Ego is the world of people who, as I fondly hope, are admiring me. Accordingly I then exist, for myself, as the beheld of all beholders, the model. If I sink in despair and self-abasement, my non-Ego is the world of the conceived real or ideal people whose imagined contempt interests, but overwhelms me, and I exist for myself as the despised Ego, worthy of their ill-will. When I speak, my non-Ego is the person or persons addressed, and my Ego is the speaker. If I suddenly note that, though I talk, nobody marks me, both the non-Ego and my Ego dramatically change together in my consciousness."[2]

The influence of the social factor in determining self-consciousness is largely bound up with the process of imitation. Baldwin brought this point into full prominence. He distinguished two phases of imitation—the 'projective' and the 'ejective.'

In the projective stage, imitation is as yet relatively unsuccessful; the mode of activity imitated and the experiences connected with its exercise are as yet more or less beyond the reach of the imitator; they have not yet become part of his existence. The conception of himself involves a contrast between what he actually is or does, and what he is trying to be or do; and this coincides with the contrast between himself and the person imitated. In so far as this is the case, his conception of the other person is 'projected'; it contains elements which do not enter into the conception of his own present self, elements which he is only trying to

[1] Royce, "Observations on Anomalies of Self-Consciousness," *Psychological Review*, Vol. II., No. 5, pp. 437-8.

[2] *Ibid.*, p. 443.

assimilate and incorporate in the conception of himself. On the other hand, when and so far as his imitative efforts have succeeded, this contrast ceases. His conception of himself coincides with his conception of the other person. In thinking of the other person, he simply ascribes his own experiences to the other person—he 'ejects,' or throws them out into the other person, instead of 'projecting,' or regarding them as something beyond what he has himself actually attained.

"For example, last year I thought of my friend W. as a man who had great skill on the bicycle and who wrote readily on the typewriter; my sense of his personality included these accomplishments, in what I have called a 'projective' way. My sense of myself did not have these elements, except as my thought of my normal capacity to acquire delicate movements was comprehensive. But now, this year, I have learned to do both these things. I have taken the elements formerly recognised in W.'s personality, and by imitative learning brought them over to myself. I now think of myself as one who rides a 'wheel' and writes on a 'machine.' But I am able to think of myself thus only as my thought includes the personal accomplishments of W. . . ."

"So the truth we now learn is this: that very many of the particular marks which I now call mine, when I think of myself, have had just this origin. I have first found them in my social environment, and by reason of my social and imitative disposition, have transferred them to myself by trying to act as if they were true of me, and so coming to find out that they are true of me. And further, all the things I hope to learn, to acquire, to become, all—if I think of them in a way to have any clear thought of my possible future—are now, before I acquire them, possible elements of my thought of others, of the social *alter*, or of what, considered generally, we may call the *socius*."[1]

To see the full importance of imitation in the development of the idea of self, we must especially consider the case of children. Children have to learn from their social environ-

[1] Baldwin, *Social and Ethical Interpretations in Mental Development*, pp. 10, 11.

ment all that is necessary to make them members of the society into which they are born. The normal child is perpetually engaged in acquiring the habits of thought and action of its elders, and in doing so is constantly developing the idea of self by a process of imitation. Baldwin notes that the child has two characteristic mental attitudes, corresponding respectively to the 'projective' and 'ejective' phases of imitation. In the first, he is receptive, submissive, and respectful. In the second, he is aggressive, self-complacent, and disdainful or patronising.

The two attitudes correspond to different social relations. "The child's sense of himself is . . . one pole of a relation; and which pole it is to be, depends on the particular relation which the other pole, over which the child has no control, calls on it to be. If the other person involved presents uncertain, ominous, dominating, instructive, features, or novel imitative features, then the self is 'subject' over against what is 'projective.' He recognises new elements of personal suggestion not yet accommodated to. His consciousness is in the learning attitude; he imitates, he serves, he trembles, he is a slave."

"But on the other hand, there are persons to whom his attitude has a right to be different. In the case of these the dialectic has gone further. He has mastered all their features, he can do himself what they do, he anticipates no new developments in his intercourse with them; so he 'ejects' them, as the psychological expression is; for an 'eject' is a person whose consciousness has only those elements in it which the individual who thinks of that consciousness is able, out of his own store of experience, to read into it. It is ejective to him, for he makes it what he will, in a sense.

"Now that is what the brothers and sisters, notably the younger ones, are to our youthful hero. They are his 'ejects'; he knows them by heart, they have no thoughts, they do no deeds, which he could not have read into them by anticipation. So he despises them, practises his superior activities on them, and tramples them under foot."[1]

[1] *Ibid.*, pp. 18, 19.

3. The One Self and the Many Selves.—When we are most intensely and persistently occupied with ourselves, it usually happens that the total self appears as parted into two phases, each of which is apprehended as a relatively distinct self. As Royce rightly observed, "I can question myself, and wait for an answer; can reflect upon my own meaning; can admire myself, love myself, hate myself, laugh at myself; in short, do or suffer in presence of my own states and processes whatever social life has taught me to do or suffer in presence of the states and processes of others."[1]

The life-history of the individual consciousness embraces a multitude of very diverse and often incongruous states and tendencies. At any moment of self-conscious reflection attention is usually fixed on one or other of these special modes of experience. In so far as they differ from each other, and from the present self which is thinking about them, there is a tendency to regard them as if they were relatively distinct selves. Thus a man, when sober, reflecting on his conduct and on his mental attitude when drunk, can hardly recognise himself as the same person. In fact he is apt to say, "I was not myself," or, "I was not quite myself at the time."

The self of our dreams is usually sharply distinguished from the self of waking life. The waking self generally refuses responsibility for the thoughts and actions of the dreaming self. In such instances, the person feels that there is more difference between himself and these special phases of his life-history than there is between himself and other persons.

These are extreme cases, but the principle has a wide application. There is always a tendency to refuse to recognise the self which is overcome by some sudden or exceptional impulse, or transformed by peculiar conditions, as one and the same with the normal self.

The same antithesis is found not only in reflecting on past states, but also in the moment of present consciousness. When the mind is divided by conflicting impulses, it often appears as if there were two *quasi*-persons in the same individual consciousness, and as if the one were criticising the

[1] *Op. cit.*, pp. 454-5.

other, contending or expostulating with it. The analogy of the relations between ourselves and other persons is transferred to the relation between conflicting groups of tendencies within our own consciousness. The best example, perhaps, is the conflict between moral principle and temptation. In such cases one of the two conflicting tendencies is often identified with our true self—with the normal flow of thought and action; and the other tendency is regarded as something relatively foreign and intrusive.

"If the tendency to the estimated act is a passionate tendency, a vigorous temptation, and if the conscientious judgment is a coldly intellectual affair, then the situation dimly reminds me of cases where other people, authoritative and dignified rather than pleasing, have reproved my wishes. . . . But if, on the other hand, the conceived act is less keenly desired, and if my conscientious plans are just now either fervently enthusiastic or sternly resolute in my mind, then . . . I myself am now, in presence of the conceived act, as if judging another."[1]

We must add to the actual past and present selves those which may exist or might exist in the future, or might have existed in the past. There is always an antithesis between ourselves as we are or have been, and ourselves as we wish to be or wish that we had been. It is always possible in reviewing the past to transform the picture of it so as to represent ourselves as thinking, feeling, and acting, not as we have actually thought, felt, and acted, but as, from our present point of view, we should wish to have thought, felt, and acted. We can disregard actual conditions and limitations, and mentally endow ourselves with powers and qualities which we neither possess nor have possessed, and we can imagine situations especially fitted to call them into play, and evoke the admiration of our social environment. Without going to such extremes as this, a man may simply say to himself, "Oh! what a fool I have been! Why did I not work instead of play?" and the like; and he may allow his mind to follow out, by a train of ideal construction, representa-

[1] Royce, *op. cit.*, p. 454.

tions of what he would have been in the past, present, and future, if he had acted otherwise.

Such ideal constructions are most common in reference to the future, especially in the young. There is a tendency to represent what the self of the future is to be and do, and what is to happen to it, in its social and other relationships, in accordance with present desires. This is sometimes mere day-dreaming; but it may also be of the greatest practical importance; for a man's future, unlike his past, is to a large extent under his own control. By dwelling on the representation of himself as he would wish to be, instead of as he is, a direction is given to his activity, which actually tends to realise his ideal. When the ethical end is said to be self-realisation, what is meant must be the realisation of a future self which lacks the imperfections and limitations of the present self.

4. Pathology of Self-Consciousness.—Under normal conditions, the tendency to regard various actual or possible phases of the self as if they were more or less distinct persons is not carried so far as to mistake metaphor for literal fact. The man still knows or can always remind himself that he is not in reality split up into a plurality of personalities, distinguished from each other in the same way as one person in society is distinguished from another person. But in many cases of insanity the analogy is no longer mere analogy for the patient. So great a transformation is brought about in the train of his experiences, that the present phase of his life-history is altogether discontinuous and discordant with his past. At the same time, the present phase is so persistent and engrossing, and the idea of the past relatively so feeble, that his whole actual bygone history is either partially ignored and partially reconstructed or is ascribed to some other person.

Cases are extremely common in which insane patients believe themselves to be such great personages as Napoleon, the Messiah, or even God the Father, and act accordingly as far as lies in their power. "A soldier, whose skin had become insensible, believed himself to have been dead since the battle of Austerlitz, where he received a wound. When he was asked

as to his health, he said: 'You want to know how Father Lambert is? But there is no Father Lambert, a cannon ball killed him at Austerlitz; what you see here is not he; it is a wretched machine made to look like him; you ought to ask them to make a better one.' In speaking of himself he never said *me*, but always *it*."[1]

Such delusions as this depend on a profound change in the nature of personal experience, which makes the present discontinuous with the past. Nervous disorders tend to bring about such breaches of continuity. In general, a change in the experiences connected with the body, and especially with organic sensation, seems to be an essential factor in the process. Sometimes the resulting illusion relates specially to the bodily self, and does not profoundly affect the continuity of personal existence in other respects. Thus a patient whose bodily sensations have become abnormal will feel as if he were made of glass or butter, and come to suppose that he actually is composed of such materials.

But when the illusion is not limited to the bodily self, but involves a transformation of the individual's whole idea of his life-history, the reason probably lies in profound alteration of emotional tone. Organic sensation is a highly important factor in emotional states; alteration in it may either produce or be attended by a general change of emotional attitude. But emotions are not merely specific modes of feeling: they also involve characteristic conative tendencies, either in the way of expansive and aggressive activity, or of shrinking and aversion. Now we have seen that these conative tendencies may be initially vague and undirected to specific objects, and that, so far as this is the case, they fasten on any object they can find. When they have not an object, they make one for themselves. Thus a herd of cattle, enraged by the sufferings of one of their number, will vent their fury on the innocent victim, if no enemy or other object of resentment obtrudes itself on their attention.

Thus emotions, in so far as they are initially vague, tend to define themselves. On the ideational plane, the process of

[1] Taine, *On Intelligence*, p. 377.

definition takes the form of ideal construction. If the emotional moods due to pathological conditions are sufficiently profound, intense, and persistent, whole systems of ideas will arise in this way which may be quite discontinuous and discordant with the actual past experience of the subject. Now emotional moods in human life commonly arise in connection with certain social situations. These same moods when they arise pathologically may define and explain themselves by the ideal representation of corresponding relations between the patient and his social environment.

"Suppose that one's depressed emotional condition, as in melancholia, or at the outset of a delirium of suspicion or of persecution, contains emotions resembling the normal emotions of conscious guilt, or the feeling of social dread. Then these feelings tend to assimilate in one's actual surroundings, or in one's memories, data which suggest, to one patient an actually believed social condemnation of his deeds, or an actual judgment of his inner conscience passed upon his sinfulness, while to another patient his own sorts of emotion suggest an especially hostile scrutiny of his appearance by the passers-by, or an inner sense that he must hide from possible scrutiny. On the other hand, feelings quite the reverse of these suggest to the exalted general paralytic whatever remembered or fancied social relations, expressing his vast powers, the fragments of left-over social habits which still survive in his chaos permit him, in passing, to express."[1]

Now the idea of self is so bound up with the idea of social relations, that an ideal reconstruction of these involves an ideal reconstruction of the self also, and in extreme cases this amounts to a breach of continuity between the past and present self, so that they appear to be separate persons.

In other cases, the two selves appear to be simultaneously present and at strife with one another. Sometimes the subject identifies himself with one of them, and sometimes he is perplexed as to which of the two he really is.

It very often happens that this division of the self into two, one of which appears as a foreign person, is determined by

[1] Royce, *op. cit.*, pp. 456-7.

hallucinations. Thus in some cases a man's thoughts appear to be stolen from him because, independently of his own volition, the words which he uses within his own mind to express his ideas utter themselves either in the form of auditory hallucinations or at least hallucinations of the muscular sense. "The thoughts are his own. The sounding of them forth, in this way, is not his. His thoughts run off his tongue, get spoken in his stomach, creak out in his shoes as he walks, are mockingly echoed or in the end commented upon by another power."[1] He explains the mocking repetition by ascribing it to another person who is hostile and contemptuous, and he fills out the idea of this other person in various ways, attributing motives to him and supplying him with words appropriate to his character.

5. The External and the Internal Self.—The idea of the self includes in all but its latest and most abstract developments the idea of the body as the vehicle of perception and motor activity. At the level of ideal construction there is an additional motive for regarding the body as part and parcel of the self. The idea of the self essentially includes the idea of its relation to other selves. But it can only exist for other selves in so far as it appears to them in bodily form.

But however important the body may be, it can never be regarded as the whole self or even as the most essential part of the self. Its attributes and movements, so far as they differ from those of other material things, appear to be initiated by something inside the organism. They follow on volitions, emotions, painful and pleasant sensations, and the like. These experiences constitute the inner self, and the body as it presents itself to the external observer is their instrument used in a way more or less analogous to that in which other material instruments are used.

The contrast between inner and outer self is made explicit, as we have seen, by the process of ideational thinking, in which the body may be apparently quiescent, while the mind is active. The same is true of dreams. Thus even in primitive

[1] *Ibid*, pp. 455-6.

stages of human development, we find an antithesis recognised between the body as outer husk and the soul as inner kernel. But we find that the more primitive modes of representing the existence of the inner self differ essentially from our own. Modern theories regard the soul as simply an immaterial substance, or identify it with the brain, or say that it is just the continuous flow of conscious states themselves. All these views are very remote from those which are naturally and inevitably taken in earlier stages of mental development.

The savage cannot find out what the inner self is by exploring the inside of the body, for this is possible only after death; and after death the inner self no longer manifests its local presence. Thus *post mortem* examination can only show that the inner self is not an internal organ of the body; that it is not the brain or heart or lungs. On the other hand, the conception of a simple immaterial substance, or of a mere series of conscious states, presupposes a development of the power of conceptual abstraction entirely beyond the reach of the savage. In all his practical dealings with the world, he has to do with things extended in space and appreciable by his senses. Even in his social relations, other persons exist for him only in their bodily setting.

Now we have seen how very slow and gradual a process it is by which the primitive mind disengages what is essential in a conception from the irrelevant material in which it is imbedded. This makes it impossible for the savage to disengage in its abstract unity the conception of a purely immaterial existence. Hence, in ideally representing the internal self, he follows the analogy of his general experience of personal beings. The internal self is for him more or less a repetition of the external self. "If a man lives and moves, it can only be because he has a little man inside who moves him."[1]

This mode of thinking is perhaps partly originated and in any case strongly confirmed by certain special experiences. Among these dreams play a prominent part. A man who is absent or dead appears to another in his dreams. The impression of the actual presence of the person dreamt of is

[1] Frazer, *The Golden Bough*, Vol. I., p. 121.

often extremely strong, and easily suggests the theory that, though the ordinary external body is lying in the grave or at a distance, the inner counterpart of this body, the soul, has actually appeared to the dreamer.

But such apparitions are not confined to dreams. All pathological conditions of body and mind, due to disease, drugs, hunger, exhaustion, and so on, tend to produce hallucinations of this kind; and these conditions are very common among savages, much more so than among ourselves. Add to this the extreme difficulty which the human mind finds in realising the termination of personal existence after death. The difficulty is not merely that of realising annihilation in the abstract, but of realising that the dead person has ceased to play his habitual part in the ordinary life of the living. The habits of thinking and acting of his surviving friends and relatives have grown up and become fixed on the assumption of his presence among them. There is always a conflict between these preformed habits and the new conditions introduced by his death; and the conflict is often intense and distressing. The survivor feels a shock of surprise, often painful, when he misses his intimate friend from his usual place. The savage's habits of thought lead him ideally to represent the dead as still having an existence analogous to his existence when alive. He thus credulously meets illusions, hallucinations, and dreams, in which the dead appear once more with the personal appearance and garments of the living. The natural explanation for his mind is that what he sees is actually present. We must remember that physiological and psychological theories of the origin of dreams and hallucinations are utterly beyond the range of savage conception.

The relation between the ordinary body and the internal impersonation is not conceived in a merely mechanical way. The unity of the whole individual is not accounted for by the interaction between the internal self and the external self. On the contrary, the reason why body and soul are in sympathetic communion lies ultimately in the bare fact that they form part of the same individual. In ordinary waking life, the soul is supposed to be locally present in the body. But it

may depart from the body without severing the connection between them. At least a modified form of sympathetic communion may still continue between them. The final departure of the soul means the death of the body; but a temporary departure is often supposed to involve only illness, or trance, or dreams.

The sympathetic communion which is independent of local presence is well brought out in the case of dreams. The savage will ascribe the soreness and fatigue of his body to the painful struggles which his soul has undergone in dream wrestlings with other souls during its temporary migrations. So presents and sacrifices to the departed are usually offered at the tomb as if to the body; the benefit goes to the soul. It is very commonly believed that the burying of the body with appropriate rites is an indispensable condition of the soul's welfare. Thus the Greeks supposed that the shades of the dead must haunt the banks of Styx or wander about the earth, until their bodies received the rites of sepulture—afterwards they could pass to the underworld and mix with their own kind. It is instructive that the regions to which departed spirits are supposed to go are in primitive thought generally represented as faint reproductions of the actual world, and the society of ghosts as analogous to the society of the living, retaining such relations as that of master and slave, rich and poor, and the like.

Since the spirit is only occasionally visible and still more rarely tangible, and since in general the relations of the living to it are somewhat vague and dim, there is a tendency to regard it as being itself shadowy and unsubstantial. But on this point primitive thought vacillates a great deal. We often find the spiritual body represented as existing and behaving in much the same manner as an ordinary body. It is sometimes represented as eating and drinking, wrestling and fighting, and even as intermarrying with the living. Marriage between a living person and disembodied spirit is not uncommon in Chinese folk-lore. But these are exceptional cases. Familiar dealings with spirits are most often supposed to be the privilege of magicians and medicine-men, who often make it a regular part of their profession to catch departed souls in

snares, and either detain them in custody, or bring them back to the body to which they belong.

If there are two material impersonations of one individual, there is no reason in the nature of the case why there should not be more. As a matter of fact we find that primitive thought often recognises the existence of several. The explanation of shadows and reflections by optical laws is beyond the range of the savage mind; they are accordingly interpreted in accordance with the system of ideas familiar to primitive thought. They are impersonations of the whole individual, much as the soul is; sometimes they seem to be identified with the soul, but they are often regarded as distinct. There is a Polynesian story of a girl who stole a young man's shadow and imprisoned it in a bottle; she then set it free and projected it upon a pool of water. "As the man moved about in his own land, so the shadow moved on the water."

Sometimes different impersonations are supposed to have different functions. Thus the Tshi-speaking people of the Gold Coast ascribe to each individual two impersonations besides his body—the *srahman*, or soul, and the *kra*. The *kra* is especially connected with the phenomena of dreaming, and of birth and heredity. In dreams and visions it passes out of the body; after death it acquires connection with some other body, so that each man's *kra* has passed through a long series of distinct embodiments. The *srahman*, or soul, cannot leave the body without suspension of obvious vital functions. After death, it passes to deadland, which in social and other arrangements is a counterpart of the world in which it has previously lived. If the man has died before completing the proper term of life, the *srahman* lingers about its former habitation.

During life, body, *srahman*, and *kra* are regarded as different impersonations of the same individual, so that what happens to any of them may affect the whole. The incidents in a dream are believed to be adventures of the *kra*. "If a native, having taken a chill overnight, awakes in the morning with stiff and aching muscles, and the usual symptoms of muscular rheumatism, he at once concludes that during the night his *kra* has been engaged in some toilsome pursuit, or in a conflict

with another *kra*, and he attributes the pain he feels to the exertions made or the blows inflicted."[1] Here the locally separate experience of the *kra* is the experience of the whole man, including the soul and body.

The primitive view of the internal self as a counterpart of the external body has only been very gradually displaced by the growth of civilisation. Even among ourselves at the present day it is very far from being extinct. People still believe in ghosts which appear under the form and even in the clothes of the living person. It is true that these ghosts are for the most part regarded as very attenuated forms of matter, and there is a popular impression that they are impalpable, although visible. But they are sometimes represented as being very palpable indeed.

As the progress of thought and knowledge brought into clearer light the unity and continuity of the material world, the conception of the material soul became modified. There was a tendency to explain its origin as part of the general course of physical nature, and its resemblance to the external body was no longer insisted on. The view taken was that life and consciousness were properties of a certain form of matter diffused throughout the physical universe. The cue to this theory was given by the phenomena of breathing and of vital heat. The general soul-substance from which individual souls were supposed to be derived was air rarefied by heat. Examples of doctrines of this kind are to be found in some of the pre-Socratic philosophers. Anaximenes regards the soul as being essentially air, and air as being essentially of the nature of soul. Air in general is to the universe what our own soul is to us. Heracleitus regards breathing as a connection between the internal soul and the surrounding air from which it is originally derived.

In later times, when the doctrine of an immaterial soul became generally accepted, the old material soul was still frequently assumed to exist together with it in human beings, and instead of it in brutes. We often find a division of psychical functions between the material and immaterial souls.

[1] Ellis, *The Tshi-speaking Peoples of the Gold Coast of Africa*, p. 151.

Ethical and religious functions were often ascribed to the immaterial principle, while lower functions, such as sensation and animal appetite, were ascribed to the material principle. Even in comparatively recent times, we sometimes find some ordinary conscious functions ascribed to the material soul. Thus Bacon says:

"The sensible soul—the soul of brutes—must clearly be regarded as a corporeal substance, attenuated and made invisible by heat; a breath (I say) compounded of the natures of flame and air, having the softness of air to receive impressions, and the vigour of fire to propagate its action. . . . This soul is in brutes the principal soul, the body of the brute being its instrument; whereas in man it is itself only the instrument of the rational soul."[1] To this sensible soul he ascribes at least sensation and feelings of pleasure and pain.

The last important survival of the doctrine of the material soul in scientific thought is contained in the doctrine of 'animal spirits,' as held, for example, by Descartes. The animal spirits consist of a fine form of matter constituting a connecting link between the body and the soul, but they are no longer regarded as themselves capable of any kind of conscious experience. They are merely part of the mechanism by which the immaterial principle acts on the body and is acted on by it. Thus the material soul for Descartes is a soul no longer; it is merely a mode of matter, and, like all other matter, sharply and rigidly distinguished from all conscious existence. With the advance of modern Physiology, it became displaced even from this position, and was recognised as a figment.

[1] *Works* (Spedding and Ellis), Vol. IV., p. 398.

CHAPTER VII.

BELIEF AND FREE IMAGINATION.

1. General Distinction of Belief and Free Imagination.—In discussing the ultimate ways in which the conscious subject, as such, may be related to its objects, we distinguished the attitude of mere supposal from that of belief or judgment, and we recognised thought as being involved in both.

When I see a match-box, I may think of matches being in it. I may, besides this, mentally assert that the box actually does or actually does not contain matches. My attitude is then one of belief. But I may also merely think of the presence or absence of matches as being possible alternatives without regarding either alternative as actual fact and without even raising the question which of them is actual fact. In this case, my attitude towards the objects which I call the existence of matches in the box and the non-existence of matches in the box is one of supposal. I may, on this basis, proceed to affirm that "if there are no matches in the box, somebody must have been using it." Here there is belief in the whole proposition, that "if there are no matches in the box, somebody must have been using it." But I do not believe either that "there are no matches in the box" or that "somebody has been using it." These propositions are only supposed. What I believe is that there is a certain connection between them. Here suppositions enter as constituents into a proposition which, as a whole, is an object of belief. For the purpose of the present chapter, such cases of tied supposal will be regarded as belonging to the domain of belief. What we are here concerned with is the distinction between belief in this wide application of the word and the free play of imagination.

In the free play of imagination, judgment or belief is subordinate in so far as it is present at all. The process consists primarily in a flow of supposition connected in an

ideally constructed whole, which as a whole is merely supposed and not asserted as actual fact. Telling a story which we make up as we go along, reading a novel and day-dreaming are obvious examples.

2. Distinction between the Conditions of Belief and Imagination.—A man sitting in his arm-chair can easily imagine himself killing a lion by a blow of his fist. But suppose that he meets an actual lion, and has to look to his own safety. This ideal combination is no longer possible for him; the idea of the lion pouncing on him and tearing him to pieces takes possession of his mind, and excludes the fanciful picture of his own powers. The same may happen without his actually encountering the lion. If in his arm-chair he is planning a hunting expedition to take place the next day, such ideas as that of killing lions with a blow of the fist will be excluded, and they will be the more completely excluded the more strenuous he is in the pursuit of the practical end in view.

This example brings out the essential distinction between the conditions of belief and of imagination. All belief involves objective control of subjective activity. The nature of the object thought about enforces certain ideal combinations to the exclusion of others. But this objective control is not absolute; it is conditional. It depends upon the end towards which mental activity is directed. So long as the subject is strenuously aiming at the achievement of practical ends, only certain combinations of ideas are possible for him. But if his mind is not bent on the achievement of practical results or on the attainment of new knowledge, almost any ideal combination which does not involve an explicit contradiction may be possible for him. He cannot imagine a thing as being at once round and square, black and white; he cannot mentally make two straight lines include a space, without destroying their straightness; but apart from such limitations, he can ideally construct all manner of relations; he can combine horse and man so as to form an image of a centaur; he can picture a giant with a hundred heads, and so on.

There is always some restriction on the play of ideal construction, besides that due to overt contradiction; but the

restriction in each case depends on the general direction of mental activity at the time. So far as the restriction exists at all, the mental attitude is one of belief; the flow of ideas being restricted by the nature of the object. Thus if we are thinking of normal men and women, we may mentally frame a narrative about them which has no reference to any actual man or woman whom we have seen or heard of. So far, the play of our ideas will be relatively free; it will not be bound down by conditions of date and place. None the less, it will be tied, inasmuch as we are not at liberty to introduce into our mental construction features at variance with the normal nature of human beings. We must not make them breathe fire, or have their heads beneath their shoulders. So far we are bound by the distinction between the credible and the incredible. There is no belief in the narrative as historical fact; but belief about human nature in general is involved in it through and through.

On the other hand, suppose that the play of our imagination does not refer to actual human beings, but to certain creatures of its own; it will then have much wider range, but it will still be more or less guided by initial assumptions. The subsequent flow of ideas will be restricted by the anterior flow of ideas. If a man has started by imagining fairies inhabiting flowers, he cannot think of them as giants inhabiting castles; so that even in this case there is a certain amount of objective restriction and consequently of belief.

Now objective restriction is at its maximum in the pursuit of practical ends, and in the pursuit of knowledge. It is therefore only in these cases that we find full belief—belief which is not blended with imagination, but contrasted with it. For a moment we may confine our attention to practical activity. The primary motives of ideal construction lie in practical needs. Ideal combinations are first framed with a view to efficient action. Only those, therefore, which will make action efficient, are sought for. By ideal representation a man builds a bridge across a stream before he comes to it; but the one thing important to him is that the bridge shall not give way when he comes to use it. Hence the flow of ideal construction is strictly limited. Only such ideal combinations

as can be translated into corresponding perceptual experience are of use; others, therefore, are as far as possible excluded. In so far as ideal constructions break down on being translated into terms of perceptual activity, the attitude of disbelief arises. What has happened is the actual fact; what was anticipated is contrasted with it as a false opinion. In this way the antithesis between the true and the false, between the credible and the incredible, becomes widened and deepened.

It appears from this that the attitude of belief and disbelief is prior to the free play of imagination. But even the savage is by no means always in a strenuously practical mood. He has his time for play as well as for work; and among other forms of play, he indulges in the play of ideas. When he is comfortable and idle, it gives him pleasure to represent things, not as they are, have been, or will be, but as he would like them to be, or in any way which may happen to interest him. He may communicate his imaginings to his comrades, and they may be handed down from generation to generation. Such works as the plays of Shakespeare, or the novels of Thackeray, are examples of the most advanced development of this mode of mental activity.

3. General Conditions of Belief.—There are two main points of view from which the problem of belief must be approached. It is at once a condition of activity, and conditioned by activity.

"The relation of belief to activity," said Bain, "is expressed by saying that 'what we believe we can act on'." [1] This may seem to be a statement rather of a consequence than of a condition of belief. But a closer scrutiny will show that the criticism is superficial. Just because belief is a condition of activity, activity must be a condition of belief. To strive after an end is to strive after the means necessary for its attainment. Hence in striving after an end, we strive after the belief which alone makes action with a view to that end a psychological possibility. Thus practical and theoretical needs play an essential part in determining what we shall and shall not believe.

[1] *Mental and Moral Science*, p. 372.

This holds good in the pursuit of theoretical, as well as of practical ends. The man of science, eager to advance knowledge, clings to working hypotheses; he clings to them because they are useful to him. He is apt to meet criticism by urging that no one ought to pull down a man's house until he has himself constructed a better. Whether the end aimed at be a practical result or an increase of knowledge, in either case the mind passes forward towards its mark as best it may, shaping those beliefs, and clinging to those beliefs, which are most helpful to it, and passing by those alternatives which would hamper and paralyse its activity.

The activity which is concerned with the increase of knowledge is in order of development subsequent to the activity which directly pursues practical ends. The ideal construction which is directly subservient to action brings into being a connected system of ideas concerning the world and the self. Theoretical activity consists in further development of this same system of ideas without direct reference to practical results. It is no free play of the imagination, but consists in the formation of beliefs, just because it is the further development of a preformed system of beliefs. The conditions and limitations of this system as a whole apply to all enlargements of it. It excludes or refuses to include all merely imaginary combinations.

Let us now turn to the other side of the question. Belief is not only conditioned by mental activity, but also involves restriction of mental activity. Objective coercion is of the very essence of belief. Whatever influence subjective needs as such may have in determining belief, they can never be the sole factor. In framing a belief, we endeavour to represent real existence as it is in its own nature, independently of our own individual consciousness. Where we feel that it is purely a matter of our own arbitrary choice whether we shall think of *A* as *B* or as *not-B*, there is no belief or disbelief. There is a state of doubt when this freedom of choice is accompanied by an effort to find something not ourselves which shall determine us one way or the other, so that we shall be able to arrive at a belief. There is a mere play of imagination when this endeavour to arrive at a belief is absent. For actual

belief or disbelief, some restriction of subjective freedom is necessary.

Thus belief is at once dependent on activity and on limitation of activity. This is no contradiction: on the contrary, the two points of view ultimately coincide. Belief depends on subjective tendencies, just because these tendencies cannot work themselves out without it. Ends can be realised only by the use of means; but in order to use means we must have some belief in their efficacy; hence the impulse to pursue an end is also an impulse to form beliefs which will make action for the attainment of the end possible. But it is not within the range of our arbitrary selection to determine what means will lead up to a given end, and what will not. This depends on the nature of the real world in which we live.

In the framing of a belief, therefore, there must always be some endeavour to conform to conditions other than, and independent of, our own subjective tendencies. Our inability to attain ends otherwise than through certain means constitutes a restriction of mental activity within more or less definite channels. If wishing were identical with having, our freedom would be absolute, and there would be no such thing as belief. The nature of the steps which will issue in a certain result are fixed independently of us. In devising means to an end, we are not free to make what mental combinations we will. Our thinking, to be effective, cannot be free. We can no more attain our ends without submitting to control independent of our wish or will than we can walk independently of the resistance of the ground on which we tread.

4. Variation in the Relative Importance of the Subjective and Objective Factors of Belief.—There are, then, two factors which co-operate in the formation of belief—one subjective, and the other objective. Neither of these factors is sufficient by itself; both must be operative. But their relative importance may greatly vary. The keen urgency of practical needs may make it necessary to come to a decision where objective data are scanty. He who climbs a cliff to escape death by drowning must use whatever foothold presents itself, though he would never have trusted to it without pressing

motives. So where there is a practical need to form a belief, because indecision would paralyse activity, the mind must rest on whatever objective indications or suggestions it can find, however slight these may be. On the other hand, where there is no interest to be satisfied, there will be no tendency to form a belief. The mind will occupy itself only with those questions which lie in the line of its own activity.

The influence of the subjective factor is the more prominent and dominant, the more primitive is psychical development in general. Primitive beliefs are nearly all relevant to the narrow circle of immediate practical interests within which the activities of the savage are confined. Wherever these interests are involved, they take shape in a body of beliefs often resting on what appear to us extremely frail objective foundations. The primitive mind does not concern itself, or only slightly concerns itself, with questions which fall outside the range of its narrow circle of practical interests. But increasing knowledge finds relevancy where ignorance fails to find it. Thus in neglecting whatever does not obviously relate to immediately engrossing needs, the primitive mind must neglect much which is really relevant to them. Hence, in the formation of belief, data of the utmost importance will be ignored because their relevancy is hidden and cannot be made apparent without patient mental effort. Thus the narrower is the circle of interests, the greater is the predominance of the subjective factor, because the mind is blind to objective data which do not obviously connect themselves with its immediate aims and tendencies.

Besides constituting the impelling motive for the formation of belief, the subjective factor also contributes to determine the nature of the beliefs which are formed. When a negative judgment would paralyse activity, the active tendency is a force arrayed on the side of the positive judgment, and *vice versa*. If a certain ideally represented combination presents itself as the only condition, or the most favourable condition, of attaining a certain end, the active tendency towards this end is of itself a tendency to believe in the ideally represented combination. If denial of this is tantamount to sacrificing

a cherished aim, the whole strength of desire helps to enforce the affirmative side.

Thus persons of vigorous and courageous temperament are apt to believe what they wish to believe. Indeed this is sometimes stated as a maxim holding good of human beings in general. *Tarde creduntur, quae credita laedunt*, says Ovid. But we must not push this view too far. Where the general mental attitude is one of fear, or timidity, or gloomy suspicion, it does not hold good. Fear or timidity or gloomy suspicion favours belief in disagreeable alternatives. Where the tendency is not to face and fight difficulties and dangers, but to evade and escape them, action will be most effectively guided by taking the most unfavourable view of the circumstances. Even if an alarm is false, it is better to be on the safe side. There is much in the religious superstitions of savages which shows manifest traces of this influence of fear upon belief.

It should be clearly understood that the distinction between the subjective and the objective coefficients of belief is not a logical but a purely psychological distinction. Whatever condition controls and limits subjective activity, so as to enforce one way of thinking and to make other ways difficult or impossible, is from the psychological point of view an objective coercion. It may be that the control thus exercised does not really proceed from the nature of the object as known to more highly developed minds. Logical analysis from the point of view of higher knowledge may show that what is operative is some association of ideas, which, though it may be vivid and insistent, is none the less casual and irrelevant. But for a mind which is unable to recognise it as casual and irrelevant, the coercive power of the association must appear as if it proceeded from the nature of the object represented.

The words 'casual' and 'irrelevant' imply that a systematic view of objective relations has already been formed, and that this system excludes the connection of things or events suggested by the association which is called irrelevant and casual. But a mind which has not attained to this systematic view cannot distinguish between control really proceeding from the nature of the object, and control proceed-

ing from what is recognised at a higher standpoint as a merely casual connection of ideas. Hence savages appear to us to confuse objective with subjective necessity. Any association between *A* and *B* through which the idea of *A* vividly and insistently calls up the idea of *B* may lead to a belief in a real connection between them. If in a fit of anger we trample on a man's portrait, it is difficult for the moment to avoid believing that we are by the act doing the man himself a direct injury.

The savage has a real and permanent belief that men can be injured in such ways. He thinks, for instance, that by destroying a man's footprints he can spoil his journey or make him lame. So the Chinese believes that by hanging up in his house ancient coins he secures for himself the protective influence of the spirits of the emperors under whom the coins were issued. Such instances are innumerable. There is nothing in the beliefs thus formed which is at variance with the preformed system of beliefs. On the contrary they are in full harmony with this. Hence subjective interests together with vivid and insistent associations of ideas exercise unrestricted control.

One main reason why the subjective factor is more dominant in primitive thought is that the preformed body of belief is comparatively small in extent and imperfectly organised. A body of belief is more fully organised in proportion as the denial of this or that combination of ideas which enters into its composition involves a greater and more destructive alteration in the whole system. Savage beliefs are not woven into a unified whole to nearly the same extent as civilised beliefs; hence the influence of the objective factor is smaller. For the influence of pre-established convictions in determining the credibility or incredibility of new suggestions is in its nature objective. However the old beliefs have been formed, and whether they are true or false, they are affirmations or denials of real existence. Whatever is rejected because of its inconsistency with them, and whatever is accepted because its denial would be inconsistent with them, is accepted or rejected because it is felt to be implied in or excluded by the constitution of the real world. Thus the influence of the objective factor develops as

the general body of belief grows in extent and becomes more highly systematised.

In this process, when it is carried far enough, truth must be the gainer; for error cannot ultimately be made self-consistent. But in relatively early stages of the process the result is to a large extent of an opposite kind. Beliefs shaped in ignorance, under the pressing urgency of practical needs, help to produce new beliefs, and give rise to an organised system of error, so that the united force of the whole resists interference with any part of it.

5. Influence of the Social Factor.—Ideal construction is, as we have seen, a social product. Hence the beliefs of the individual are to an immense extent shaped and determined by the beliefs current in the community in which he lives. This is an objective factor of paramount importance. But its logical value of course depends on the process by which current beliefs at first came into being. When these have no adequate basis in fact, their social endorsement simply serves to safeguard them against doubts to which the experience of individuals might otherwise give rise.

If a belief in witchcraft, for instance, is already established in a community, those persons who think they have in their own experience evidence for its reality will have an immense advantage over any individuals who may venture to oppose them. The most acute reasoning and exhaustive research will have little chance against the most flimsy and prejudiced tale of old women causing sickness in children or preventing the cows from yielding milk. It must seem futile and perverse to put forward other explanations of these phenomena when there already exists an established explanation which, so to speak, forms part of the social order.

The adverse critic is an eccentric person who sets his individual fancy in opposition to the whole community. He is promptly suppressed. It is, however, uncommon that such a critic should arise within the community itself apart from the intrusion of foreign influences.

The people of a community often maintain their beliefs by trusting one another, as the inhabitants of the Scilly Islands

are said to have eked out a precarious livelihood by taking in one another's washing.

6. Some Features of Primitive Belief.—We have seen that the formation of new beliefs depends at every step on the nature of the beliefs which are established. Thus, in reviewing the history of human thought, we have to take account of two points. On the negative side we have to remember that complex systems of ideas which are familiar to us have not yet come into being in earlier stages of development. In particular, the power of mechanical construction, and the mechanical understanding of natural process was in the beginning extremely rudimentary and limited in the range of its application. Hence there are certain general conditions of interaction between material things constantly recognised by modern culture which are not present to the mind of the savage, or even to the ignorant members of civilised society.

For early thought, it is abstractly conceivable that anything should act on anything else. The unity of the individual thing determines the connection of its parts; it is not the connection of the parts which produces the unity of the thing. Hence there is no reason why the component parts of the individual whole should not interact even when they are separated from each other in space. Besides this, the primitive view of what is and is not part of an individual whole differs from ours.

The savage is in this respect powerfully influenced by associations which we should call casual and irrelevant. Whatever he has habitually connected in thought with a person or thing, he is disposed to regard as part of that person or thing, and as having sympathetic communion with it He continues to associate vividly the dead body with the ghost, the amputated limb with the man who has lost it, and he cannot help feeling that what is done to the body makes a difference to the ghost, or that what is done to the amputated limb makes a difference to the man who has lost it. Similarly, he habitually associates a man's clothes, or his tools and weapons, or his other belongings, with the man himself; in thinking of the personal belongings, he is impelled to think of

the person, and he is led to regard them as part and parcel of the total personality. Hence these external appendages are for him no mere external appendages; the unity of the individual is present and operative in them. By appropriating a dead man's spear, he may appropriate his skill and good-fortune, and the like.

The unity of the world in general is vaguely conceived after the analogy of the unity of the individual thing. The unity of the world is not explained according to a system of uniform and abstract laws regulating the connection of its parts. On the contrary, things and events are supposed to be capable of sympathetic communion just because they form part of the same world. Anything from this point of view may be really connected in determinate ways with anything else. Specific characteristics, powers, and modes of behaviour will appear as ultimate and inexplicable. They will appear as what we should call occult qualities intrinsic to the things themselves, and not as admitting or requiring further analysis or explanation. Any interaction or real connection may be accepted as a fact, if it be vividly impressed on the mind in relation to some strong practical interest. For example, there is no keener or more widespread practical interest than that which is felt in the course of future events. Hence we find all over the world a belief in signs and omens, and methods of divination. Often appeal is made in various ways to a superhuman being supposed to possess prescience. But in the most simple cases, anything which is found suggestive to the persons interested may be regarded as a sign.

Among the Tshi-speaking tribes of the Gold Coast, divination is practised by the priests in ways which vary according to the particular caprice of the moment. In time of war, a method of ascertaining which party will get the better is to haul on a rope fastened to a tree till it breaks. While it is being pulled, the names of the combating parties are called out alternately, and the name which is called out at the moment when the rope breaks is that of the party which will gain the advantage. We may compare the belief in fortune-telling by cards, which is sometimes found among ourselves.

This then is the first point to be emphasised in contrasting cultured with savage thought. The limitations imposed on our ideal construction by our pre-existing knowledge, and especially by our mechanical view of nature, do not exist for the savage mind.

But besides considering the ideas which are absent from the savage mind, we must also consider the positive nature of the ideas which are most predominant in his thinking. We have seen that the conception of individual unity is familiar to him and constantly utilised by him. But among all individuals those which are most familiar, interesting, and best known are human beings—himself and the members of the society in which he lives. Hence the constant and prevailing tendency which we find in primitive thought to interpret all things in terms of personal life and personal relations.

Whatever arrests his attention and fixes his interest as a source of good and evil to himself is regarded by him as having some sort of conscious existence more or less analogous to his own. This is possible because of his failure to understand the mechanical explanation of natural events and processes. When the structure and operation of a piece of mechanism is fully understood, it can no longer be regarded as a separate and independent agency prompted by internal impulses, analogous to the will of personal beings. But where the principle of action is regarded as something ultimate and independent, intrinsic to the nature of the individual thing, there is nothing to prevent the mind from treating the agency as personal or quasi-personal. The cataract or the whirlpool appears a living thing to the poet in his poetic moods; for in these moods he ignores the fact that the water is simply behaving in accordance with certain abstract laws under certain given conditions. This fact is not ignored by the savage; it has never been realised by him. Hence, what may be a transient play of imagination in the civilised mind, is the permanent and serious attitude of the savage mind.

It is permanent and serious because it is prompted and upheld by practical needs. In presence of personal agencies, he can never feel himself utterly helpless. He can always attempt to influence them as he influences his own fellows in

society. He can propitiate them by offerings, by prayers, by self-humiliation, by flattery, and even by threats and punishments. Of course, these means often fail; but they also fail frequently in the case of human beings. Personal caprice and perverseness introduce incalculable elements into the problem. But this only serves to make possible the survival of the anthropomorphic point of view. Failure can always be explained, and apparent success can always be regarded as convincing evidence. Continued malignancy on the part of the supposed personal agency can always be ascribed to deep resentment of neglect shown to it, or of injury done to it, consciously or unconsciously. Besides, it is always possible to say that things would have been still worse if proper methods had not been taken.

It has been shown that the primitive conception of personal existence differs in many points from our own; and this difference appears in the mode of personifying natural objects and agencies. Just as the human person has an internal and external self, personified things have also an internal and external self; and as the internal self in the case of human beings is a sort of duplicate of the body, so all things which are regarded as separate agencies are supposed to have spirits of a similar kind. Hence the widespread savage doctrine that everything has its 'double.' The ghost of a spear may exist and kill people after the spear itself has been destroyed. When sacrifices of food, clothes, and utensils are made to the dead body, their spiritual counterparts are appropriated by the soul. We saw that the same individual may have not only two but many impersonations of this kind, all in sympathetic communion with each other, so that the unity of the whole is present and operative in all of them. This is even more true of personified natural agencies, when they are powerful and important. Savage deities often originate and are conceived in this way.

To select an instance at random, there is a god called Behnya worshipped by the Tshi-speaking tribes of the Gold Coast. Behnya is primarily a river; he has also a human shape, with whip and sword. He has an image and stool, which used to be washed with the blood of human victims offered to him.

The body of the human victim was cut into small pieces, and distributed round the outskirts of the town, rendering it impossible for a hostile force to make an entrance. There was also a certain rock in which his influence was present and operative. Thus the river itself, the human shape, the image and stool, the pieces of the body of the human victims and the rock were all separate vehicles of the influence of Behnya. He was impersonated in all of them.[1]

[1] Ellis, *The Tshi-speaking People of the Gold Coast*, Chap. V.

CHAPTER VIII.

THE AFFECTIVE TONE OF IDEAS.

1. Introductory.—The pleasures and pains of ideational processes have two sources. They are either due to a remnant of the feeling-tone of an actual sensation or perception persisting in ideal revival, or they arise independently in and through the ideational process itself as an activity directed toward an end. It must also be borne in mind that trains of ideational thought always have an accompaniment of organic sensation faint or intense. They occasion changes in the common sensibility, which have often a conspicuous affective tone.

2. Revived Conditions of Affective Tone.—Feeling-tone cannot be directly revived. Its recurrence depends on the reinstatement of the original conditions of production. Now the reproduction of the percept in the ideal image is at the best only partial, and we should therefore expect the revival of feeling-tone to be partial also. Much allowance must of course be made for differences between individuals; but it may be said generally that the pleasures and pains of actual sensation are very faintly echoed in the corresponding ideal images.

Some apparent cases of intense revival are illusory, being really due to concomitant organic sensations. Thus the idea of undergoing a surgical operation may produce a widespread and intensely disagreeable disturbance of common sensibility; but the feeling-tone does not belong to the mere idea of being cut, etc. Excluding such cases, it would seem that strictly sensational pleasures and pains occur only to a very limited extent in imaged revival. We must however guard against making too absolute a statement. Probably persons who can visualise colours with great vividness can also enjoy them in their ideal reinstatement, in a way approaching more nearly

the actual sense-experience than persons who visualise poorly can readily comprehend.

The pleasures and pains due to perceptual combination in space and time are in general more perfectly recoverable by those who have a sufficient power of mental imagery. The man who can visualise distinctly and vividly may, in recalling before his mental eye a picture or a landscape, renew to a large extent his original enjoyment of it. There are some few persons gifted with an exceptional power of auditory revival who can enjoy music almost as well in reminiscence as in actual hearing. The main drawback they find is the effort which it costs them. Actual hearing is very much easier.

In actual perception an object may be pleasing or displeasing, not through the immediate feeling-tone of the sensations which it produces or their grouping in space and time, but through the previous experiences with which it has been connected. The sight of a bunch of grapes may give pleasure in part because we have had the experience of eating grapes. The feeling-tone is due to the re-excitement of the cumulative disposition left behind by previous experiences of the object. Now this cumulative disposition is also re-excited in ideal revival, and with it the feeling-tone. In general, the agreeableness or disagreeableness of the ideal revival is not so intense; but apart from interfering conditions, it is generally present in some degree. Poets often produce their best effects by accumulating references to objects round which pleasing associations cling. Tennyson's *Brook* is a good example:

> I wind about, and in and out,
> With here a blossom sailing,
> And here and there a lusty trout,
> And here and there a grayling,
>
> And here and there a foamy flake
> Upon me, as I travel
> With many a silvery waterbreak
> Above the golden gravel.

In this and similar poems, a number of objects pleasantly toned by the cumulative effect of past experiences are referred to in succession, and the total result is extremely agreeable.

A very important source of ideal pleasures and pains lies in the reminiscent revival of past activities in which we have been triumphant or defeated. The greater the difficulties overcome, the greater in general is the pleasure of reminiscence. Where we have been successful after a struggle, the pleasure of ideal revival is often much more unmixed than the pleasure of the original experience. In recalling past obstacles and difficulties, we have always the consciousness that they have been overcome, and this reduces to a minimum the disagreeableness of the original struggle. We are not bound to dwell on the unpleasant parts of the experience at more length or in more detail than is required to enhance the pleasures of success. Even where we have been defeated, reminiscence is often more pleasing than displeasing. The reason is that the mere lapse of time has raised us to a point of view from which we can regard past success or failure as a matter of indifference. This in itself is a kind of victory. If the reminiscence of our past struggles continues on any ground to be interesting, it gives us pleasure rather than pain.[1] Besides this, we can always skip more or less slightly over occurrences which would be disagreeable even in their ideal revival.

All that we have said about revival of feeling-tone must be understood with one important qualification. It is necessary to distinguish between the attitude of imagination and the attitude of belief. The mere ideal representation of an object may in itself give pleasure or pain; but this must not be confused with the pleasure or pain arising from our belief in the existence or non-existence of the object under given conditions. Doubtless the pleasure of ideal revival is at its maximum when it takes the form of the pleasure of anticipation. A person living in a crowded city may take pleasure in ideally recalling trees and woods and mountains as a mere play of imagination. But a new source of intenser pleasure arises when he finds that he can take a holiday and actually visit the scenery of Scotland or Switzerland.

The reverse occurs when his mind is disagreeably disturbed by the thought that these things are beyond his reach. "A

[1] Of course this is not the case when the consequences of past defeat continue to affect unfavourably our present position.

busy man reads a novel at the close of the day, and finds himself led off by a reference to angling or tropical scenery to picture himself with his rods packed *en route* for Scotland, or booked by the next steamer for the fairyland of the West Indies. Presently, while the ideas of Jamaica or fishing are at least as vividly imagined as before, the fancied preparations receive a rude shock as the thought of his work recurs."[1] The " rude shock " is due to the direction of attention to the actual existence or non-existence of what has been previously merely imagined. This brings with it a desire for the actual experiences themselves. The belief that they are out of reach thwarts this desire and produces pain which often displaces, though not always completely, the pleasures of imagination. In general, the thought of a pleasing object which is recognised as beyond our reach gives pain rather than pleasure when there is a desire for its actual possession. To enjoy the pleasure of ideal revival in the case of unattainable objects, we must be able to adopt the attitude of imagination or make-believe, and this is very often impossible.

3. Affective Tone of Belief. — Ideational activity may assume two forms. On the one hand, it may be directed to the production of some new result in the real world, or to the increase of our knowledge of the real world; on the other hand, it may be a mere play of the imagination. The conditions of pleasure and pain in the two cases are not quite the same, and it will be well to treat them separately. In both cases whatever furthers activity so as to make it more efficient, conduces to pleasure; and whatever obstructs it and makes it inefficient, conduces to pain.

We shall consider first those trains of ideas which are directed towards the production of real results or the increase of knowledge. Two modes of furtherance and obstruction may be distinguished—the material and the formal.

Material obstacles consist in ideally foreseen circumstances which would actually bar the way to the execution of a plan or to the occurrence of a desired event. As Spinoza says,

[1] Ward, *Psychological Principles*, p. 282.

whatever hinders the body's power of acting hinders the mind's power of thinking; whatever would, in fact, obstruct the execution of a plan, obstructs the formation of the plan, when it is ideally foreseen. If I am planning an excursion and discover that the railway arrangements at a certain place are fatal to its execution, this circumstance arrests the flow of my ideas just as it would arrest their realisation. The belief that a certain event will occur interferes with the ideal train of thought, just as the event itself would interfere with the actual train of occurrences. What has been said of obstacles is equally true of furtherances. The prevision of circumstances which would facilitate the execution of an ideal scheme facilitates its formation.

Formal obstacles and furtherances are those which depend on the form of the flow of ideas and not on the ideas themselves. They are due rather to error, ignorance, misapprehension or confusion on our part, than to the actual circumstances of the case. Doubt and contradiction arising at a critical point arrest the flow of ideas, just as the positive prevision of an external obstacle does. If in laying our plans for an excursion we discover, not that the train arrangements at a certain place are unfavourable, but that we have no means of finding out what they are, the flow of mental activity is held in suspense. The belief that there will, and the belief that there will not, be a train fit for our purpose are equally justified and unjustified, so that their conflict blocks the onward progress of our thought.

Suppose now that one authority, *A*, says that there will be a train, and another, *B*, that there will be no train, the state of suspense is intensified. The doubt arising from ignorance passes into the doubt arising from positive contradiction. The statement of the one person furthers and stimulates activity, while the statement of the other suppresses it. If in the long run we come upon evidence which proves that a train runs just at the time we want it, there is a release from tension and an onward bound in the flow of thought which constitutes a highly pleasurable furtherance of activity.

Similarly, apart from any previous doubt or contradiction, the mere fact that we find ourselves able to arrange the details

of a complex plan so that they fit into each other without hitch or hindrance, is a source of pleasure.

Another formal condition of pain is the struggle to find connection between data which in spite of our efforts continue to appear detached and isolated. This is perhaps best illustrated when we are attempting to follow the train of thought in another person's mind, either by reading or listening. We are looking for a logical connection between the statements which follow each other; but if the exposition be bad, or the subject-matter too hard for us, we find incoherence instead of coherence, and the greater our mental effort the more painful it is. A corresponding pleasure is felt when facts which have been previously disjointed and detached in our minds are brought under one point of view, and shown to be exemplifications of the same principle working under different conditions. Here the efficiency of mental activity is increased. "When . . . we discern a common principle among diverse and apparently disconnected particulars, instead of all the attention we can command being taxed in the separate apprehension of these *disiecta membra*, they become as one, and we seem at once to have at our disposal resources for the command of an enlarged field and the detection of new resemblances."[1]

We have laid down the general principle that obstruction of mental activity is painful, and its furtherance pleasant. This is true, if properly understood; but there are complications which are apt to cause confusion if they are not carefully explained. Above all, it must be noted that an obstacle to the attainment of an end does not necessarily bring mental activity to a standstill. What is really painful is dead strain comparable to pushing against an unyielding wall. But an obstacle, whether formal or material, to the attainment of an end, may heighten, instead of arresting the flow of ideas, just as the dangers of mountaineering call into play the resources of the climber, thereby increasing his bodily and mental activity, and contributing to his pleasure. A difficulty in face of which a man feels himself helpless is painful in proportion to the strength of the conative tendency which it thwarts. On the

[1] Ward, *op. cit.*, p. 258

other hand, a difficulty which calls his powers into fuller and more varied play may be a source of pleasure. Whether it will be actually so or not depends upon the special conditions of the case.

It is necessary to distinguish between two kinds of ends: in the one, it is part and parcel of the end that it should be attained in a certain way by our own activity; in the other, it is a matter of indifference whether it occurs with or without our co-operation. If we are trying to hit a mark with a stone, it will give us no satisfaction for somebody else to hit the mark; it will give us no satisfaction to walk up to the mark and place the stone on it. So in guessing a riddle it gives us comparatively little satisfaction to be told the solution; the pleasure lies in finding it for ourselves. On the other hand, if we are hungry and desire food, we are perfectly content to have it placed on the table for us. Our satisfaction is not at all diminished by the fact that we did not prepare it ourselves; on the contrary, the necessity of preparing it ourselves would in most cases be an actual drawback.

We have stated the contrast between these two kinds of ends, so as to bring out the antithesis between them as sharply as possible. But as a matter of fact, they are for the most part blended with each other, satisfaction lying partly in the attainment of the final result, which we may call the material end, and partly in the process of attaining it, which we may call the formal end. We may suppose that Oedipus was a man who delighted in guessing riddles; and ordinarily his satisfaction would lie in finding out the answer for himself. But when he had to deal with the Sphinx, his satisfaction would mainly consist in the deliverance of Thebes, and in his own escape from being eaten.

Now in the case of an ordinary riddle, difficulty would be mainly a source of pleasure—because it would give scope for the fuller exercise of his mental powers. But in guessing the riddle of the Sphinx, the conditions are essentially altered; for here the welfare of Thebes and his own life were at stake, and these interests had a much greater relative importance than the exercise of his ingenuity in guessing riddles. Thus, inasmuch as the difficulty threw doubt on the attainment of

the material end, it would bring unmixed pain, which would probably overwhelm and overbear the ordinary pleasure of Oepidus in overcoming intellectual obstacles.

We may sum up as follows.—The continuance of a conation in face of an obstacle gives rise to mere dead strain, and is therefore painful, in so far as the subject feels himself powerless to deal with the obstacle. On the other hand, so far as the obstacle calls into play the resources of the subject to overcome it, it heightens free mental activity, and to that extent gives rise to pleasure. But even in this case a condition of pain is introduced if and so far as the presence of the obstacle makes doubtful the attainment of that final result of activity which we have called the material end. The pain is the greater the stronger the doubt is, and the greater the importance of the material end.

We must carefully distinguish between obstructed activity and diminished activity. An obstacle blocking the onward progress of a train of thought has for its first effect an intensification of the conative tendency which it renders ineffective. It is only in a gradual way that the conation diminishes in intensity, until it is displaced by some other activity. This takes a longer time the stronger the interest involved.

The removal of an obstacle, either by our own activity or by external circumstances, is a source of pleasure. The resulting pleasure is by no means a mere equivalent of the pain of previous obstruction. Sometimes it is less, and very often it is greater. When the preceding tension is not too prolonged and intense, the pleasure of relief for the most part exceeds the pain which is its pre-condition. Thus such an activity as solving a chess-problem is predominantly pleasing, in spite of periods of dead strain, in which there appears no hope of solution. So a novel with a good plot creates pleasure by a series of alternating checks and releases of mental activity. The extreme case is found in certain forms of the ludicrous. A pun impels the mind to identify objects utterly disconnected with each other. This of course involves a conflict, and an obstruction of the flow of thought. But the obstruction is so transient that it scarcely gives rise to anything that can be called pain at all. On the other hand, the relief which comes

with insight into the true state of the case may be a source of keen pleasure. Mental activity suddenly obstructed and so heightened is immediately set free, and is so much greater than the situation demands that it has nothing to do but enjoy itself.

It should be noted that the same conditions which increase or further mental activity may also be the conditions which initially excite it. Let us take the case of a man who finds, either that he has come into a fortune, or that he has lost one. Consider first the sudden transition from poverty to riches. One effect may be the opening of the field for the satisfaction of conative tendencies which actually played a large part in his conscious life in the period of poverty. But besides this there will be many tendencies which were comparatively latent while he remained poor, partly because they were displaced by more pressing needs and partly because of the hopelessness of attempting to satisfy them. The sudden accession of wealth will open a free field for the satisfaction of these previously latent tendencies, and it will at the same time transform them into conscious conations.

In the opposite case of the rich man becoming poor, many conscious ambitions and projects will be crushed; but besides this there is much in his mode of life as a rich man to which he has paid no attention because it has been a mere matter of course and of routine. But his routine habits, so soon as they are obstructed by poverty, become changed into conscious conations; the same condition which denies these conations satisfaction, calls them into being.

4. Affective Tone of Imagination.—One characteristic of imagination is the absence of the material end. The end is simply the working-out of the ideational process itself, apart from any special result to be produced in the real world or in the advancement of our knowledge of it. This gives imagination a great advantage as a pleasure-yielding activity. In pursuing material ends, we are subject to the real conditions on which their attainment depends. We are thus compelled to face all the obstructions and difficulties which the constitution of the real world imposes. In imagination, on the other

hand, limiting conditions are imposed by ourselves. If we begin by fancying that we are as strong as Samson, and proceed to fancy that we meet a lion, this is only a favourable opportunity for rending the lion like a kid. If on the other hand we actually anticipate meeting a lion, the problem is how to avoid being rent ourselves. We need introduce no obstacles into the flow of imaginative activity, except such as can easily be overcome by imaginary conditions and so serve to enhance our pleasure on the whole. Take, for example, such an imaginary narrative as *Monte Cristo* or *The Three Musketeers*.

Of course there must be a certain internal coherence in the play of imagination. Explicit contradictions give rise to the pains of obstruction as they do in the pursuit of practical ends or of knowledge.

Besides the logical incoherence arising from explicit doubt or contradiction, there is also a kind of incoherence affecting the formation of the idea of an object, apart from reference to its existence or non-existence. Under this head comes incongruity between the structure of an object and its function. The function of a pavement is to be trodden on, and for this purpose the more level it is the better; if it is worked in mosaic, so that its parts appear in relief, the effect on the eye is unpleasing. We may know quite well that it is even; but its apparent unevenness interferes with our idea of a pavement. The same kind of unpleasantness is produced by the sight of a key so elaborately decorated that it appears unfit for its proper function. Similarly the lover of books feels discomforted if he sees a favourite volume upside down on the shelves.

Unpleasantness may be due to mere violation of habit. Most people who have been accustomed to the ordinary English mode of spelling are annoyed when they see words like 'honour' and 'colour' spelt 'honor' and 'color.' This effect is intensified in so-called 'phonetic spelling.' If in a picture shadows do not fall as the direction of the light requires, the result is unpleasing even before the incongruity is explicitly detected and formulated. Similarly, incongruities in the development of character in a novel obstruct the flow of ideas and create the impression of unnaturalness, even though no contradiction is explicitly recognised. This kind of incoherence

may attach to all forms of ideational activity. It is here brought under the head of imagination, because it affects the flow of ideas as such in distinction from beliefs concerning existence and non-existence.

5. Sentiment and Emotion.—What is true of perceptual process holds, *mutatis mutandis*, of ideational. On the perceptual plane, the actual presence of a dangerous situation excites fear; on the ideational, the ideal prevision of a similar situation has a similar effect. All the general characteristics of emotion which we have already enumerated[1] apply equally to perceptual and ideational process.

There is only one point which appears to require more extended treatment at this stage. We noted that emotions usually exhibit a parasitical character. They are in the main secondary phenomena, and presuppose the existence of more specific tendencies. The anger, for instance, produced in a dog by taking away its bone presupposes the specific appetite for food.

Now on the ideational plane the specific tendencies which condition the occurrence of emotion are incomparably more varied and complex than the primary perceptual tendencies. All the various systems of ideas which grow up in the process of ideal construction of the world and of the self have their conative aspect. Each system of ideas is a general tendency to feel and act in certain ways under certain circumstances. It is convenient to have a general name for ideal systems considered from this point of view. It does not appear that any better word can be selected for the purpose than 'sentiment,' though in so employing it we extend its application beyond the range of ordinary usage. If we give this extended application to the word, we may regard emotions which presuppose mental dispositions organised through previous trains of ideational activity as episodes in the life-history of sentiments.

The credit of first drawing attention to this distinction between emotion and sentiment belongs to Shand, and we

[1] Bk. III., Pt. I., Ch. IV.

cannot do better than quote his words. Emotions "are in a sense adjectival and qualify a more stable feeling. Whereas the specific organisation of our sentiments—affection for our friends, the home-sentiment, and every sentiment that we can use the term 'love' to express, as love of knowledge, art, goodness, love of comfort, and all our interests, as interest in our health, fortune, and profession, interest in books, collections, self-interest—these, so far from being mere adjectives and qualifying other feelings, are the relatively stable centres to which the first attach themselves, the substantives of these adjectives, the complex wholes which contain in their possible life-history the entire gamut of the emotions.

"In the love of an object . . . . there is pleasure in presence and desire in absence, hope or despondency in anticipation, fear in the expectation of its loss, injury, or destruction, surprise or astonishment in its unexpected changes, anger when the course of our interest is opposed or frustrated, elation when we triumph over obstacles, satisfaction or disappointment in attaining our desire, regret in the loss, injury, or destruction of the object, joy in its restoration or improvement, and admiration for its superior quality or excellence. And this series of emotions occurs, now in one order, now in another, in every sentiment of love or interest, when the appropriate conditions are present.

"Now consider how these same emotions repeat themselves, often with opposite objects, in the life history of every sentiment which we name dislike or hatred. There is pain instead of pleasure in the presence of the object, desire to be rid of it, to escape from its presence, unless we can injure it or lower its quality, hope or despondency according to the chances of accomplishing this desire, elation or disappointment with success or failure, anger or fear when it is thrust upon us and persists, surprise when the unexpected occurs, regret or grief, not in its loss or injury, but in its presence and prosperous state."[1]

[1] "Character and the Emotions," *Mind*, N.S., Vol. V., No. 18, pp. 217-8. The more detailed treatment in Shand's *Foundations of Character* should also be read.

The distinction between emotion and sentiment is to a large extent a distinction between dispositions and actual states of consciousness. Such a sentiment as friendship cannot be experienced in its totality at any one moment. It is felt only in the special phase which is determined by the circumstances of the moment. If we are parting from our friend, we feel sorrow; if we are about to meet him after long absence, we feel joy. The joy and the sorrow are actual experiences; but the sentiment which includes the susceptibility to either, according to circumstances, cannot in its totality be an actual experience. It is a complex emotional disposition[1] which manifests itself variously under varying conditions. These varying manifestations are the actual experiences which we call emotions.

Thus we may say that, so far as actual experience is concerned, the sentiment is constituted by the manifold emotions in which it manifests itself. But this must be understood with an important qualification. We must not suppose that all sentiments are capable of manifesting themselves in the same emotions. On the contrary, the character of the emotion is specifically different according to the nature of the sentiment on which it depends; and the difference may be important enough to justify a different name for the emotion.

This is specially exemplified in the distinction between the emotions which have reference to personal and to impersonal objects respectively. The "emotions common to our love of whatever object become complicated with new differentiations in the love or hatred of a human being. Pleasure in the presence of the object, desire for it in absence, for the preservation of its existence, for its superior quality, anger or fear when it is threatened, hope, admiration, disappointment, regret, recur, and constitute the love of the object, of its well-being; but the specific emotion of sympathy is differentiated."

"The nearest approach to this in our love of inanimate things, or those great constructions of our thought, business, knowledge, art, morality, is the interest we take in the con-

[1] See Bk. III., Pt. I., Chap. IV.

tinuance of the object, in its improvement, or heightened quality, and, conversely, in the pain which any loss of quality, injury, or destruction occasions. Now if we supposed the object were self-conscious and took pleasure in its own continuance and improvement, and felt pain in its injury or lowered quality, there would then occur a sympathy or identical feeling excited in two conscious beings in reference to the same object. Thus, where human beings are concerned, there necessarily arise coincidences of this sort which, multiplying in those common situations where danger or injury is present, develop the emotion of sympathy as a new component of the love of the object. And in the process of development, pity acquires a qualitative flavour distinguishing it from the pain felt in the injury or destruction of inanimate objects.

"In the next place, the pleasure felt for the excellence or superiority of an object that we love, develops into the new emotions of respect and reverence: respect where there is a superior power or quality which fails to win admiration, reverence where this superior quality is recognised as moral. And both admiration and something of fear blend in this emotion and give to it a flavour and specific quality of its own.

"Lastly, consider how the regret or sorrow that we feel when we have injured any object that we are interested in or love, where human beings are concerned, and our action is not accidental but the outcome of anger, or the change from love to hatred, differentiates the new emotions of remorse and repentance. Repentance is no mere revival of this same universal sorrow or regret; it has acquired a character of its own with the blame that we pass on ourselves, the futile effort to recall and undo the past, the hope and desire and resolution to make the future different. And remorse too has a character of its own, with the fear and even horror that blend with it, the regret for what has been done, without the hope and resolution of repentance, but rather with a deep despondency or despair which sees no possible escape."[1]

[1] Shand *op. cit.*, pp. 218-19.

CHAPTER IX.

VOLUNTARY DECISION.

1. Conative Aspect of the Conception of the Self.—Under the concept of the self as expressed in the word 'I' is included in systematic unity the life-history of the individual, past, present, and future, as it appears to himself and to others; together with all its possible or imaginary developments. We have already described the way in which this complex ideal construction grows up. We have now to point out that its evolution accounts for the origin of will, as implying deliberation and choice.

Voluntary action is to be sharply discriminated from impulsive action, and deliberation from conflict of impulsive tendencies. The difference is, that in impulsive action follows the isolated conative tendency; whereas in voluntary decision special conations and their ends are first considered in their relation to the total system of tendencies included in the conception of the self. When two disconnected impulses simultaneously prompt to incompatible courses of action, if the conception of self does not come into play, one interferes with the other in a quasi-mechanical way. There is merely a trial of brute strength between them. Instances are sometimes found in young children and animals. The characteristic expression of their mental state is a sort of oscillation between two modes of action, each of which is begun in turn and then gives place to the other.

"When a young child suddenly comes face to face with a strange dog, the impulse towards . . . and the impulse away from . . . are realised in quick succession. The child goes up to the dog, runs back to its father, approaches the dog again, and so on."[1] Titchener tells us that "in face of the two impulses, (1) to shut a door on the right hand, and (2) to

[1] Titchener, *Primer of Psychology*, p. 246.

seat himself at his typewriter-table on the left," he actually began " a right-hand movement towards the door and then all at once " slued round " to the typewriter, without having closed it."[1] All of us can no doubt recall similar experiences.

Deliberation in no way resembles this alternate jerking in opposite directions, as if pulled by a string, and the decision which follows it is not a mere triumph in strength of one isolated impulse over another. Voluntary action does not follow either of the conflicting tendencies, as such; it follows our preference of the one to the other. It is the conception of the self as agent which makes the difference. The alternative is not 'this?' or 'that?' but 'shall *I* do this?' or 'shall *I* do that?' Each line of action with its results is considered not in isolation but as part of the ideally constructed whole for which the word 'I' stands. The impulse of the present moment belongs to the self of the present moment; but this is only a transient phrase of the total self. If the impulse is realised the completed action will take its place as a component part of the life-history of the individual. He may live to regret it.

In his present mood, with bottle and glass before him, he may desire to get drunk; but sobriety may have been the habit and principle of a lifetime. If he yields to temptation, the remembrance of the act will stand out in painful conflict with his normal tendencies. He will be unable to think of it without a pang. This incompatibility between the normal self and the present impulse, if vividly enough realised at the moment of temptation, will restrain him from drinking. If it is not sufficient, further developments of his conception of himself may be more efficacious. He may think of himself as churchwarden or elder; he may think of the ideal aspirations of his better moments; he may call to mind the thought of himself as reflected in other minds—the dead friend who expected so much from him, and who would be so shocked at his lapse—the talk of the general public conceived as pitying, contemptuous, or malicious. He may even consider how he would like to look back to such an episode on his death-bed.

[1] *Ibid.*, p. 247.

Obviously, this detailed development of what is included in the man's conception of himself as a whole might go on interminably. As a matter of fact, it is possible that it would not be needed at all. He might simply say, "What! *I* do such a thing? How could the thought ever have occurred to *me*?" In this case the mere concept of the self in its vague totality without detailed development would be sufficient to produce a decision. The thought of getting drunk attracts the man; but the thought of *his* getting drunk repels, so as to give rise to instant rejection of the suggested course of action.

2. Deliberation.—Very often, however, the thought of the self does not at once give rise to a decision, positive or negative, but only to arrest of action, so as to give time for deliberation. It may be that the way in which this or that line of conduct, if realised, would affect the self as a whole, past, present, future, and ideal, can be brought before consciousness with sufficient fullness to determine action only by a more or less prolonged train of thought. When this is so, the concept of the self as a whole will not directly tend to reinforce or suppress a desire; it will rather tend to postponement of action, until the concepts of self and of the action and its consequences are developed in such detail in relation to each other that a decision becomes possible. In this way arises deliberation.

The alternatives before the mind in deliberating may be simply doing a thing or leaving it undone; or they may include two or more definite and incompatible lines of action. In principle, there is no essential difference between the two cases. When two or more definite lines of action are considered, each of them has to be brought into relation with the general concept of self, and from this point of view they have to be compared with each other.

The general point of view in deliberation may be described as follows. A certain line of action being suggested as possible, I contemplate myself as I shall be if I put it in execution, so as to make it part of my actual life history, and on the other hand I contemplate myself as I shall be if I leave it undone. I follow out this representation of a hypothetical self in more

or less detail until that turning-point in the process which is called 'voluntary decision' emerges.

In the more developed forms of deliberation there is a kind of mental see-saw. Now one alternative, and now another, comes predominantly before consciousness, and the mind is variously attracted and repelled by each in turn. The desires and aversions which arise in this way are called motives. Hence the process of deliberation is often called a 'conflict of motives.' Motives are not mere impulses. They come before consciousness as reasons why *I* should act in this or that way. They are not independent forces fighting out a battle among themselves, while the self remains a mere spectator. On the contrary, the motives are motives only in so far as they arise from the nature of the self, and presuppose the conception of the self as a determining factor. From this it follows that the recognised reasons for a decision can never constitute the entire cause of decision. Behind them there always lies the self as a whole, and what this involves can never be completely analysed or stated in the form of definite reasons or special motives.

While the process of deliberation is going on, the motives are motives for deciding: when the decision is made, the triumphant motives become motives for action. Or, to put the case in another way, while the process of deliberation is going on, the competing desires are regarded as possible motives for action: when the decision is formed, they become actual motives for action.

3. Voluntary Decision.—The phrase 'voluntary decision' is ambiguous. It may mean the transition from the state of suspense to the state of resolution; or it may mean the state of resolution when it has once been attained. It will be simplest to treat first the decision as already formed—the state of being resolved.

The most obvious difference between the state of indecision and that of decision is that in the first we do not know what we are going to do, and that in the second we do know what we are going to do. While deliberating, we are making up our mind, and we do not know what our mind is going to be.

When we have formed a decision, we have come to know our own mind. The conception of the self has become fixed where it was previously indeterminate. The realisation of one line of conative tendency is now definitely anticipated as part of our future life-history, so far at least as external conditions will allow of its execution. Opposing conative tendencies either cease to operate, or they appear only as difficulties or obstacles in the way of carrying out our decision. They are no longer regarded as possible motives of action. We have come to the settled belief that, so far as we are concerned in our present state of mind, the lines of action to which they prompt will not be carried out. They are thus placed outside the sphere of deliberation, and in consequence cease to be motives. If they persist at all, they merely serve to make the execution of our voluntary decision more painful and difficult. But they do not on that account impair the strength of this decision; on the contrary, they may only give an opportunity for exhibiting the strength of the decision. With the full emergence of the decision, the conflict of motives, as such, ceases.

"This termination of the struggle does not merely mean that one impulse or group of impulses has turned out to be stronger than its opponents. It might conceivably manifest its superior strength without a cessation of conflict. When two unequal and opposite forces are applied to a particle, the particle will move in the direction of the stronger force; but the action of the weaker force still continues to manifest itself in a diminution of velocity. The triumph of the voluntary impulse is not of this kind. In a perfect volition, opposing impulses are not merely held in check; they are driven out of the field. If they continue to exist, they do so as external obstacles to a volition already formed. They are no longer motives; they are on the same footing with any other difficulty in the way of attainment."[1]

On the other hand, the motives which in the process of deliberation arrayed themselves on the side of the course of action that actually comes to be adopted, persist after deliber-

[1] Stout, "Voluntary Action," *Mind*, N.S., Vol. V., No. 19, p. 357.

ation is over as the recognised motives of the voluntary decision. We will the act, because we desire it, or at least have an aversion from omitting it, or from its alternatives. Thus, the state of the voluntary decision may be analysed as follows: (1) there is the belief that so far as in us lies we are going to carry out a certain course of action; (2) this belief is founded on that kind of reason which we call a motive. It is recognised as having its ground in our present conative tendencies. Thus we may define a volition as a desire qualified and defined by the judgment that so far as in us lies we shall bring about the attainment of the desired end because we desire it.

4. The Forming of a Decision.—We have yet to examine how the state of decision supervenes on that of deliberation. At this point the vexed question of 'free-will,' as it is called, arises. According to the libertarians, the decision, at least in some cases, involves the intervention of a new factor, not present in the previous process of deliberation, and not traceable to the constitution of the individual as determined by heredity and past experience. The opponents of the libertarians say that the decision is the natural outcome of conditions operating in the process of deliberation itself. There is according to them no new factor which abruptly emerges like a Jack-in-the-box in the moment of deciding.

Now it must be admitted that the transition from the state of indecision to that of decision is often obscure, and that it frequently appears to be unaccountably abrupt. This makes it difficult or impossible to give a definite disproof of the libertarian hypothesis on psychological grounds. But certainly the *onus probandi* rests with those who maintain the intervention of a new factor which is not a development or outcome of previous conditions. If we cannot definitely disprove the presence of such a factor, we can at least say that the facts are far from compelling us to assume its existence.

Deliberation may be regarded as a state of unstable equilibrium. The mind oscillates between alternatives. First one conative tendency becomes relatively dominant, and then

another. The play of motives passes through all kinds of vicissitudes as the alternative courses of action and their consequences are more fully apprehended in relation to the self. As the process advances, equilibrium tends to be restored. New developments of conative tendency cease to take place; deliberation comes to a standstill because it has done its work. In this relatively stationary condition, it may be that one of the alternatives, with the motives for it, has a decided and persistent predominance in consciousness, so that the mind no longer tends to revert to the others. At this point the mind is made up, and the result is formulated in the judgment, "I will do this rather than that."

But there are other cases which present more difficulty. It may happen that deliberation comes to a standstill without any one alternative acquiring a definite predominance. The mind tends first to one and then to the other without result. There are no new developments tending to give a superiority to either, and the result is hopeless suspense.

It would seem that under these conditions no voluntary decision ought to supervene, or if it does supervene, it must be due to the intervention of a new factor and is not merely the outcome of the deliberative process. Now as a matter of fact we find that under such conditions voluntary decisions frequently do come into existence. They may even be of wide-reaching importance, like Caesar's determination to cross the Rubicon. But probably in all such instances one or both of two traceable and recognisable conditions of a psychological kind are operative. These are (1) aversion to the continuance of painful suspense, and (2) the necessity for action of some kind.

"It may be that though we are at a loss to decide between two courses of action, we are none the less fully determined not to remain inactive. Inaction may be obviously worse than either of the alternative lines of conduct. We may then choose one of them much in the same way as we take a cigar out of a box, when it is no matter which we select."[1] In view of the necessity for action, a comparatively slight predomi-

[1] *Ibid.*, p. 364.

nance of the motives for one alternative may be sufficient to determine decision, though it would have been ineffective under other conditions. Or again, being pressed to decide, either by aversion to the state of irresolution or by the necessity for doing something, we may simply adopt the course which seems to be uppermost in our minds at the moment, although we have no confidence that it would remain uppermost if we continued to deliberate. Or we may mentally consent to allow the decision to be determined by some irrelevant circumstance such as the fall of a penny.

We determine that if heads turn up we shall do *A*, and that if tails turn up we shall do *B*. Curiously enough, the reverse frequently happens. If heads turn up we do *B*, and if tails turn up we do *A*. This is due in part to an aversion to having one's conduct determined in such an arbitrary and irrelevant way. But it often happens that immediately after the appeal to chance has been made, and has issued in favour of one alternative, the motives for the other alternative are mentally set in contrast, not with the opposing motives present in the preceding deliberation, but with the trivial result of the appeal to chance. They thus acquire a momentary predominance which determines voluntary decision.

Sometimes volition takes place before the process of deliberation has fully worked itself out. In this way, acts come to be decided on which would have been suppressed if they had been more fully considered. Here again, the necessity for acting in some way, and impatience with the state of indecision, are operative factors. But the reason often lies in the intensity of some impulse of the present self which derives its strength, not from its relation to the total system of conduct, but from the circumstances of the moment.

In the vicissitudes through which the process of deliberation passes, it will often happen that this isolated impulse through its momentary intensity will acquire such a predominance as to arrest the full development of other motives, which, if they had come into play, would have given rise to a different decision. The decision which thus takes place after imperfect deliberation is generally called impulsive. It is not supposed to be voluntary in the same degree as that which takes place

after fuller deliberation. The agent often commits the act knowing that he will live to repent it. Most cases of yielding to temptation are cases of deliberation arrested and cut short by the transient strength of a present impulse. It is in such instances that the agent is most keenly aware in retrospect that he might have acted otherwise than he actually did. He feels that the act does not fully represent his true self. If he had fully developed all the motives which were inoperative owing to imperfect deliberation, the momentary impulse might have been suppressed instead of realised.

5. Fixity of Voluntary Decision.—The persistence with which a voluntary decision, when once formed, maintains itself against obstacles is often much greater than can be accounted for by the strength of the desire which was its motive at the outset. There are many reasons for this. One is that the line of conduct determined on is identified with the conception of the self. "When I judge that in so far as in me lies I shall realise a certain end, the endeavour to realise that end becomes *ipso facto* an integral part of the conception of myself. Failure to realise it is regarded as *my* failure, *my* defeat. Thus volition becomes strengthened in the face of obstacles by all the combative emotions. These are of varying kinds and of varying degrees of strength in different individuals; but all tendencies to hold out or struggle against opposition, merely because it *is* opposition, are enlisted in the service of the will, inasmuch as the idea of the line of conduct willed is an integral part of the idea of self."[1]

"The fixity of will is also strengthened, often in a very high degree, by aversion to the state of irresolution. Suspense is in itself disagreeable; and when we have emerged from it by a voluntary decision, we shrink from lapsing into it once more. Besides this, prolonged and repeated indecision is highly detrimental in the general conduct of life. The man who knows his own mind is far more efficient than the man who is always wavering. Hence in most persons there is a strong tendency to abide by a resolution, just because it is a

[1] *Ibid.*, p. 358.

resolution. This tendency is greatly strengthened by social relations. If we are weak and vacillating, no one will depend upon us; we shall be viewed with a kind of contempt. Mere vanity may go far to give fixity to the will."[1]

Volition also becomes fixed by the action which follows on it. So soon as we have attained the settled belief that we are going to follow out a certain line of conduct, we immediately begin to adapt our thoughts and deeds to this belief. We thus come to be more and more committed to the course determined on. To withdraw from it would be to disturb our arrangements; to baulk expectations raised in others; and to arrest the general flow of our own mental activity. The more the mind has become set on one thing, the more it would be upset by being diverted to another.

If I have once decided on going to New Guinea to investigate the manners and customs of savages, instead of staying at home to lecture on Psychology, the whole direction of my mental activity flows into channels corresponding with my preformed resolution. I begin to read up books about savage tribes and about New Guinea in particular. The arrangements for my outfit and voyage, the kind of work I am going to do, the kind of adventures I shall meet with, the men I am to co-operate with, and other topics such as these, engross my mind. The more advanced this process is the greater fixity does my volition acquire. "To disturb it is to disturb the whole system of tendencies with which it has become interwoven. In this way I commit myself to such an extent that it becomes impossible to draw back."[2]

Perhaps the fixity of volition is not adequately accounted for by reasons such as these. There appear to be individual differences in this respect which depend upon inherited constitution, so that they cannot be explained by psychological generalities. In some men infirmity of purpose appears to be innate. They change like a weather-cock, and can never be relied on. Others follow up their voluntary resolutions with a dogged persistence which is often utterly unreasonable. Some men are born obstinate, and others vacillating.

[1] *Ibid.*, p. 359. [2] *Ibid.*, p. 358.

6. "Action in the Line of Greatest Resistance."—Some volitions take place and are maintained only by an effort. This is especially the case when voluntary decision follows some general principle of conduct, or some ideal aim, in opposition to an intense impulse of the present self which is excited and maintained by the actual conditions existing at the time.

James laid the greatest emphasis on this common experience. "We *feel*, in all hard cases of volition, as if the line taken, when the rarer and more ideal motives prevail, were the line of greater resistance, and as if the line of coarser motivation were the more pervious and easy one, even at the very moment when we refuse to follow it. He who under the surgeon's knife represses cries of pain, or he who exposes himself to social obloquy for duty's sake, feels as if he were following the line of greatest temporary resistance. He speaks of conquering and overcoming his impulses and temptations. But the sluggard, the drunkard, the coward, never talk of their conduct in that way or say they resist their energy, overcome their sobriety, conquer their courage, and so forth."[1]

There can be no doubt that James here describes the facts accurately and well. But he proceeds to interpret them as evidence in favour of the libertarian view. If volition is merely the outcome of preceding psychological conditions, it must follow the line of least resistance, but in the cases described it follows the line of the greatest resistance. This would seem to imply the intervention of a new factor. Before admitting this conclusion, we must analyse more carefully the experience on which it is based.

We said above that when a voluntary decision was once formed, "opposing conative tendencies either cease to operate or they appear only as difficulties or obstacles in the way of carrying out our decision." The disappearance of opposing tendencies, on the one hand, or their persistence as obstacles, on the other, are the two alternatives which correspond to action in the line of least resistance and in the line of greatest resistance.

[1] *Principles of Psychology*, Vol. II., p. 548.

Now whether they persist or disappear depends upon the presence or absence of circumstances over which we have no control. The simplest case is that in which we voluntarily decide in opposition to some present organic craving, such as the craving for drink. The craving itself is maintained by organic conditions which continue to operate both in the very moment of decision and after the decision is made. Thus, to use James's apposite phraseology the volition is "hard" because it is both formed and carried out against a persistent obstacle. On the other hand, if the decision is in favour of indulging the animal appetite, counter motives tend to disappear altogether, instead of persisting as obstacles. They are not maintained by organic conditions, nor are they obtruded on the mind by any other circumstances. As soon as the man has given way to temptation and begins to drink, he loses sight of the considerations which had previously tended to restrain him. Besides this, the drink itself, if he takes enough of it, soon obliterates any lingering traces of reluctance. Thus in resolving to drink the man certainly decides in the direction of least resistance; indeed, there may be virtually no resistance at all. On the other hand, in deciding to restrain his appetite, he decides in the direction of greatest resistance, because the appetite itself still persists after his decision.

The case is not essentially dissimilar when the persistence of motives as obstacles is due to other circumstances. The interests opposed to the adopted course of action may be so complex, they may play so large a part in our life, that they continue to obtrude themselves upon us even when we are deciding or have decided that their realisation is not to be identified with our conception of the future self. They thus persist as obstacles in the moment of resolution, and after resolution. Regulus, in determining to return to Carthage, could hardly dismiss from his thoughts all that he was giving up and the violent death which awaited him. Perhaps if he had decided to remain at Rome, his mental conflict would have been much less acute. Surrounded by family and friends, and with all kinds of congenial channels open for his activity, he would perhaps have been able to avoid dwelling on the thought of his violated promise.

If this analysis be correct, cases of "hard" volition do not show that, in the process which leads up to a decision, the weaker motives triumph. We must carefully separate two questions. The first is, How does the voluntary decision issue out of the previous process of deliberation? The other is, How far do opposing tendencies become inoperative when the voluntary decision is made? In proportion as they remain operative, they constitute obstacles and render volition "hard." But this has nothing to do with the psychological conditions which determine the volition. It in no way proves that these conditions are inadequate, and that a new factor such as the libertarians assume is required to account for the result.

7. Volition and Bodily Activity.—A voluntary decision is normally followed by action which carries or tends to carry it into effect. Setting aside for the present the case of voluntary attention, where the will merely determines the direction of thought, we have here to consider the relation between volition and bodily movement.

Motor efficacy is not essential to the state of voluntary decision as a psychical fact. "The question as to the nature of a certain mode of consciousness is quite independent of the question whether or not this mode of consciousness will be followed by a certain train of occurrences in the organism and in the environment."

"If I will to produce an explosion by applying a lighted match to gunpowder, my volition is none the less a volition because in the course of its execution the match goes out or the powder proves to be damp. Similarly the volition is none the less a volition if it turns out that my muscular apparatus refuses to act, or acts in a way contrary to my intention. The connection between certain modes of consciousness and corresponding movements of the limbs is necessary to the maintenance of our existence; but it does not enter into the constitution of the conscious state which precedes the executive series of occurrences. When the conscious state is one of volition, it is necessary that the subject should look forward to the bodily movements, either as practically certain or at

least as possible. A belief of this kind is an essential ingredient of the voluntary attitude. But the existence of the belief is in itself sufficient. Its truth or falsehood is a matter of indifference. In a precisely analogous way we must, in determining to produce a gunpowder explosion, assume that the powder is or may be dry enough to take fire. But it is by no means necessary that the gunpowder in point of fact should be dry."[1]

Normally, however, volition is followed by corresponding movements. How does this transition take place? James has supplied what appears to be a satisfactory answer to this question. The passage of volition into movement is, according to him, a special case of the general tendency of ideas to act themselves out. The mere representation of an action tends to give rise to the action itself, and will do so in the absence of interfering conditions. "Try to feel as if you were crooking your finger, whilst keeping it straight. In a minute it will fairly tingle with the imaginary change of position; yet it will not sensibly move, because *its not really moving* is also a part of what you have in mind. Drop *this* idea, think of the movement purely and simply, with all brakes off, and, presto! it takes place with no effort at all."[2]

It very frequently happens that ideas pass into action without preceding volition. "Whilst talking I become conscious of a pin on the floor or of some dust on my sleeve. Without interrupting the conversation I brush away the dust or pick up the pin. I make no express resolve, but the mere perception of the object and the fleeting notion of the act seem of themselves to bring the latter about."[3] Experiences of this kind are very common. We have already had occasion to dwell on the tendency of ideas to express themselves in imitative gestures; and in that connection we adduced other evidence to show that ideas tend to act themselves out in proportion to their vividness and dominance in consciousness.

We now turn to the special case of volition. Volition is normally followed by movement, because the voluntary

[1] Stout, *op. cit.*, p. 355. [2] James, *op. cit.*, Vol. II., p. 527.
[3] *Ibid.*, p. 522.

decision gives to the representation of the act decided on a settled predominance in consciousness as against the representations of alternative courses. This is James's account of the matter, but it is possible to push psychological analysis somewhat further, so as to show how the predominance arises. During the process of deliberation, the subject is as yet uncertain what he is going to do. Incompatible courses of action are ideally represented as possible alternatives. With the voluntary decision comes the belief that one of them is to be carried out to the exclusion of the others. It is this belief which gives to the idea of the action the predominance leading to its execution.

This is perhaps best illustrated by what takes place in the hypnotic state. It is well known that the hypnotised subject responds passively to all kinds of suggestions from the hypnotiser. Within certain limits it is necessary only to suggest the idea of an action or group of actions to bring about performance. "Tell the patient that he cannot open his eyes or his mouth, cannot unclasp his hands . . . and he will immediately be smitten with absolute impotence in these regards."[1] Tell him that he is a pig or a lion or a baby or Julius Caesar, and he will proceed to enact the part. Now, though the suggestion of the mere idea tends to have this effect more or less, yet the result can be produced with far more certainty and conspicuousness when the operator imposes on his patient a *belief* that he is such and such a person, or that he is going to do such and such a thing. Hence suggestions mainly take the form of assertions, such as, "You will do this," "You will not do that." When the patient has once adopted the belief that he is going to act in a certain manner, the ideas of alternative courses are suppressed, and the action follows.

It seems probable that the predominance which voluntary decision gives to the idea of a line of action is essentially connected with the belief that this is the line which we are going to follow out, to the exclusion of other and incompatible alternatives.

[1] *Ibid*, p. 603.

8. Involuntary Action. Fixed Ideas.—In the strictest sense an involuntary action is one which takes place in opposition to a voluntary decision. Thus if I am determined to make a certain stroke at billiards, and if in the moment of action the muscular apparatus fails me, so as to give rise to an unintended jerky movement, my action is strictly involuntary.

But cases like this do not interest us here. What we are concerned with is the defeat of the will, not by an accidental circumstance interfering with its execution, but by an antagonistic impulse. We have an example of this in the unsuccessful effort to restrain a reflex movement over which we have normally sufficient control. Suppose a party of soldiers to be climbing a crag in the dark so as to surprise a castle. Noiselessness is a condition of success. A sneeze or a cough probably means defeat and loss of life. Now it is possible to a large extent to restrain the actions of sneezing and coughing; but if the irritation of the mucous membrane is sufficiently intense and persistent, temporary repression only makes the ultimate outburst more violent. One of the soldiers may be determined not to sneeze, although the impulse is so strong as to give him great uneasiness. The tendency to sneeze is a conation; to restrain it is painful, and to indulge it would be a relief. None the less, if the impulse prove irresistible, the sneeze is involuntary.

In this instance the involuntary act follows on organic sensation and not on an idea. It does not take place because the ideal representation of the act of sneezing has become predominant, but merely because of the intense irritation of the mucous membrane.

There is, however, a wide class of instances in which the will is defeated by the obstrusive intensity of an ideal representation. In spite of the mental assertion that we are not going to perform a certain action, the idea of that action, owing to other conditions, acquires and maintains a dominance in consciousness which ultimately leads to its realisation.

This may happen even when the ideally-represented object is not desired, and even when the only feeling towards it is that of intense aversion. A man standing on an eminence, such as the top of a cathedral tower, and looking down into

the vast depth beneath him, thinks of what it would be like to throw himself down. Owing to the fascinating interest of the thought, the idea of the action and its consequences obtrudes itself upon him with intense vividness, and he feels himself impelled to carry it into execution. He may have a very distinct and clear volition to the contrary; he may utterly refuse to identify the idea of the action with the idea of self. He mentally asserts, "I shall not," or, "I will not"; and as a rule this voluntary decision triumphs over the 'fixed idea' as it is called. But it still remains true that the fixed idea derives its vivacity from conditions independent of the will; and it is always possible that the impulse to realise it may acquire sufficient strength to overcome a contrary volition. Some people actually do throw themselves down precipices in this way.

This result, however, is not common under normal conditions. It is in pathological cases that the fixed idea becomes really formidable. This is partly due to imperfect powers of deliberation. The conative tendencies which would have restrained the act lie in abeyance; the concept of the self in its unity and totality can be only very inadequately developed in relation to the act contemplated. But there are instances to which this explanation does not apply. In such instances it is not the absence of inhibiting tendencies, but the positive strength of the impulsive idea which leads to action.

Ribot gives a case of a man who was possessed by the idea of killing his mother. "'To you' said he, 'I owe everything; I love you with all my soul; yet for some time past an incessant idea drives me to kill you.'" Tormented by this temptation, he leaves his home, and becomes a soldier. "Still a secret impulse stimulated him without cessation to desert in order to come home and kill his mother." In time, the thought of killing his mother gives place to that of killing his sister-in-law. Someone tells him that his sister-in-law is dead, and he accordingly returns home. "But as he arrives he sees his sister-in-law living. He gives a cry and the terrible impulse seizes him again as a prey. That very evening he makes his brother tie him fast. 'Take a solid rope, bind me like a wolf in the barn, and go and tell Dr. Calmeil. . . .' From him he got

admission to an insane asylum. The evening before his entrance he wrote to the director of the establishment: 'Sir, I am to become an inmate of your house. I shall behave there as if I were in a regiment. You will think me cured. At moments perhaps I shall pretend to be so. Never believe me. Never let me out on any pretext; the only use I shall make of my liberty will be to commit a crime which I abhor.' "[1]

This is a case in which the fixed idea was not executed; but it might easily have taken effect, and many similar cases could be adduced in which it actually did so. What it is important to note is the conflict between the self as a whole arranged on the side of the volition, and the isolated impulse to action which derives its strength merely from the fixation of an idea by pathological conditions. In these cases the conation which resists the will arises primarily from the fixation of the idea in consciousness. The fixation of the idea itself does not arise from any desire for its object. But under normal as opposed to pathological conditions, the commonest cases of involuntary action are those in which an idea becomes fixed through intense appetite or craving arising from organic conditions. To take an example given by Shand, a man may have a morbid craving for drink or opium, and the idea which moves to its satisfaction may at last become irresistible.

Now here there are four possible alternatives—

In the first place, indulgence in the drink or opium may be contrary to the man's express volition at the moment when he drinks. This is probably a very rare occurrence. As a rule, when the impulse is strong enough to produce action, it is also strong enough to prevent or displace an opposing volition.

In the second place, there may have been a preformed resolution to refrain from the action; but at the moment when the action takes place the contrary impulse acquires such intensity as to pre-occupy the field of consciousness, so that the volition is temporarily in abeyance. Here action at the moment is non-voluntary rather than involuntary But taking a broader view, we may call it involuntary, because it runs

[1] Ribot, *Maladies de la Volonté*, p. 77, quoted by James, *op. cit.*, p. 542.

counter to a volition which has lapsed only for the time being, and recurs in consciousness immediately after the act is over, in the form of remorse.

In the third place, the action may take effect before a voluntary decision has been arrived at. In the midst of the conflict of motives, the idea corresponding to the animal appetite may become so vivified as to pass into action while the process of deliberation is still working itself out. We may act before we know our mind. A man, while still mentally hesitating whether he is to drink a glass of spirits or not, will find that the organic craving has so vivified the idea of drinking that he is swallowing the spirits before he has determined whether to do so or not. The action is then involuntary, because it interrupts the process of forming a volition. It may also be involuntary in a deeper sense; it may be that from the constitution of the man's whole nature, he would certainly have willed otherwise if full deliberation had been possible before acting.

In the fourth place, the organic craving may be the motive of a genuine volition, and the action may therefore be voluntary at the time at which it takes place. None the less, there is a sense in which the action may be regarded as involuntary. A comparison may be made between the totality of interests defeated by indulging in the drink or opium, and the animal craving itself considered as a relatively isolated impulse. If the craving were taken away the self would still be left. If on the other hand, all the interests which are opposed to the indulgence were taken away, there would be little left but the morbid appetite itself. Thus the denial that the act is voluntary may have a good meaning. It may mean that the volition of the moment is discordant with the general volition of a lifetime, so that the intervals between the periods of indulgence are embittered by remorse. It is supposed that the morbid craving by its isolated intensity prevents full deliberation. There is, it is assumed, in the man's nature a vast system of conative tendencies which, if they had found fair play, and developed themselves in consciousness, would have determined volition even if they did not determine action.

Of course, when we regard the question in this way, the voluntariness or involuntariness of an action is a matter of degree. We tend to think of the opium-eating of a man like Coleridge as a kind of external misfortune, because it is alien from the ideal aspirations which we regard as constituting his true self. To this extent, we do not hold Coleridge responsible so much as the unfortunate craving which possessed and mastered him. In the case of a man of meaner nature, our judgment would be very different.

9. Self-Control.—All the cases of involuntary action which we have discussed in the last section are cases of deficiency of self-control. Self-control is control proceeding from the the self as a whole and determining the self as a whole. The degree in which it exists depends upon the degree in which this or that special tendency can be brought into relation with the concept of the self and the system of conative tendencies which it includes. Failure in self-control may arise from one or both of two conditions. On the one hand, the overpowering intensity of a relatively isolated impulse may prevent the due evolution of the concept of self even when this is fully formed and organised. On the other hand, the defect may lie in the degree of development which self-consciousness has attained, or in organic conditions, mostly of a pathological kind, which disorganise the self, and prevent the full development of its normal contents.

To quote Clouston: "The driver may be so weak that he cannot control well-broken horses, or the horses may be so hard-mouthed that no driver can pull them up. Both conditions may arise from purely cerebral disorder. . . An imbecile or dement, seeing something glittering, appropriates it to himself. . . . The motives that would lead other persons not to do such acts do not operate in such persons. I have known a man steal who said he had no intense longing for the article he appropriated at all, at least consciously, but his will was in abeyance, and he could not resist the ordinary desire of possession common to all human nature."[1]

[1] *Clinical Lectures on Mental Diseases*, quoted by James, *op. cit.*, pp. 540-1.

On this statement James remarks: "It is not only those technically classed imbeciles and dements who exhibit this promptitude of impulse and tardiness of inhibition. Ask half the common drunkards you know why it is that they fall so often a prey to temptation, and they will say that most of the time they cannot tell. It is a sort of vertigo with them. Their nervous centres have become a sluice-way pathologically unlocked by every passing conception of a bottle and a glass. They do not thirst for the beverage; the taste of it may even appear repugnant; and they perfectly foresee the morrow's remorse. But when they think of the liquor or see it, they find themselves preparing to drink, and do not stop themselves; and more than this they cannot say."[1]

We have a good example of the inverse case in which the concept of self is fully organised and easily developed, but finds itself impotent in the face of an abnormally intense impulse, in the case of the man who was possessed by the fixed idea of murdering his mother.

The process of ideal construction through which the concept of self grows, is gradual, and reaches different degrees of perfection in different persons. The more highly systematised and organised it becomes, the more effective it is. Self-control is greatest in the man whose life is dominated by ideals and general principles of conduct; but this involves a development of conceptual consciousness which is absent from children and savages. We accordingly find that children and savages are to a great extent creatures of impulse; they have comparatively little power of deliberation, so that action tends to follow the conative tendency which is excited and supported by the circumstances of the moment. Remoter considerations are comparatively inoperative. The self which determines action is predominantly the present self, not the total self as ideally represented.

Thus the savage wastefully exhausts his present store in riotous indulgence, and is improvident of the future. He cannot be brought to work in a regular and persistent manner. He may be industrious enough for a time in order to gain a

[1] *Ibid.* p. 541.

little money, or some other object which he happens to covet at the moment; but so soon as his immediate end is attained, he thinks no longer of working, but only of enjoying his gains. He is scarcely capable of pursuing a distant aim, which requires persistent and repeated activity continued for a long time without obvious result. Ends which are at least in part immediately attainable seem to be the only ends which effectively determine his action. For this reason he does not appreciate the value of time. The end he is pursuing at the moment has for him an absolute rather than a relative importance. He does not regard it merely as part of the great business of life which must be subordinated to the whole. He does not feel the necessity of completing the transaction in which he is interested in time to proceed to other matters. Hence he often sorely tries the patience of the civilised European by spending altogether disproportionate time and energy on relatively trivial bargains, etc.

Such mottoes as "time is money" do not appeal to the savage mind. The same holds of young children, as we all know. To them the bird in the hand is worth a thousand in the bush.

10. Voluntary Attention.—A voluntary determination may be either a determination to perform certain bodily movements or a determination to attend to certain objects. Attention, so far as it follows upon an express volition to attend, is called 'voluntary attention.' All attention which is not so initiated is 'non-voluntary' or spontaneous. When we attend not merely without an express volition to attend, but in opposition to such a volition, attention is in the strictest sense 'involuntary' and not merely non-voluntary.

A good illustration of voluntary attention is to be found in "certain psychological experiments, in which the experimenter fixes his attention on an uninteresting object, in order to observe phenomena attending the process of fixation. He determines to attend to the object for the sake of observing what takes place when he attends to it. The spontaneous and the voluntary direction of attention are not merely distinct: they are also antagonistic. Everyone desires to

avoid futile worry and fret; but no one has a mind so well regulated as to be able to divert his thoughts at will from irremediable misfortune, and unavoidable sources of anxiety. When, owing to overwork, our minds are besieged at night by a subject which has occupied us during the day, we vainly endeavour to compose ourselves to rest. We *will* to expel the intrusive thoughts; but we cannot keep up the effort persistently; and so soon as it is relaxed, the spontaneous movement of attention recurs, and murders sleep."[1]

"All mental training and discipline depend on the victory" of voluntary attention. "This usually takes time. The resolution to devote attention to an unattractive subject can only succeed after repeated effort followed by repeated failure. The mind wanders at first, and requires to be again and again recalled to its task. We form a design to occupy ourselves with a certain topic. So soon as this design is being carried out, we cease to think of it and of the motives which prompted it. We think instead of the subject-matter which we had resolved to study. But this subject-matter is, *ex hypothesi*, uninteresting. It cannot, therefore, command attention. Accordingly our thoughts wander from the point, and have to be recalled by a renewed effort of will. This fitful alternation of attentiveness and inattentiveness may continue until fatigue and tedium cause the task to be abandoned. On the other hand, interest may grow up as the subject of study becomes better known. When this happens, the periods of concentration become gradually prolonged, until the necessity for deliberate effort ceases to exist.

"Thus the function of voluntary attention in such cases is to create spontaneous attention. When it fails in this, it produces only exhaustion and disgust. A person condemned to spend his whole life in constantly reiterated efforts to fix his mind on a hopelessly uninteresting topic, would go mad, commit suicide, or sink into a state of coma. Voluntary attention belongs coincidently to the province of intellect and to that of practical volition. It is the '*conduct* of the understanding,' and, like external conduct, is subject to moral

[1] Stout, *Analytic Psychology*, Vol. I., p. 241.

law. In intellectual morality the fundamental virtue is patience."[1]

The voluntary determination to attend plays a large and important part in the more complex forms of deliberation. We may compare the value of conflicting motives in relation to the total system of our lives; and we may find that, considered from this point of view, a certain motive or group of motives has not the strength and prominence which it ought to have. We may then attempt to give it this strength and prominence by voluntarily turning our attention in a certain direction.

Thus a candidate preparing for an examination may find in himself a strong disposition to laziness, tempting him to spend a day in idleness. He may at the outset very faintly realise the special considerations which make such a course inadvisable: but he may at the same time know that these considerations are important, and that if he neglects them he will bitterly regret doing so. This at the outset may not constitute a motive sufficient to lead to a definite decision to apply himself to work instead of play; but it may be sufficient to give rise to the voluntary decision to fix attention on the reasons for working, and so to give to these reasons the strength and liveliness which they initially lack. In this indirect way he may reach a distinct and effective decision to go to work with steadiness and energy.

It is in such cases as these that the consciousness of freedom is most conspicuous. For in such cases we not only will our act, but in a manner we will our volition. The voluntary determination to act issues out of the voluntary determination to attend; and the voluntary determination to attend directly and obviously depends on the controlling influence of the concept of the self as a whole.

11. True Freedom.—It must not be supposed that anything we have said in this chapter implies a denial of the freedom of the will in the sense in which such freedom is claimed by the ordinary consciousness of humanity. We have only

[1] *Ibid.*, p. 242.

thrown doubt on a certain theory of the nature of such freedom —the theory which goes by the name of 'libertarianism,' or of 'contingent choice.' By 'contingent choice' is meant a choice which does not issue out of the total process of mental life in accordance with psychological laws, but springs into being of itself as if it were fired out of a pistol. This theory makes free decision arise by a kind of spontaneous generation. Those who oppose libertarianism sometimes call themselves 'determinists.' Some determinists agree with the libertarians in identifying freedom with contingent choice; they only disagree in denying the existence of such choice.

As against both these, we maintain that freedom consists in self-determination, and that self-determination means self-control. Self-control, as we have defined it above, consists in "control proceeding from the self as a whole and determining the self as a whole. The degree in which it exists depends upon the degree in which this or that special tendency can be brought into relation with the concept of the self and the system of conative tendencies which it includes."

Another way of putting this is to say that acts are free in so far as they flow from the character of the agent; for character is just the constitution of the self as a whole. Character exists only in so far as unity and continuity of conscious life exists and manifests itself in systematic consistency of conduct. Animals can scarcely be said to have a character, because their actions flow from disconnected impulses. "If an animal could be supposed to think and speak, it could not refer its actions to itself, but only to its impulse at this or that moment."[1] Character is little developed in savages as compared with civilised men; for they have relatively little power of considering particular actions in relation to an organised system of conduct. Now the development of character and the development of freedom are two aspects of the same process. A man's acts "are his own only when he *is himself* in doing them,"[2]—when they express his total character rather than his momentary impulse.

[1] Mackenzie, *Manual of Ethics*, fifth edition, p. 97. [2] *Ibid.*, p. 98.

It follows from this account that freedom is an ideal which can never be completely realised, and this ideal coincides with that of self-realisation, as expounded by Mackenzie in his *Manual of Ethics*.[1] But the last word about freedom lies neither with Psychology nor with Ethics. Its full discussion involves an examination of the relation between the thought and will of the individual mind, and the reality of the universe. This relation from the point of view of any special science such as Psychology is utterly inexplicable. The more closely and conscientiously we endeavour to explain it by the ordinary categories of any special science, the more plain it becomes that, so regarded, it is a miracle—indeed the miracle of miracles.

Psychology cannot explain how it is possible that an individual can consciously mean or intend something. To say that he has a present modification of consciousness which resembles an object is very far from being the same thing as saying that he has a thought of this object—that he means or intends it. I may now have a toothache, and you may have a toothache exactly like it, but my toothache is not the thought of your toothache. Will and thought are not explicable by such categories as causality, substance, resemblance, or correspondence. Hence, truth and freedom are ultimately topics for the metaphysician. As psychologists, we deal not with the ultimate possibility of will and thought, but only with their mode of occurrence as time-processes taking place in the individual mind.

[1] See especially Bk. II., Chap. V., § 12, "The True Self."

APPENDIX.

THE GESTALT THEORY.

1. **Gestalt Psychology.**—'Gestalt psychology' is the name given to an approach to psychological problems initiated by Wertheimer's investigation of the visual perception of movement [Wertheimer, 1912]. The elaboration of the theory and the experimental investigation of its implications were the work jointly of Wertheimer, Köhler, Koffka, and their pupils. This approach is often represented as if it were primarily a body of speculative theories, and a knowledge of Gestalt psychology is supposed to be knowledge of a number of specific dogmas which have been put forward by members of this school. This view neglects, however, its most important aspect. Gestalt psychology is primarily a body of experimental research. Its theoretical doctrines have directed this research and systematised its results. Even if all of its doctrines were either false or not original [as some of its opponents have suggested] it would remain true that what has been found out in the course of the experimental investigations inspired by those doctrines is a new and important addition to psychological knowledge.

No system of scientific theory can lay claim to finality; it is sufficient that, at any one time, it sheds light on the next problems to be investigated. A valuable contribution to psychological theory is one that opens out a new field of scientific enquiry. 'The essential requirement of a scientific theory is not that it should be a final statement of truth, but that it should be adequate for the field of enquiry to which it belongs at the stage of knowledge existing at the time it is put forward. That new knowledge gained in the future will necessitate modification of the theory is almost certain. Indeed we may say that, in the history of science, the most fruitful hypotheses have been those that led to researches

which ultimately proved them to need modification. The value of Newton's three laws of motion in the systematisation of mechanics and dynamics is not less because later research in those fields necessitated the modification of Newton's laws which were made by the theory of relativity. The value of a scientific theory is to be judged by the extent to which its systematisation of known facts leads to fruitful results in the search for new facts and new hypotheses. Judged by this criterion, Gestalt psychology has amply proved its value.

2. Wertheimer's Experiments on Movement Perception.— It is probably to be regarded as a historical accident that the foundations of the Gestalt psychology were laid by Wertheimer in the account he published in 1912 of experiments performed on the appearance of movement which results from successive stimulation of two points on the retinal field [the phi-phenomenon]. The theoretical argument which he developed from these experiments might equally well have been founded on other observations in the field of perception in which some characteristic is found in the perceptual response to a complex stimulus which is not present in the ' sensations ' which would result from the simple parts of the stimulus acting separately, and which also is not to be explained as compounded of these sensations. Such characteristics are to be found, for example, in the ' modes of appearance ' of colours and in colour constancy [Katz, 1911], in the figure-ground articulation of the perceptual field [Rubin, 1915] and even in the familiar fact of depth perception. In his theoretical discussion of the phi-phenomenon, Wertheimer was, therefore, arguing a case of much more general application than to the explanation of the particular effect that he was describing.

The case was, in brief, that if two points are successively illuminated at certain speeds of succession [about ·06 sec.], what is seen is not two bright points in different positions appearing alternately, but a single bright point moving between the two positions. This appearance of movement is as definite as that obtained from an actually moving object. It is not the result of eye-movements, since the appearance of movement persists when the eyes are held still. It is not to

be explained as an illusion of judgment, since it fulfils none of the conditions that would be expected from an illusion of judgment; in particular, knowledge of the fact that there are in reality only two stationary illuminated points does not weaken the appearance of movement, and this apparent movement produces a negative after-image of movement just as would a real movement. Wertheimer contended, therefore, that the effect could not be explained by supposing that what was immediately experienced was simply the two light sensations and that the movement effect was the result of some process of inference or judgment. He claimed that, on the contrary, the movement must be regarded as an experienced effect resulting as immediately from the succession of stimuli as would the experience of a stationary light from the stimulation of any single part of the retina.

This explanation is in marked contrast with a view of the nature of the perceptual response to complex stimuli that is implied in the type of explanation given by many experimental psychologists who had inherited the tradition of thought characteristic of the greatest of the founders of experimental psychology—Helmholtz. This traditional view is that every local stimulus in a complex system of stimulation gives rise to its own sensation and that the perception is a psychological resultant of the combination or integration of these sensations.

This view has been called by Köhler, the 'constancy hypothesis.' The use that Helmholtz made of this principle of explanation may be made clear by an example. He knew that a white object might still look white although the prevailing illumination was predominantly green [as in a forest] so that the condition of stimulation of the eye must be the same as that which normally gives green sensation. This is the fact now known as 'colour constancy' or 'phenomenal regression to "real" colour' [Katz, 1911; Thouless, 1931]. To explain this fact, Helmholtz pointed out that we have seen such objects in different illuminations. "By seeing objects of the same colour under these various illuminations, in spite of the difference of illumination, we learn to form a correct idea of the colours of bodies, that is, to judge how such a body would look in a white light; and since we are interested only in

the colour that the body retains permanently, we are not conscious at all of the separate sensations which contribute to form our judgment." [Helmholtz, 1856, Vol. II., p. 287.]

It is clear that Helmholtz's view of this matter assumes the principle criticised by the Gestalt psychologists—that there is a sensation of green from the white paper which is the inevitable product of the conditions of local stimulation, and that what is actually perceived is a result of processes of judgment acting on this unexperienced sensation. To this view, the Gestalt psychologists would oppose the view that we do not experience the paper as green and judge it to be white but that we experience it as white. The local peripheral stimulus is undoubtedly such as would be caused by the action on the retinal surface of somewhat green light, but there is no consequent sensation of green. The perceived whiteness is not, according to Gestalt theory, due to a double process of green sensation acted on by a judgment correcting for the greenness of the illumination, but is an immediate consequence of the character of the whole visual field of which the green illumination is a part.

It is easy to point to experimental observations which make it clear that there is not necessarily any sensation of which we are conscious that corresponds to the conditions of local stimulation of the end-organ. This is obviously the case when we perceive a white object as white in a greenish illumination, and a more familiar example is to be found in the perception of distance in which the 'double images' assumed on the constancy hypothesis are certainly not generally seen. It is not, however, possible to devise any experiment which will decide crucially the truth or falsity of the constancy hypothesis if we follow Helmholtz in assuming that sensations may determine perceptions without being themselves experienced. If this assumption is made, it would seem to be possible to fit any conceivable fact of perception into the framework of the constancy hypothesis. It is, however, reasonable to ask whether a perceptual theory accepting this hypothesis or one rejecting it best fits the observed facts over the whole range of perception with the minimum of assumptions.

On the constancy hypothesis, perceptual experience will normally be of a kind which corresponds exactly with the conditions of local stimulation although there will be a special class of ' illusions ' in which experience and judgment disturb this simple relationship. So long as we confine ourselves to such conditions of experimentation as were for a long time habitual in psychological experimentation, in which only a small part of the perceptual field was observed in isolation from its surroundings, the constancy hypothesis appears to fit well enough. As soon, however, as we start observing objects as part of a complex perceptual field, ' illusions ' become the general rule and the constancy relationship becomes exceptional. There seems, therefore, to be no sufficient reasons for retaining the distinction between normal or ' correct ' perception in which sensations correspond to conditions of local stimulation and abnormal perception or " illusion " in which they do not. In all cases, except in the special circumstances of the traditional psychological experiment, determination by the whole perceptual field of what is perceived in any part of the field appears to be the rule and not the exception, and the existence of the unexperienced ' sensation ' corresponding exactly to the conditions of local stimulation appears to be an unnecessary hypothesis.

4. The Gestalt Problem.—The fact that in our perceptions of objects, there are characteristics which do not belong to any sensation, is not a new discovery of the Gestalt psychologists. Towards the end of the last century, von Ehrenfels had pointed out that a whole perception might have characteristics which were not present when a small part of it was isolated. Examples are to be found in the ' milkiness ' of a turbid fluid or the melody of a succession of musical notes. He called any such characteristic a ' Gestalt-qualität ' [von Ehrenfels, 1890]. Also Hering, although he held the sensation theory, effectively escaped from its limitations when he described what are generally called the " modes of appearance of colours "—*i.e.* such visual appearances as volumniousness of colours, glow, etc. [Hering, 1879 and 1920]. These are characters of colours which depend on their spatial and other

relationships within a whole visual field and not on properties of the corresponding local stimulation. Hering may be regarded as laying the foundation of the ' phenomenological ' method of approach to perception, that is, the study of perceptions as they appear and not as they may be explained as a result of analysis. This method was carried much further by Katz who initiated the quantitative treatment of such effects [Katz, 1911] and extended the phenomenological approach to the field of touch perception [Katz, 1925].

Perhaps the relation of the Gestalt psychologists to these writers can be expressed most clearly if we follow Petermann in referring to the problem of the characteristics of mental wholes which are not to be explained as contributed by their constituent parts as ' the Gestalt problem ' [Petermann, 1932]. The Gestalt psychology is a particular radical solution of this problem by the denial that the elements [*e.g.* the sensations] reached by traditional psychological analysis are real constituents of such mental wholes as perceptions.

Although this solution may be modern, at least as a clearly enunciated scientific principle, the problem itself is more than two thousand years old and is not peculiar to psychology. The central doctrine of Buddhism—of the impermanence of compounded things—is essentially a solution of the Gestalt problem. It teaches that elements alone are real and that the wholes organised out of these elements [such wholes as selves] are unreal and transitory. The development of physical science followed, on the whole, the same theoretical path as the Buddha and succeeded in attaining an understanding of the physical world by reducing organised physical wholes to their elements as atoms.[1]

It was natural that psychology should begin by following the same path, and the ' atomistic ' tendency in psychology was shown by the early treatment of thought as compounded of atomistic ' ideas ' and of perception as compounded of atomistic ' sensations.' The fact that these lines of approach

[1] It is arguable, however, that this is only true of the early stages of physical theory and that later developments have taken place by the readmission of the ' whole ' characters which the earlier analysis ignored [Köhler, 1920].

had proved sterile prepared the way for Wertheimer's reversal of the early physicists' solution of the Gestalt problem. It is obvious that a mode of thought adequate for the simpler problems of physics may be by no means adequate for psychology. The suggestion of the Gestalt psychology was that, for psychological facts and for the physiological correlates of psychological facts, we should try out the hypothesis that compounded wholes are the realities.

It is clear that, if the argument of the Gestalt psychologists is accepted, we cannot make a sharp distinction between sensation and perception, and we may, therefore, find little use for the term 'sensation' [Koffka, 1922]. Instead of 'sensations' determined by local stimuli and perceptions determined by the interaction of judgment and experience with sense stimuli, we have only the difference between perceptions obtained under simple and under complex field conditions respectively. Similarly, there is no room for Ehrenfels's conception of a 'Gestaltqualität.' If all characteristics of perception are the product of field conditions and not merely of the local stimulation, it is not possible to make a distinction between Gestaltqualitäten which are determined by field conditions and other perceptual qualities which are not.

Recognition of the Gestalt problem is also to be found in the present work of Stout. Thus he says: "A complex whole has attributes which do not belong to any or all of its parts." [Stout, 1913 and 1932, p. 185.] An example of such a complex whole is to be found in 'conative unities' carried out over a period of time and resumed after interruption [Stout, 1898, pp. 73 ff.]. Such a conative unity is to be found in the playing of a game of chess, which is bound together by a single conative continuity although its course may be interrupted by other activities not belonging to this conative unity. Stout also recognises the Gestalt problem in perception: "the response is primarily conditioned not by specific stimuli acting in isolation, but by complex changes in the perceptual situation as a whole" [Stout, 1932, p. 231]. Perceptual events were also recognised to form wholes in time and not only contemporaneous wholes. Thus: "In these instances [when climbing a rock, threading a needle, etc.], perceptions are not isolated

facts; they form series having a certain unity and continuity similar to that of trains of ideas or trains of thought " [Stout, 1898, p. 243, and 1932, p. 309].

It is thus clear that the Gestalt psychologists were not the first to recognise the Gestalt problem. On the theoretical side, however, they performed the important task of rescuing this problem from an obscure position of occasional recognition and making it the corner stone of their psychological theory. More important perhaps was the fact that they gave it a dominant position in experimental work where the tradition of analysis had led a disproportionate amount of energy to be expended on experiments on sensation while the experimental investigation of perception had [with rare exceptions] been almost wholly ignored.

5. What is a 'Gestalt'?—The student faced with the problem of finding out what the Gestalt psychology is about is likely to begin by asking what is the meaning of the word 'Gestalt'? If he turns to his German dictionary, he may find a generous choice of English equivalents. Cassell's *New German Dictionary* [London, 1889] gives: " form; shape, figure; mien, air; aspect, manner; vision." The English equivalent commonly used in discussions of Gestalt literature is, however, none of these, but is 'configuration.'

This, however, does not get us very far towards understanding the technical use of the term in Gestalt psychology. Perhaps the best approach to the understanding of this special use is an article by Köhler [Köhler, 1926]. In this article, Köhler argues that the real units in the perceptual field are not independent local elements of sensation, but are such things as figures, moving or stationary objects, etc., which are to be regarded as products of the interaction of different local stimuli with one another. He goes on to say: " Intimately related to the existence of real units and boundaries in the field of vision we find the fact that there are "*forms*" in this field. . . . wherever we see these units they have forms, this being the reason why in the German terminology those units are called 'Gestalten' " [*Op. cit.*, p. 180]. In the same article, Köhler argues that these perceptual units have the character

of dynamically interconnected systems [such as a network of wires between the terminals of an electric battery] in which the properties of each part are determined by the character of the whole system. "Nobody can prevent me from concentrating my attention upon one small part of this conducting system . . . But the next step I have to make, if the theory shall agree with the facts at all, must consist in my admitting that the small part of the process is *as* it is not for its own sake and independently, but only in so far as in the other parts of the system the corresponding processes are going on. The stationary distribution of electric current in a given system is a dynamic equilibrium of the *whole* system, not to be reduced into independent branches of current" [*op. cit.*, p. 165]. A book which I see lying on the table or a circle that I have drawn on a piece of paper may, thus, be Gestalten in the visual field—perceptual units whose unity is determined by the dynamic equilibrium of the visual processes set into activity by the stimuli acting on the retina. These objects can also become members of a group of a higher order. I can arrange the books in a circle forming a Gestalt of a higher order in which again there is interaction between part processes to form a new perceptual whole.

Having discovered the meaning of the word 'Gestalt,' however, the student may be discouraged by the discovery that the word is not of much importance in Gestalt psychology. It is not [so far as I can discover] used in Wertheimer's original article [Wertheimer, 1912]. Elsewhere, it is used only occasionally and generally without explanation or definition. In one of the leading laboratories of the Gestalt psychologists, I understand that the professor prohibited the use of the word by his staff and students since he found that its use led to verbal and superficial explanation. It is indeed clear that the meaning of the word 'Gestalt' is not the key to the understanding of Gestalt psychology. It is a conception used in the Gestalt psychology and happens to have given its name to that system, but it is not descriptive of the system. A better descriptive term would have been 'the field theory of psychology.' The essential feature of the theory of perception is that it regards all perception as occurring in a perceptual

field of which the properties of the parts are determined by the properties of the field. The extension of Gestalt psychology beyond perception is the extension of this field theory to other psychological regions, such as the theory of thinking [Wertheimer, 1920], of remembering [Zeigarnik, 1927], of learning [Tolman, 1932], and of social psychology [Lewin, 1936].

6. The Theory of Isomorphism.—The Gestalt theory is not only a theory of the nature of psychological processes; it is also a theory of the nature of their physiological concomitants. The essence of this part of the theory is that the physiological processes corresponding to psychological Gestalten are themselves gestalt processes of the same character. Thus Wertheimer, having rejected the view that the phi-movement was an illusion due to an error of judgment, was led to ask what kind of brain process did lead to the appearance of movement [Wertheimer, 1912].

His answer to this problem was that it must be the same kind of brain process as led to the appearance of movement in the perception of an actually moving object. He postulated that this was the passage of a process of excitation from one part of the visual surface of the brain to another, and argued that this could take place under the conditions of observation of the phi-phenomenon if we suppose that the excitation of one point on the visual cortex caused the spreading out from that point of an effect which predisposed surrounding parts to excitation. If a point *a* is stimulated a short time after a neighbouring point *b*, there is a "kind of physiological short-circuit from *a* to *b*" and a wave of excitation will pass from one to the other. That the appearance of movement is only found within a narrow range of time intervals between the two stimuli is easily explained on this hypothesis since, if the time interval is too long, the predisposition to excitation started by the stimulation of *b* will have faded out by the time *a* is stimulated, whereas if the time interval is too short, it will not yet have reached *a*, so no short circuit will take place.

That facts of experience are paralleled by events in the nervous system has, of course, been a very general assumption

in psychology. This, however, is a physiological explanation of a different kind from those that have usually been put forward in the past. Visual perception was, for example, regarded by psychologists following the tradition of Helmholtz as partly a matter of sensations which have their physiological concomitants in stimulation of some number of end-organs in the retina, and partly as a matter of higher processes of judgment, etc., which, no doubt, had their own cerebral correlates about which it would be profitless to speculate. So far as neural correlates of perceptual processes were postulated they were simple excitations of end-organs and equally simple conduction of separate impulses from these end-organs to the brain. While it was recognised that perceptions were not simply mosaics of separate sensations, no guess was made as to the physiological aspect of the process by which these separate sensations were integrated to form perceptions. The general tendency in the past has been to recognise the structural complexity of psychological processes but to attribute them to relatively simple physiological correlates. Where these physiological correlates have been regarded as the causes of psychological processes [as in mechanistic theories of psychology] the tendency has been to attribute to psychical processes the same character of simplicity as is assumed in the physiological correlates. So we get a type of theory which may be called ' simple mechanism ' such as is found in reflexology [Bechterew, 1917] and in early behaviourism [J. B. Watson, 1919]. Wertheimer suggests, on the contrary, that we must attribute to the concomitant physiological processes an equal structural complexity with that of the psychological process itself. This theory is the theory of ' isomorphism.' It is essentially a mechanistic theory of psychology, but a kind of mechanistic theory which is free from the grave inadequacy of simple mechanistic theory.

Some years after the publication of Wertheimer's paper, Köhler put forward another theory of the physiological correlate of Wertheimer's movement phenomenon, which was of a type more generally applicable to Gestalt problems [Köhler, 1923]. Its most important difference was that he shifted the place of the physiological correlate of movement from the

cerebral cortex to the conducting tracts. Wertheimer's theory was consistent with the possibility that processes on the end-organ and in the neural conduction tract were separate and atomic and that they gained the character of field processes in the cerebral cortex. That this cannot be wholly true is clear even from the work of Hering since his experiments on simultaneous contrast show that the processes of the retina [or of the optic nerve] are field processes in which the response of one part of the visual organ is a function not only of the local stimulation of one part of the retina but also of the conditions of stimulation of the rest of the retinal field [Hering, 1874]. In this explanation of contrast, he was in sharp opposition to Helmholtz who treated the responses to local retinal stimulation as atomic.

If not the brain surface only but the whole system of retina, conduction tract and visual cortex is treated as subject to field laws, the range of possible physiological explanations of the appearance of movement is widened. Köhler suggested that the action of the first stimulus starts a column of elements of current along the optic nerve. When a similar column of current starts from the position of the second stimulus, it is to be supposed that the two columns will attract one another so that they unite and only one process reaches the psychophysical level. If at the beginning, the first current is fully formed while the second is only in the course of formation, it is to be expected that the second will be displaced in the direction of the first. So by successive stimulation of two retinal points at suitable intervals one would get the appearance of a single object moving alternately from one point to the other, as is actually observed in the phi-phenomenon.

The theory of isomorphism is probably the part of the Gestalt theory which has been most sharply criticised by its opponents. Some have objected to it as a mere unproved speculation while others have disliked its mechanistic tendency. Whether or not, however, a mechanistic theory can give a final account of mental processes, it is generally accepted as a working principle in science that we must apply mechanistic principles of explanation so far as possible. If there is a region in the investigation of contingent facts in which

mechanistic explanations can not work, that region is outside the field of scientific explanation. The use of mechanistic principles as a working method in science does not necessarily imply the acceptance of a mechanistic philosophy. That the general theory of isomorphism is speculative is, of course, true, and is readily admitted by the Gestalt psychologists. It must remain speculative until we have a direct way of observing the processes of the central nervous system in far more detail than is possible at present. It is, nevertheless, a very probable hypothesis and, if we are to speculate at all about physiological correlates of psychical processes, one more likely to lead to fruitful research than the assumption of atomic physiological processes corresponding to field psychological processes.

It is also obvious that any particular explanation of a Gestalt process based on the principle of isomorphism must be somewhat speculative. This is sufficiently shown by the fact that Wertheimer and Köhler were able to give different explanations of the phi-phenomenon both of which were in conformity with the principle. If such explanations must necessarily remain entirely unchecked by experimental observation, they would be of little scientific value. This, however, is not the case. Köhler's hypothesis leads to an obvious experimental consequence which can be tested; if the phi-phenomenon is due to the mutual attraction of columns of current from the two stimulated points, then the end positions of the apparent moving object should appear to be nearer together than the successive stationary objects which are seen when the time interval is too long for the phi-phenomenon to occur. That such shortening of the distance between successively stimulated points did occur for touch sensations was already known. Scholz then carried out an investigation to discover whether the expected shortening took place under the conditions of the visual phi-phenomenon [Scholz, 1924]. He found that for moderate distances the apparent distance between the two points of stimulation was shortened as expected; for very short distances, however, the apparent distance was increased. Although this exception may be explained away, it is clear that the confirmation of the theory is not, in this

case, altogether satisfactory. It is, however, an example of the fact that a physiological hypothesis based on the theory of isomorphism may lead to consequences which may be subjected to experimental test. That fact is sufficient to justify the theory of isomorphism as a legitimate scientific hypothesis. Whether it is a true one must be judged by its success in correctly predicting experimental results. The work of confirmation lies very largely in the future.

7. Physical Gestalten.—There was an obvious preliminary difficulty in making plausible the theory of isomorphism. Gestalt processes might be supposed to be characteristic of psychical facts whereas nerve currents and the excitations of end organs and cerebral surfaces are facts in the physical world. If processes in the physical world are atomic and do not follow gestalt laws, it is unreasonable to look for gestalt processes in the nervous system. Köhler, therefore, argued that, in the physical world as well as in the psychical world, we find gestalt processes in which properties are found which are characteristic of systems as wholes and are not compounded of the properties of their parts [Köhler, 1920 and 1929]. One example of such a physical Gestalt has already been given —a network of wires carrying the current between the two terminals of an electric battery.

In this contention, Köhler is arguing a case which would be very generally admitted. The necessity of the field conception of 'organisation' in physiology [not particularly in the physiology of the nervous system] has been argued by J. S. Haldane [Haldane, 1913], and a wider use of the same principle of thought has been made by Smuts [Smuts, 1926]. While the physical sciences made their first great advances by the use of atomistic methods of thought, field conceptions have become increasingly important in more recent physical advances. The contention that processes in the nervous system may have gestalt characteristics [which is essential to the theory of isomorphism] is obviously a reasonable one if we admit the existence of Gestalten in the physical and organic world.

8. Wider Implications of Gestalt Theory.—Although Gestalt theory started with the study of perception, it has by no means confined itself to this field. Its supporters have regarded it as a principle capable of illuminating all fields of psychology. Wertheimer early concerned himself with the problems of thinking from this point of view [Wertheimer, 1920], and this line of investigation has also been followed by Duncker [Duncker, 1926]. Harrower has studied the formal character of jokes in the light of Gestalt psychology [Harrower, 1932]. A new and important line of research in memory was Zeigarnik's study of the effect on remembering of the stresses left by uncompleted tasks [Zeigarnik, 1927]. Of great importance to the theory of memory is also the investigation by Köhler and Restorff of the effect of homogeneity of the material on the difficulty of remembering [Restorff, 1933]. This is an experimental study of the process by which 'aggregate traces' are formed by the combination of the memory traces of items which resemble one another. This is a study of considerable practical importance since the formation of such aggregate traces may be regarded as the foundation of all conceptual thinking. It is also of interest as throwing light on the famous memory experiments of Ebbinghaus with nonsense syllables in which the difficulty of remembering appears to have been largely due to the homogeneity of the material and its consequent tendency to form a single aggregate trace.

Perhaps the most ambitious attempt to apply the principles of Gestalt psychology to a field distant from that in which it was originally developed is Lewin's combination of Gestalt psychology with the mathematical methods of topology in order to solve the problems of social psychology [Lewin, 1936]. It is too early to judge of the success of this method of approach. To its advocates, it appears to be the opening for the first time of a genuinely scientific approach to social psychology, while its opponents regard it as merely a method of drawing diagrams to support an over-simplified system of explanation of social behaviour.

9. Conclusion.—In a short account of the Gestalt psychology, the writer cannot avoid giving more space to its doctrines than

to its experiments. The reader may, in consequence, form the mistaken conclusion that it is primarily a body of somewhat controversial theory. Gestalt psychology would have contributed little of value to experimental psychology if it were merely a body of doctrine about which psychologists could argue as to how much was true and how much was new. The real answer to the question of what Gestalt psychology is getting at is to be found in the direction it has given to experimental research. Until recently the experimental researches of Gestalt psychology were less well known to English-speaking readers than its theories, since there were many accounts of its theories easily available to English readers while its experiments were scattered in technical journals and were very largely in German. There is no longer any reason for ignorance of its experimental achievements since these have now been summarised and systematised in Koffka's *Principles of Gestalt Psychology* [1936]. There are also translations of many of the principal contributions to Gestalt psychology, including many experimental investigations, in Ellis's *A Source Book of Gestalt Psychology* [1938]. It is to these books that the reader is advised to turn for fuller information on the matter.

R. H. THOULESS.

Note.—The author is indebted to Professor Koffka and Mr. C. A. Mace who have read this appendix and made many helpful criticisms.

List of books and articles referred to in the appendix.

Bechterew, V. M., *General Principles of Human Reflexology* (English translation), 1933. (First published in 1917.)

Duncker, K., 'A Qualitative (Experimental and Theoretical) Study of Productive Thinking (Solving of Comprehensible Problems).' *Pedagogical Seminary*, 1926.

von Ehrenfels, C., 'Über Gestaltqualitäten,' *Vierteljahreschr. f. Philos.*, XIV., 1890.

Ellis, W. D., *A Source Book of Gestalt Psychology*, 1938.

Haldane, J. S., *Mechanism, Life and Personality*, 1913.

von Helmholtz, H. L. F., *Treatise on Physiological Optics* (English translation in 3 volumes), 1925. (First published, 1866.) [Page references are to the English edition.]

Hering, E., *Zur Lehre vom Lichtsinne*, 1874.

„ 'Der Raumsinn und die Bewegung des Auges,' *Handbuch der Physiologie*, 1879.

„ *Grundzüge der Lehre vom Lichtsinn*, 1920.

Katz, D., *The World of Colour* (English translation), 1935. (First published, 1911.)

„ *Der Aufbau der Tastwelt*, 1925.

Koffka, K., 'Perception, an introduction to the Gestalt-Theorie,' Psychological Bulletin, XIX., 1922.

„ *Principles of Gestalt Psychology*, 1935.

Köhler, W., 'Über unbemerkte Empfindungen und Urteilstäuschungen,' *Zeitschr. f. Psychol.*, LXVI., 1913.

„ *Physische Gestalten in Ruhe und im stationären Zustand*, 1920.

„ 'Zur Theorie der stroboskopischen Bewegung,' *Psychol. Forsch.*, III., 1923.

„ 'An Aspect of Gestalt Psychology,' *Psychologies of* 1925, 1926.

„ *Gestalt Psychology*, 1929.

Lewin, K., *Principles of Topological Psychology*, 1936.

Petermann, B., *The Gestalt Theory and the Problem of Configuration*, 1932.

von Restorff, H., 'Über die Wirkung von Bereichsbildung im Spurenfeld,' *Psychol. Forsch.*, XVIII., 1933.

Rubin, E., *Visuell wahrgenommene Figuren* (German translation), 1921. (First published, 1915.)

Scholz, W., 'Experimentelle Untersuchungen über die phänomenale Grösse von Raumstrecken, die durch Sukzessiv-Darbeitung zweier Reize begrenzt werden,' *Psychol. Forsch.*, V., 1924.

Smuts, J. C., *Holism and Evolution*, 1926.

Stout, G. F., *Manual of Psychology*, First edition, 1898; Third edition, 1913; Fourth edition (revised by Mace), 1932.

Thouless, R. H., 'Phenomenal Regression to the "Real" Object' (I. and II.), *Brit. Jour. of Psych.*, XXI., 1931.

Watson, J. B., *Psychology from the Standpoint of a Behaviourist*, 1919.

Wertheimer, M., 'Experimentelle Studien über das Sehen von Bewegungen,' *Zeitsch. f. Psychol.*, XLI., 1912.

„ *Über Schlussprozesse im productiven Denken*, 1920.

Zeigarnik, B., 'Über das Behalten von erledigten und unerledigten Handlungen,' *Psychol. Forsch.*, IX., 1927.

SUPPLEMENTARY NOTE BY G. F. STOUT.

My purpose in this note is to add to Dr. Thouless' excellent account of the Gestalt Psychology some indication of my own relation to it. I accept fully and unreservedly the fundamental principle that the factors determining mental process operate within a field and that the way in which they operate depends on and varies with variable field-conditions. But, though I accept the general principle, there are important respects in which I differ from the way in which the Gestalt Psychologists use it and the consequences which they deduce from it. I shall here refer to two main points on which I am not satisfied with their psychology of sense-perception.

(1) Their almost complete denial of the part played by past experience in perceptual process;

(2) Their neglect of the difference between sensation and perception or, more precisely, between what I call sensible appearance and perceptual appearance.

(1) The old association psychology used only one main key to all the problems of perception—the revival of past sensation as a supplement to present sensation. They did so because they started from an assumption which excluded the possibility of any other procedure. Starting from a multiplicity of separate and independent sensations they could account for our present complex perceptions only by a process through which the separate sensations come to cohere with each other with more or less intimacy according as similar sensations have been more or less constantly conjoined with each other in past experience. In this way, for instance, Berkeley and his successors—Hume, the Mills, and Bain—attempted to account for our present visual perception of the real distance, size, and shape of bodies as the result of the uniform conjunction and covariation of certain features of visual and tactual experience.

By introducing the conception of a perceptual field[1] the Gestalt Psychologists destroyed the theoretical basis of the old associationism and opened out new and very fruitful lines of research. But it seems to me that they have thrown out the baby with the bath-water. The bath-water is associationism; the baby is the use of empirical explanation in the psychology of perception. The second is not dependent on the first. There is no reason why the results of past experience should not operate within a perceptual field in ways determined by variable field-conditions. Yet I find in such writers as Koffka hardly any recognition of this possibility and no serious attempt to work it out for all that it is worth. On the contrary they in general treat the field-theory and empirical explanation as if they were mutually exclusive alternatives. Not content with showing that there is much which the empirical factor cannot account for and that it has often been wrongly used, they seem bent on banishing it entirely or almost entirely. They are never tired of arguing against the possibility of empirical explanation and they sometimes seem to proceed on the principle that any stick is good enough to beat a dog with. Take, for instance, the visual perception of the real relative size of bodies at different distances from the eye. They urge that this is present at so early a stage in the life history of children and animals that it cannot possibly be due to the lessons of experience. But the assumption that the empirical factor must work too slowly is quite arbitrary. On the contrary, there are good reasons for expecting the process to be very rapid. If the inheritance of acquired aptitudes is admissible at all, it ought to be operative in this case. But setting aside this possibility as too controversial we must at least take into account natural selection as favouring in a drastic way those individuals who learned their lesson rapidly. Apart from such biological considerations it may be fairly urged that the individual has from the outset the strongest practical motives and also the constantly present opportunity for learning to perceive by sight the real relative size of objects.

[1] This was anticipated in a way of his own by James Ward in his doctrine of a presentational continuum.

It is a pursuit of continual and absorbing interest. So far from finding it strange that a chimpanzee has acquired this perception in three months I should not be surprised if it made considerable progress in three days or even three hours. It may be objected that a chimpanzee is not intelligent enough for this. I reply that what is required is not ideational but *perceptual* intelligence, and this is possessed by animals in a high degree.

I may add that the advocates of the empirical explanation appeal for support to cases of operation for congenital cataract. Has this alleged evidence been adequately examined by the Gestalt Psychologists ?

(2) " It is clear," says Dr. Thouless, " that if the argument of the Gestalt psychologists is accepted we cannot make a sharp distinction between sensation and perception . . . Instead of sensations determined by local stimuli and perceptions determined by the interaction of judgment and experience with sense stimuli, we have only the difference between perception [= sensation] under simple and under complex field-conditions respectively." I admit that the Gestalt psychologists are right in rejecting the distinction in the form in which it is here stated; for in this form the basis for it is removed when associationism is rejected. But it may be understood in a fundamentally different way which is quite independent of associationism and consistent with the doctrine of a perceptual field. So understood the distinction is, I maintain, undeniable and of primary importance both for theory of knowledge and for psychology. Its nature will be best explained and its existence established by considering examples of it. Consider first the perception of motion as it occurs under the conditions of Wertheimer's experiments. " If two points are successively illuminated at certain speeds of succession (about 0·6 seconds) an appearance of movement is created as definite as that obtained from the actual movement of objects " (Thouless). I hold that this statement is essentially ambiguous. " Appearance of movement " has two distinct meanings which it fails to distinguish. It fails to distinguish between what I call perceptual appearance and what I call sensible appearance. The perceptual appearance

consists in the fact that there *seems* to be an objective movement of a single physical object. What thus seems to exist may or may not really exist. When, as in the present instance, it does not, the perception is said to be illusory. It need not even be believed to exist, when there is independent reason for doubt or disbelief. None the less perceptual appearance in general involves at least a tendency to believe, which issues in full belief if it is not counteracted by other conditions. In this instance, it would be counteracted by the knowledge, otherwise acquired, that there are in reality only two stationary points. Even when we are forearmed with this knowledge we may in the moment of perception find it hard to believe that the seeming objective movement is not actually taking place.[1]

What constitutes perceptual appearance is that something seems to the percipient to exist objectively, which may or may not really exist, and which may not even be believed to exist. The sensible appearance, on the contrary, is not a seeming at all. Neither is it anything which may seem to exist without in fact existing. It is actually experienced and therefore must actually exist. In Wertheimer's experiments the sensible appearance of motion is not indeed a physical or 'objective' motion. None the less, it is an actual motion occurring within the extensive field of visual sensation. This is shown by the fact that it is unaffected by the knowledge that there are objectively two stationary illuminated points where these seem to be a single moving point. On the other hand the perceptual appearance is not unaffected by knowledge of the objective fact. With such knowledge seeing is no longer believing. What would otherwise be an illusory belief is transformed into a suppressed tendency to believe.

The sensible appearance is itself an actual sensation. But it is also an appearance of something other than itself. It is

[1] To avoid misunderstanding I have spoken of belief rather than of judgment. But I consider it quite admissable to say that perceptual appearance involves either judgment or, at least, suggested judgment. But if we use this language, we must remember that we are concerned not with reflective judgments about what we perceive, but with judgments which belong to the process of perception itself. Such perceptual judgments differ in important ways from judgments of reflection.

an appearance of what seems to the percipient to be a physical object. It is so because of the part it plays in determining the perceptual seeming. It need not be, and rarely is, the sole condition on which the perceptual seeming depends. But in the absence of other conditions what is or seems to be a physical object is perceived as having the same nature as its sensible appearance. In Wertheimer's experiments, for instance, the seeming objective movement is a counterpart of the actually experienced movement within the field of visual sensation. Now if this were so in all sense-perception, it might reasonably be contended that the distinction between sensible and perceptual appearance, even if it is valid, is unimportant for psychology. If they always coincided with each other, it would be useless in tracing the course of mental life to discriminate between them. I reply that such strict parallelism is far from being universally present. In what follows I shall try to show by examples that the perceptual appearance by no means wholly depends on the sensible appearance.

The perceptual appearance may be present when the sensible appearance is absent. What I take to be an example of this is discussed by Koffka,[1] though he attempts a different explanation. When I see a book lying on a table, the surface of the table seems to me to stretch under the book, and the underside of the book to be in direct contact with the top of the table, but distinct from it. As Koffka puts it: "The book on the table does not destroy the unity of the top of the table which is clearly behind it . . . My book is red, the top of the table is black. I see the red book on the table, and yet when I see the book I see no black colour, although at the same time I do not see the table as broken." The book is not seen as a projecting part of the table; both book and table are seen as complete objects, including the parts of each which are hidden from the eye. My explanation is that though there is no sensible appearance either of the top of the table where the book covers it or of the under-surface of the book, there is a perceptual appearance of both, dependent on other

[1] Principles of Gestalt Psychology, pp. 178 sq.

field conditions. Among these field conditions I should include the empirical factor. If it is not the sole condition, it is at any rate important. We see the book not as part of the table but as something distinct from it and lying upon it because we have in past experience found these and similar objects to be loose and separate from each other. We have, for instance, lifted books from tables, put them down on tables, and moved them about on tables.

What alternative explanation is possible? Koffka attempts one. As I understand him, he asserts that there is a sensible appearance both of the underside of the book, and of the part of the table's surface which it covers. But these sensible appearances are both colourless, and this according to him removes all difficulty which might otherwise be felt. He produces no direct evidence of the existence of such colourless vision[1] and it is permissible to doubt or deny its possibility. But whether possible or not it is in this instance irrelevant. For what I perceive as stretching under the book is not a colourless surface but the *black* surface of the table. If on lifting the book I found the part of the table which it previously covered to be green and not black, I should be perceptually surprised, as I am when I remove a picture from its place on a wall where it has been hanging for a long time.

Whenever one thing is perceived as being behind another, then setting aside cases of transparency as possible exceptions,[2] the perceptual appearance is present without any corresponding sensible appearance. This holds for all perception of things as having insides. When, for instance, I see a billiard ball or grasp it in my hand there is a sensible appearance only of its surface or part of its surface. There is none of the inside which its surface includes. If I try to picture mentally what is inside, I can obtain only images of surfaces. If the ball is broken up into small fragments, it is still only the surfaces of these fragments which sensibly appear, not what is inside

[1] He refers to the fact, which I do not dispute, that we may see motion without seeing anything that moves. But this is unconvincing. For the motion is perceived as a change within a field of colour sensation.

[2] I do not think that they really do constitute an exception.

them. To prevent misunderstanding I must add that I do not hold that the perception of things as having insides can be accounted for by the empirical factor. It cannot be accounted for at all by associationism.

If the perceptual appearance can exist without the sensible, it is not surprising that when both are present they may vary independently of each other. When I touch the table in front of me with my hand, I am perceptually aware of two distinct and separate objects in relation to each other, the surface of the table and the surface of my hand as in contact with it. Yet there is only one complex tactual sensation constituting the sensible appearance. No doubt the two perceptual appearances are connected with different abstract characters of this complex sensation. But these different characters are not separate sensations, whereas we are perceptually aware of two separate objects, the hand as touching and the table as touched by it. Other instances of the same phenomenon are to be found in indirect touch, as when in writing I perceive through the same tactual sensation both the pen-holder in my hand and the paper with which the pen point is in contact. It is through such indirect contact that the blind man can feel his way with a stick.

Turning from touch to sight we find something analogous. When I look through a window-pane at the opposite side of the street, then, apart from any reflective judgment, the house opposite looks as big as a house really is, whereas the space enclosed within the frame of the pane looks very much smaller. Yet the sensible appearance is the same for both. The same holds for all cases in which we look through a relatively narrow aperture in such a way that the boundary of our peep-hole is visible as well as what we see through it. In asserting this I am not relying on physiological considerations. I should say the same if I did not know at all even that I had a retina.

Where sensible appearance is the same, perceptual seeming may be different. The converse is also true. There may be different sensible appearances without any corresponding or proportionate difference in the objects as they seem to the percipient to exist in the moment of perception. I find a

very important illustration of this in the seeming relative sizes of objects seen at different distances from the eye. Within certain limits of distance the objects seem to be, roughly speaking, the size they really are. Since the time of Berkeley, it has been a much debated question why they do not seem to be of the same relative size as the corresponding retinal images. The Gestalt psychologists find the reason in field conditions other than the stimulation of the retina. So far I agree. But I cannot follow them in their account either of the way in which these field conditions operate or of what they are. As I understand them, what they assert is that the sensible appearances themselves are enlarged in proportion to the distance of the thing seen from the eye. By every test which I can apply I find that is not true. It is mainly, if not wholly, the perceptual appearance which is affected. The book in my hand seems very much smaller than the book-case facing me at the other side of the room. It seems small enough to find its place on one of the shelves. If now I hold the book in such a way that its sensible appearance is immediately juxtaposed to that of the book-case, the sensible appearance of the book is found to be actually the larger of the two. Yet there is no appreciable increase or decrease in the size of either sensible appearance as compared with what they were before making the experiment. There is certainly none great enough to account for the facts. When we thus succeed in fixing attention not, as in ordinary vision, on things seen, but on their sensible appearances as such, this unusual direction of interest frequently, though not necessarily, makes a difference to perceptual appearance. Objects seem or tend to seem of the same relative size as their sensible appearances. Thus in my experiment, the book may seem to be objectively bigger than the book-case rather than very much smaller as in ordinary vision. But under the conditions of this and similar experiments, there is no change or comparatively little change in the size of the sensible appearance.

I cannot avoid the inference that in ordinary vision of objects at different distances the sensible appearance so far from being identical with the perceptual seeming, does not even approximately correspond to it. The reason must be

sought in field conditions other than the stimulation of the retina. Such conditions may in some degree make a difference to the sensible appearance. But in the case we are considering they mainly affect the perceptual seeming. And I see no way of adequately accounting for this unless we recognise as a very important factor the effect of previous experience in which we have dealt practically with objects at close quarters, and manipulated them under the guidance of sight and touch.

It is quite otherwise with the piece of paper in the green wood which looks white although it is illuminated by green light. For in this case it is futile to say that though the paper seems to be white its sensible appearance is green. However much I examine the actual sensation itself, it is unmistakably white and not green. This holds for many similar phenomena which Helmholtz explains as due to judgment.

INDEX.

ACQUIRED characters, hereditary transmission of, in relation to spatial perception, 475 ff.
Activity-factor, in perception, 408
Active and passive touch, 457 ff.
— sight, 477
Activity, theoretical and practical, in relation to attention, 157, 158
— ideal, obstruction of, 518 ff.
— as condition of belief, 603
— theoretical, relation of, to practical, 604
— as restricted by belief, 604
— bodily, and volition, 641 ff.
Affection, relation of, to conation, 106, 117
Affective attitude, 106 ff.
— subjective state of, 107
— always part of total consciousness, 110
— how distinguished from conative attitude, 112 ff.
Affective states, graduated between pure pleasure and pure pain, 108 ff.
Affective tone, of sensation, 377 ff., 381 ff.
— factors contributing to determine, 388
— of sensation and conative tendency, 391 ff.
— of sensation, on the physiological side, 393 ff.
— theory connecting, with wear and repair of nervous tissue, 392, 402
— of attention, 397 ff.
Affective tone of revived motor process, 400 ff.
— due to pre-formed associations, 402 ff.
— of special sensations, 381 ff.
— in relation to their intensity, 381 ff.
— in relation to their duration, 383 ff.
— in relation to their quality, 384
— as due to surplus excitation, 385
— qualitative diversity of, 387
— diffused effects produced by, 387
Affective values, relativity of, 107
After-image, negative, 280 ff.
— and contrast effect, 281
— positive, 282 ff.
— distinguished from primary memory-image, 134
Alphabet, oral and manual, 553
— oral, discovery of, 554
Analysis, conceptual, 530
— development of, through comparison, 535
Analytic Psychology, author's, quoted, 50, 144, 225, 226, 497, 514, 541, 650, 652
Anaximenes, his view of the soul, 598
" Animal spirits," doctrine of, 599
Animals, interpretation of signs of mental states of, 50
— fallacy of false analogy between mind of, and human mind, 51
— sense of smell in, 267
— examples of instinctive behaviour in, 328 ff.

Animals, examples of primary retentiveness in, 312 ff.
— evidence against existence of free ideas in, 316
— learning by imitation in, 317 ff.
— explicit ideas in, 324
— impulse in, 325
— imitative impulse in, 359
— distinction of separate things by, 429
— congenital predispositions in, 475
— comparison in, 534 ff.
— constructions of unaffected by human environment, 578, 579
— character in, 653
Anthropology, value of, to the psychologist, 37
Apartness, perception of, 128 ff.
— in epicritic sensibility, 250
— as dependent on motor sensations, 251 ff.
Apperception, as involved in all attentive perception, 178
— instances of, 178, 179
— character of, 179
Appetitive process, its tendency towards an end, 201
Apprehension, act of, distinguished from object apprehended, 101
— implicit, 162
Arborescence, 65
Articulate speech, unity of composition of, 554; *see* Language
Association, experiments on, 57
— of ideas, parallel to neural connections, 81 ff.
— and reproduction, 198 ff.
— work of, in reproducing mental image, 198
— motor, 221 ff.
— feeling-tone due to, 402
— of ideas, 504 ff.
— basis of connection by, 504; *see* Ideas
Associations, casual, of savages, 610
Atomism, 660
Attention, Bk. I., Ch. III.
— conditions of, 167
— division of, in introspection, 42 ff.
— effects of, 179
— place of, in formation of neural habits, 84
— general nature of, 160 ff.
— as conation, 157
— in relation to practical activity, 158
— and motor activity, 215 ff.
— distinction between, and inattention, 161 ff.
— as distinguished from separate discernment, 161, 167
— in relation to stimulus, 167 ff.
— faint and evanescent, 172 ff.
— to displeasing objects, 173 ff.
— unity and continuity of, 176 ff.
— divided, 177
— as tendency to develop object, 177
— order and distinctness introduced into object by, 183
— discovery of unity inherent in its object by, 186
— expectant or prospective, 308, 345, 399, 415
— modes of fixing, 212 ff.
— experiments on "span" of, 194
— facilitation as due to, 190
— selective, in instinct, 344
— when instinctive, 346 ff.
— in perceptual process, 307 ff.
— imitation as form of, 357
— affective tone of, 397 ff.
— part played by continuity of, in estimating lapse of time, 500
— relation of ideas and images to, 144 ff.
— increased, as cause of improvement of memory, 527 ff.
— voluntary, distinguished from involuntary attention, 650

Attention, spontaneous or non-voluntary, 650-2
Attributes, unity of, in the same subject, 416 ff.
Axons, 64

BACON, F., on the "sensible" soul, 599
Bain, on tendency of ideal movement to pass into actual movement, 543
— on relation of belief to activity, 603
Baldwin, M., on projective and ejective phases of imitation, 585 ff.
Barrie, Sir J. M., map of a child's mind, 35
Beats, and dissonance, 292 ff.
Bechterew, 665, 670
Behaviourism, 5, 31, 665
Belief, 103 ff.
— doubt as belonging to the attitude of, 104
— and free imagination, Bk. IV., Ch. VII.
— general distinctions of, and free imagination, 600, 601
— distinction between conditions of, and imagination, 601 ff.
— objective control of subjective activity by, 601 ff.
— relation of, to practical activity, 602
— and disbelief, 603, 604
— general conditions of, 603 ff.
— as conditioned by mental activity, 603
— as involving restriction of mental activity, 604, 605
— relative importance of subjective and objective factors in, 605 ff.
— features of primitive, 606, 610 ff.; *see* Savages
— psychological character of distinction between subjective and objective characters of, 606, 607
Belief, influence of the social factor in, 609 ff.
— attitude of, in revival of feeling-tone, 617, 618 ff.
— as influencing voluntary action, 642, 643
Berkeley, his theory of spatia perception, 485 ff.
— referred to, 430, 467
Bethe, A., referred to, 267
Biological view of instinct, 331 ff.
Blackness, sensation of, how conditioned, 283
Blind, spatial perception of the, 459 ff.
— combination of synthetic and analytic touch in the, 460 ff.
— analytic exploration of the, 461 ff.
— -spot, 271
Body, awareness of, 432
— the, as spatial centre, 433
— the, as related to feeling, 435
— spatial presentation of the, by means of skin sensation, 471
— perception of the, as solid, an aid to tri-dimensional perception, 474
— and mind, Introd., Ch. III.
— knowledge of, 18, 432 ff.
— scientific hypotheses about relation of, 77
— and will, 435
— -complex, 433
Bow-wow theory of language, 555
Brain, the, as subject of consciousness, 17 ff.
— relation of, to the mind, 17
Bridgman, Laura, case of, 37
Broad, C. D., 29 (note), 71, 78 (note)
Brown, Thomas, on divergent associations, 511
Buddhism, 660

CARPENTER, W., quoted, 168
Categories, 414; *see* Spatial Unity, etc.
Causality, category of, 420
— and customary repetition, 420

Causality for perceptual thought, 421
— relation of, to distinction between sensible appearance and external reality, 439 ff.
— as ideal construction, 568 ff.
Cells, description of, 62
Cerebral process, connection with psychical process, 72 ff., 666
Cerebrum, control of lower centres by, 68 ff.
Change-experience, immediate, 497
Change-sensations, 132
Character, freedom of will determined by, 652, 653
Children, interperation of manifestations of mental states of, 50
— natural signs in, 548
— co-operative ideal construction in, 576 ff.
— acquisition of knowledge by, by means of language, 576, 577
— educational influence of imitation on, 577 ff.
— development of the idea of self in, 586
— as creatures of impulse, 649
Choice, contingent, meaning of, 653
Cleland, on the structure of the eye, 270
Clouston, Dr., on failure of self-control, 648
Coenaesthesis, 244
Cognition, relation of, to conation, 117, 218
Cold-spots, 246
Colour-blindness, total, and dark adaptation, 274
— partial, 276
— partial, alternative explanations of, 276
— types of, 276
Colour constancy, 656, 657, 681
Colour-tone, 269
— differences of, 272
Colour-tones, graduation of series of, 272
Colour-wheel, use of, for mixing lights, 279
Colouring, as secondary condition of visual perception, 483, 484
Colours, degree of saturation of, 269
— differences in intensity and saturation of, 273
— complementary, 278
— primary, 279
— effects of contrast on, 279 ff.
Comparison, Bk. IV., Ch. III.
— at the perceptual level, 311
— deliberate, 533, 535
— in animals, 533, 534
— in animals, experiment testing, 391 ff.
— as involving free ideas, 534
— theoretical or practical end subserved by, 535
— development of conceptual analysis through, 535
— dependence of, on language, 535, 536
— analytic, process of, as determining laws of nature, 570
Complication, form of implicit revival, 205 ff.
— example of, from differences in quality of sounds, 206
— illustration of, from qualification of sight by touch, 207
— of touch by sight, 207
— due to connection of motor, tactual, and visual sensations, 259
— in perceptual process, 323
— in visual and tactual perception, 487
Conation, definition of, 112
— conditions of satisfaction of, 114, 115
— end of, as indeterminate, 114
— nature of, as conditioning habit, 226
— satisfaction of, in relation to pleasure and pain, 392
— relation of, to cognition, 117, 218

Conation, practical, Bk. I., Ch. V.
Conative attitude, 112 ff.
— how distinguishable from affective states, 112 ff.
— how connected with the active side of our being, 115 ff.
Conative process, use of the word "end" in, 113
— "end" as object of, 114
— ascending levels of, 217 ff.
Conative tendency, conditions of, 114 ff.
— modifications of, 227
— primary, secondary, 232
— relation of, to affective tone, 391
— unities, 661
Conception, Bk. IV., Ch. III.
Concepts, words as expressing, 539
Conceptual process, higher form of ideational process—analysis and synthesis, 529, 530
— language as instrument of, 537 ff.
— as dependent on language, 539
— illustration of, from a sentence, 539
— thinking, natural signs as instruments of, 550
Conscious agency, affirmed by parallelism, 94
— distinctive functions of, on the parallelistic hypothesis, 94 ff.
— failure and success in relation to, 116
Consciousness, 14 ff.
— unity of, 13
— unity of, involved in recognition, 13
— unity of, different from unity of material things, 13
— modes of, their relation to the mind, 15
— unconscious factors connected with, 24
— in the hypothesis of parallelism, 87
— unity of, physiological counterpart of, 78, 79
Consciousness, total never entirely free from affective tone, 110
— field of, and attention, 161 ff.
— vague background of, brought into full attention, 163
— distinct, as determined by nature of stimulus, 168 ff.
— not-yet and no-more, 498, 499
Consentience, absence of, in mental revival, 135
Constancy hypothesis, 657
Contact-sensations, interval between, 255
Contiguity, law of, 505
— law of, and continuity of interest, 506
— law of, and immediate succession, 506, 507
— law of, and improvement of memory, 527
Continuity of attention, 176 ff.
— of interest, 154 ff., 506
Contrast effect, in light-sensation, 279 ff.
Cortex, description of, 68 ff.
— direct connection between conscious process and, 72
— control of lower centres by, 69
— synthetic function of, 69
— sensory areas of, 73
— motor areas of, 74
— other areas of, 75
Couch, Sir A. Quiller-, illustration of supposal and belief from, 104, 105
Craving, nature of, 384
Cushing, Dr., experiment of, on cortical areas, 74, 75
Cutaneous sensations, 245 ff.
— experiments in localisation of, 246 ff.
— protopathic, 248

DARK-ADAPTATION, 274 ff.
Darwin, on instinct, 329, 332 ff., 334, 353
— examples from, 314
Deaf-mutes, spontaneous origin of natural language in, 547 ff.

Decision; *see* Voluntary Decision
Deliberation, contrasted with impulse, 325 ff.
— origin of, 631
— general point of view in, 631, 632
— process of, as conflict of motives, 632
— as state of unstable equilibrium, 634
— decision taking place after imperfect, 636, 637
— voluntary attention in complex forms of, 652
Dendrons, 64
Descartes, his doctrine of the material soul, 599
— referred to, 365
Determinists, 653
Difference-threshold, in Weber's law, 299
Differentiation of sense-experience, 236 ff.
Ding-dong theory of origin of language, 556
— theory of origin of language, reducible to theory of imitative gesture, 556, 557
Directions, perception of, part played by sight and touch in, 479 ff.
— distinction between, primarily tactual, 481
Disagreeable objects, attention to, as test of frivolous or serious character, 175
Discernment, threshold of, in Weber's law, 299
Disparateness, between points of the two retinas, 489
Dispositions, 20 ff., 187 ff.
— complex, nascent excitement of, as determining direction of thought, 152 ff.
— cumulative, 193
— cumulative, illustrated from rhythmic repetition, 194
— cumulative, illustrated from rhythm of verse, 195
Dispositions, cumulative, illustrated from music, 195
— cumulative, in connection with active movement, 196
— cumulative, re-excitement of, 198 ff.
— congenital, for spatial perception, 475 ff.
— interpenetration of, as condition of improvement of memory, 528; *see* Mental, Physiological, Psychophysical dispositions
Dissonance, 292 ff.
Divergent recall, 509
— associations, 511 ff.
" Double," among savages, 613
Doubt, as belonging to the attitude of belief, 104
Dreams and hallucinations, 11, 446 ff.
— as hallucinations, 447
— as assuming the character of illusions, 448
— and hallucinations, influence of, on savages, 595, 596
Duncker, 669, 670
Duration; *see* Protensity

EBBINGHAUS, Professor, experiments of, on association, 505, 506
— on decay of memory, 525, 526, 669
Ehrenfels, 659, 661, 670
Ejective stage of imitation, 585 ff.
Ellis, on dreams of savages, 598
— on savage worship, 614
Emotion, Bk. III., Ch. IV.
— general characteristics of, 362 ff.
— varied nature of conditions arousing, 363
— sources of, 363 ff.
— distinguished from emotional mood and organic changes, 364
— parasitical character of, 365
— and organic sensations, 365 ff., 369 ff.

Emotion, James's general theory of, as organic sensation, 365 ff.
— relation of, to pleasure-pain and conation, 403 ff.
— ultimate qualitative differences of, 371
— distinguished from emotional disposition, 375 ff.
— imitation of, as language, 546
— in ideational process, 625
— distinction between, and sentiment, 625, 626
Emotional disposition, sentiment as a complex, 627
— distinguished from emotional moods, 363 ff.
— tendency of, to persist, 364
— and past and present selves, 591
End, use of the word, in conative process, 113
— as end-state, 114
— as object of conative consciousness, 113
Energy, law of conservation of, and parallelism, 87
— law of conservation of, and interaction, 88 ff.
Epicritic sensibility, 248 ff., 251 (note)
— not sufficient for perception of spatial order, 454
Epiphenomenalism, doctrine of, in the parallelistic hypothesis, 93
Ethics and freedom of the will, 654
Experience; *see* Learning by experience
Experiment, scientific, as method in psychology, 35, 53 ff.
Experimental method, nature of, 53 ff.
— drawbacks of, 57
Extension, difference between, and extensity, 127
— extensity with acquired meaning as, 458
— visual, intimate correlation of, with tactual extension, 486
Extensity, as general character of sensations, 127 ff.
Extensity, difference between, and extension, 127
— protopathic, 249
— connection of, with apprehension of spatial order, 452
— as continuous repetition of local sign difference, 453
— combination of, with motor sensations, in giving apprehension of spatial order, 471 ff., 467
External object, meaning of, 404
External objects, distinction of, from their sensible appearances, 436 ff.
— conditions of apprehension of co-existence of parts of, 468
— in connection with motor activity, 438 ff.
External world, growth of perception of, Bk. III., Part II.
— characteristics of, 404
— psychological problem of, 407ff.
— ultimate principles of unity of, 411 ff.
— development of knowledge of, through breaking up and recombination of sense-data, 413
— rudimentary awareness of unity of, 413
— spatial unity of, 414 ff.
— apprehension of, as tridimensional, 414 ff.
— temporal unity of, 415 ff.
— relation of subject and attribute in, 416 ff.
— causal unity of, 420 ff.
— fundamental problems in development of perception of, 427 ff.
— as ideal construction, Bk. IV., Ch. V.; *see* Ideal construction
Eye, stages in development of, 238 ff.
— facetted eye of insects and crustacea, 240, 241
— structure of the, 270 ff.

FACILITATION, 189 ff.
— as due to attention, 190
— experimental illustrations of, 191
Fear caused by suddenness or intensity of an impression, 373
— caused by unfamiliarity of an impression, 373
— and anger, conditions of, 372 ff.
Fechner, his explanation of Weber's Law; *see* Weber's Law
Feeling attitude, 106 ff.; *see* Affective attitude
— tone, of sensation; *see* Affective tone
— of ideas, Bk. IV., Ch. IX.
— revived conditions of, 615 ff.
— imagination and belief in revival of, 617
— of ideational activity, 618 ff.
Ferrier, on alphabetical sounds, 554
Figure-ground articulation, 656
Fixation, movements of, 212
Fixed ideas, 644 ff.
— when opposed to volition, 644
— in pathological cases, 645 ff.
— under normal conditions, 646 ff.
Form, perception of, 132
Foster, M., experiments on a frog, 66-7
— on result of direct stimulation of nerve fibres, 238
— on odorous sensations, 266
— on noises and musical sounds, 289, 290
— on pitch, 290
— on beats, 292
— on dissonance, 293
— examples from, of difference-threshold, or threshold of discernment, 300
Fovea centralis, 271, 274, 477, 488
Fraser, Dr. J. G., quoted, 594
Free-will, part played by, in forming a decision, 634 ff.
— as consisting in self-control, 652
Frog, experiments on, to illustrate reflex actions, 66-7
Fundamental tone, 294
Future, reference to the, primitive nature of, 415 ff.
— condition of advance in knowledge of the, 416

GESTALT, meaning of, 662 ff.
— Psychology, 45 (note), 133, 655 ff.
Gestalt-qualität, 659, 661
Gesture-language, conventional element in, 551 ff.
Goldscheider, Dr., experiments of, on appreciation of position by means of joint-sensations, 261

HABIT, and automatism, 224 ff.
— examples of, without attention, 225 ff.
— of thought and will, 226
— conditions of formation of, 226
Haldane, J. S., 668, 671
Hall, Stanley, 36 (note)
Halliburton, on nerve impulses, 65
— on heat-spots, 246
Hallucinations, dreams as, 447 ff.
— as assuming in part the character of illusions, 448
Hamlet, illustrations from, 95 ff., 109
Harmonic intervals, 291
Harrower, 669
Hartmann, H., on fear in gorillas, 373
Head, Dr., experiments of, on conditions of cutaneous sensibility, 246 ff.
Hearing, organ of, 289
Heat-spots, 246
" Heavy " contact, localisation of, 247
Hedonic-tone, as generic term for pleasure and displeasure, 111
— and organic welfare, 388 ff.
Hegel, referred to, 516
Helmholtz, 657, 658, 665, 666, 671, 681
— his theory of light-sensation, 284 ff.; *see* Light-sensation.
— his theory of sound-sensation, 296

Heracleitus, his view of the soul, 598
Hering, 659, 666, 671
— his theory of light-sensation, 284; *see* Light-sensation
Hobhouse, on instinct, 338 ff.
— experiments carried out by, 318
Hudson, on fear in birds, 373
Human activities, difference between, and animal activities, 325
— beings, instinct in, 350 ff.
— congenital aptitudes for movements in, 350
— congenital dispositions in, 350
— innate tendencies in, as mark of instinct, 351
Hume, on the principle of union, 442
— on difference in force between impression and image, 136
Hypnotic state, action following volition illustrated from, 643, 644

IDEA and image, distinction and relation of, 134, 148 ff.
Ideal activity, constructive side of, 518 ff.
— obstructions in flow of, 518 ff.
Ideal construction, 513 ff.
— as determined by the predominant interest of the moment of revival, 515 ff.
— ultimate nature of, 517 ff.
— a finding of possibilities, 518
— of external world, Bk. IV., Ch. V.
— motives guiding 561
— theoretical interest as determining, 561, 562
— practical ends as determining, 562
— verification and re-interpretation of, 562
— space as, 564 ff.
— time as, 565 ff.
Ideal, relation of past and future in, 566
— objective time a product of, 567
— causality as, 568 ff.
— determined by practical experiences, 569
— thinghood as, 571
— union of thinghood and causality in, 572
— from mechanical point of view, 572 ff.
— in savages, 574 ff., 610 ff.
— as a co-operative process, 576 ff.
— social factor in, 579
— co-operative, individual acquiescence in, 579, 581
— co-operative, in primitive communities, 580
— revival, motor element in, 541 ff.
Ideas, tied or implicit, 204
— explicit, 205
— trains of free, 210
— trains of free, and perceptual process, 306 ff.
— explicit, accompanying perceptual process, 323 ff.
— explicit, but tied, 324
— explicit, in animals, 324
— trains of, Bk. IV., Ch. I.
— association of, 504 ff.
— association of, by contiguity, 505
— association of, continuity of interest as most important condition of, 506
— association of, by reproduction of similars, 507, 508 ff.
— association of, resemblance as condition of, 507 ff.
— association of, modification of ideally revived object in, 513
— conditions on reproductive side, obstructing flow of, 518
— tendency of, to issue in movement, 543 ff., 642

Ideas, tendency of, to issue in movement a mark of primitive development, 544
— issuing in imitative gesture, 545
— feeling-tone of, Bk. IV., Ch. VIII.; *see* Feeling-tone, Ideational activity
Ideation, Bk. IV., Ch. III.
— generalisation involved in, 529, 530
— compared with details of sense-perception, 530
Ideational and conceptual process, Bk. IV., Ch. III.
— process and perceptual process, 387, 529
— representation; *see* Image
— process, reproductive and productive aspects of, 503; *see* Association of Ideas, Ideal construction
— process, determinateness of, due to conceptual synthesis, 532
— activity, feeling-tone of, 618 ff.
— activity, material and formal conditions of feeling-tone of, 618, 619
— activity, obstructed and diminished, distinction between, 622 ff.
Ideo-motor action, 216
— illustrated by thought-reading, 216
— in daily life, 216
Illusion, 446 ff., 659
— with element of hallucination, 447
Image, and idea, distinction and relation of, 134
— verbal, 149
— verbal, as instrument of conceptual thinking, 149
— and impression, characteristic differences of, 135 ff.
— and impression, difference of, in intensity, 136
— and impression, difference of, one kind of, not degree, 137
Image and impression, difference of, in distinctness, 140
— and impression, relation of, to subjective activity, 144
— and impression, relation of, to motor activity, 145
— and impression, relative independence of, 146
— fragmentariness of, 135
— causes of indistinctness of, 142 ff.
— meaning of, 529
— power of control of, 451
— origin of language in motor elements of, 542
Imageless thoughts, 148 ff.
Imagery, mental, experiments on, 57
— mental, ways of fixing attention on, 215
— mental, as means of following continued existence of external objects, 433, 434
— mental, acquired meaning of, 149 ff.
— mental, unsteadiness of, 144
Imagination, place of supposal in, 104 ff.
— free, and belief, Bk. IV., Ch. VII.
— distinction between conditions of, and belief, 601 ff.
— among savages, 603
— in revival of feeling-tone, 617, 623 ff.
— advantage of, as pleasurable activity, 623
— pain due to incoherence in play of, 624
Imitation, Bk. III., Ch. III.
— as means of fixing attention, 214
— at the perceptual level, 311
— deliberate, learning by, in animals, 317
— spontaneous, learning by, in animals, 319
— as form of social tradition, 355
— automatic, kinds of, 356

Imitation as special development of attention, 357
— instinctive, 359
— learning by, 360 ff.
— part played by, in co-operative ideal construction, 577 ff.
— educational influence of, 577 ff.
— importance of, in development of idea of self, 585
Imitative impulse, 356 ff.
Immediate experience, 10 ff.
— modifications of, accompanying excitement of complex dispositions, 151 ff.
— knowledge, 10
Immediate experiences, 6 ff.
— when primarily objective, 7 ff.
Impressional intensity, 139
Impulse, in perceptual process, 325 ff.
— meaning of, 325
— action on, controlled by the total self, 326 ff., 361
— distinguished from voluntary action, 629
Inattention, 161 ff.
Inference, in perceptual consciousness, 320
Inhibition, 191
Innervation, sense of, 74
— reasons for denying existence of, 258 ff.
Instinct, Bk. III., Ch. II.
— examples of, connected with procuring of food, 328 ff.
— examples of, connected with defence, 330
— examples of, connected with care of offspring, 330 ff.
— purely biological view of, 331 ff.
— as form of vital adaptation, 333 ff.
— congenital variations in, 334
— psychological factor in, 334 ff.
— distinguished from reflex action, 335 ff.
— attentive consciousness involved in, 336
Instinct, persistency with varied effort as mark of, 337
— learning by experience as mark of, 338, 351
— original intelligence shown in, 344 ff.
— blindness of, 342 ff.
— intelligent character of, not wholly due to prior experience, 343
— as a psychical fact, 346 ff.
— in human beings, 350 ff.
— connate interest as mark of, 351
— wide and narrow application of the term, 351 ff.
Instinctive activities, specialisation of, 347
— whether originally unintelligent, 340 ff.
— influence of previous experience on, 340 ff.
— rudimentary conation in, 347 ff.
— imitation, 358 ff.
Intensity, as character of sensations, 127
— of sensation, and affective tone, 381 ff.
Intensive magnitudes, measurement of, 60 ff.
Interaction, hypothesis, of, 85 ff.
— and conservation of energy, 87
— metaphysical argument against, 89, 90
— bearing of, on psychological procedure, 91 ff.
Internal perception, 433
Interest, place of, in forming neural habits, 83 ff.
— meaning of, 106
— dispositional, as determining distinct consciousness, 167 ff.
— general direction of, facilitation due to, 190 ff.
— when instinctive, 347
Introspection, in pre-scientific psychology, 34 ff.
— systematic, 37
— definition of, 37 ff.
— three stages of, 38 ff.

Introspection, obscurities and fallacies of, 39 ff.
— difficulties of, 39 ff.
— necessity of co-operation in, 43
— as applied to sense-experience, 44
Involuntary action, 644 ff.
— as caused by inability to restrain reflex movement, 644
— caused by intensity of ideal representation, 644, 645
— following on idea fixed through intense organic craving, 646ff.
— caused by deficiency of self-control, 648; *see* Fixed ideas
Involuntary attention, 650
Isomorphism, theory of, 664 ff.

JAMES, W., illustration of parallelism from, 95
— on dominance of the thought of an action, 216
— on the place of images in mental life, 155
— on interval between contact-sensations, 255
— on joint-rotation, 263
— on intelligence in instinct, 340
— general theory of emotion advocated by, 365 ff.
— criticism of his theory of emotion, 366 ff.
— example of fear in animals from, 373
— on retinal impressions, 482, 483
— on meaning of present time, 498
— on imagelesss thought, 156
— on visualising, 137
— on competition of associations, 512, 513
— on improvement of memory, 527
— on hard cases of volition, 639
— his view of hard cases of volition criticised, 639 ff.
— on passage of volition into movement, 642
— on passing of ideas into action, 642, 643
— on failure of self-control, 648
Johnson, W. E., 79 (note), 125 (note)
Joints, sensitiveness to movement at, conditions of, 259
— motion-sensations of, 260 ff.
— structure of, 262
Joint-sensations, 263
— experiments proving importance of, 261 ff.
— meaning of, apart from association, 260, 263
Judgment, and supposal, 103 ff.

KANT, his "proof" of principle of causality, 440 (note)
Katz, 656, 657, 660, 671
Keller, Helen, case of, 37
Kinaesthetic sensations; *see* Motor sensations
Kingsley, M. H., quoted, 545 (note)
— referred to, 549
Koffka, K., 219 (note), 655, 661, 670, 671, 674, 677
Köhler, W., 45 (note), 655, 657, 660, 662, 663, 665 ff., 668, 669, 671
Kruse, on natural language in deaf-mutes, 547

LADD, on surplus excitation, 385
— on differences in affective tone, 387
— on dream-experiences, 448
Lamb, Charles, referred to, 174
— quoted, 570
Language, and conception, Bk. IV., Ch. IV.
— as an instrument of conceptual analysis and synthesis, 537 ff.
— as means of communication, 537 ff.
— origin of, 540
— origin of, in motor constituents of mental images, 542, 543
— natural signs as fulfilling function of, 545 ff.; *see* Natural signs
— imitation of emotion as, 546

Language, origin of conventional, 547, 553 ff.
— other theories of, 555 ff.
— conventional, advantages of, 557 ff.
— social intercourse by means of, 576 ff.
Learning by experience, 115
— as mark of instinct, 338, 341, 349
— intelligence in instinct not wholly due to, 340
— at the perceptual level, 314 ff.
— relation of, to motor associations, 320 ff.
— revival of acquired meaning in, 322
— relation to, of learning by imitation, 360 ff.
Lehmann, A., referred to, 382 (footnote)
Lewin, 664, 669, 671
Libertarians, hypothesis of, 634
— hypothesis of, James's arguments in favour of, 639
— relation of, to determinists, 652 ff.
Light and shade, distribution of, as secondary condition of visual perception, 483
Lights, of different wave-lengths, effects of mixture of, 277 ff.
— methods of mixing, 279
Light-sensation, Bk. II., Ch. IV.
— nature of stimulus of, 268 ff.
— colour-tone of, 269
— intensity of, 269
— degree of saturation of, 269
— contrast effects in, 279 ff.
— physiological theories of, 284 ff.
— statement of Helmholtz's theory of, 284
— difficulty in Helmholtz's theory of, 285, 286
— objection to Helmholtz's theory of, from cases of colour-blindness, 285
— failure of Helmholtz's theory of, to account for contrast effects, 286
Light-sensation, statement of Hering's theory of, 287 ff.
— -sensations, descriptive analysis of, 271 ff.
— -waves, nature of, 268
— illustrated from wave traversing rope, 268
— length of, and colour-tone, 269
— amplitude of, and intensity, 269
— complexity of, and degree of saturation, 269
Lipps, referred to, 401 (footnote)
Local sign, meaning of, 128 ff.
— sign, differences, implicit apprehension of, 129
— difference, extensity as continuous repetition of, 466
— continuum, 467
— signature, of visual sensations, 131
Localisation, 469 ff.
— of protopathic sensations, 249
— relative, as dependent on epicritic sensibility, 251, 253
— distinction between, and projection, 480 ff.
— acquirement of meaning in, 470
— influence of, on projection, 472 ff.
Locke, on the distinction between a thing and its qualities, 16
— on differences in retentive power, 188
— on comparison in animals, 534
— referred to, 517
Lotze, on imageless thought, 533
— on atomic theories, 572
— on self-acting machinery, 573
Lubbock, on eyes of limpets, worms, etc., 239, 240

MACH, referred to, 290
Mackenzie, J. S., on impulse in animals, 653
— his ideal of self-realisation, 654
Magic among savages, depending on explanation of parts by whole, 575

Mallery, Col., on natural signs in children and savages, 548-52
Marshall, H. R., on pleasant phase of a disagreeable experience, 382
— theory of, connecting affective tone with wear and repair of nervous tissue, 394 ff.
— on surplus energy, 395
Mass and energy, as analogous to mental dispositions, 23
Material world, meaning of, 404
McDougall, on connection between brain and consciousness, 18
— on mental disposition, 22
— on sensory pleasures, 117
— on attention in formation of neural habits, 84
— on energy-transformations of the body, 89
— on congenital dispositions in children, 351
— his definition of 'instinct,' 348
— on capacity for emotion without organic sensations, 370
Meaning, acquirement of, 192 ff.
— reproduced, 199 ff.
— occasional, of a word, 538
— acquired, example of, from a tune, 200
— acquired, case of, from newly hatched chick, 200
— acquired, affective tone of, 402
— revival of, as minimum in way of reproduction, 199
— apprehension of, 204
— reproduced as an implicit idea, 204 ff.
— revival of acquired, in learning by experience, 322
— in perceptual process, 323
Mechanical operations, relation of, to ideal construction, 564
— point of view, in category of Thinghood, 572
— presuppositions of, 572
— in primitive thought, 574
Meinong, followed in treatment of Weber's law, 305
Memories, variety of, 526
Memory, Bk. IV., Ch. II.
— definition of, 521
— personal and impersonal, 521
— good and bad, 522 ff.
— serviceableness as mark of a good, 522
— rapidity as mark of a good, 523
— duration of power of recall as mark of a good, 524
— conditions of serviceableness of, 524
— decay of, with lapse of time, 525
— and past time, 528
— improvement of, by practice, 526 ff.
— improvement of, caused by increased attention, 527 ff.
— in connection with association, 527, 528
Mental activity, and belief, 603 ff.
Mental dispositions, 20 ff.
— relation of, to conscious process, 22
— why classed as mental facts, 25
— and physiological dispositions, 25, 26
Mental process, in others, 44 ff.
— systematic order in, 32
— connection with bodily behaviour, 33
— teleological character of, 33
— effect of pleasure and pain on, 389
Mental tests, 60
Metabolism, 63
Metaphysics, as dealing with will and thought, 654
Mill, J. S., referred to, 405
Mind, the, its relation to consciousness, 14 ff.
— relation between, and the brain, 17 ff.
— attributes of, other than consciousness, 16 ff.
— and body, Introd., Ch. III.
— and body, hypothesis about relation of, 77 ff.

Modality, differences of, in sensations, 126
Morgan, Lloyd, on eye of snail, 239
— on compound eyes of insects, 240
— on general instinctive activities, 331
— on persistency with varied effort, 337
— on instinctive activities in chicks, 338, 339
— on instinctive movements, 350
Motion, immediate experience of, 132
— compared with joint-sensations, 260 ff.
— sensations, of joints, not a combination of position-sensations, 262
Motives, process of deliberation as conflict of, 632
— as arising from the nature of the self, 632
Motor activity, as factor in distinction between sensible appearance and reality, 437 ff.
— relation of images and impressions to, 145 ff.
— adjustment, pleasure-pain of, 399
Motor areas of cortex, 74 ff.
— not directly connected with sensations, 74 ff.
— no direct connection with will, 75
Motor associations, 221 ff.
— formed under control of interest, 221
— dependent on present perception, 222
— as means of reinstatement of previous experiences, 223 ff.
— when automatic, 222 ff.
Motor effort, feeling of, without motor sensation, 258 ff.
Motor process, pleasure-pain of revived, 400 ff.
Motor sensations, relation of, to power of relative localisation, 249
— function of, in contributing to the discernment of the posture and motion of limbs, 256 ff.
— importance of, in appreciation of weight and resistance, 257
— meaning of, as acquired by association with touch and sight experiences, 259 ff.
— as contributory factor in the apprehension of spatial order, 466
— acquired meaning of, 467
Movement, perception of, relation to apprehension in Thinghood, 430
— revival of, in ideal representation, 541
— ideal, tendency of, to pass into actual, 543 ff., 642
Mozart, memory of, for music, 523
Musical sounds and noises, 289
— combination of, from different sources, 291
Myers, on sensation of black, 284
— on elaboration of physiological change conditioning sensation, 288
— on first performance of an instinctive act, 343
— quoted, 177, 182, 247, 248, 249

NAPOLEON, as type of strenuous character, 175
Natural signs, as language, 545 ff.
— relation of, to demonstrative signs, 546
— evidence for primitive nature of, 547 ff.
— spontaneous origin of, in deaf-mutes, 547 ff.
— in children, 548
— use of, among savages, 549

Natural signs, mutual understanding of, among experts, in spite of diverse dialects, 550
— formative principle of, always the same, 550
— as instruments of conceptual thinking, 550 ff.
— analogy between, and conventional words, 550
— as paving the way for arbitrary signs, 551
— tendency of, to become conventional, 551, 552
— do not develop into a conventional language, 552
— distinguished from conventional signs, 554
Nervous excitement, revival of, in perceptual process, 323
— nature of universals in, 558
— impotence of, to express higher universals, 558 ff.
Nervous process, distinctive functions of, on the hypothesis of parallelism, 93 ff.
Nervous processes, circuit of, 72 ff.
— relation of, to psychical processes, 71 ff.
— in the cortex, 68
— in the sub-cortical centres, 68
— cerebral control of, 69
— system, constitution of, 64 ff.
— parts of, 68 ff.
— connection between, and sense-organs and muscles, 68
— comparison of, with organisation of office, 70 ff.
Neural habit, law of, on the parallelistic hypothesis, 82 ff.
Neurons, description of, 64
Neutral tints, 271 ff.
Newton's Laws of Motion, 656
Noises and musical sounds, 289

OBJECT, psychological use of the term, 8, 35
— of thought, 99 ff.
— of thought, distinguished from act of thinking, 101
Objective point of view, 3
— and subjective, meaning of, 6, 8
— and subjective time, 567
— time, an ideal construction, 568
Objects of thought, identity of, 102
— how apprehended by individual subject, 120
— order and distinction introduced into, in attending, 183
— unity of, imposed by attention, 184
— unity in nature of, 185
Objects, how far Psychology is concerned with, 4
— presented, as data of Psychology, 34 ff.
Obliviscence, as cause of indistinctness of images, 142
Observation of minds of others, as method of Psychology, 44 ff.
Organic sensations, 242 ff.
— re-instatement of, through motor association, 224
— indefiniteness of, 129 ff.
— difference between, and sensations of the special senses, 242 ff.
— hunger and thirst as examples of, 243
— as conditions of affective and conative consciousness, 244
— produced by impulses from the brain, 244
— stimulus of, 245
— accompanying sensations of the special senses, 245
— affective tone of, 377 ff.
— influence of, on nervous system, 378
— as pains, *see* Pain-sensations
— part played by, in emotion, 369 ff.
— normally present in emotion, 369 ff.
Organic welfare, relation of, to hedonic-tone, 388 ff.
Overtones, 294 ff.

PAIN, anger caused by, 372 ff.
— -sensations, 245 ff.
— adequate stimulus for, 246
— distinctive characters of, 246
— affective tone of, 379
— differentiating qualities of, 379
— effect of, on cognitive process, 381
— -spots, 245 ff.
Parallellism, hypothesis of, 77 ff.
— difficulties of, 77 ff.
— empirical nature of, 80
— problem of, to explain mental associations, 80 ff.
— and law of neural habit, 82 ff.
— and control of subjective interest, 84
— summing up of claims of, 91
— bearing of, on psychological procedure, 91 ff.
— in relation to conscious agency, 92 ff.
Paul, on variations in meanings of words, 538
Peckham, on instinct in wasps, 337, 346
Percept; *see* Impression, Sensation
Perception; *see* Affective tone, Pleasure-pain
— of external world, Bk. III., Pt. II.
— of third dimension, 468, 658
— tactual, Bk. III., Pt. II., Ch. III.; *see* Touch, Tactual perception
— visual; *see* Visual perception
— temporal, Bk. III., Pt. II., Ch. V.; *see* Temporal perception
Perceptual consciousness, development of, accompanied by more delicately differentiated sensation, 236 ff.
— external reality for, 459 ff.
— time in, 496, 498
Perceptual data, unification of, 561 ff.
Perceptual process, as related to learning by experience Bk. III., Ch. I.
— contrasted with trains of free ideas, 306 ff.
— characterised by attention, 307 ff.
— unity and continuity of, 309, 661
— awareness of the universal in, 310 ff.
— comparison in, 311, 319, 320
— imitation in, 311
— lack of power of discrimination in, 311
— advantages of, 312
— primary retentiveness in, 312 ff.
— learning by experience in, 314 ff.
— inference in, 320
— forms of reproduction in, 323
— explicit ideas accompanying, 323 ff.
— and ideational process, distinction between, 324 ff, 529
— impulsive character of, 325 ff.
Persistency with varied effort, in instinctive behaviour, 337
— in ideal activity, 518
Personification, mode of, by savages, 613
Petermann, 660, 671
Phenomenal regression, 657
Philology as supplying psychological data, 37
Phi-movement, 655, 656 ff., 664 ff., 675
Photo-chromatic interval, 275
Physical Gestalten, 668 ff.
Physical nature, control of, acquired by mechanical operations, 564
— world, meaning of, 404
Physiological dispositions, 26
Physiology, material point of view distinctive of, 96
Piéron, H., 70, 71
Pillsbury, W. B., on noises brought into distinct consciousness, 164
— on part played by apperception in reading, 179

Pillsbury, quoted, 164, 170, 179, 192
— experiments of, illustrating facilitation, 191 ff.
Pitch, 290 ff.
Pitch, power of distinguishing difference of, 290, 291
Pleasantness, transition from, to unpleasantness, 381 ff.
Pleasure and pain as affective states, 109
— in attending, 397 ff.
— in perception of external movements, 398 ff.
— in perception of geometric forms, 401
— -pain of success and defeat, 401 ff.
— relation of, to emotion, 403
— revival of sensational, 615, 616
— revival of perceptual, 616
Possible, discovery of the, as essential to ideal construction, 517 ff.
Potential energy, 24
Predispositions, congenital, 26 ff.
Preperception; *see* Complication
Pre-scientific psychology, 30 ff.
— presuppositions of, 32 ff.
Present time, determination of, 497, 498
— specious, 498
Pressure-sensations, 250
Primitive belief, 610 ff.; *see* Belief, Savages
— communities, 580
— power of society in, 580
— magic, conditions of, 575
Projection, 465 ff.
— influence of localisation on, 472 ff.
Projective stage of imitation, 585 ff.
Protensity, as character of sensations, 127
— of special sensations, relation of, to affective tone, 381 ff.
Protopathic cutaneous sensations, 248
Psychical dispositions; *see* Mental dispositions
— factor, in instinct, 346 ff.
— occurrences, and physical occurrences, disparity of, as argument against interaction, 89
— process, relation of, to nervous process, 72 ff.
— states, measurement of duration of, 58 ff.
— measurement of intensity of, 60 ff.
— measurement of external conditions of, 59
Psychological point of view, 3 ff.
Psychology, scope of, Introd., Ch. I.
— data and methods of, Introd., Ch. II.
— basis of, in pre-scientific knowledge, 30 ff.
— pre-scientific, nature of, 30 ff.
— pre-scientific, presuppositions of, 32 ff.
— scientific, data and methods of, 34
— objects as data of, 34 ff.
— introspective method in, 37 ff.
— manifestations of mental process in others as data of, 44 ff.
— experiment as method of, 53 ff.
— quantitative methods in, 58 ff.
— teleological point of view as distinctive of, 96
— freedom of will not ultimately explicable by, 654

QUALITY, as character of sensation, 126
— of special sensations, relation of, to affective tone, 384
Quantitative methods, in experimental psychology, 58 ff.

REACTION, simple, forms of, 58
— simple, time taken by, 58
— simple, apparatus for measuring, 58

Reaction, compound, complications introduced in, 58 ff.
Reality, contrasted with appearance, 436 ff.; *see* External reality
Recognition, at the perceptual level, 310
Reduplication, as cause of vagueness of mental image, 143
Reflex action, 65
— illustrations of, 66 ff.
— physiological character of, 233 ff.
— when accompanied by sensations, 233 ff.
— distinguished from instinctive movements, 334 ff.
Reflexology, 665
Relational order, and spatial extension, 451 ff.
Reminiscence, meaning of, 521
— pleasures and pains of, 617
Remorse, 326
Reproduction, 198 ff.
— revival of meaning as form of, 199 ff.,
— free, 210
— of similars, 507 ff.
—of similars, pecularities of, 509 ff.
— serial, 509, 510
— ideal, motor element in, 541
— motor, tendency of, to pass into actual movement, 543
Resemblance, whether an independent condition of association, 507 ff.
Restorff, 669, 671
Retentiveness, 187 ff.
— effect of rhythmic repetition of the same stimulus on, 194
— primary, 197
— working by way of reproduction, 198 ff.
— primary, relation of revival of meaning to, 199
— as condition of formation of habit, 226 ff.
— at perceptual level, 312 ff.
— instances of, in animals, 313 ff.
Retentiveness not synonymous with memory, 521
— power of, 527
Retina, description of, 270 ff.
Retina's own light, 272
Retinal image, formation of, by means of lens, 240
Retinas, correspondence of points of the two, in binocular perception, 488
— disparateness in correspondence of the, 489
Retrospection, relation to introspection, 43
Rhythmic movements, pleasure experienced in, 399
Ribot, T., case of fixed idea from, 645, 646
Robertson, Croom, on learning of language by children, 577
Royce, Professor J., on idea of self as involving idea of relations to other selves, 584
— on variations in idea of self, 585
— on the division of the total self, 588
— on tendency conflicting with the true self, 589
— on emotions due to pathological conditions, 592
— on strife between past and present self, 593
Rubin, 656, 671

SATURATION of colours, 269
Savages, ideal construction in, 569 ff.
— anti-mechanical mode of explanation of, 574
— conception of individual unity in, 574, 575
— views of, about the internal self, 594 ff.
— influence of dreams and hallucinations on, 594, 595
— views of, on sympathetic communion between soul and body, 595, 596

Savages, subjective factor of belief among, 606, 608, 610 ff.
— views of, on unity of the individual thing, 610
— views of, on unity of the world, 611
— tendency of, to interpret things in terms of personal life, 612
— personification of natural objects and agencies by, 685 ff.
— deficient in self-control, 649, 650
— character in, 653
Schäfer, on movements at the joints, 262
— quoted, 255
Schmalz, on natural signs in deaf-mutes, 547, 558
Schneider, G. H., classification of instinctive actions, 328
— example of primary retentiveness in animals, 313
Scholz, 667, 671
Selective attention, in instinctive activities, 344 ff.
Self, the, in perceptual process, 325 ff.
— the embodied, awareness of, 432 ff.
— the embodied, motor activity of, a factor in distinction between sensible appearance and reality, 437 ff.
— the, as ideally apprehended, Bk. IV., Ch. VI.
— general nature of, 581 ff.
— distinction between inner and outer, 582
— the, thought of, involving thought of relations to other selves, 584
— the, variation of idea of, 585 ff.
— the, importance of imitation in development of idea of, 585
— the one, and the many selves, 588 ff.
— the future, representation of, 589
— the, delusions relating to, 591
Self, past and present, influenced by emotional tone, 591
— the, external and internal, 593
— theories regarding the inner, 593, 594
— representations of the internal, by savages, 595
— primitive views of relation of body and internal, 595 ff.
— modern survivals of primitive view of the internal, 598
— the, conative aspect of the conception of, 629
— the relation of impulse to, 629
Self-consciousness, stages of explicit, 38 ff.
— social factor in development of, 583 ff.
— the true, and conflicting tendencies, 588, 589
— pathology of, 590 ff.
— self-control, 648 ff,
— definition of, 648, 653
— causes of failure in, 648, 649
— as dependent on development of the concept of self, 649
— children and savages deficient in, 649, 650
— freedom of will consists in, 653
Self-determination, key to problem of freedom of will, 653
Self-realisation, idea of, 654
Sensation, Bk. II.
— general nature of, 121 ff.
— conditions of, 121
— no such thing as absolutely pure, 124
stimulus and, 234 ff.
— without perceptual distinction, 295, 304 ff.
— increase in intensity of, how correlated with increase in stimulus, 301, 304; *see also* Weber's Law
— affective tone of, 377 ff.; *see* Light-sensation, Sound-sensation, Organic sensations, etc.

Sensation, intrinsic characters of, 125 ff.
— and reflex, 233 ff.
Sensations, as constituents of perception, 656, 659, 660, 665, 675
— as immediate experiences, 7 ff., 121 ff.
— as objective experiences, 7 ff.
— subconscious, 161 ff.
— reference of, beyond immediate experience, 124
— never without derivative meaning, 124 ff.
— inseparable characters of, 125 ff.
— differences in kind or modality, 126
— feeling attitude of special, 381 ff.
— double contact, acquirement of meaning of, 470
— vividness of, 137
Sense-experience, introspection applied to, 44
— differentiation of, Bk. II., Ch. I.
— perceptual value of, 235 ff.
— function of, to challenge attention, 235
— function of, to guide complex actions, 236
— delicate differentiation and restriction of, 236 ff.
Sense-factor, in perception, 408
Sense-impressions, efficacy of, determined by dispositional interest, 167 ff.
— intensity of, as determining distinct consciousness, 168
— extensity of, as determining distinct consciousness, 168 ff.
— relative novelty of, as determining distinct consciousness, 169
— as guiding instinctive activity, 335
Sense-organ, definition of, 234
— -organs, 64-5
— movements of adaptation of, 212 ff.
— differentiation of, 238 ff.
— gradual evolution of, 238
Sense-organs, evolution of special, for sight, 238 ff.
— -perception, complex nature of simplest object of, 409 ff.
Senses, distinction between higher and lower, 236
Sensibility, common, 244
— epicritic, 248
— common, affective tone of, 377 ff.
Sensible appearance, relation of, to thing, 436 ff.
— qualities, correlation of different, as belonging to the same thing, 444 ff.
Sensory areas of cortex, 73 ff.
— spots of skin, 245 ff.
Sentiment and emotion, 625 ff.
— as name for ideal systems in their conative aspect, 375, 625, 626
— as a complex emotional disposition, 627
Separate things, singling out of, 427 ff.
Serial reproduction, 509, 510; *see* Contiguity
Shand, A. F., on distinction between emotion and sentiment, 625, 626
— on emotions referring to personal and impersonal objects, 627, 628
Sherrington, C. S., quoted, 65, 67, 69, 243, 244
Sight, illustration from, of gradual evolution of sense-organs, 238 ff.
— active and passive, 477, 492, 493
— disadvantages of, as compared with touch, 478, 479
— advantages of, over touch, 479
Signs, natural, 545 ff.
— demonstrative, as part of language, 546
— conventional, correspondence between, and meaning, 554

Significance; *see* Meaning, Apprehension of
Similars, reproduction of, 507
— reproduction of, as involving only partial identity, 510
— reproduction of, distinguished from processes following on it, 510
— reproduction of, in connection with improvement of memory, 527
Skin, minute sensorial areas of, 245
— sensations, awareness of spatial order by means of, 471
Smell, sense of, 266 ff.
— appropriate stimulus for, 266
— sense of, in animals, 267
Smuts, 668, 672
Social factor, influence of, on belief, 609 ff.
— intercourse, debt of the individual to, 576
— factor in constitution of external reality, 579 ff.
— factor in self-consciousness, 583 ff.
— relations and past and present self, 592
Soul, the, modern theories of, 594
— the, primitive views about, 593 ff.
— modification of conception of the, as material, 598
— the, material and immaterial, division of functions between, 598
— material, last survival of doctrine of, in scientific thought, 599
Sound-sensation, Bk. II., Ch. V.
— stimulus of, 289
— general theory of, 295 ff.
— Helmholtz's theory of, 296 ff.
Space, tri-dimensional, 439, 440, 468
— tri-dimensional, perceptions of relations, aided by localisation, 473 ff.
— as ideal construction, 564 ff.
Space, origin of conception of infinity of, 565
Spatial order, distinctive character of, 451 ff.
— and extensity, 452
— motor-sensations as combining with extensity to give apprehension of, 466, 471
— conditions of apprehension of, 468
— and perception of a third dimension, 468
— congenital dispositions for apprehension of, 475
Spatial perception, Bk. III., Pt. II., Ch. III.-IV.
— nature of problem of, 451 ff.
— of the blind, 459 ff.; *see* Tactual perception, Visual perception
— secondary means of, by the eye, 481 ff.
— unity, category of, 414 ff.
— its relation to the apprehension of a third dimension, 414 ff.
Spatial whole, apprehension of, 464
Spectrum, how formed, 272
— order of colours in, 272 ff.
Speech, theories of origin of, 555 ff.; *see* Language,
Spencer, H., on transmission of acquired characters, 475
"Stataesthetic" sensations, and motion sensations, 262
Stereoscope, binocular perception illustrated by, 490 ff.
Stimulus and sensation, 234 ff., 305; *see also* Weber's Law
— adequate and inadequate, 235
— external and internal, 231
Stratton, G. M., experiment of, in distinction of directions by the eye, 480, 481
Sub-conscious, sensations, function of, in mental life, 165, 305
Sub-consciousness, 162 ff.
Subject, feeling attitude of, to object, 106 ff.

Subject, conative attitude of, to object, 112 ff.
— unity of attributes in, as a category, 416 ff.
— and object, 3
— ultimate modes of relation between, 97 ff.
— cognitive relation of, 102 ff.
Subjective, point of view, 4
— and objective, meaning of, 8
— and objective time, 567 ff.
Substance, and its attributes, 16 ff.
Sully, on feeling-tone due to association, 402
— on the "no-more" consciousness, 499
— on children's treatment of dolls, 515
Supposal, and judgment, 103 ff.
Surplus energy, and feeling attitude, 385 ff.
— energy, H. R. Marshall's theory of, 394 ff.
Synapses, 65 ff.
Synthesis, conceptual, 531, 532

TACTUAL areas, of cortex, 74
— perception, Bk. III., Pt. II., Ch. III.
— perception in the blind, 459 ff.
— projection and localisation in, 464 ff.
— sensibility, acquired meaning of variations of, 469
Taine, on delusions of self-consciousness, 590, 591
Taste-sensations, 264 ff.
Tastes, compensation and rivalry between, 265
Teleological point of view, peculiar to psychology, 96
Temperature sensations, adequate stimulus for, 245
Temporal perception, Bk. IV., Pt. II., Ch. V.
— unity, category of, 415 ff.; *see* Time, Time-transience
Tendon-sensations, appreciation of pressure and strain by, 256
Tennyson, quoted, 525, 616
Thing, relation of, to varying sensible appearances, 436 ff.
"Thinghood," apprehension of, 429 ff.
— as ideational, 536
— as ideal construction, 571
— connection of, with causality, in ideal construction, 572 ff.
Third dimension, development of perception of, 468
— effect of localisation on perception of, 473 ff.
Thorndike, experiments of, on process of learning by experience in animals, 314 ff.
— theory of, to account for learning by experience in animals, 320 ff.
— theory of, criticised, 321
— experiments of, in connection with category of causality, 421
— referred to, 519
Thought, 98
— habits of, 226
— imageless, 148 ff.
— -reading, as illustrating ideo-motor action, 127, 544
— and sentience, 120
Timbre, 294 ff.
Time, past, present, and future, 497 ff.
— distinction of, at perceptual level, 498 ff.
— perception of, 496 ff.
— present, determination of, 497, 498
— perception of, bound up with attention, 499
— lapse of, 500 ff.
— as ideal construction, 565
— objective, an ideal construction, 567
— perception of lapse of, 500 ff.
— experiments on, 500

Time, conditioned by continuity of attention, 500, 502
— -transience, immediate experience of, 496 ff.
Titchener, E. B., on introspection, 44
— on imagery, 136
— on laws of attention, 183
— on conflict of impulses, 629
Tolman, 664
Tongue, parts of, and taste-sensations, 264 ff.
Touch perception, 660
— sensations, adequate stimulus for, 245
— sensations, localisation of, 249 ff.
— spatial perception by; *see* Tactual perception
— passive or synthetic, 460
— active or analytic, 460
— union of synthetic and analytic, 471, 476, 478
— horizon, 463
— advantages of, over sight, 478, 479
— advantages of sight over, 479
— -spots, 246
Traces; *see* Dispositions
Tylor, example from, of tendency of natural signs to become conventional, 552
— on imitative sounds, 556
— on imitative gestures, 558

UHTHOFF, referred to, 491 (note)
Unconscious factors, dispositions as, 20 ff.
Unconscious mental states, 27 ff.
Union, principle of, as original category, 417
Unity; *see* External world, Categories, Spatial unity, etc.
Universals, words as expressing, 539

VISUAL area, of cortex, 73
— imagery, sketchiness of, 141
— appearances, varying magnitude of, 481
Visual perception, Bk. III., Pt. II., Ch. IV.
— combination of analysis and synthesis in, 477
— relation of, to tactual, 478, 486
— of third dimension, 478
— distinction of the directions in, 480 ff.
— secondary conditions of, 481 ff., 488
— perception, effect of distribution of light and shade on, 483
— interpretation of associative conditions of, 484
— as monocular, 485 ff.
— intimate correlation of, with tactual, 486
— moulding of, by tactual, 486, 487
— as binocular, 488 ff.
— illustrated by the stereoscope, 490 ff.
— as binocular, active vision required for development of, 491, 492
— as binocular, determination of distance of fixation-point in, 493, 494
— as binocular, dependent on association with tactual data, 494-5
Visualising power, differences in, 141 ff.
Volition, definition of a, 634
— James on "hard" cases of, 639 ff.
— criticism of James's view of hard cases of, 639 ff.
— and bodily activity, 641 ff., 720 ff.
— passage of, into movement, 642
— why normally followed by movement, 642
Voluntary action, article on, by author, quoted, 633, 635, 637, 638, 641
— distinguished from impulsive action, 629

Voluntary action, determined by the conception of the self as agent, 630
— in line of greatest resistance, 639 ff.
Voluntary attention, 650 ff.
— distinguished from involuntary and non-voluntary attention, 650
— attention, illustrated by experiments, 650, 651
— relation of, to spontaneous attention, 650-2
— in deliberation, 652
Voluntary decision, Bk. IV., Ch. IX.
— as result of deliberation, 631
— nature of, 632 ff.
— cessation of conflict of motives with emergence of, 633
— analysis of state of, 634
— forming of, 634 ff.
— free-will in, 634 ff.
— libertarian theory of, 634, 653
— causes of, when not the outcome of deliberation, 635, 636
— impúlsive, 636, 637
— fixity of, 637 ff.
— fixity of, and conception of self, 636
— fixity of, determined by aversion to irresolution, 637, 638
— fixed by action following on it, 638
— motor efficacy not essential to state of, 641
— why it determines action, 642, 643

WARD, Dr. J., on congenital predispositions, 27
— illustrations of complication from, 205, 207
— on difference between complication and free ideas, 210
— on motor associations, 222
Ward, Dr. J., on earliest differentiation of colours and sounds, 237
— on the whole of presentation, 412, 413
— on arrangement of motor experiences, 457
— on unsteadiness of images, 144
— on divergent associations, 512
— on comparison, 532
— on apprehension of time-order, 566
— on apprehension of the self, 581
— on inner and outer self, 582
— on imagination and belief, 618
— on feeling-tone of ideational activity, 620 ff.
— quoted or referred to, 143, 163, 312
Washburn, Miss, 315, 317, 318
Watson, J. B., 5, 56, 665, 672.
Watt, H. J., referred to, 78, 125 (note)
Wear and repair, in nervous system, connection of, with affective tone, 393 ff.
Weber-Fechner Law, Bk. II., Ch. VI.
Weber's Law, experimental facts of, 298
— fundamental facts underlying, 299
— and difference-threshold, or threshold of discernment, 299
— and absolute-threshold, 300
— interpretation of, 300 ff.
— limitations of, 305
— Fechner's explanation of, 302 ff.
— objections to, 302
— tested, as regards extensive magnitude, 302 ff.
— tested, as regards intensive magnitude, 304
Wertheimer, 655, 656 ff., 661, 663, 664 ff., 669, 672, 675 ff.
Will, the, not directly connected with motor areas, 75
— habits of, 226

Will, freedom of, 634 ff.
— true freedom of, 652 ff.
— freedom of, consisting in self-control, 653
— the, freedom of, dependent on character, 653
— freedom of, not ultimately explicable by psychology, 654; *see* Free-will, Voluntary Decision, Volition

Words, variation in meaning of, according to context, 538
— occasional meaning of, 538
— as expressing universals, 539
— mental control over articulation of, 542

"YELLOW SPOT"; see *Fovea centralis*

ZEIGARNIK, 664, 669, 672

PRINTED IN GREAT BRITAIN BY UNIVERSITY TUTORIAL PRESS LTD., FOXTON NEAR CAMBRIDGE

UNIVERSITY OF LEEDS
INSTITUTE OF EDUCATION