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THE ELEMENTS OF EXPERIENCE AND THEIR INTEGRATION: OR MODALISM.

By HENRY J. WATT.

§ 1. Introduction.

A considerable time has now elapsed since psychology in its turn awoke to the new vigour of life that the experimental method brings to every science. Inquiry has been pushed into every part of the field and multitudes of new facts have been made known. These have been arranged as well as possible to show how one is dependent on the other or what is the joint effect of several. But nothing like a coherent body of knowledge has emerged therefrom. It is a common complaint that psychology is a medley of all sorts of curious and commonplace facts, which can hardly make a show of the coherence that is expected of a science. In many ways there seems to be no difference between it and physiology. Psychology stands at a certain disadvantage in this respect. For although the elements of its subject-matter are for it pure data, given without the possibility of further question, yet from the point of view of the biological sciences and perhaps philosophy in general, experience is an effect conditioned by physical and physiological circumstances. It is a curious fact that many prominent workers of the sister science of physiology have recently claimed the right to expel consciousness entirely from the scope of their subject-matter and from their list of conditions and results. However foolish and impossible this may be for the physiologist as inquirer, much may be said for it when the systematic ideal of causal explanation is the goal in view. For a mere knowledge of condition and effect is never quite satisfactory. It is this same spirit which has led some psychologists to banish any mention of body or brain from their treatises and to aim at a pure science of experience. Thus far, perhaps, the burden has lain more lightly on the physiologist, upon whom the stringently closed system of causes of the physical sciences acts with great compulsion. For the psychologist, however, it is no easy matter to set himself free. Only in respect of the intellectual and emotional parts of experience has it been attempted with any success, for we are, in any case, almost quite ignorant of any detailed connexion between these and physiological conditions. The psychology of the senses, on the other hand, cannot be loosed from physiology in any high-handed manner. By themselves, sensory experiences seem very erratic and peculiar. They seem too much the product of other influences and too independent of one another to form a closed field in themselves. And yet, as it stands, psychology cannot but be ashamed of its feeble command of the senses. Its knowledge of them is hardly more than

a mere bundle of clippings from physiology. And when the attempt is made to treat sensory experiences purely as such, the chapter on the attributes of sensation which results is so dry and barren, that it is condemned and omitted altogether by not a few writers.

A fresh attempt must be made to secure the independence of psychology. This will have little value unless the province of sensation is first attacked and freed from the domination of physiology. No general demand or principle will meet the case. It must be shown that physiology can make no positive contribution to the special work of a psychology of the senses and that the seemingly scattered and incoherent material of sensory experience is capable of self-complete and satisfactory systematisation. Only thus may independence properly be claimed. For we shall then have proved that psychology not only must, but can stand alone. It is, indeed, not to be forgotten that psychology and physiology are, in certain respects, closely attached to one another. Physiology provides a basis for experimental interference with experience which is invaluable to psychology, while psychology acts to some extent as a feeder to physiology. But however complete may be the parallelism between the two regions which general considerations lead us to expect, the promise of a comprehensive science of psychophysics seems to lie rather in the independent development of the two contributory sciences than in their narrow companionship.

It has been claimed sufficiently that introspective observation is the primary method of psychology. But every advance in the science sends us back to a more minute and observant pursuit of the method. If we are to convert our scattered sensory experiences into a coherent system, we must re-examine the whole field. We must note with all possible accuracy every variety of experience simple or complex. Every complex experience must be analysed into its simplest parts. But in doing so, we must not fail to observe whether the process of analysis destroys any feature of the complex experience, whose origin in the elements of our analysis we are unable to explain completely by synthesis of these elements. Just in this respect has psychology been in grave fault. We have been satisfied to know upon what conditions our complex experiences and their modifications rested, but we have not tried sufficiently to show how the elements of our experience combined to give our complex experiences. This must be attempted again and there can be no rest for our science till it is accomplished.

In those cases in which our experiences show variation in respect of any characteristic, the strict method of introspection seems to suffice.

Thus we know that some sensations have certain attributes in common, intensity, extensity and the like. But a number of cases are in dispute. Some sensations do not seem to share these attributes and some others seem to have peculiar ones of their own. Introspection is thus obviously insufficient to meet all cases. We must find another method whereby the properties of the elements of our experience can be determined. Like the chemist and the physicist we can find this only in a detailed study of the compounds into which these elements enter and of the manner in which they join to form complex experiences. We must know not only what are the elements of our experience and what are their essential properties or characteristics, as far as is possible by direct inspection of them, but we must also know the manner and method of their integration and other elements, so that by this knowledge we may be enabled to complete and perfect our knowledge of these elements.

But that is not all. Our knowledge of these elements and their properties must enable us to understand completely how, when a certain complex of elements is given, a certain complex experience results therefrom. No characteristic of the latter must remain unexplained. We must be able to give assent to a statement in the form of an equation, that this or that arrangement of the elements of experience, as we find them given, is wholly and completely identical with a complex experience. The notion of transcendence must finally be banished from any self-respecting science of psychology. In a word, we must be able to show the presence of causality in experience. That we have not been able to do so, has undoubtedly been due to the fact that the complexities of experience were taken too much for granted, that analysis was the prevalent method of study and that no attempt was made to show the connexion between the attributes of the elements and the integrative complexes of experiences and their modifications. No use was made of the attributes except that of unprofitable definition. It must speedily become clear that in psychology, as in the natural sciences, the problem of the elements and their properties is second to none other. Far from being dry and useless, the problem of the attributes must become a centre of the most vivid psychological interest. There can be no doubt of its difficulty. We must follow the example of the sister sciences of nature and converge the efforts of all pure mental science upon the problems of the constitution of experience and its fundamental laws.

§ 2. PRELIMINARY DEFINITION OF SENSATION.

A definition of sensation may be attempted by reference to its psychological peculiarities or to its psychophysical basis or to both of these. But as sensation is generally considered to form only a part of experience, it is hardly possible to begin study of the varieties of experience by enumeration of its purely psychological characteristics. For we do not yet know what these are and we must be able to point out sensation to one another ere we reach any sort of unanimity regarding its psychological definition. Besides, even although we may finally ascertain that certain psychological features are common to all sensations, there are difficulties in the way, which would become the greater, if we could not delimit the matter of sensation by other means. We must therefore turn to psychophysical means to fix our subject. We have sufficient security, if we find a means of pointing out to each other which of the whole mass of experiences we call sensation and intend to study. That means we find in the sense-organ and in its stimulation. We may accordingly define sensation as the simplest parts or elements of those experiences that are immediately and regularly dependent upon the stimulation of a sense-organ. Such a definition as this accords well with the practice of an experimental science. By means of a periodic recurrence of the stimulation and consequently of the sensation, it is easy to direct the attention of the observer towards the experience to be observed, while all possibility of confusion with other experiences which might be evoked along with sensation can be avoided by the observation of the parts of the total complex which recur regularly and without the mediation of any other experiences. Sensations are not attached to any other experiences as if they depended upon them. They form, at least in part, the groundwork or foundations of experience. As sensations are dependent upon the stimulation of sense-organs, they are clearly largely independent of such influences as attention and abstraction, so that we run less risk of error in starting our study with them. Having obtained a definite reference within the whole, we have provided ourselves with a means towards definite study of the other varieties of experience, as well as with a gauge for such variable influences as attention.

It is often said that there is no such thing as pure sensation to be found in experience and that sensation, therefore, exists only as a psychological abstraction. Without knowledge to seize hold of it and convert it at least into perception, it is declared, pure sensation would

be pure nothing, as unintelligible as is to the idealist an object independent of the mind which knows it. In the face of such an extreme view, any attempt to study sensation would be futile and objectless. But whilst we may admit that sensation never does in us occur as an object of study unless it evokes other mental processes than itself, whatever they may be, we may yet maintain that sensation is a real object of study. In the introspection of sensation, our observation is directed upon sensation as defined, in whatever setting it occurs. Sensation may often be observed to remain constant in character under differences in the introspective processes directed upon it. Besides, our definition of sensation does not call for the isolation of sensation in experience, but only for its isolated study.

While defining sensation in the first place by reference to the stimulation of a sense-organ, we do not forget that we are by no means sure of the position and nature of the sense-organs of all well-accepted sensations. Yet we are justified in regarding them as sensations, because we can verify their immediate and regular dependence on external stimulation. We know from obvious examples of sense-organs, how specific in quality and point of action the stimulation must be that is to affect a sense-organ and how dependent its success is on the integrity of afferent nerve-fibres.

The regulative simplicity of the definition refers in the first place to the experimental procedure implied therein. Simplicity of some kind will, of course, also be a characteristic of the psychological nature of the sensational element. But we cannot presume upon the ultimate psychological definition. We must just carry experimental analysis as far as we can, although we cannot hope to find therein any means of judging whether our analysis is complete. For a mere *ne plus ultra* cannot form a systematic criterion. Only in the psychological characteristics of sensations can we expect to find some such standard, the formulation of which will then constitute the psychological definition of sensation. Our only guide will therefore be the typical uniformity of sensation.

§ 3. The Independence of Psychological Investigation.

The chief classes of sensations are (1) those of cutaneous origin, touch or pressure, warmth, cold and pain; (2) those of taste, of which there are four chief varieties; those of (3) smell; (4) sound; (5) vision; of each of which there are an indefinite number of varieties, which

differ only slightly from one another and, except in the case of smell, can easily be arranged in order of resemblance; those of (6) articular, and (7) labyrinthine origin, each generally recognised to consist of two groups, sensations of position and sensations of movement; (8) those of muscular origin; and finally, (9) a crowd of less varied and obscure sensations.

All these varieties of sensation are said to differ from one another in quality. If the difference in quality is so radical that it is impossible to pass from the one sensation by gradual or imperceptible steps to the other, as *e.g.* that between tones and colours or between warmth and cold, it is sometimes called a difference in modality. It is generally considered to be of great systematic importance to determine all the possible varieties of quality and to arrange them as such and in relation to sense-organs and stimuli. Distinctions of quality are, of course, in all cases based primarily upon true introspective differences between sensations, but there is as yet no clear test of quality. Consequently a number of cases have been long disputed. Is pitch, for example, the quality of tonal sensations, and in what respect do the articular sensations from various joints differ? We must not forget that sensations differ from one another in other ways than quality and that, unless we are guided by some defensible criterion, we may mistake these other aspects for quality. This is most to be feared in those cases in which no variation in quality is really present. Any apparent variation is so readily ascribed to quality. The conclusions we shall reach later will show that the present classification by quality is not sufficiently critical and does not lead to useful systematic results.

In spite of the primacy of the introspective basis of quality, the relation to the sense-organ still exercises a fairly strong influence upon the distinction of qualities. It is generally admitted (1) that from one and the same sense-organ only one single quality or a group of closely allied qualities can be evoked. Conversely it is held (2) that each marked difference of quality or each difference of quality, no matter how slight, so long as it cannot be obtained from a mixture of other qualities, *e.g.* those of tonal pitch, implies a different sense-organ. It might therefore readily be supposed that the existence of different systems of sense-organs implied some qualitative difference between the corresponding sensations. Such is not the case. The above statements are still true even if the same quality of sensation may be evoked from different systems of sense-organs. Experimental research of recent years has, in fact, distinguished a superficial from a deep system for

touch and pain, and a protopathic from an epicritic system for touch, warmth and cold. It is, conversely, a familiar fact that similar series of visual sensations—all tones from white to black of fair intensity—may be evoked by the medium of different sense-organs, namely the rods and cones of the retina. There are no marked differences of quality between the sensations from these different systems of organs, but there is a tendency to interpret any obscure difference as qualitative (23, p. 36). In the case of labyrinthine sensation a qualitative distinction is usually made between sensations of position and sensations of movement and is justified by reference to the anatomical and functional independence of the two systems of sense-organs and the resulting independence of the two groups of sensations. The reasons generally given for the distinction of two groups of articular sensation (difference of threshold, different relation to galvanic interference) also imply a reference to sense-organs, although no duplicity of sense-organs has yet been established. We shall consider these arguments later in more detail. It is sufficient to point out here, that even if they were valid, they would not effect their purpose. The sensations in question, even though they were evoked from perfectly distinct systems of sense-organs, might still be of identical quality. Any difference in quality must be decided purely and solely upon the basis of an examination of the psychological characteristics of the sensations concerned.

The same conclusion is applicable to the sensitive areas of the eyes, ears and nostrils and to the multiplicity of individual sense-organs found in all senses. Each of these repetitions, of course, has its own special use. We may also expect them to be represented psychically, but we can only determine the nature of this psychical differentiation by psychical methods of examination and comparison.

Sense-organs may be reduplicated for other reasons than distinction of quality. A differentiation in respect of the intensity of stimulus may sometimes be necessary, as in the eye, where the rods respond efficiently to a stimulus which evokes no reaction from the cones, while the cones respond comfortably to stimuli which overwhelm the rods and necessitate their instant withdrawal from the full severity of the stimulation.

In the same way, we find in the sense of temperature a double form of apparatus, of which one, as judged by the sensations evoked from it, seems to respond vigorously and diffusely to all effective stimuli, while the other has a wide range of response and adaptation. There is no reason in this fact why the two series of sensations should not be closely related psychically.

We are therefore compelled to make our study of experience to a large extent independent of the physical and physiological study of the sense-organs. There is certainly a close relation of dependence between sensation and sense-organ, but we must beware of expecting a continuous parallelism between the arrangements of each. The very complexity of the more central arrangements of afferent fibres should warn us of this. We must therefore conclude that a reduplication of sense-organs of allied function may determine a variation of sensation by quality or by intensity, by extensity or by localisation or by some other aspect. What the variation in any case will be, we cannot tell by mere examination of the sense-organ. We must examine the experience itself. Not even in cases of doubt can we safely allow ourselves to be guided by consideration of local or functional separation in the sense-organ. We can expect to settle the classification of a disputed aspect of experience only by a direct study of it or by comparing it in form and function with other similar experiences. Our psychological interest lies only in the forms of variation of our experiences and in their functions as experiences.

Still more distant, therefore, must our interest be in those physiological processes inherent in the sense-organ which produce no new variation of sensational experience, *e.g.* adaptation, positive and negative after-effects, and contrast, while theories of the adequate or proximate stimulus to the sense-organ have no psychological significance at all. Our only interest in the sense-organ lies in the fact that it somehow makes a certain form of experience possible at a certain place and time.

§ 4. THE TYPICAL CHARACTERISTICS OF SENSATION.

Typical characteristics are often distinguished and are commonly known as attributes, which are said to be inseparable from sensations and to be variable independently of one another. These attributes have hitherto been determined solely by mere direct inspection of the elementary sensations themselves and, as commonly accepted, include intensity, extensity, duration and perhaps order or localisation. Feeling-tone, which may be pleasant or unpleasant, has often been included amongst the attributes, but is now generally treated as an elementary kind of experience, qualitatively different from all sensations (14, p. 227). It is recognised that sensations often occur which are indifferent in respect of feeling-tone, which, in other words, are devoid of it. Besides, even when one and the same stimulus is used to evoke sensations, feeling-

tone varies so much in different people, that it might well be considered to be another kind of experience not directly and immediately dependent upon the stimulation of a sense-organ. Of course, a state cannot at one time occur with, and at another time without, one of its attributes, if this word attribute is to have its usual meaning. It is possible, however, that the separability of feeling-tone from sensation is only one of many indications that the various modifications of experience, of which the attributes form one group, are capable of much more freedom and complexity than has commonly been supposed.

(*a*) *Intensity.*

If attributes are inalienable accompaniments of sensation, we may expect to find them in the most elementary sensations—in those evoked by the stimulation of the simplest elements of sense-organs that can be functionally distinguished. Although it is by no means easy to determine the elements of even the comparatively simple sensory apparatus we find in the skin, yet it may safely be maintained that, as far as we know, a variation in the sensation from the simplest parts yet distinguished of accessible sense-organs like those of the skin, tongue and eye, is possible. This direction of variation or attribute is that of intensity, which is produced typically by an increase in the amount of the physical stimulus acting on the sense-organ. It is a peculiar fact that the lowest degree of intensity of similar sensations is not always so comparable as we should expect. The stimulation of a protopathic area of skin, for example, always evokes, when effective at all, a more vivid sensation than does the stimulation of normal parts. Weber's law, in fact, seems to hold only for the epicritic system; the variation of intensity found in the protopathic system is much more limited and rigid (23, pp. 50, 106 f.). The minimal degree of intensity produced by certain sense-organs cannot therefore possibly be considered to be the absolute psychical minimum for that sensation; hence it is illusory to say, as many do, that when the intensity of a sensation is reduced to zero, the sensation disappears, for we have no conceptual means of determining the degree to which any given minimal intensity approaches zero.

We also find that certain sensations vary in intensity very little or not at all. Such are the labyrinthine and the articular sensations of position in particular, and also some of the less frequent, miscellaneous sensations. Yet we could hardly maintain that these sensations offer to introspection no aspect of intensity. Only it is particularly hard

for introspection to seize hold of any aspect of experience that cannot be varied; for it is just by variation, especially in definite relation to changes in the evoking stimulus, that an experience offers itself best to introspection. We may therefore admit the presence of intensity in all sensations, except perhaps those of vision, where, though apparently present, it seems to certain psychologists to be merged in quality.

Extensity.

Besides intensity there is no other obvious variation in the sensation dependent upon one and the same sense-organ. But another attribute can be made clear if we evoke the same quality from neighbouring sensitive elements of the same kind. Sensations of the same quality from neighbouring sense-organs stimulated simultaneously fuse with one another and give rise to a more extended sensation of that quality. In this form the aspect of extensity is easily observed, so that we can now detect its presence in the sensation from the elementary sense-organ, although it is practically devoid of all variability there. Differences in extensity can be traced between the correlated sensations of cutaneous origin. The sensations from skin-spots are undoubtedly extended; but that of warmth is certainly more extensive than that of cold and cold than that of touch or superficial pain. All protopathic seems to be much more extensive than epicritic sensation. Possibly extensity is now, for the most part, in that rigid undifferentiated condition in which we find intensity in the protopathic cutaneous, and in some other senses. It is hardly variable and therefore difficult to observe in labyrinthine and articular sensations of position and in the less frequent sensations. Some of these are, however, more or less massive or diffuse, so that we need not doubt its real presence in them. In smell it seems also to be latent. In sound it takes the form of voluminosity (*v.* later, p. 143).

In one group of cases only do we find a variation of extensity comparable to that of intensity. If *e.g.* the two eyes are directed in varying degrees of convergence upon two pictures which together give a clear binocular picture, it will be seen that the combined figure seems much smaller and nearer when the convergence is great and progressively larger when it is reduced. It is not possible to measure this variation of extensity, as we measure lines, by laying a graduated measure against it, for the measure itself changes in apparent size with the change of extensity of what we measure. We can only compare these variations

in extensity as we compare different intensities. This form of variation, like intensity, does not involve any change in the number or identity of the sensitive elements stimulated; for there is no change in the visual stimulus corresponding to the change of extensity. The changing stimulus lies elsewhere, probably in the kinaesthetic sensations connected with convergence and divergence.

Between extensity and intensity we find very often that there is less independent variability than the usual definition of attributes requires. An increase of extensity often leads to an increase in intensity and *vice versa*, so that in the judgment referring to the stimulus and based on sensations, an increase of the one in the sensation may lead to the judgment of the increase of the other in the stimulus. Explanations of this reciprocity of intensity and extensity suggest that neighbouring stimulations overlap to some extent and so become intenser, or that an intense stimulation radiates and so becomes more extensive. These explanations are, of course, physiological and not psychological. But the slight correlation of intensity and extensity thus given does not seem to call for any psychological explanation.

There are certain exceptions to the rule for extensity just given. The two ears and the two eyes are not two neighbouring sense-organs of the same kind; they are rather two sensitive areas or masses of sense-organs. When they are combined to certain special uses, other modifications of sensation than that of extensity appear. Extensity is not obviously given in sound; the same quality of sound does not appear in different extents, although tones of different pitch vary from one another in voluminosity. Probably the two nostrils act in ways analogous to that of the two eyes and ears, but our sense of smell is so degenerate and our knowledge of it so limited, that we may even suppose we make little use of the powers we have. Further consideration of these cases must be postponed.

Order.

But even when two sensations are of the same quality, intensity and extensity, they can easily be distinguished from one another. Let, *e.g.*, two spots on either hand be isolated and stimulated in the same way. We can tell at once that they are two and from what parts they came, so to speak. We know "where they are." It is a familiar fact that the primacy of this local aspect of sensations has long been the subject of debate. And it may safely be said that the nativistic theory

is in so far correct, as some sort of inalienable aspect, responsible directly or indirectly for localisation, must be attributed at least to some sensations. Otherwise it is not evident how any sensations should ever come to be located. For differences of quality are not introspectively identical with those of localisation, or they would not be so easily distinguished from one another. If they are the same, there must be two kinds of quality—true quality and localisation-quality—which is the same thing as before. If it is meant that slight variations of quality combine to form localisation, it is not at all clear why just localisation and not some other form of experience should result from the combination. On the other hand, if only some sensations possess a local sign, it is not evident how the significance of that sign is to be transferred to any other sensation, even if the latter happens to accompany it regularly. It is not even evident that such a transference could take place without any mechanism, on the basis of mere contiguity in experience. For how could we expect experiences to attach themselves to one another, not to speak of interchanging characteristics, merely because they occur together? The only way in which they might do so is by mere mechanical association. We could not then expect to find that one would be for our experience attached and referred to the other as belonging to it, or that out of the connexion some new modification of experience should arise. For how could we claim to understand or to explain such occurrences? A science of psychology would here be faced with the unintelligible and irrational. The problem is merely a case of the general problem which is the object of our study: if a modification of experience is not common to the primary elements of it but arises with their combination, how does it so arise, and upon what aspect of these elements is it based? The formulation of such a problem calls for a vigorous protest against the admittance of irrational sequences in experience. The natural consequence of admitting such possibilities is the abandonment of every attempt to resolve them for psychological science. Salvation from such hopelessness could only be brought by some happy accident of experimental research. But if the mind is the instrument of rationality, we may at least expect it to be itself thoroughly amenable to rational, scientific treatment. And science cannot stop at the determination of mere dependencies; that would be a blind science, a science without the light of causal statement and conviction.

For the present, therefore, we shall accept naïvely the presence of a distinguishable aspect in sensations localised in different parts

of a sensitive area. There is no doubt that they can be distinguished primarily and in isolation, without the help of any sort of special association or inference. But it may be said at once, that this aspect of elementary sensations, though it undoubtedly distinguishes each element from others of the same kind, is capable of development along its own line, like any other attribute. There are complex, separable forms of localisation-consciousness, just as there are of quality, intensity and extensity. The success of our view will depend largely, if not wholly, upon what we can do with such a starting point. Its sufficiency and correctness may be questioned at present, if only for the reason that the single method of introspection, as we have already pointed out, is liable to error in dealing with the less variable attributes of sensory experience. But the results which our starting point leads to will ultimately justify it.

This third aspect of sensations we will call order. It is to some extent a form of individuation, by which sensations are differentiated, in the first place in relation to others of the same quality, but also ultimately to those of a different quality. But order is essentially an aspect of sensation, perfectly comparable to intensity and extensity. We might call it place in the mind, if it were not that place tends to imply that the mind has some real spatial extension, at certain points of which the sensations are to be found, whereas we have to remember that order is a place-aspect of sensations, which it qualifies, without any relation to real *locus*. Order is therefore the better name, as it involves only the idea of distinction, relatively to others of the same quality, intensity and extensity, by means of an aspect of arrangement inherent like these attributes in the sensation itself. The order of every sensation is fixed relatively to all others present, but does not depend upon the number and kind of these. Two sensations are not as such of neighbouring order because they are alone together in consciousness. They may still be of very different order. This attribute of order is much more important than any of the others for the development of experience and especially of the higher reaches thereof. It is the basis of all kinds of localisation and of many other complex modifications of experience.

Order is present in the form of localisation relatively to one another in all sensations, except those of sound and smell. In the case of articular and labyrinthine sensation, it seems much more advisable to treat their differences as differences of order rather than of quality. How should we otherwise be able to treat them as a system of interrelated positions? Sounds are, of course, localised in space, but this localisation is known

to be not a primary peculiarity of these sensations, but an integration based on the simultaneous use of the two ears in ordinary cases and perhaps also often on differences of timbre or harmonics. Sounds are not localised at a certain point of a sensitive area; indeed it is improbable that each ear contains neighbouring sense-organs of the same kind. Sounds, however, assume an order relatively to one another in the form of pitch. In smell we are unable to suggest any primitive aspect of order. Smells are localised by a secondary indirect process, similar to that of sound and most usually by variation of intensity, consequent upon turning or approaching the nose towards the source of smell. Have we now so little versatility in smell that we cannot pick up the lines of their order? It is impossible to say. Our very ignorance regarding smell constitutes by itself one of the most difficult of psychological problems. The two ears, the two nostrils and sometimes the two eyes do not afford us sensations which differ in order, so that sensations of the same quality from each of these pairs of parts do not give rise to the same modifications of sensory experience, as do sensations of different order from a single sensitive area.

Other aspects.

To the above three attributes a fourth—order in time, duration, or protensity (24)—is sometimes added. There are many good reasons why such an aspect should be expected. But many difficulties lie in the way of its study. It is for one thing very hard to decide the simple introspective problem whether the order in time of an experience is a true attributive aspect, or is merely position in real time, identical with the temporal succession of events in the material world. Two sensations may be of the same quality, intensity, extensity and order, and yet be distinguishable. But is this distinction not a purely conceptual one? On the other hand it may rightly be asked whether any such conceptual distinction could be made, unless it had first a basis in sensational experience itself. The answer to this very important question is one which will be decided largely by the results of a study of those attributes which are clearer, as well as of the complex modifications of experience which result from them. For the present, we may without inconsistence decide in favour of an attribute of time-order or protensity of some kind, without attempting to give it a precise characterisation. Indeed, further study may give us reason to look for and find still other attributes of sensation than those enumerated. The

problems raised in this paper can only be worked out in detail for a few cases, but it will be evident that they are very general. The study of the one will act and react upon that of the other.

(*b*) *Difficulties.*

Study of the attributes of sensation allows us to institute a comparison between such senses as those of cutaneous origin and that of hearing, which gives results of great advantage to the further study of the modifications of sensation. This comparison is based in the first instance upon introspective evidence, and finds its further justification in the psychological results which emerge from it.

Cutaneous sensations are varied by the attributes of intensity, extensity and order, but they show little variation in quality. Hearing, on the other hand, has a great variety of distinguishable "qualities," which are undoubtedly capable of variation in intensity. But these qualities do not seem to be extended after the manner of cutaneous sensation; and in so far as only simple forms, poor in harmonics, are presented to one ear, they seem to be devoid of any sort of localisation or order. Such is the result of what might claim to be a simple unreflecting comparison of cutaneous and auditory sensation. Sound seems to diverge more from the probable "type" than any other kind of sensation.

Closer consideration, however, leads to a very different conclusion. Instead of having given a purely unreflective, unbiassed judgment, we may possibly have been influenced very strongly by a comparison of results. Have we not really been comparing the outcome of integration in cutaneous with that in auditory sensation? Have we not, in fact, argued that, if sound had extensity, it ought to give us the sort of spatial extensiveness that we find in touch and vision, and that, if the elements of sound from one ear had order, they should arrange themselves over our skin or in space around us, unaided by the other ear or by differences in timbre? That we have indeed done so we shall best and easily find out, if we ask the question, whether the aspects inherent in sound, both in their primitive and in their complex forms, are closely comparable with those of touch and vision. If they are really comparable, we must, of course, look for some reason for the differences between touch and vision which influenced us in the first instance. If we can find it, we shall have clear proof that we were influenced in our argument by a principle we failed explicitly to state or to adopt: that like attributes should lead to like integrative results.

Sound.

Are the attributes of sound and touch, then, exactly comparable? There can be little doubt but they are. The manifold "qualities" of hearing are capable of the most definite arrangement in one continuous series of tones from the lowest to the highest pitch. No other "qualities" fall of themselves into so precise and unmistakable an arrangement. What evidence has introspection to offer against the classification of these differences as differences of order? On the contrary, introspection can justify such a treatment now, as it did long ago. "Till the time of Aristotle tonal qualities were considered essentially as a *ποσόν*, not as a *ποιόν*" (25, vol. I. p. 136, note). In fact, in spite of definite rejection of this view, it is hard for the adherents of the qualitative view of pitch to suppress the tendency to treat it as order. The qualitative order of tones is said to be "analogous" to the spatial (*ibid.* vol. II. p. 55). Mach, indeed, traces an analogy between the fixation of spatial points and the fixation of tones (18, pp. 182 ff.). Let us, therefore, frankly treat pitch as order and see what the result will be.

Tones are generally recognised to vary in voluminosity progressively, the deepest having the greatest, the highest the least volume. Pitch and voluminosity cannot be identified with one another, for we are able to discriminate differences of pitch much more keenly than differences of voluminosity. Several tones of the same or of different pitch sounded together do not give an increase in voluminosity, as we should expect. They fuse in extensity as little as do the extensities of tactual sensations from the two hands. But for the former there may be forthcoming as good an explanation as we can give for the latter. The facts, therefore, should not prevent us calling voluminosity the extensive aspect of tone, if we are justified by introspection in doing so.

If we recognise, then, that, just as all tactual sensations have the touch-quality in common, so all tones share the same sound-quality, we shall have our full complement of attributes: quality as such or mere sound, order or pitch-place, and extensity or voluminosity. Beyond these three aspects, tone does not seem to have any other characteristics than intensity and those that are the result of the integration of different tones. Even timbre is shown to consist of, or to be actually analysable into, separate tones, each provided with the aspects we have enumerated.

The peculiarity of tone is that of these attributes two—pitch (order) and voluminosity (extensity)—are mutually dependent variables. It is impossible to run through the variations of pitch without at the same

time varying voluminosity and *vice versa*. As tone is elementary sensation and as pitch and voluminosity are its primitive attributes, it is impossible to look for an explanation of this interdependence of attributes elsewhere than in a physiological theory of the sense-organ. Such an explanation, if it is not actually there already, may be said to be in sight at the present time. But it cannot concern us here. We can do no more than acknowledge the introspective fact of interdependence of pitch and voluminosity.

For this very reason it is evident that extensity in tone cannot, as in the other senses, be a variable dependent upon the occurrence of many tone-sensations of neighbouring or different order. For as each pitch or order has a different voluminosity inseparably attached, though easily distinguishable from it, the aspect of pitch will always suffice to segregate its fellow voluminosity from others, even when there might be a tendency for them to fuse in some manner, and *vice versa*. Many tones together, therefore, will not fuse, as sensations of the other senses do, in any way except intensity[1]; and even that will occur, of course, only when the tones are the same in quality in its threefold aspect, *i.e.* in pitch. In other words, tones of different pitch sounded together will always be distinguishable, even if they are not always distinguished from one another. It need hardly be added that sounds fuse together as mere sounds apart from all aspects or attributes.

Many high tones of nearly the same pitch, even when they are consonant, would not therefore give a voluminosity equal to that of a tone of great depth. The voluminosity of all together may very well differ from that of any of them alone, in a way peculiar to such combination, but it will never approach towards that of a deep tone. For this and other reasons it will often occur that many tones together are not distinguished from one another, but they can always be distinguished as soon as the attention is directed upon their order or pitch, their voluminosity, or the integration of these. For if homologous aspects of two tones are distinguishable from one another in isolation, they cannot be completely fused with one another when they occur simultaneously.

We have thus brought the introspective nature of auditory sensation into line with that of all the others except the visual and olfactory. And we have explained the first apparent discrepancy between tone

[1] Or timbre, which we may neglect for the moment, as it is obviously not a characteristic of the elementary sound. Timbre, as an integrated character of tone-complexes, forms an interesting problem for psychological treatment.

and the general type of sensation. But it is generally recognised to be very difficult to decide whether noise is a unique quality of sound or not. Our revision of sound will here also give us a definite point from which to proceed. A noise may be said to be a simple sound whose pitch is not yet audible, because it has lasted less than the time of two vibrations, or a complex sound of many pitches which make each other indistinguishable to the unaided attention. We have good reason to let this definition pass, as we know similarly from the sense of pressure that it takes less time to be aware that we have been touched than to be aware where we have been touched. This is Külpe's law, that "general denominations are more easily reproduced than special" (14, p. 172).

If our analysis is so far correct, we shall expect to find it justified by the nature of the modifications which result from the further integrations of tone-sensations. These integrations should be parallel in mechanism and effect to the integrations of similar attributes in touch and vision. On the other hand, the treatment of pitch as quality defers indefinitely all hope of explaining the facts regarding melody, interval and tonality, besides those of discrimination already mentioned. There is also evidence of a genetic nature to show that the sense-organs of hearing have in all probability developed out of those of a sense with the full number of attributes, viz. pressure. But our argument can hardly lead us to suppose that sensations of hearing have actually developed out of those of pressure. For the skin sensations, whose sense-organs might also be connected genetically with those of pressure, all show differences of quality without any obvious loss or integration of attributes. If any theory of psychical development is suggested by the analysis of the attributes of hearing and their identification with those of the other groups of sensations, it must be one which traces all varieties of sensation back to a common origin or at least to a common type.

Vision.

We have already noticed that visual sensations are characterised by the attributes of order and extensity. Certain observers, however, hold that they are devoid of all intensity. The intensity which is apparently present, it is urged, is really a form of quality[1]. It is clearly impossible to settle this question on its introspective basis alone.

[1] For references, *v.* 28, pp. 21, 324.

We must look for some other ground of argument. It is a further peculiarity of vision that it offers the vast range of progressively different qualities indicated in the colour-body. All other groups of sensations than those of vision, hearing and smell, occur only in one, or perhaps sometimes a few discrete qualities and do not seem to lack any of the usual attributes except perhaps in virtue of their obscurity to introspection. We should hardly venture to urge a plea of obscurity to excuse the apparent absence of certain attributes in vision and hearing, although the plea might hold for smell. It is of interest to recall that the great variety of sound-qualities can be explained by the variation and integration of extensity concomitantly with that of order. Only one form of quality similar to the unique qualities of pain, pressure and most other sensations except taste need be postulated. This integration, further, has to be accounted for by reason of physiological determination not of any special psychological integration of pitch and extensity; for, though correlated differently in sound, these are attached to one another in the same way in all sensations. In pitch we have still obviously a difference of psychical order, now inseparably attached to quality. There seems to be a great variety of sound qualities, though there is clearly only one.

We might therefore surmise that the typical form of elementary sensory experience is such that, when a difference of quality occurs, it is a radical difference and that these elements of experience could not be expected to fall into different classes of very similar sensations, such as those we find grouped together as visual, auditory and olfactory. We should rather expect discrete forms, such as touch, pain and more especially cold and warmth, which, though they are both concerned physically with temperature, have nothing in common as sensations. Primitively we should have one sound experience, one or at most a few unconnected and dissimilar visual experiences and a few for smell[1]. For a sensation which has a number of variable aspects must have some unchangeable aspect. Why should it otherwise be called one? If there are any primitive visual experiences, it is certainly difficult to locate them purely psychologically amidst the flux of qualities. The great variety of visual experiences, therefore, calls for some explanation. This explanation must, however, be left for the

[1] It is interesting to notice that it is in these complex senses only that we find most evidence of physiological integration and in particular the processes of compensation and rivalry. This would suggest that even the four qualities of taste are too many for one sense and that without integration only a single quality is found.

future to bring. The need for a psychological theory of vision is great, for we have none as yet. Our theories of vision run out into pure physics or physiology and leave all purely psychological problems entirely alone.

Smell.

Of all the sensations, those of smell offer the greatest resistance to any form of investigation. The mere difficulty of manipulating the smell stimulus is overwhelming. We have practically no kind of a theory of smell at all, physical or physiological. The slight clues given by partial congenital anosmia and olfactory fatigue have lead to no tangible results. In psychological theory, where we might reasonably expect to be less hindered, we are quite as badly situated. For we have only a tentative and imperfect classification of smell qualities at the best. These seem to be of indefinite number and devoid of all extensity or order. This ignorance constitutes of itself an important puzzle. For if the rich and progressively differentiated varieties of our experience, including those of the senses, are derived from simpler, more abruptly differentiated elements, as we must suppose, it is difficult to understand how this process of integration can be completely hidden as it is in vision and smell[1]. For vision we might suppose that we just do not yet see what is there to be seen. For it is a postulate of our whole treatment that the elements of experience are not lost to view when they integrate to form some new modification of experience, but that they may be seen in the integrative modification once we can read this rightly. But we have to remember, on the other hand, that these elementary integrations are always physiologically conditioned, although their form must follow psychological lines; special physiological conditions may make the process of integration very complex indeed, especially in highly developed senses, such as those of smell and vision. Thus we may expect that the unravelling of such difficulties may come rather by means of physiological experiment, than by unaided psychological analysis. Whatever happens, there can be no doubt that the psychological result must consist of a reduction of the complex progressively variable qualities of vision and smell, characterised by peculiar attributes and wanting in some of the usual forms, to a few simple abruptly different elementary sensations, characterised by the typical attributes.

[1] But cp. feeling, later, p. 193.

(c) *Conclusion.*

The typical characteristics or attributes of sensation may therefore be put down as (1) quality, in virtue of which sensations fall into separate species, abruptly differentiated from one another thereby, (2) order, which constitutes the individuality of single sensations of the same quality and gives them a definite place in the total experience of any one moment, (3) intensity, by which a variation of each individual sensation is made possible, and (4) extensity, by virtue of which each individual sensation is capable of continuous fusion with others of the same quality, whatever be their intensity, so long as they are of neighbouring order. It is a peculiarity of extensity that it is not bounded by precise limits; and for this and other reasons it cannot be argued that the distinction of elements of experience is fallacious and destructive on the ground that we should never be able to understand how such discrete elements fuse and combine with one another. No real psychical limits are presupposed by the distinction of elements of experience and their typical characteristics. In spite of the difficulties of vision and smell, so many different kinds of sensation do actually show all these characteristics, that we may expect every elementary sensation to be characterised by them. We have the more reason to assume this for sensations of certain kinds which, as we have remarked, show little or no actual variation by way of these attributes, since we have good cause to believe that the occurrence of many of the possible variations of cutaneous sensations, such as those of temperature, is dependent upon the range of function of the sense-organs which subserve them. There can be no doubt that the most highly developed senses are those of sound, vision and smell. Sound, which is still clearly in course of development, as the peculiarly rapid advancement of the musical art indicates, we have already reduced to the type. Vision is even more complex, but it still stands close to the type, except for the alleged absence of the attribute of intensity. As the linear series of progressively different tone-qualities is explained by integration of a single unchanging quality with other attributes of the type, so we may hope to explain the tridimensional variation of visual qualities by a similar process of integration. The vast and probably multi-dimensional variation of smell qualities would suggest perhaps a still more elaborate process of integration. One attribute of smell which might account for some part of this, at least, is missing, viz. order. It is uncertain whether

extensity is also missing there or is only difficult to observe, because it is not integrated to varying a real extensity, as in touch and vision.

It is important to emphasise that the problem of the elements of sensory experience and their typical characteristics forms the central and essential problem of any psychology of sensory, if not of all experience whatsoever. For, as we shall endeavour to show in the following pages, it is by means of the fusion of variations in these attributes, that elementary sensory data are linked and integrated into complex experiences, which contain these differences in them subsequently in the form of new modifications of sensory experience attached to the whole unity of integrated data. An architectonic of experience is as unthinkable without the attributes, as is an architectonic of matter without the physical and chemical properties peculiar to its elementary constituents. Far from being the outcome of meaningless psychological abstraction, the problem of the attributes is vital to the existence of any pure science of psychology; and its progress is dependent not only on the means of observation peculiar to psychical subject-matter—introspection, but it is assisted enormously by a study of the forms of compounds which experience shows. It must be our next task to analyse as many as possible of these compound experiences, and to ratify, extend or correct our knowledge of the attributes of elementary sensation by means of the knowledge of the mechanism of combination we thus gather. A means or basis of combination is always necessary; for we must remember that experiences, whether elementary or compound, cannot be expected to arrange themselves by any means external to the mind or not operative in the mind. They must arrange themselves entirely by themselves, purely in virtue of their inherent psychical powers. We expect, of course, some sort of parallelism between the psychical and the physiological, so that we may trace the dependence of the one upon the other. But we have, as yet, no hope of explaining the characteristics of the former in terms of those of the latter. It is still more vain to suggest that physiological arrangements explain a form of psychical arrangement which is not grounded in characteristics inherent in the psychical elements themselves. The physiological arrangement, doubtless, determines the latter and is, of course, a valuable item of knowledge. But an explanation of psychical arrangement must be full and satisfactory and must carry conviction in itself. Experiences hardly ever come singly and successively, or in pairs and simultaneously, so that they might be connected or arranged by mere isolation; they come always in crowds. Why, then, should one of them

link with another and not with a third, if not by virtue of the intrinsic affinities of their characteristics? No external power of body or of will could rule them. This reflection is often ignored by those whose interest in the study of experience is partly or wholly physiological, and by all who take the orderliness of experience, as it stands, for granted.

And it is just in the attributes that this means or basis of combination of the elements of experience is to be found. What could be more likely? Where else should we look for any means of combination? The states which result from the combination of the elements of experience show an introspective character which stamps them at once as elaborations or secondary forms of the primary modifications of experience, the attributes. Nothing could be more plausible than the theory that all secondary modifications are derived from the primary attributes by the integration of differences of the elements of experience given in respect of one of these attributes. We have every reason to maintain this for all secondary modifications until we meet with some pure datum of experience other than sensory. Integration must result in a modification of the integrated attribute. We cannot expect to find a modification of extensity resulting from differences in the attribute of order of the sensory elements given, or a modification of order consequent upon differences of intensity. For we should not be able to give final assent to any such equation and should thereby fall short of our ideal explanation. By experimental investigation we may exhaust all the discoverable conditions which affect an event, but experimental exploration can never be enough. Our knowledge can never be complete, till we can supply a convincing causal identification which contains evidence in itself that it is complete. We must be able to show that, in respect of some one aspect, conditions and event are identical. This is clearly impossible, if on the one side stands intensity, on the other order, no matter how clearly we may have shown a correlation between the two sides. To uphold this position, however justifiable it be, calls for some courage. For we find in the psychology of the day quite a number of these irrational sequences. Only one need be mentioned; it is commonly held that our localisation of sounds is dependent upon the difference in intensity of a sound as it reaches the two ears. As it stands this may be true. But that psychically realised differences of intensity of sound turn into or produce of themselves a localisation of that sound is a proposition no one can assent to. Either the facts, as stated, are wrong, which does not seem to be the case, so careful and repeated has been the

experimentation on this question; or differences of intensity in physical sound evoke some hitherto undetected attribute of sensation, which, along with the sounds given, suffices by integration to yield psychically localisation of sound. If we can discover this integrating attribute of sensation, we must then be able to assent to the identification and we shall be justified in considering our statement as final, unless experimental exploration shows us that we have omitted one or more stages. In any case, the final statement must be convincing as such. Nothing less than this can be our ideal, if we are ever to have a causal science of pure experience.

§ 5. THE MEASUREMENT OF EXPERIENCE.

It is a familiar fact that the attempt has been made to measure the variability of the simple sensation. And as intensity is the only attribute of the elementary sensation from the unit sense-organ that is capable of variation, it is natural that the effort to measure should have been concentrated upon this attribute rather than upon the others. Yet one might have thought that the idea of measurement was more applicable to the attribute of extensity; for the simple sensation provides a natural unit of extensity, whose multiplication seems to lead to an increase of that attribute. But it will be remembered that this increase of extensity, which can be measured by the conformity of a unit-standard with parts of the amount measured, is not at all a variation of extensity comparable to the psychical variation of intensity. The extensity of one and the same elementary sensation is never variable, and in sensations of any one class it is usually found in a rather rigid, undifferentiated state; it seems to find true variation only in vision and sound. In vision, its variation is dependent upon change in convergence; in sound, we find it attached to pitch in the form of voluminosity, which is variable, but does not grow by the accretion of sounds. In regard to order, it was hardly to be expected that the attempt to measure should be extended thereto, for no elementary sensation differs by itself in order and each elementary sensation has a different form of order from every other. Only in sound has order, in the form of pitch, been made the object of measurement and there it is notable that the usual results are not obtained.

But even though intensity seemed to invite a quantitative study, it is obviously impossible to apply the quantitative concept to that attribute. For there is as little hint of any distinguishable unit in

a given intensity, as there is in a given order or in extensity in the strict sense. Nor does the fixation of an arbitrary scale of just perceptible differences of intensities attributive to different sensations lead to any other reality underlying or conditioning intensity than those of a physical or physiological nature, which are already sufficiently measurable. More decisive than all else is the fact that we cannot manipulate our arbitrary unit, however chosen, so as to add it to or take it away from a given sensation.

It is hardly possible to bring further argument to bear against the possibility of measurement. We cannot hope to make one aspect of experience the basis of standardisation of any other. We should expect with as much reason to succeed in applying the notion of sensational intensity or extensity to the quantitative concept as to succeed in applying the terms of conceptual quantity to sensational intensity. Just as great is the world of difference between the order-differences of sensation and the conceptual orders of a mathematical or of any other system. These and indeed any other psychical characteristics are utterly incomparable and incommensurate. We can, therefore, only demand that the lines of variation of experience be carefully observed and compared. It will then become evident that experience varies along certain lines in ways peculiar to itself. A multiplication of units would not constitute variation at all. Nor is anything to be gained by the supposition that these variations are really quantitative; for the actual variations in any modification of experience serve us well enough to indicate the physical stimuli which evoke them and to enter as such indications into the work of the mind. When we find, as we do, that these stimuli can be treated and manipulated as consisting of unit-amounts, the variations of our experience will serve to indicate their presence and action and will stand conceptually as indices of quantities. It is not our concern, nor is it possible to show at this point how this takes place.

The question whether experiences may differ from one another without being recognised as different, does not arise here. For a slight difference by way of variation may just as well pass unrecognised as a slight difference by way of quantity. There is also a great difference between the mere presence of differences and the distinction of differences. The integration of differences and the process of distinction of differences have each their special conditions, which are not necessarily the same (cp. below, p. 176). Outside of these limits we cannot expect differences to lead either to any form of integration or to their own

distinction. Indirect proof of their presence therefore creates no problem. Turn the matter round as we may, we never do more than recognise differences by variations of certain modifications of experience directly or indirectly, as far as is possible.

In this connexion it is important to notice that, besides the primitive attributes already treated, we find in sensory experience a number of secondary modifications, each of which has its own peculiar manner of variation. Examples of these modifications are motion with its variation by speed, distance with its much less marked variation by extent of distance, and depth. Motion and distance we shall study in some detail immediately. These modifications have not usually been held clearly before the attention in the treatment of the problem of measurement, although quantitative experiments have been carried out upon them. The reason for this neglect is that they have not been treated properly as modifications of experience. We may say generally, however, that the problem of mental measurement and any formula such as Weber's law are applicable only to variable modifications of the same nature as that of intensity. We may also with much safety assume that where a threshold and a just perceptible difference are determined, we are there dealing with one of these variable modifications of experience. So many quantitative determinations have been made of distance in the form of discrimination of points that it is surprising that explicit reference is not always made to the fact that distance is a modification of the same peculiar kind as intensity, with a line of variation of its own. For that and other reasons the work on the discrimination of points looks awkward and out of place in any systematic treatment of psychology, unless it is recognised for what it is: the investigation of the discriminability of orders (primary attribute) and of distances (secondary modification, *v.* § 7).

The attempts that have been made to measure sensation have sometimes been characterised as the determination of sense-distances or of distances between the different points of variation of any modification of sensational experience, as fixed with reference to the evoking stimuli (27). We may, for example, judge that one degree of intensity is as far above another as the latter is below a third, and the like. If there is any such distance which may be presumed to be objectively fixed and constant, *e.g.* the just noticeable difference, it may be adopted as the basis of measurement. Our measurement with this unit will be as real as is the measurement of height, time and weight, for what is measured is in these cases never magnitude, but merely the distance between

limiting points ("magnitudes"). "The prototype of all measurement is linear measurement in space" (27, pt. 1, p. xx).

We must be careful to see that we know how much is involved in this statement. Spatial points have certainly no magnitude. But they are equally devoid of any inherent qualitative character. For conceptual science they can be fixed only by their relations of distance to some fixed point. But neither this fixed point nor the unit of distance has any inherent qualitative fixation in science. Hence the necessity for science of finding some natural unit of distance which is independent of the immanent qualifications of our experience; hence also the impossibility of finding a naturally fixed position. For natural distances, *e.g.* wave-lengths, are repeated and therefore lend themselves to conceptual treatment, in so far as they may be presumed to remain constant in repetition, in spite of the inconstancy of their bounding positions. It is therefore enough, if these can be fixed in attention for a short time. But position cannot in turn find its ultimate fixation by reference to distance. Being in itself nothing, it can be fixed only by reference to the inherent specifications of experiences.

It is the peculiarity of experience that each part of it contains its own qualitative characteristics apart from all relation to other parts. These characteristics we have found to be quality, intensity, extensity, order and, perhaps, protensity. Even the point or "spot" of sensation is qualitatively fixated in a way that is independent of all real positions and of time. These immanent characteristics cannot be taken over by science into its conceptual schemes, so that they must be converted into conceptual indices, based upon processes as independent of experience and its intentions as possible. But it would be a mistake to suppose that science is interested only in the fixation of points by conceptual distance-references. It wishes, wherever possible, to state the actual composition of these "points" themselves. This weight, it says, is 1 cwt., or one hundred weights. When it says a hill is 1000 feet high, it does not mean that the highest point of it is itself 1000 feet. It has, in each case, to consider its own intention and the license of the real facts. The inherent indications of experience cannot be treated conceptually. Any success in doing so would destroy them utterly. But they could be arranged conceptually by reference to one another. One must, however, remember that this reference (sense-distance), as a scientific instrument, must itself be purely conceptual. It has for its unit a process whose constancy is presumed, but whose nature is hardly understood—distinction of difference. It cannot properly be compared

with the distance between points in tactual or visual space or purely sensory distance. Distance is as direct as feeling and as *anschaulich* as intensity or depth. What the distinction of differences is, we do not yet know, but it can, at least, never be identified with sensory distance. For sensory distance is given only by sensations which differ in respect of order. It does not result from differences in respect of intensity, extensity or quality.

In a word, the whole work of measurement from the purely psychological side ends just where it began, in the determination of relations to effective stimuli, to favourable and unfavourable circumstances, of the just noticeable presence or difference of experiences or of their modifications. As experiences and more especially their modifications can be made to vary regularly in most cases, although some are practically unvaried, just noticeable differences between these variations are thereby implicitly arranged. That the stimuli corresponding to these just noticeable differences stand to one another in average cases approximately in a certain relation, is an important fact, but it tells us nothing about the experiences that was not already revealed by the changes of these experiences themselves. As the distinction between two variations of any modification of sensational experience is not itself a modification of sensational experience or a variation of such a modification, but a different, later and probably highly complex mental process, it follows that the determination of just noticeable differences will be subject to a number of influences of a purely psychological nature, which we cannot at the present moment understand or systematise. They may therefore be put aside as belonging to another part of our study, although they may serve there as an important basis of research. It will also be clear that we may pass by all detailed questions regarding the stimulus-values of thresholds and just noticeable differences. The value of these, as evidence of the existence of a relation of dependence between one mental state or modification and another, has probably been very much overestimated. For these values depend, as we have already noticed, very largely upon physiological conditions in the sense-organs and do not seem to be due to purely psychical restrictions. We may therefore expect them to fluctuate so much from type to type and from case to case, that their values for psychological theory can only be the slightest. We are therefore free to proceed with our study of the varieties of experience.

As no true measurement of experience is possible, we cannot expect the mind's evolution to be based upon its measurement of itself, or to show

quantitative laws. Nothing is given but a number of experiences qualified by certain variable or unvariable aspects. The mind's evolution must therefore rest upon these differences. We must expect to find that the widest use is made of these differences. Far from being a hindrance to unification and progress, they are just what makes these things possible.

§ 6. Secondary Modifications of Sensation.

It need hardly be said that all secondary modifications of sensation must be observable directly; their presence may not be inferred. Changes of a peculiar indescribable kind, evident only after direct experience, supervene under certain circumstances, and though seeming to add something to the complex of sensations to which they are attached, nevertheless do not so radically change their sensational foundations that the identity of these before and after their appearance is ever in doubt. As modifications of sensation, they are distinguished from other modifications of experience in that they are dependent upon the stimulation of sense-organs for their first occurrence at least, and that, in their full variety and distinction, they attach only to sensations. They can be distinguished from the attributes of sensation by the fact that the latter are hardly separable from sensation at all, as far as we know; whereas secondary modifications never accompany the single sensation derived from a single sensitive element. On the contrary, they are always evoked by the action of stimuli on two or more sensitive elements, unless successive stimulations of one sensitive element suffice. From the psychological side they presuppose the simultaneous or successive conjunction of two or more sensations. While these necessary conditions are always complex, they are not always of the same nature. Sometimes the stimuli or the sensations refer to one and the same sense, sometimes to different senses, while the modification which results forms an extension of that attribute whose differences are integrated. The study of the secondary modifications of sensations will therefore be rather complex, and will in any case involve consideration both of their introspective nature and of their sufficient conditions, in so far as these are of a purely psychological nature. It will be necessary in each case to find for each secondary modification of sensory experience and its variations not only an unambiguous complex of sensory data, but to show how certain variable aspects of these can be identified with the modification which results from them.

For the present, however, we shall study only two of these modifications—motion and distance—and the simplest and most primitive forms of these.

I. *Motion.*

When we cast around for further differences in sensations than those already mentioned, we cannot fail to have our attention drawn early to one of the simplest and biologically most important of all further warnings from the environment of an organism, viz. motion. In its generic form, *motion is obtained when successive sensations from neighbouring, or, within certain limits, separate sense-organs of the same kind, differing at least in respect of the attribute of order, fuse with one another.* We shall refer later to the limits of difference of order within which the integration of motion can occur. For the present we shall neglect them and consider only the case of continuous motion produced by a moving stimulus. Motion is found developed upon every group of sensations which show distinct variations from one another in order, viz. the cutaneous sensations, especially touch, articular sensations of position, visual sensations and also auditory sensations, where it is known as melody.

Cutaneous. On the skin it is found that every nerve-ending and every touch-spot can be distinguished from every other, with the exception, perhaps, of those that lie too close together to allow of isolated stimulation. If this result is to be obtained, certain precautions must be taken. The stimulation must be confined to the two touch-spots to be examined, a sufficient pressure must be used, as nearly equal in the two cases as possible, and a certain interval must be allowed to elapse between the two stimulations. If two points are stimulated in this way, we have the impression that the stimulus has moved on the skin (10, pp. 721 f.). Motion is thus found in its simplest and clearest form in passive cutaneous touch. As a secondary modification it rests in this case solely upon the difference in order of the sensations from two neighbouring pressure-points.

Articular. Motion is developed upon the sensations of position of the limbs and appears, as such, in the form of what is known as sensations of the movement of the limbs. These two groups of experiences are usually carefully separated from one another, as if there were even a qualitative difference between them. For this reason they are both known as kinds of sensation, whose differences presuppose the existence of different kinds of sense-organs. In favour of their separation,

it is argued that sensitivity to movement varies from part to part of the body, but does not run parallel to the sensitivity of these parts to their position. Thus the movements of fingers and toes seem to be felt equally well, although we are hardly conscious of the position of the latter (10, p. 751). In favour of their identification through the medium of the modification of motion, the following considerations have to be urged. (1) It is a familiar fact that in the sense of vision and more especially in that of touch, the discrimination of simultaneous points is very much less acute than is the sensitivity to a moving stimulus. The sense of position, in touch and in vision, or the sensitivity to the mere presence of a sensation may also be said to be much blunter than the sensitivity to movement, especially if the stimulus whose position has to be observed has been acting steadily for some time and is accompanied by others. Let it move even very slightly and it will be noticed at once. (2) Both the sensitivity to position and the sensitivity to movement vary in different parts, but not concomitantly[1]. It is evident, therefore, that the objective disparity between sensations of movement and those of position is not greater than that between a moving touch[2] or sight and a simple sensation of these kinds. (3) From the subjective side, it may also be said that there is quite as great a difference between a steady visual sensation and a moving one as there is between sensations of position and sensations of movement. It is clearly an easy matter to show that both visual sensations and visual motion are dependent upon the same sense-organ, but there are obvious difficulties in the way of the accurate physiological identification of articular sensations of position and movement. We are therefore thrown back upon psychological comparison and analysis and there can, surely, be no doubt that in the light of the considerations just put forward the physiological

[1] Cp. 10, p. 366, "Die Wahrnehmung von Bewegungen an der Netzhautperipherie ist nach Exner und Aubert viel feiner als das Distinktionsvermögen daselbst, und Exner schreibt den peripheren Netzhautpartien geradezu die Rolle zu, Wahrnehmungen von Bewegungen zu vermitteln." It is therefore evident that any difference of effect produced by faradisation of a joint upon the thresholds for articular position and for movement cannot be brought forward as an argument in favour of the qualitative distinction of articular position and movement. In fact, the greater blunting to position is quite natural.

[2] Such expressions are used deliberately. Seen from the level of perceptual integration, they are of course insufficient. They would then become "a moving tactual stimulus," etc. From the sensational level, with which we are here concerned, "a moving touch" is correct and unambiguous. In strict psychological sense, there never can be any confusion of stimulus with sensation or the like, but only of one level of integration with another.

and psychological independence of these two classes of sensation would constitute a gross extravagance of sensory mechanism[1].

We are therefore confirmed in our previous opinion (p. 140) that the sensations of position from one joint, or from various joints for that matter, are to be considered as differing in order. The derivative nature of the sensation of position is sometimes supported by reference to the fact that we gradually lose a clear sense of the position of the arm if the attention is distracted and every movement and contact of the arm with other parts of the body is prevented (cp. 30, p. 155); the sensation of position, it is held, is only an after-effect of that of movement. But such an argument is worthless. The facts can be explained by a theory of adaptation similar to that commonly accepted for touch, that pressure is only felt where there is a quick change of pressure over a given area (8). The facts, therefore, support the primacy of the articular movement as little as that of tactual movement, as against the simple sensation from the "spot." Psychologically the facts may indicate the presence of the aspect of intensity in articular sensation. A semblance of extensity seems to be given in the different voluminosity of the sensation of movement from the thigh compared with that from the little finger. We should then have the full complement of attributes in this sensation, all of which, however, owing to the peculiar physiological conditions of the case, are much clearer and more easily observed in the complex of movement than in the single elementary sensation of position.

Labyrinthine. Our awareness of the motion of the body as a whole may also legitimately be conceived as a form of motion and as based upon sensations of position of the body as a whole. This view is also opposed to current theory, which treats the two kinds of experiences as different kinds of sensation. Physiological investigation supports the latter in so far as two separate sets of sense-organs are found, one for each group of sensations. But this is only apparently a difficulty. For it is well known that the various parts of the skin and of the retina, which contain very frequent repetition of the same sense-organ, are not

[1] The physiological problem of the sensory mechanism, of which at the present time we know next to nothing [cp. 30, p. 25], is in this case, as in all others, quite irrelevant, for it is quite possible that it consists of a very complicated form of physiological integration. This is unimportant to psychology, so long as the sensation evoked possesses the full number of attributes, including order. It would, on the other hand, be a highly important fact for psychology, if it suggested to us the lines of psychological integration. We find a physiological integration, for example, in the labyrinthine organs of position and movement.

equally sensitive. Again, we find different systems of sense-organs in the skin, which provide us with very similar kinds of sensation whose peculiarities show variation; the sense of temperature, for example, is based on a protopathic and an epicritic system, of which only the latter shows the process of adaptation. So too in vision do we find different kinds of sense-organs procuring very similar sensations, which differ, however, again in regard to the process of adaptation or special sensitivity to certain degrees of light. It may be agreed, then, that a reduplication of sense-organs giving the same primary experience, whose actually realised complications vary somewhat in character, is quite a usual occurrence.

It may be taken for granted that the sense-organ connected with motion of the body as a whole is a special device for obtaining sensitivity to all acceleration of movement, so that the organism may adjust itself to the change. This sensitivity to acceleration of motion can only be obtained if the change brought about by any acceleration is removed as quickly as possible, so that the organ may be highly receptive to any new acceleration. The organ of position, on the other hand, must be specially sensitive to position as against movement. An organ which has to be stimulated continuously by the fact of its having taken up a certain position could hardly at the same time be one which responds delicately to even an incipient change of speed of motion. For the readjustment of the organ to motion might very well be taken for a readjustment to position and *vice versa*. Their separation, therefore, becomes a matter of necessity. The provision of a large sensitive area, such as the skin, in part of which a motion-complex could be produced and set in order-relations to sensations from other parts, would not obviate the necessity for separation. For the stimulus to sensations of position and movement of the body as a whole must surely affect the whole body and, therefore, the whole specially sensitive area at once. If the whole skin at once were always affected either by constant or by moving pressures, our tactual would closely resemble our present articular sensitivity. For we should then be keenly sensitive to waves of motion passing over the skin, but we should quickly lose our sense for them, when they came to rest and acted continuously on the same elements of the sensitive area. Creatures endowed with our sense of touch, who lived in a fluid medium which never moved over them except in continuous waves passing from head to tail and which never exerted steady punctate pressure stimulation upon them, would never experience anything but touch-motion. There must, therefore, be specialisation as

well as separation of sense-organs for position and movement of the body as a whole.

What, then, are the attributes of these sensations? Sensations of position do not seem to be capable of variation in intensity or extensity. We can therefore have only the vaguest, if any, introspective appreciation of the actual degree in which these aspects are given, and we can make no use of them in experience, if they do not vary. For integration with an unvarying element could not render an ambiguous complex of sensory data unambiguous. But of variations of position we are definitely, although not often in isolation, aware. The question therefore arises whether these variations are variations of quality or of order. For several reasons it would be more acceptable to call them variations of order. For our sensations of position do not seem to differ in quality. How should we be able to treat them all as sensations of position, if they differed in quality? Or how should we come to arrange them for our use into a system of interrelated positions? If they differ in order, however, the basis of their arrangement and of their use is at once given. Mere introspection can hardly lead us further than this.

When introspection fails, we must have recourse to a comparative study of the forms of integration in which labyrinthine experience occurs. An examination of these must show us how it enters into combination with other sensory experiences and what new feature or modification of experience results therefrom. If even then we are not quite clear of our difficulties, we must resort to general principles of integration, derived from an examination of the manner of integration of sensations whose elementary characteristics are familiar to us. Now we do find cases of the integration of the order-aspects of sensations, whether these be qualitatively the same or different, while we have no good example for the occurrence of an integration of the order-aspect of one sensation with the quality of another of the same or of a different kind. We shall, therefore, assume, for the present, that labyrinthine sensations vary in order.

It must, however, be noticed at this point that the psycho-physiology of the labyrinth is entering upon a critical stage of its existence. It is on the one hand, a matter of doubt whether the vestibular nerve has any direct connexion with the cortex (2, pp. 78, 91), and it is asserted that the existence of vestibular sensations proper is not proved (*ibid.* p. 91); on the other hand, there is evidence that voluntary inhibition of nystagmus does away with the sense of bodily rotation, not merely after the rotation has stopped, but also during the actual rotation

(5, 13). It may be shown in time that our labyrinthine motion is a modification, resulting from a more or less complex process of integration of visual or, in the broadest sense, pressure-sensations or both. It must, however, in any case remain the modification of motion it is and be amenable to the line of treatment here advocated. Its difficulties and problems offer no particular obstruction to our theory, which will, on any showing, probably be right in the main principle.

Olfactory. We can point to nothing resembling motion in the sense of smell. The attribute of order is not patent in olfactory sensation. Presumably there are in this sense no neighbouring sense-organs of the same kind. If there are, the attribute of order has been so integrated with others that it is at present unrecognisable. Probably the very slow rate of change possible with olfactory stimulations precludes the realisation of the integration of these hidden differences of order into a motion-like modification, which would, as such, be readily noticeable. For in all other senses the rate of change of order which constitutes motion must not fall below a certain minimum. We are here faced with problems, not with radical exceptions or difficulties.

Visual. Motion is visual, *par excellence.* If the primary visual sensations are well marked and in sharp contrast with one another, as are *e.g.* those from a broad black strip upon a white ground, motion of the black strip can be detected at some 50—60 sec. of arc per sec. of time displacement. The limit of distinction of visual points from one another is found when these subtend an angle of about one minute. On the retina this angle would allow one unstimulated visual element to intervene between the two excited by the points seen. Higher visual acuity than this is rather exceptional and is very difficult to explain visually without the help of eye-movements, whereby the increase of sensitivity may possibly be obtained by a movement of the eye allowing one and the same visual element to be stimulated by the two points successively or, less probably, by the kinaesthetic sensations afforded by the eye-movements as such (10, pp. 346 f.). As the minimum angle for the detection of motion is smaller than that for the detection of distance, where only one intervening point is presupposed, we may at least assume that visual motion supervenes upon the successive stimulation of two sensitive elements of neighbouring order.

Time-limits of motion. Change of order must take place at a certain minimum rate, if motion is to appear. This is most familiar in vision, for which the limiting value has just been given. With slower speeds the motion only appears after some seconds or not at all. In this

respect motion behaves quite like the attributes, *e.g.* intensity. In the simplest form of pressure-motion, when the stimulated surface is quite at rest, there is also a minimal rate of displacement, which has not yet been determined exactly (10, p. 722). For articular sensation the minimum rate of displacement varies from 0·25° in the hip-joint or 0·3° in the shoulder-joint to 1·4° in the ankle-joint per second (10, p. 753). The range of speed of displacement throughout which motion is appreciated is very great; in vision the highest limit is some 24,000 times the lowest limit (10, p. 368). The threshold for the perception of motion is the higher, the farther towards the periphery of the field of vision the stimulation takes place.

Speed. The rate of change of order appears in motion in the form of speed. Speed is measured by reference to the distance traversed by the moving body in the unit of time. In experience, however, we notice differences of speed without any conscious reference to distance or time and without any medium of comparison. Motion as a modification is not more truly motion with a fast speed than with a slow one. It is always just motion. Its form of variation is speed, which, however, we can measure only in the way we can measure other variable modifications of experience, by relating stimuli to just perceptible differences. Judgments of speed are, therefore, based upon a direct criterion, present in experience (17, p. 374).

Order-difference limits of motion. No real motion of an object is necessarily presupposed by a moving sensation. Change of order, as defined, is alone requisite. But this change need not progress strictly from one order to the next neighbouring. A considerable change of order is compatible with the effect of motion. Certain stages of the motion may be omitted without spoiling the effect. Upon this fact the familiar apparatus of the wheel of life or the stroboscope and of the cinematograph is based. A succession of pictures of an event, each of which, of course, is entirely devoid of any movement or displacement, is projected upon the eye and is seen as a perfect representation of continuous motion. A series of small electric lamps set at a certain distance from one another, which can be lit and extinguished successively, serves to demonstrate this fact in its simplest form (19, pp. 60 ff.). The continuity of the motion is broken if the time or space intervals between the lights exceed certain amounts, which are to some extent interdependent; but the effect of motion is not suppressed unless these intervals are much larger. If the time-interval between the lights is decreased beyond the value for continuity, several of the lights become

visible at once, each one being in apparent motion. A full psychological definition of motion states, therefore, that motion is the unification of successive differences in order of sensations which follow one another within a certain range of time-intervals. This range is determined by the degree of the difference of order of the sensations, which may not exceed a certain amount. The introduction of intervals without the omission of phases means a slowing of the motion which results; the omission of phases is followed by no marked effects, until the interval reaches a certain amount, when the motion becomes jerky and interrupted. Although the effect of motion is still distinctly present, the single sensation or picture can be distinguished more and more as the time-interval increases. The modification of experience which results from this integration of order-differences may be described as unitary and progressive change of order.

How do the primary sensations integrate to form the modification? There seems to be no valid reason why we should not say that, when two or more sensations of position of neighbouring order are evoked successively at a certain interval, they unite to form the experience of motion. Conversely, we may assert without fear of serious opposition that two or more sensations of position are given psychically, when a corresponding experience of motion is evoked by the successive stimulation of two neighbouring sensitive elements. We cannot object that no sensations are distinguishable in the integrated states. For we could not expect these sensations to be distinguishable, so that we might discriminate them one from another. It is just because they integrate to form a unity, that we have any such state as motion at all. To prove a fusion of particulars to unity we do not need to show a temporal process whereby discrete particulars have come together into unity. And we do have a multiplicity of sensations in this immediate unity, in so far as we realise it in its own inherent character—change of order.

It is important to mention a number of ways of stating or explaining the connexion between the integrating sensations and the resulting modification, which have been put forward for one or the other modification of experience. The consideration of these statements may seem very pedantic and forced in relation to motion. But it is just because of this that we would repeat them here; for if they are inapplicable in the case of motion, we shall learn to dismiss them here and shall understand their invalidity in cases parallel to motion, where they have seemed to be of genuine worth.

Our past experience is often considered to have an important influence. It might be said that, having often experienced two tactual or visual experiences successively in a complex of circumstances which otherwise led us to know that a stimulating object was moving over against us, we have come to know that these successive sensations mean motion; so that, when they afterwards occur without the complex interpretative circumstances, we yet know from past experience that they mean motion. Or it may be maintained that some inner power of thought operates upon the data of sense and extracts from them certain meanings, previously implicit in them, or unites with them to form a state of meaningful perception. Or it may be claimed simply that our experience grows from within and blossoms out into these modifications. It may even be said in abandonment of all problems that the mere juxtaposition of the data of sense is all that we ever seem to experience or do experience; there is no new, nameable modification of sensory experience at all; from beginning to end we have only sensations in juxtaposition.

Most of these "explanations" are empty, because they do not state how the result actually obtained is brought about by the means alleged. The mechanism of the operation is left in entire obscurity. How, for example, should past experience be capable of all it is supposed to do? If we only mean to state the fact that our present experience is dependent upon experiences we have had, we must be at pains to state that we do not know the mechanism of this dependence. We must also attempt to discover its specific nature[1]. Not only motion, but all secondary sensory modifications—melody, distance, interval, depth, apparent size, position, distance and depth, tonality, and all the *nuances* of perception—present the same problem: by what means does it come about that the presented appearance of sensory data changes with circumstances? These many and various changes cannot be adequately explained by a reference to the knowledge we have gained of the approximate real nature of the objects which evoke them, or the like. For it does not appear how the significance of any knowledge we may have gained should actually change the appearance of our sensory experiences as they present themselves to us. It can be

[1] As Stumpf says (25, Vol. II. p. 195): "Wenn die Kraft, welche allein Verschmelzung bewirkt, wegfällt, wird der Effect ebensowenig eintreten, als die Locomotive aus Gewohnheit läuft, wenn sie einmal nicht geheizt ist oder...dem Kurzsichtigen, der sich eine Brille anschafft, nun etwa gewohnheitsmässig immer noch alle Umrisse ineinanderlaufen." So too, of course, for any secondary modification of experience and any extra-mental influence.

easily recognised that knowledge has not this penetrating influence in every case. If it is shown for any case that cognitive states are the effective influence, we must also be able to show how they produce the change in question. If we can show that the sensory data themselves suffice as an explanation, then we can dispense with remoter influences, whether these accompany any changes regularly or not. For it is not at all unlikely that knowledge in many cases is dependent upon sensory changes and not *vice versa*. In any case, it is impossible to work with the conception of transcendence, whereby a complex state of mind derives its appearance in part from influences which are not given psychically at the moment. We have already noticed that we cannot carry our demand for a causal explanation further back than the elementary data of experience; but we must be able to reduce our whole experience to these and to explain it fully without appeal to any other data. For, as it is clear that all our knowledge has been gained from our experience, it is not intelligible how our experience should reveal what it is not yet affected by. For experience can only reveal that which modifies it. If experience shows any change, there must be some new datum present responsible for it. We cannot expect to explain the simpler in terms of the more complex, but the contrary. We must therefore find all the elements of experience and attempt at least to explain all experience in terms of these.

Our only possible conclusion, therefore, is that a moving sensation consists of at least two primary sensations as such and in so far as they are not the same in respect of order; so that the two together present a change of order, that is motion. The further difference of increased extensity which they also present, we are not at present concerned with. It might, however, be urged that there is no apparent way in which two pressure-sensations could come into such close union that their differences of order might form a new unitary modification of sensation-complex whose elements do not seem to be individually segregated. But our definition of sensation sets no limits to the boundaries or affinities of sensations to one another. The presence of extension as an attribute may logically, but does not psychologically, presuppose the existence of limits to that extension, which, as we see in vision, are only got by virtue of a quick change in quality, *i.e.* by contrast. In touch a boundary is given by a special emphasis on quality, where the change in pressure is rapid; no sharp limit is given thereby, but only a certain amount of extension (22). We may therefore confine ourselves to saying upon what occasions sensations

do actually fuse their differences in respect of any one attribute into some new unitary modification.

Motion is not based upon any conscious comparison of the order-aspects of the first and last or of these and the intervening sensations. Nor is there any unconscious inference from these. It is simply the integration of the differences in respect of order of the given sensations. Nor can we analyse the experience of motion into a series of sensations of position. We know the positions a flying arrow has occupied, but we cannot separate out in sensory experience the unit-sensation of any one position. For where motion is in experience, there never is merely a number of different positions, but a series of positions which unify to form progressive change of position. Motion is not merely a way of speaking of or a name for a number of positions. It is a new modification, which though based on sensations of different order, is more than these, because it is a unity of them. It is a difference of position[1], based on given orders and integrated from them immediately in the way characteristic of experience. Our point of view, therefore, cannot be called sensationalism. Nor is it that view which looks upon every new unity of experience as a unique, irreducible element. It contains both of these positions in itself and finds a partial truth in each.

The sensations upon which motion in any particular case is based are not lost in the resulting experience of motion. We do not propound a kind of mental chemistry, as that was understood by early British psychologists. For the experience of motion, though new and unique, supervenes upon the quality of the sensations given as an integration of their order without thereby changing their quality so as to make them in any way unrecognisable. Nor are the extensity and intensity of the integrating sensations necessarily changed in the least, although they may be so slightly according to circumstances, when these operate upon them. This is a point of view which must be maintained throughout the whole treatment of mental modifications.

Motion and the Attention. Motion is said to exert a strong attractive power over the attention. But we need not yet appeal to remoter powers such as that of the attention. In an otherwise resting field of cutaneous, visual or auditory sensations, a moving sensation is not merely one among others. It is one like the others, of course, but it

[1] Here is the inset for one of the central problems of philosophy, how the mind knows differences together. This is first of all a problem for descriptive psychology. It must not, however, be confused with our issue, which is concerned with what results when differences are given together. The problem of knowledge is quite another.

is characterised by a peculiar modification which the others lack, and having this feature of motion it behaves in our mind as would the sight of a single red rose in a bunch of white ones, a single light in the darkness or a single sound in the silence. That our attention is drawn to each of these things, means simply that only one of a peculiar class of experiences is presented in each case. The separation for the attention is given without the help of the attention at all. To this peculiar isolation, which the presence of a mental modification may give to a sensation, we have, of course, to add the peculiar sensitivity which is represented by the much lower threshold for successive than for simultaneous discrimination.

The attention may be directed upon any of the phases of a motion generally. But in particular instances, it is very much easier to isolate certain phases than others. This fact accounts for the conventional representations of men and animals in motion and especially in rapid motion. The most prominent phases are, of course, those at the beginning and end of any motion or at a change of motion, where vision obtains the advantage of the slightly longer duration of these phases. These positions, once made familiar in art and illustration, help to fix the attention of those who study them, so that they are seen regularly and are used to suggest or symbolise motion. The strange positions which men and animals occupy when in motion, as revealed by modern photography, are observed for the first time by everyone with great surprise. Naturally they seem very ludicrous, because we never do see animals or men in these positions unless they are in motion. To see them in these positions at rest has the same queer effect as the sight of a person suspended in mid-air, as if comfortably at rest upon a couch, would have. We see them without that conscious modification which alone supplies the key to their interpretation. The difficulty we experience in isolating these phases of motion in the attention really shows us the attitude of attention towards motion. When many motions are given together, the attention behaves in the same way as when many sensations of any kind are given together. No one would suggest that when many motions are given, the attention to them all is raised consistently to a higher level. Attention to motion, therefore, is rapid when only one motion or unitary complex of motions is given. Then the attention behaves as it does to any peculiar and unique object. When there are many motions, the attention acts towards them as towards any group of similar experiences, sights, sounds or thoughts. It even finds it particularly hard and embarrassing

to follow one among many motions, until it is trained to it, and it will overlook one movement of importance among many others of a similar kind as readily as it will overlook one of many motionless objects.

In attending to motion, the attention must in the first place be directed towards the moving sensations. We may express this better in accordance with actual speech by saying that we attend more to the things that move than to their actual motion and that we cannot abstract their motion from them entirely, so as to separate the one from the other. For the present, however, we must attempt as far as possible to avoid the phraseology of knowledge, for such modifications as motion do undoubtedly occur before there is any clear evidence of the occurrence of knowledge. The matter may, perhaps, be best stated by saying that the modification of motion cannot be separated from the basis of sensation upon which it rests. No motion, we may assert, ever occurs without the simultaneous occurrence of primary sensations. The connexion between these two things is, however, psychically much more obvious than this. Motion is psychically always *attached* to primary sensations. This fact it is which has led, as we may now say, to the hypostatisation of a class of sensations of movement of the limbs. Obvious though it be, it is important to emphasise here, that a modification such as motion cannot be experienced alone or attended to alone in separation from its basis in primary sensations. Apart from such separation, it may be attended to for any length of time allowed by the continuous operation of the sensory stimuli to the primary sensations which carry it. For, as has already been indicated, these sensations, and with them motion, are adequately conditioned by the stimulatory complex and the ensuing integration, apart from all higher processes of integration which may be implied by attention. No modification of experience can be separated or detached from its integrative basis, so that the observation of the former is dependent upon the continuance of the latter. If the integrative basis of a modification is itself dependent upon the attention, the resulting modification will of course be destroyed if the attention is directed upon it.

Melody. Melody is based upon tone-sensations which differ progressively or within certain rather indefinite limits in order or pitch[1].

[1] There is, in sound, another form of motion that stands for change in the place of origin of the sound-stimulus. But that is obviously a derivative of the localisation of sound, which again is dependent upon intensive differences. The nearest relative of visual motion is, therefore, melody. The spatial motion of sound resembles the integration discussed in the text in many ways, but it cannot be dealt with here.

There can be no doubt whatsoever about the introspective similarity of the two modifications; which seem different only because one is change of localisation and the other change of pitch. Pitch *moves* in a melody. A succession of tones of different pitch which does not move is no melody and can be realised only under certain circumstances of time- and pitch-interval. A melody is not merely change of brightness, nor is it merely meaning or emotionality, although it may also be these at any time. It is essentially a unity and progression of pitch.

All the psychological characteristics of motion may be transferred to melody. The minimal order-difference which will constitute melody, as all the physiological theories of hearing suppose, is the passage of a stimulation from one sensitive element of the ear to the next neighbouring. As in vision, so here also change of order must take place within certain rate-limits, if melody is to be appreciated. An upper limit of melody, as of motion, is only given by the possibilities of the physiological process of damping of the resonators of the ear, or of the equilibrium of forces at the sensitive element. Melody therefore also varies in a characteristic way by its speed, or by the interval which it compasses in a given time, although this is very much affected by the simultaneous change of voluminosity, which adds to the quickness of change a certain difference of brightness and lightness or sombreness and weight, or, it may be, also an emotional sense of gloom or gaiety. Melody, like motion again, is restrained within certain limits of successive order or pitch-differences. The continuity of melodic progress is not markedly affected by the introduction of a pitch-interval between two immediately successive tones, as in *legato*-playing on an instrument with fixed tones. With certain rates of succession of tones it seems to be perfectly continuous in its progression[1]. With slower rates it seems to rest at each tone for an instant and then to spring to the next following, while with higher rates we hear several tones together. Beyond a certain, not very definitely fixed, interval our

[1] Certain pathological conditions may very much increase the maximum pitch-interval that may separate successive tones, which, played at a certain rate of succession, seem to form a perfectly continuous progression of pitch. In the case described by Grant Allen (3) this interval even in the middle octaves was as great as a third. These pitch and time intervals and the whole introspective problem of melody have not been investigated experimentally, as far as I am aware. The statements of the text are based only upon general observation, but are easily verified. It is significant that Stumpf (Vol. I. p. 185), against the view of Grant Allen, who compares this increase of the critical pitch-interval "properly" to loss of quality in vision (*i.e.* colour-blindness), finds in the facts a greater resemblance to pathological cessation of function of *parts* of the field of vision, *i.e.* disappearance of certain "orders."

sense of melody is not aroused. This limit we reach approximately with the octave. Nor is melody affected by the introduction of a time-interval between the successive tones, as in *staccato* playing, provided that it is not too large. Here again the limits have not been precisely ascertained.

It is therefore evident that, on the whole, the musician's use of the words motion, line, curve, wave and the like in relation to melody is, from a psychological point of view, perfectly justified. Obviously it is no mere analogy with vision or with the arts of vision which prompts the use of these terms, but rather introspective familiarity with the motion-like nature of melody, its smooth continuity or jerky abruptness and its evenness or variation of speed. In this connexion, the usual means adopted to increase the motion-like progression in melody are interesting. The player often dwells very slightly on one or more tones to the disadvantage of a few following, which have then to be got into a slightly less time, so that in them the speed and therefore the continuity of progression is increased. In exaggerated form this is the familiar *tempo rubato.* A proper grading of intensity will also often accentuate motion. The composer has the obvious means of multiplying the number of intervals of a unit-size passed in the bar, which heightens speed, the introduction of continuous or chromatic passages, which increases the smoothness and continuity of motion or line, *legato* indication, and in *legato* passages the variation of the number of tones passed in each beat, which, by varying the motion, makes it more prominent.

Melody also offers itself with the same ease and difficulty to the attention, as does motion. If pitches can be distinguished at all, it is impossible to overlook a melody upon a background of consonance which does not physically overwhelm it. It is difficult to follow one melody amongst several, unless the tones are marked out by some constant feature, *e.g.* highest pitch of tones sounded simultaneously, a certain timbre, as when melody is played on one instrument amongst others, a certain intensity or the like, as when several voices are played on one instrument at once. It needs practice to follow several melodies together. An isolated part of a melody is as bizarre and meaningless as is part of a motion. If anything, it is the beginning of each which is most typical and representative for imagination and recall.

Melody is inseparable from tones, to which it is always attached. It cannot be recalled apart from them and is therefore ever experienced anew. Properly speaking, we should say that a series of sensations is

revived which integrate to melody. Of course the melody may be the real object or aim of recall, but nevertheless the integrating tones are the mechanism of this recall. If we make the continuance of the integrating tones dependent upon the attention, it is impossible to attend to a melody without destroying it. If melodies are not separately reproducible, neither do they leave an image behind, nor can they associate with one another or with images. Melodies have no intensity, voluminosity or localisation, apart from the tones upon which they are based. The variation of their constituent tones in voluminosity gives them, as already noticed, a varying character of brightness, besides that of "speed" native to them. Their other qualities come from other forms of integration.

It is often said that melody presupposes one or other thing, such as rhythm, consonance, interval or tonality. But after our consideration of motion as a modification, we may conclude that melody presupposes nothing not included in its definition. It is possible without tonality or consonance, as in the birds. Its intervals may be most indefinitely fixed, as in the first cooing of a child. It may or may not always be psychically concomitant with rhythm; it is at least in no way dependent upon it.

§ 7. II. *Distance.*

The next modification of experience in order of simplicity and the nearest allied to motion is distance. When a motion of some extent occurs, we do not recall at the end of it where its beginning was and infer the amount of its course therefrom; we have rather a direct experience of the amount of the distance. This direct experience, like motion, is independent of any conscious comparison of the order-aspects of the first and last or of the intervening sensations. The experience of distance is not composed of sensations of position; nor is it the imagination of the extended pressure of an object stimulating the extensity intervening between the two points touched (*v.* 29). It is based on the differences of order of certain sensations of the same qualitative class. Nor is there any conscious or unconscious inference from the two end-positions. As we have already urged for motion, so we would argue for distance, that the difference in order of two or more sensations of the same quality constitutes a distance. No one assumes the existence of a class of sensations of distance. Distance is generally recognised as a perceptual result, but such a classification clearly raises it much too far above its real sensational basis.

Distance must be carefully distinguished from motion. An approach to progressive difference of order is essential to motion. Beyond certain limits of difference the motion tends to disappear. Distance is not confined by these limits, so long as the two or more constitutive sensations are not restrained by one or other circumstance from free integration. Even two points at the limit of order-differences may constitute a distance. Successive occurrence of sensations is presupposed by motion, but not by distance, which is only restrained by too great a time-interval between them. Though the limits of this interval have not been fixed, it is clear from experiments already done that the time-limit for distance is much greater than for motion. Motion is within its limits the integration of successive and progressively continuous order-differences. Distance is within its limits the integration of any simultaneous order-differences. The limits of motion are set by degree of order-difference and by time-interval. The limits of distance are set only by time-interval. Distance may therefore occur apart from motion when the integrating sensations are given simultaneously. It is naturally more distinct in this form, since observation may be directed upon it as long as it continues or for any length of time. It is, on the other hand, often more urgent and clearer when it accompanies motion, for being clearly delimited by the progression of motion, its objective basis is thereby already unified and therefore always unifies to distance as well. Besides, two modifications are more effective than one. If there is any rivalry of distances, that characterised by motion will be more effective.

We find distance in all those senses which show order and are capable of the modification of motion. In the sense of pressure it has been treated experimentally in an exhaustive manner in the discrimination of points touched on the skin. This is the very familiar aesthesiometrical work. In vision extensive research has also been carried out involving the comparison of lengths of lines or of distances between points. Distances traversed by moving limbs have also been carefully studied. Only in hearing is the modification of distance less familiar under this name. There it forms the familiar phenomenon of interval. It can hardly be disputed that as a matter of fact we are in some way aware of the extent of movement or of translation of the body on the basis of labyrinthine sensation. We cannot expect to have a fine sense of distance in this particular quality of sensation, for, as we have seen, positions are here not given in isolation. It is therefore as impossible to separate single positions from the continuous motion

here, as it is in continuous visual motion. Labyrinthine distances are thus appreciable and comparable, but they cannot be accurately fixed or subjected to conceptual treatment.

That distance, like motion, is constituted not by orders or by sensations of position, but by difference of order, is borne out by many facts. The chief of these is the ease and accuracy with which extents of movement and distances can be noted and compared, even when the end-positions of the distances compared are different. We may easily remember a distance or motion without remembering the position of its limits[1]. All the facts concerning the variation of apparent distance under certain circumstances also bear this out. "When a movement is freer and easier than an other, and so produces a less sensation, it is underestimated with regard to this other and tends to be prolonged" (30, p. 109). The apparent distance of a movement is also affected by fatigue, slowness of motion and attention, which make a movement appear longer than it otherwise would appear to be (30, p. 109). Each of these influences has the effect of making differences of order seem greater than they really are, because the difference of orders of the end-positions is distorted and not these orders themselves, as they are psychically given. This distortion of differences is doubtless great where distances are given by means of motion, for then the temporal lapse of the first sensations leaves nothing to guide the judgment except the modification of distance; but the same kind of distortion is possible in distances given in simultaneous stimulation, especially when distances proper and not end-positions are compared, as in the comparison of short lines as such. Distances seem greater at one time than another, merely because a variable modification of experience like distance is a direct psychical datum which arises under the same conditions as *e.g.* intensity. The distortions of all modifications of experience by various influences seem to have a common nature. They would have to be considered systematically in connexion with the illusions.

Threshold of distance. For the discrimination of successive stimulations this is nearly always somewhat, and sometimes very much, lower than for simultaneous stimulations. Two touch-spots stimulated

[1] Cp. 30, p. 155. The systematisation of the facts suggested by Woodworth makes the path of research seem infinitely long and completely excludes any gleam of daylight from it. On the other hand, the one here proposed has all the merits of a system. The facts arrange themselves in it willingly and form profitable knowledge. The whither and where of surrounding facts also become clear and violence is done to none.

successively are distinguishable from one another when they constitute neighbouring sense-organs, while simultaneous stimulations need to be many times as far apart from one another to be distinguished as two. The origin of this peculiar fact is to be found rather in physiological than in psychological conditions. It is usually explained by supposing that the stimulation for each sensitive point radiates over a certain area round its most intense effect upon the cortex, so that the edges of two areas excited simultaneously from two neighbouring points often overlap and produce either one maximum or a level, until they are so far away that the sum of the edges where they overlap is not equal to the maximal part of either area, and these therefore form two points of maximal excitation. This explanation is supported by introspection, which shows that when the distance between the two points is increased, the stimulation is felt first as one point, then as an increasing oval or small line and then as two separate points. The distance in the oval or between the two points increases rather markedly as soon as the points stimulated begin to be differentiated as two or as an oval. It is therefore evident that if we are to attribute any systematic psychological importance to the fact of thresholds and their variations, we must, in the case of touch at least, hold rather to that of successive than to that of simultaneous stimulation.

The facts are much the same for vision; one unstimulated sensory element must lie between two that are stimulated, if these are to be distinguished. Otherwise the two points are felt as a short line or oval. With the help of successive stimulation or eye-movements, the threshold for the psychical realisation of order-differences and therefore of motion and distance may be reduced to the lowest possible limit, to that of neighbouring sensitive elements. So in articular sensation, we are able to distinguish short movements, before we are able to discriminate from one another the two end-positions occupied by the limbs. We may therefore maintain generally that the modification of distance is present as soon as a difference in the order-aspects of two successive sensations is given at the proper interval of time. These intervals are not known to be different from those indicated for motion.

Direction. Short distances are therefore perceived before the points bounding them can be distinguished from one another. Only when the points stimulated are some little distance from one another can they be distinguished as discrete. The same holds for the appreciation of the direction in which two points lie to one another; for

this involves a quite clear discrimination of the order-values in at least two points of the line formed by the end-points. Awareness of direction seems to be an experience which involves higher forms of integration than motion and distance. Appreciation of distance, on the other hand, is based on the psychical presence of order-differences and involves no discrimination of positions, as in cutaneous, visual and articular sensations. In labyrinthine sensation direction is said to be distinguishable as soon as motion is felt at all (10, p. 750). We have already noticed that we have here no means of distinguishing end-positions. Possibly the peculiar composite nature of the sense-organ has some determining effect here.

The apparent distance separating two points varies with the threshold for their discrimination; the higher the threshold, the smaller will the distance seem. This relation is doubtless based upon the unequal number of touch-spots at various parts and the consequent unequal representation of various areas of the skin upon the cortex. There is no reason to suppose that the physiological separation of two areas of excitation on the cortex should vary much from part to part.

The variation of distance. A form of this is given in the greater or less distance that may be integrated from the differences in psychical order of the constituent sensations. Judgments of distance, or, as they are often called, of extent, are therefore, like those of speed, based upon a direct criterion present in experience. So *e.g.* movements of the arm may be and will usually be judged as to their extent directly by mere reference to the modification of distance which ensues. That this should have been denied in favour of duration as the basis of judgment[1], can only be accounted for by the fact that opinion generally separates sensations of position and of movement into two different classes. But if sensations of movement are supposed to be elementary, it is, to say the least, unusual to suggest that they are primarily qualified by an aspect of extent of this unique kind, so different from the usual extensity. On the other hand, these sensations can hardly be supposed to have an aspect of extent, for their supposed derivatives—sensations of position—do not show much of it. In place of extent, therefore, duration is the only obvious sort of attribute these sensations have to show, and even that can hardly be called obtrusive in sensations

[1] Cp. 17. "The comparison of the length of arm-movements is made through the comparison of the duration of one or several of the sensations arising from the movements (preferably the joint-sensations) and of a particular value of the joint-sensation, called here the rate-value." For experimental data against this view, cp. 12 and 30, chap. IV.

of position. Duration and extent may, of course, be distinguished in sensations of movement after a fashion; where extent is the distance in our sense and duration the time taken to move the arm through that distance (21). But if extent can vary, surely order, or perhaps even quality, should also be variable, which does not seem to be assumed in this case. The only convenient and at the same time the obvious way out of these difficulties is to connect the two groups of sensation as we have done, and to see that sensations of movement constitute the modification of motion and distance for sensations of position, which then have the full complement of attributes necessary for the judgments based upon them, viz. quality, order, extensity, duration and intensity. We can then readily allow[1] that motion, the speed of motion and distance are all specifically perceived, while the duration of motion is as directly given in experience as is any duration. The same is true of the order of any sensation or of the general character or change of character of any motion, *i.e.* of the position of a movement.

There is a very great difference between the true comparison of distances in introspection and the comparison of lengths of line by laying one alongside the other. In the former we compare with one another the differences between two pairs of orders; in the latter we compare single orders with one another and infer from the result the comparison of the intervening distances. These two processes are both possible, because distance, like extent, is based upon the order-aspects of more than one sensation. It is therefore possible to turn both the primary and resulting secondary modifications into amounts or quantities by the identification of the orders of the elementary unit-sensations. Motion can also be treated in this way and is actually measured for physical purposes for the identification of points passed in a unit of time. But such measurement is not usually possible to the unequipped eye, except in the case of the modifications based on simultaneous data, such as distance and extent. It is so easy and advantageous to measure in this way that we have constantly to be on our guard against it in experimental work. No one relies solely upon the comparison of distances as such, where comparison by identification of orders is at all possible. If we wish to obtain comparison of distances, we have to use a method which will prevent the identification of orders. Under these circumstances we find that results conforming closely to Weber's

[1] With Woodworth, 30, pp. 150, 169 f. Woodworth, however, gives no clear indication of the basis of these different perceptions. With him too we may readily allow direct "judgments" of the force used in, and the resistance opposed to, any movement.

law are obtained for short lengths of line. The law does not hold, however, throughout a large range of distances, because of the ready applicability of the quantitative, conceptual form of identification. In the simple form in which distance and extent occur within the data of any one sense, it cannot be said to vary truly as a modification. True variation may, however, occur within narrow limits, or by the integration of data of heterogeneous senses, *e.g.* touch and articular sense, to a large degree.

The attempt has been made to express the results of the measurement of sensations in Weber's law in terms of sensory distance instead of in terms of component units of sensation. But the least recognition of the nature of the modification of distance, as discussed above, shows that it has nothing to do with the conceptual or numerary order of just perceptible differences of any kind, even of distance itself. Distance is not integrated from any other attribute than order (cp. above, § 5, p. 153).

Distance and the attention. We have discussed the relation of the modification of motion to the attention, and have suggested that the attention is apparently attracted by motion, because motion in an otherwise resting field forms a single one of a class of experiences not represented and therefore seems to attract the attention as does a single light, a single sound or any other unique experience. Now it can hardly be said that distance exerts a strong attraction upon the attention. There is no doubt about its presence in the case of distance as given by the aesthesiometer, by separate points in an empty visual field, or as an accompaniment to any motion. In the last case its presence is as evident as is that of motion. In the first two cases and more especially when the two points are rather far apart and are not the only points excited, its presence is not so evident and unmistakable. For in this case not merely one, but all our visual experiences are modified by distance. There is therefore just as much rivalry in reference to the attention as when any group of similar experiences is given. So long as our sensory experiences are taken collectively or the attention is in any way helped to grasp a number of points as a unity, the integration of distance will be complete and exhaustive. We are all familiar with the effect of symmetry and balance of distances in this respect. If very many points are given and if the attention for any reason is directed closely towards one point, *e.g.* by its motion, there may be an imperfect psychical realisation of its distance. We very often notice a tendency to emphasise and heighten the effect of distance

by the conversion of a simultaneous distance into a successive one, as for instance, when we more accurately measure the distance between two points by looking from the one to the other. In this way one distance is separated from others by means of motion and reduced to the form in which sensitivity, at least to the threshold sensation, is greatest. It need hardly be added that distance is not realisable apart from its constituent sensations, whether actual or revived.

Interval. In sound distance appears as interval. The characteristics of the modification of distance are found in that of interval. Interval results from the integration of either successive or simultaneous tones. It is directly experienced and is not the result of judgment or of the conceptual comparison of the pitches given. It presupposes no knowledge or realisation of the absolute pitch, but only the psychical presence of tones of different pitch. Appreciation and comparison of interval can therefore occur in a perfect form without "absolute ear," as for example in the case of Wagner. Interval has no limits in respect of the pitch-differences of the constituent tones, although its successive form is limited by time-interval. Melody, as we saw, has both "space" and time-limits. Interval may occur without melody, but it is more urgent and clearer with it than without it. In fact many people can recognise interval only in its successive form.

The threshold of interval is peculiarly affected by the physiological peculiarities of hearing, which give rise to beats and intertones when tones of neighbouring pitch are given simultaneously. The difference between simultaneous and successive intervals is therefore marked. Small successive intervals are not disturbed by physiological excrescences as are small simultaneous intervals. But for these disturbances we might expect to find that the threshold for the simultaneous form is higher than that for the successive form[1]. For if the physiological theory of cortical representation used to explain touch-discrimination be adopted here, we should have a fusion of excitations corresponding to order-differences and with it a fusion of differences of voluminosity, which are much rougher. The result would be a rather more intense tone of voluminosity equal to that of the greater of the two tones and of slightly

[1] Cp. the facts detailed by Stumpf (25, Vol. II. p. 397). A tone, under certain circumstances, seems to be slightly lowered in pitch when another, considerably deeper, is sounded, and to be raised slightly, when a much higher one is given. This probably has a physiological foundation, as well as the psychological one that is exemplified in some of the visual illusions.

indefinite pitch. For all we know, this may be actually realised[1] in those cases in which the pitch of the two ears is different. But it cannot become a prominent peculiarity of the discrimination of tones. As in other forms, the distinction of direction in melody and interval has a higher threshold than has that of motion. Interval shows the same relation to the attention as does distance.

The appreciation of interval, as of melody, is independent of consonance, tonality and rhythm. It arises, as we must suppose, simultaneously with melody, and both are there as soon as the constituent differences of pitch are given. The origins of consonance, tonality and rhythm are quite separate problems. In talking of interval in the primitive sense, we cannot mean consonant, dissonant or "tonal" intervals. There can be no doubt that, whatever may be the actual state of human hearing now, interval is psychically conceivable and possible without any consonance, tonality or rhythm. It seems best to refer consonance to a physiological basis, whereby, owing to the partial identity of stimulation of a tone and its octave and the like, a partial fusion similar to that of simultaneous touches, too near to be distinguished or from neighbouring sides of two adjacent fingers, takes place. The recurrence and mutual compatibility of pitches seems to be quite another phenomenon[2], which is known as tonality. For it a special explanation suitable to its peculiarities has to be sought.

§ 8. Retrospect.

These two, motion and distance, are the only modifications of sensory experience which result from the integration of the elementary sensations of one and the same sense. We have selected them for study in order to show clearly the peculiar modification of experience inherent in each, its derivation from a common attribute and the similarity of the phenomena peculiar to the same generic modifications, motion and distance, in the various senses. A number of other peculiarities of these modifications were mentioned and will be referred to again. For having thus established the general type of a derived modification, we shall now use our knowledge to classify certain experiences, hitherto supposed to

[1] Even without this, we must allow that the discrimination of simultaneous tones is not more wonderful than the discrimination of touches on the skin. In fact, our whole treatment shows that these processes are parallel. The arguments of page 143 are only special pleas. The extensities of sound cannot be supposed to overlap just because they are neighbouring or because one is greater than another.

[2] Cp. Stumpf (25, Vol. II. esp. p. 197).

be elements or aggregates, as modifications resulting from integrations as yet undiscovered. We shall thereby justify our starting point and by it advance to new knowledge.

There are many well-known modifications of sensory experience besides motion and distance. There is no need to attempt an exhaustive enumeration of them. Some, like the localisation of sounds and tonality, belong apparently to the products of a single sense. Others seem to result from the integration of sensations of different senses. Examples of these are depth and apparent size, the vertical direction in vision, and many complex forms of apparent motion and distance. Each of these will call for careful study. But that cannot be attempted here, for it is the purpose of this paper not to cover the whole field, but by a study of the simplest cases to draw attention to these new and highly important problems.

The phenomenological study of these other modifications of sensory experience presents no new difficulties. We can readily classify them in reference to the primitive attributes of sensation. We can explain their introspective barrenness and elusiveness, their attachment to sensation, their incapacity for isolated existence or recurrence, and so forth. Only the actual analysis of these modifications into their constituent elements, and the discovery of the whole mechanism of their integration, physiological and psychological, now present any difficulty. And that rests ultimately in our ignorance regarding essential facts involved in these complex integrations. But having succeeded in dealing with the phenomenological problems of our subject-matter, we may feel assured that we are on the path towards a solution of the new integrative problems which will arise.

§ 9. CONCERNING THE SUFFICIENCY OF SENSATIONS AS ELEMENTS OF EXPERIENCE.

The efforts of the earlier psychologists of the associationist period seemed to lead to a clear conclusion. The only elements of mind appeared to be impressions or sensations and their counterparts in indirect revival, while the only bond of connexion between them was association. But although this result was eminently satisfactory and efficient in the first rush of study, on closer examination it was soon found to break down in many subtle cases. A subsidiary principle was therefore needed to account for the fact that the elements of mind do not always seem to survive in the complex state; for where no further

elements were forthcoming, psychologists were justified in seeking to explain, as well as they could, how the given elements could be thought to account for all known varieties of experience. Thus we get the conception of mental chemistry, which we can, of course, now easily recognise to be even in its origin mistaken. But at the time, reasoning by analogy suggested it as a likely manner of realistic interpretation of the mind. Such a conception breaks down, because we cannot apply those indirect tests that are pre-supposed by a realistic interpretation of the mind. Physiological tests of its correctness, even if they were unambiguous, are often practically beyond our reach; and we have had no success in indirect psychological tests, which might have proved the unconscious presence of sensory elements in states that could not be reduced directly to these elements. Whether these tests were ever actually carried out is a matter of indifference to our present interests. The chief objection to the view was based on its greatest difficulty. It did not explain how out of the elements given something arose which appeared to be essentially different from these elements. Only one explanation lay to hand—association; and as, in ordinary cases, no such radical change of appearance was produced by the action of association, its presence could not explain these mysterious transformations in certain cases. Instead of seeking an outlet by the postulation of new forms of connexion between the elements of mind, later psychologists allowed their minds to be impressed with the apparent qualitative difference between the elements and the alleged compound states. Thus we next find a growing conviction that at least feeling is an elementary state of mind, other than any of the known sensations. It might have to be classified as a peculiar kind of element with characteristics fewer or other than those of any sensation, but it must in any case stand apart. When this point was reached, the influence of the prevailing Kantian attitude towards knowledge and the needs of the experimental extension of psychology which had just come into vogue, checked any further advance for a number of years. Now that experimental observation has greatly extended the basis of psychology and a temporary exhaustion of the more obvious problems of the senses has encouraged the attack upon the less tangible states of mind, we find a rapid extension of this attitude towards feeling. Any mental state which is not clearly reducible to more elementary states is to be itself an elementary unit. So we find thoughts, conscious relations, attitudes, recognition and the like added to our lists of elements (6, 7, and others[1]).

[1] Cp. also 29: "Wiedererkennen ist als Bewusstseinsinhalt ebenso primär und unerklärbar, wie Rot oder Lust."

We have now to turn to the other side of the process and ask how the study of the modes of combination of elementary states of mind has progressed. Unfortunately, we find practically no advance whatsoever. The experimental investigation of memory and reaction has worked so successfully with the notion of association, that, in spite of all sorts of restrictions and parentheses applied to any suggestion of its universality, no other form of combination has been sought. Even the earlier attempts to vary the form of association by adding to mere contiguity the bond of similarity, contrast and the like, have been very often abandoned by experimental research. Whatever may be our final conclusion regarding association, it is clear that even in its primitive form it has been a most useful conception. Whether its statement is complete and adequate is another question, which need not be touched upon here. The only really satisfactory chapters of psychology of the present time deal with association. But the scope of this force is rapidly being traversed and its limits will soon become rudely apparent.

Psychology can hardly remain satisfied with such elements as thoughts, relations, recognition and feeling. All sorts of difficulties have already been raised regarding the last of these. What are its adequate conditions? What are the organs which subserve it? Why is it individually so very variable? It is not at all easy to construct a physiological theory to answer these questions. Much more must this hold for thought and the like. From the psychological side also many questions demand an answer. We want to know what characteristics these new elements have, so that we may be able to distinguish them as experiences from our sensational elements. And if their characteristics are other, fewer or more than those of sensations, we have to ask how they contrive to exist without attributes which are generally considered to be essential to the existence of sensations. A satisfactory answer to these questions will not be readily forthcoming.

Amidst the ruins of the old associationist theory in its various forms two parts remain intact and firm: the elements of sensation and the bond of association. We have seen how the distinction of new elements attempts to fill out the deficiencies and raise a new scheme of mind. But it is possible that the elements of sensation are, after all, sufficient in themselves and that it is our binding material that is insufficient and unstable. Considering the difficulties involved in the postulation of elements other than those of sensation, it is surely the more correct method to see how far we can carry our elements of sensation by the postulation or demonstration of a variety of forms of combination.

Only when we fail to progress on these lines need we recur to the differentiation of new elements. Their justification, in any case, will not be easy.

§ 10. Feeling.

As sensation. It is certain that feeling is a peculiar modification of experience, extremely unlike sensation. To try to reduce feeling to aggregations of organic, or, more especially, visceral sensations is a hopeless task (4). For, however decisively it may be shown that feelings are always accompanied by or are dependent for their occurrence upon some or certain sensations, no means has yet been established of proving that feelings consist of sensations. Feelings do not appear to introspection to be composite; and they do not show those sensational characteristics which we should expect to find in aggregates of sensations. Any decisive differentiation between feeling and sensation, therefore, precludes the theory that feelings are aggregates of sensations. For no matter how many accompanying sensations are tabulated, the feeling itself will always constitute an irreducible remainder. It need hardly be added that other peculiarities of feeling, especially its inherent reference to all kinds of processes, whether they be sensational, intellectual or conative, are not adequately explained by this theory.

On the other hand, the mere classification of feeling as sensation (26) is undoubtedly a weaker method of dealing with the problem. It is hardly possible, if a strict psychological definition (28) of each is sought. Only if we emphasise the discrepancy between different kinds of sensation, so that we treat them not as a type, but as a heterogeneous collection, can we sufficiently apologise for the inclusion of feeling amongst them. But to do so is to discount the value of what we thereby gain. If the value of classifying feeling with sensation does not lie in the introspective identification achieved, it must be found in the consequences for physiological and genetic theory. For the former a parallelism of relation between sensation and feeling on the one hand, and their sense organs on the other, is the weightiest proof. But here the difficulties are greater still. For an independent feeling, isolated from all reference to other experiences, must be of the rarest occurrence[1]. Any attempt to determine the sense-organ of a feeling-

[1] The occasional independence of feeling is witnessed by Külpe (14, pp. 227 f.); Ladd, whom Titchener quotes (28, p. 42), retains the reference of feeling, but denies any necessary time-relation of feeling to "the sensations and ideas by which we classify them." The

sensation is idle speculation, while various peculiarities of feeling to be mentioned later remain unexplained. Such a theory of feeling would be useless, even if it were possible. It makes no positive contribution to the explanation of any of its peculiarities. If it be said that the theory explains the rapid evolution of such an art as music, in which things formerly unpleasant are now very pleasant, it may be pointed out that, on the basis of analogy, more could be said against the rapid evolutionary adaptation of a sense-organ than for it.

There remain, therefore, only two psychological theories of feeling for our consideration. None other seems possible. Both maintain the unique peculiarity of the experience; but, while the one considers feeling as an irreducible element of experience, the other holds that feeling is the result of the integration of other experiences. To the former most psychologists of the present day adhere, while the latter has been advocated by Herbart and Lipps.

As element. Objections have already been raised to the view that elements exist heterogeneous to the sensational type. If the occurrence of extensity in some sensations makes it hard to admit its total absence in other sensations, we must find the case of feeling equally embarrassing. In dealing with sensation, we had the advantage of starting from a psychophysical definition which definitely grouped our material for us before we attempted psychological definition. Feeling was not included therein. For not only is its sense-organ purely hypothetical, but it has as experience none of that local precision and dependence upon stimulation which is sure evidence of dependence upon a sense-organ. Even if we could let that deficiency pass, we can hardly turn to a study of the compound experiences into which feeling enters in the hope of discovering thereby any latent attributes, not observable by introspection. There is no integrative modification of feeling to be thought of, unless it be the reference of feeling to other experiences, which it thereby qualifies. But that would probably necessitate the postulation of an attribute of order inherent in feeling, a clear, definite localisation or basis of psychical arrangement in the independent, isolated feelings. Since feeling can be excited by practically any kind of experience, we should then be able to arrange and realise a whole system of feelings, a feeling-world similar to our visual world, or a feeling-world which would really

extreme position held by Külpe is now modified to refer only to Gemeingefühle (*v.* 16, p. 185): "Die Einzelgefühle sind an bestimmte Einzelinhalte (Empfindungen, Vorstellungen, Gedanken und deren Komplexionen) gebundene Gefühle. Die Gemeingefühle sind umfassende, allgemeine, das ganze Bewusstsein färbende Gefühlszustände."

constitute a psychical universe. But, as a matter of fact, it is feeling which is placed by reference to other experiences. These do not constitute two separate systems, mutually coordinated like vision and touch.

Integrative theories of feeling. These have taken various forms. For Herbart feeling is the relation to one another of ideas which support or inhibit one another. Much the same is maintained by Lipps, with the addition of a direct reference to the relation of ideas to the ego. A recognition of this feature of feeling is also given in the earlier statements of Plotinus, Descartes, Leibniz and Wolff, that it portrays the momentary perfection or imperfection of the soul. We may neglect, for the moment, their use of the word knowledge, which for the sake of systematic statement we must here read as awareness, for there can be no suggestion that feeling is a state of knowledge. If we leave out of account the old superstitious craving for mystical unity in the greatest things, which led to the connexion of unity with perfection and therefore to the assertion of the unity of the soul, in spite of its many-coloured experiences, we may claim the view for this class. For the perfection of the soul was doubtless based upon the harmony of the soul and its experiences or of these amongst themselves. Why should the state of perfection of the soul otherwise change? Lastly, we find a similar view in the reference of feeling to the form of reaction of apperception to sensations (Wundt), or perhaps in the classification of feeling as a "Gestaltqualität" or formal, qualitative modification of experience. But none of these theories has explained why these relations should emerge as feeling and why feeling should have its many peculiarities. It is unnecessary to discuss the validity of these views now. It will be sufficient to point out, after the development of our own theory, in what their validity consists.

Varieties and characteristics. It is now commonly recognised that there are only two kinds of feeling—pleasure and displeasure. By some, *e.g.* Wundt, a multiplicity of qualities is advocated. The position we take up does not, however, require a preliminary discussion of this question. No better statement of the arguments against a multiplicity of qualities could be given than that of Külpe (16). These are: (1) the general comparability of pleasures and displeasures in reference to one another, whereby a methodical view of the value of experience can be obtained, no matter what its underlying qualitative differences may be; (2) the possibility of an unlimited interchange of feelings; (3) the indifference of feelings in reference to comparisons of sensations, images or concepts, whereby

a purely unbiassed, objective comparison of these things is rendered possible; (4) the fact of a general transference or irradiation of feeling, whereby a feeling dependent upon an experience (*a*) can be transferred to an experience (*b*), if there be a regular bond between (*a*) and (*b*); (5) the fact of a very extended analogy among feelings and the resultant possibility of a replacement of one impression by another or of the characteristics of one by another, whereby we can talk of a bitter sorrow, a sweet happiness, a tender regret, a rude misfortune, a cool feeling, an ardent sympathy; (6) the absence of direct influence of feelings upon memory and (7) the improbability of a great variety of pleasures and displeasures; for if we had this, it would be easy to arrange feelings on their own merits into a vast scheme, whereas, as we have already suggested, there is no such vast variety, but only the merest distinction of pleasant and unpleasant feelings in independence of the objects or states they qualify. As Külpe says, there is no need for feelings to express over again the variety sufficiently expressed by impressions, but only to show their nature, attractive or otherwise. This whole statement is of the greatest interest to our position, for, as we have maintained that the properties of sensation can be determined, not merely by direct inspection of them, but also by examination of their modes of combination with other experiences, so it shows that a broad survey of the forms of connexion of feeling with other states will help to settle the nature and forms of variation of feeling, even when introspection may leave these still in dispute.

These two kinds of feeling—pleasure and displeasure—(1) do not depend for their occurrence upon the stimulation of any one particular kind of sense-organ. It is remarkable that they (2) seem to leave no image, (3) are not reproducible, and (4) are not associated with one another or with images. They are (5) also very frequently, if not always, consciously referred to or attached to other experiences[1]. Feelings are (6) amenable to introspection only to a limited degree. Anything that tends to weaken or dispel the experiences upon which they are based, thereby weakens or dispels them. Feelings (7) vary in intensity, but do not seem to have any extensity or localisation, except in so far as they are attached to experiences which are localised and extended. Finally it may be maintained that feelings (8) arise only when two or more experiences are given, or that no single elementary sensation is of itself capable of evoking feeling necessarily or regularly,

[1] Cp. on these points, 16, pp. 183 f.

but that, if the feeling seems to be aroused regularly by some elementary sensations, as *e.g.* by those of the lower senses, taste, smell and the like, the regularity of occurrence is not absolute and is therefore dependent upon some other element of experience which is usually present, but may be absent. Whatever detailed casuistic may be brought against these statements, they have all a large amount of probability and may therefore be presumed in favour of any position which can use them.

Comparison of feeling and motion. Our theory of integration demands that we refer a modification of experience such as feeling to an experiential basis in more primary experiences and make a statement of identity between these two which shall be self-evident. We have every right to seek our primary basis of feeling in the experiences to which it refers or is attached. We saw in the case of sensory integrations how an integrated modification of experience is attached to its primary basis. Motion, *e.g.*, is inseparable from a sensory basis; it (1)[1] need not always be attached to one particular sense, but it cannot be experienced in isolation from all sensory forms. Even the recollection of a motion never implies the isolation of the experience from its sensory basis; for to dream of a movement is to dream of the successive sensations progressively different in order and so to realise afresh the experience of motion. In other words, (2) motion of itself leaves no image behind. This does not, of course, mean that we rarely think of motion that is not given by stimulation. Such a statement would be just as absurd as the declaration that we never think of feelings unless they are actually elicited, whether for the first time or afresh by the recall of the experience liked. We can think of motion or of depth[2] or of any experience we may have had, whether we can have it now again or not. But we usually recall events in single successive stages of projection and motion (3) is not reproducible in isolation by itself, but is re-created afresh in our experience when our memory of successive phases is sufficient to re-establish it. There is no evidence for the existence of a memory image of motion which differs from sensational motion, as the imagery of the usual sensations differs from these. The same is true of feeling. But as our theory provides an adequate basis for the re-creation of motion, so also may an integrative theory do for

[1] The numbers in this paragraph refer to those of the previous one.

[2] It has been said that we never recall depth in representation. Probably we seldom do so. The most vivid memory of depth I have noticed occurred when I was engaged in a special study of the experience of depth. I dreamt I saw a picture of a bunch of flowers in perfect depth-effect. In my dream I shut one eye to observe disparity of images and the depth-effect immediately vanished.

feeling. In the same way it would be easy to show (4) that motions do not associate with one another. So one process of recognition does not recall another. Not only is motion psychically inseparable from, but it is always (5) attached to, or more or less embodied in, the experiences which form its sensory basis. It is obvious, therefore, that (6) motion cannot as an experience be studied in isolation from its sensory basis. It is even impossible to lay hold of motion by itself and describe it. Motion is indescribable except in terms of the sensations upon which it is based. Of course, sensory data may be steadily maintained by the action of external influences, and we may exert our introspective attention to the utmost without disturbing the experience of motion, so long as the effort does nothing to dispel these sensory data. Motion is a purely mechanical sensory integration. Feeling, on the other hand, even when its primary basis consists of elementary sensory data, *e.g.* those of vision and hearing, seems to involve attention or some vague attitude in a subtle way. This accounts, however, not for the elusiveness of the pleasure experience for introspection, but for the speedy collapse of the sensory basis of a feeling as soon as attention is directed to other experiences than that sensory basis itself. Hence the rapid disappearance of feeling when introspection is turned upon it. We can bring the observation of motion into the same state, if we try to observe it in isolation from its sensory basis by diverting the eyes from the moving thing. This argument is, of course, not at all prejudiced by the fact that we have experiences of motion which, in the view of some, are really primary and irreducible, *e.g.* those of articular and labyrinthine origin. On the contrary, we must conclude that the very difficulty of these experiences for introspection is due to the fact that they are modifications of motion, which are not usually correctly analysed and whose primary elements are very weak when isolated, or resist isolation altogether. It is clear, finally (7), that a derived state like motion need not share all the characteristics of the sensations upon which it is based. Indeed it cannot. It is a secondary form of that attribute whose differences it integrates to unity, and it may show forms of variation owing to the influence of factors which affect the primary attribute integrated, as does motion in speed, in so far as the rate of change of order in time varies. A motion cannot, as such, be intense, or spread out or saturated. Feelings are of two "qualities," pleasure and displeasure, and they also vary in intensity. But they are not extended, localised, ordered, or saturated.

There is therefore a very close resemblance between the two,

experience of feeling and of motion, which would certainly justify their classification together. We have every reason to expect that the same kind of explanation is valid for the two states; and as we have found the theory of integration adequate to explain all the characteristics of motion, we may apply the same principle of explanation to feeling with much hope of success. However different feeling may be, as experience, from any others, it is clear, at least, that its characteristics are not unique and that it is probably the product of integration.

Is the integrative basis for feeling sufficient? Although in the previous pages we have shown the similarity between feeling and other products of integration, we have not yet verified for feeling one of the essential conditions of integration, viz. (8) the presence of a multiplicity of primary experiences in every case of feeling. There can be no question, however, that such a plurality of data is present in the vast majority of cases. It is the harmony of experiences, of colours, sounds, tastes, smells, motions, distances, objects and thoughts which is the object of feeling, *par excellence*. In many cases a single one of these is distinctly pleasing only because it is in some way a change from some other. The only formidable exceptions are found in the so-called lower senses of taste and smell. There we seem to find single, isolated, elementary sensations which evoke very pronounced feelings. All children and most adults find sweet tastes pleasant and sour or bitter ones unpleasant. At least there seem to be clear cases in which a merely sweet taste, as such, is liked, while strong, bitter tastes are disliked. In considering cases like these, we have to remember that the same sweet or bitter taste does not always evoke the same feeling, although it seems to act solely by itself. To the one person it may be pleasant, and to another or to the same person at another time it may be indifferent or unpleasant. In the face of the apparent isolation of any taste and its feeling, this has often been expressed by saying that the feeling evoked by a single experience is not due to psychical, but to physiological necessity, which again is to be referred to physical and chemical conditions or to the vagaries of biological selection. But such an explanation has already been shown to be untenable. For it either implies the existence of a sense-organ for pleasure or it denies altogether, or rather ignores, the possibility of a psychical causation, and it fails in any case to explain the peculiarities of feeling. We can really do nothing at all with the assumption that our experiences are merely hitched to one another, we know not how. Unless we can show convincingly that they are pure and primary datum, we must at least

endeavour to show some form of systematic and regular connexion between them. In so far as they are primary datum, we must be able to show that our experiences are immediately and regularly dependent upon some form of objective condition which is not experience, as we know it. In so far as they are not mere, primary datum, we must endeavour in principle to show that they are wholly and solely the result of the interaction of those experiences which are mere primary datum. If a primary element of experience is found in apparent isolation with what is obviously a derived modification of experience and then again is found without it, we may, on our hypothesis, fairly look for some undetected variable element of experience, present in the first case and absent in the second.

Fortunately there is evidence to show that some such variable element exists. An extreme case like that described by d'Allonnes (4) shows that the integration of feeling is impossible without internal visceral sensations. There is therefore no difficulty in assenting to the statement that a multiplicity of sensory data must always be present with feeling. In the case referred to, no distinction of feeling was made between a glass of water and a glass of castor oil; a choice was made in favour of the water only by help of conceptual remembrance. It would certainly be wrong to maintain upon the basis of this and similar cases that feeling consists of visceral sensations. For we should again fail completely to explain the peculiarities of feeling. If feeling were an integration or aggregation of such sensations, we should experience it as such, it should bear all the characteristics of sensation as such or of an integration of sensation, and it should be referred or attached to visceral sensation. In the case of the simple feelings, however, we find an attachment or reference, not to visceral sensation, but to all or any kinds of sensations or experiences which evoke them. That the visceral factor is not a direct constituent of the feeling itself is shown by the considerable unlikeliness and unexpectedness of the existence of a visceral factor at all. Feeling, therefore, does not consist of visceral sensations, nor are these the only essential element in feeling. If the parallelism of feeling and motion is of any value, it shows that one, at least, of the essential elements of an integration is that to which the modification which results refers or is attached. The pleasant sight or sound, the nasty taste or smell must each contribute one of the differing elements which constitute the integration. In the case of tastes and smells the visceral factor indicated by these abnormal subjects may be highly probable and acceptable as the integrative complement to the

exteroceptive sensation. For the sensations of the lower senses bear a clear reference to the internal, digestive apparatus. Our appetite is stimulated by them, they suggest inhalation or embodiment or they at least draw us nearer. But it is hardly so with sights or sounds. Lovely pictures and music do not often consciously stir our bowels or rouse our bodily appetites ; nor does their unpleasantness bring to our minds the dispeace of our organs. The pleasantness of pictorial art or of music seems usually to reside wholly in itself. It is pleasing or ugly solely on its own merits, or at least largely so, and hardly at all because of its effect upon the viscera of the connoisseur. At the most we say we do not care for a work, because it does not appeal to us, does not arouse in us, perhaps, the emotions and sentiments to which we are most prone. These latter experiences may be dependent upon and may carry a conscious reference to the internal organs of the body. But the peripheral, primary pleasantness of the sensations of the higher senses can hardly be thought to do so. This view is supported by the fact that it is so rare to find a single sensation of these senses which is pleasing, purely by itself. But there is, of course, nothing to prevent visceral sensations from being aroused by and integrating with these higher sensations upon occasion.

Of what attribute of experience is feeling the integration? Far from being peculiar to visceral sensation, it must be one which is universal in experience. We know that two or more different qualities of almost any group of sensations may form a pleasant or unpleasant combination, although differing only in order or place in time. We shall, of course, look for examples of this in those senses in which we do find a variety of qualities, *i.e.* in vision, sound, smell and taste. Senses like touch or those of the joints or muscles, which have little or no qualitative variations, seem to be more or less indifferent. Even a variety of orders, as in visual, pictorial arrangements, of durations, as in rhythm, and possibly also of intensities and extensities, as in the arts of vision and sound, may be pleasant or unpleasant, without any other accompanying differences. We do not usually find that qualities of different senses combine to give pleasure or displeasure, unless we except those single sensations of the lower senses of cold, warmth, pain, taste and smell in their conjunction with sensations of visceral origin. Differences in a secondary modification of experience are also often the object of feeling. A complex of motions, of distances or of depths may be liked or disliked, while this can hardly be asserted of any single one of these. In view of this fact and of the high frequency of feeling in reference to

the senses of vision, sound, smell and taste, which already show direct or indirect evidence of integration, it might be thought that feeling is the index or result of the mutual harmony of integrations. It is certainly not a regular accompaniment of integration as such. It would have no *raison d'être* and could not explain itself as such. If feeling means the harmony or smooth working of the mind, this can only commence with a second level of integration, if at all. It would be rash to attempt to go beyond these conclusions at the present time to a specific theory of the attributive basis of the modification of pleasure. The results of experimental investigation are too scanty and contradictory to give any clear leading (8). We need not be surprised that we are meanwhile unable to point to the integrative basis of feeling, although we have made the demand that psychological explanations must be causal and self-convincing. In the articular and labyrinthine "sensations" of movement, we have examples of experiences the reduction of which baffles many psychologists, although the integrative basis is in these cases moderately obvious. We shall hope to be able to explain feeling completely, when our attention has been drawn experimentally or by analysis to its attributive basis. For this purpose, we must have more details of an introspective nature concerning the moment of realisation of feeling. There need be no particular difficulty in applying introspection fully, for we do not need to introspect feeling itself, but only its sensory or other accompaniments. We have the further guidance of the variation of intensity peculiar to feeling, which, after the analogy of motion, would suggest that the attribute of which feeling is the integration is capable of a variation by degree, similar to that of intensity in the sensations. The duplicity of quality of feeling also suggests that we have to deal here, not with a simple, primary attribute, but with an integrative activity of some kind, which is capable of reversal. The activity theories of feeling seem of all to be nearest the mark. It is quite unnecessary to point out what theories of feeling of a metaphysical or other nature are completely discounted by the integrative theory here advanced.

§ 11. RECOGNITION.

It is generally acknowledged that recognition is a peculiar experience which calls for some explanation from any theory of the constitution of mind. It has hardly been claimed as a sensation; the prevailing tendency has been to treat it as a complex experience or as a unique, non-sensational element.

As sensation. On sensationalistic principles, recognition is easily accounted for. It consists simply in the revival of those sensations which were previously given simultaneously with the complex of sensations now recognised. On general principles, it is explained in the same way, without the restriction to sensation. Experimentally this has been verified in so far as it has been shown that such revival does accompany or follow recognition in the vast majority of cases (9). Cases of revival are, however, possible without accompaniment of recognition. We seem unable to say what kind of recall constitutes recognition. Although experimental analysis gives an almost general rule, the synthetic statement of it seems very unsatisfactory. Put a number of actual and of revived sensations together and does recognition supervene? Surely not! We miss some proof that the elements or experiences given are actually such as can be shown convincingly to give the state to which they are equated. The difficulty of such a synthesis is only increased when we find that the state of recognition can supervene before the sensations upon which it might be based are revived at all[1]. An explanation of this is sometimes attempted by supposing that recognition can occur when associated experiences are merely excited and not yet actually revived; as if a tendency to reproduction, in some physiological or real psychical sense, could produce an effect upon the experience which is to be recognised, without reviving in experience the states which it serves to reproduce. For the present, we refuse to discuss a theory which thus begs the question and does nothing to explain the psychical peculiarities of the state of recognition. It can be sufficient only where everything else fails, where, as in the case of the sensational elements of experience, there is left nothing psychical by the use of which we might attempt to explain their peculiarities. But it is not claimed in this case that recognition is an isolated, elementary state; for it is firmly attached to the state recognised and does not occur alone. These and other peculiarities call for some explanation, which such a view cannot give. For, while its theory may be sufficient physiologically, it is insufficient psychologically, in that it cannot explain how the state of recognition comes to be hitched to one out of, possibly, many experiences of the same kind. There can be no doubt that the state of recognition is, at least, a modification of experience which is not identical with any one

[1] Cp. 1, "Dans l'acte de la reconnaissance le souvenir se joint à l'impression avant qu'il se développe en image."

sensational element or mere aggregate of these on the lines of associative synthesis.

As element. But it has been claimed that recognition is a peculiar non-sensational element of experience. Against this we have to urge, as before, that nothing has been done and probably nothing can be done to explain the psychical peculiarities of these elements. The acceptance of such a view bars the possibility of any closed science of experience, at all complete and self-coherent. We are left with a psychical pluralism which does not even invite reduction. It must be said, however, that the acceptance of non-sensational elements of experience is not really an independent view, but is only an expression of the recognition that certain states of mind are unique in character and very unlike sensation and have, so far, defied any satisfactory reduction to sensation.

It may be noticed that recognition does not seem to occur entirely in isolation. I am not aware that the contrary has ever been maintained in this case, as has been done for feeling by Ladd. It would seem absurd to think that recognition should occur as a state without any experiences which might constitute an object for it. It may seem equally absurd to make a similar statement for feeling, unless for a general state of feeling, in distinction to the special, detailed state not referred to the self as a whole. Except that it may be established that other experiences of some kind always do form one of the conditions of the appearance of recognition, there is no apparent reason why recognition, if it is an element, should not occur in isolation. The view which considers recognition elemental might, however, point to false recognition as a case of the partially isolated occurrence of the state, apart from its correct and realistic implications. But here, again, we find no explanation of the reference of recognition to an object, correct or false.

As secondary modification of order. We must hence revert to an integrative theory of recognition. Clearly this modification of experience bears a strong resemblance to the attribute of order, as we find it in the sensations, in the form of localisation or especially in sound as pitch and secondarily as localisation, or in the modifications of motion, distance, depth and perhaps direction. Recognition is "qualitatively" the assignment of a place or order of a special kind to an experience which, so far as its elements, their attributes and integrations are concerned, is in recurrence[1]. It may, therefore, be classed as a

[1] The notion of mental causality cannot demand a recurrence of the real material of mind, as if our experiences, once had by us, went off on a round by themselves and then

secondary modification of order. It seems, however, to be an unvaried modification and, in this respect, unlike motion and feeling. We either recognise or we do not. Our certainty and clearness of recognition vary somewhat, but these variations can hardly be said to be necessary and characteristic, as are those of feeling and motion. They are more probably based upon the process of recall involved in recognition than upon the integration which constitutes recognition. The falsity or correctness of recognition is also no true variation of it, but is rather another modification of experience which may occur in many other connexions than that of recognition. The order given to each experience by the recognition of it is, of course, different, as is the order of different sensations of the same quality, intensity, extensity and duration, but the recognition-order of one and the same experience does not vary. One and the same experience may be recognised by different contexts, but in this case a radical change has been made in the complex which integrates to recognition, similar to that which occurs when an object that has aroused pleasure in one mental setting, arouses displeasure in another mental setting. This is no true variation of recognition, but a change in the states revived and thereafter integrated to recognition. Its explanation, therefore, belongs to that of reproduction in general.

Comparison with feeling and motion. Recognition (1)[1] does not depend for its occurrence upon the stimulation of any one particular kind of sense-organ. It seems (2) to leave no image of itself behind. This does not, of course, mean that we never think or remember of having recognised anything that is not now presented for recognition. It means, that if the state of recognition is ever "revived," it is recreated afresh by the recall of the experience which was recognised, the subsequent recall of the context of recognition and the integration of these experiences anew to the unity of recognition. But if this occurs outside the efforts of introspective experiment, it must be of very rare occurrence. Obviously, then, recognition (3) is not reproducible in isolation, nor (4) do states of recognition associate with one another. Recognition is (5) always attached to or, more or less, embodied in the experiences which constitute its integrative basis and cannot, therefore, (6) be studied introspectively apart from that

as *esse ipsissima* returned. We cannot expect to go further than identity of quality and all attributes of each element. Anything more than this would lead us out of psychology into metaphysics.

[1] These numbers refer to those on pp. 187 and 188.

basis. It is of the most fleeting nature and vanishes as soon as the attention is turned exclusively upon it. It resists description except in conceptual terms referring to the experiences which form its integrative basis. Recognition, finally (7), need not share the characteristics of the experiences upon which it is based. It has and can have no intensity or extensity or localisation in space or the like. It shares all the peculiarities of an integrative modification of experience and has in special those peculiar to integrations of order[1].

Is the integrative basis sufficient? An integrative theory of recognition will demand a reduction of the state to the integration of differences in order of the states upon which it is based. We must, therefore, be able to show (8) the presence of a multiplicity of more simple experiences in every case of recognition. But it may be pointed out that such a multiplicity cannot exist in every case, for the state of recognition has been admitted to occur before the revival of the circumstances of the first occurrence or without the recall of the first experience, in so far as it was identical with the data now recognised. We here face an important problem which can only be settled by a comparative study of the integrations of sensations of different senses, such as constitute our full and complex space-perception. For the present, we suggest that an integration seems possible that leaves the quality and other attributes of the objectively less interesting elements very much in the background, while making use of their aspect of order for the purposes of integration. A lengthy search may be necessary to reveal the presence of the elements to which one of the differing orders belong. For unless the orders integrated are very little different from one another, why should we expect the qualities, extensities or intensities, whose orders are integrated, to be near one another in the focus of attention? Even in the case of next neighbouring orders, there is no sufficient reason why we should expect this, except in the case of the primary aspect of order, attributive to the

[1] It is an obvious conclusion from the whole work of this paper, that states like feeling and recognition can be attended to just as well as can sensory states. We should find no great difficulty in stating the attributive relationships of any secondary modifications of experience. But attention cannot find in any mental state what is not there to find; and we can have no desire to make in reference to it a needless assertion of incapability. The argument of the text, especially that of point (6), is, therefore, justified only by reference to the usual similar statements made for feeling. Recognition disappears as soon as the attention is turned upon it exclusively, because to do so is to divert the attention from the integrative basis of recognition and to destroy it.

elementary sensation[1]. It is just the aspect of order whose integration takes place in this particular case, and not that of quality or intensity. It is, of course, impossible to specify *a priori* the time that may elapse between the occurrence of a state with recognition and the presence of the revived state. It would even be difficult to show that the latter is not present simultaneously with recognition and that its apparent absence is not due merely to the fact that it has not yet passed before the objective of introspection. But it would be unworthy to base a position upon such a possibility. We know from experiments on abstraction (15), that the orders of certain elements may be present and admitted introspectively without their qualities being distinctly introspectable, even if present; and we know that qualities can be given and distinguished without their localisation, right or left of one another, being introspectively distinguishable. The possibility of the separation of the attributes for introspection, even if only for a moment, must be admitted. Where, therefore, integration refers to one aspect among several and unites it to a similar aspect in another state, round which as a unit the interest of the moment concentrates, there we may expect a still greater separation of the remaining aspects for the introspection. We may maintain that recognition is based upon the psychical integration of the order-aspects of percepts, although it is often present before any associated percepts can be identified introspectively.

The integration of recognition and full revival may properly be considered to be different processes[2]. It is one thing for a state to be revived and joined to another to form an integration, and another thing for that revived state to be considered by itself and identified. We should expect with as little reason always to be able to state the direction or to distinguish from one another the constituent elements

[1] The focus of the attention and other similar terms are misleading, in so far as they suggest that our experiences make their way to the centre of a circle, as it were, dragging all connected experiences with them, more or less. On the contrary, it may be claimed that only the order-aspects of our experiences change without any movement of attention, unless we use that term to indicate the direction of the integrative and associative processes now taking place. If we recognise an object, therefore, our 'attention' must necessarily be directed to the process of recognition and the object recognised, but it need not be directed to the associated states which form the integrative basis of recognition, unless these take up the work of integration and recall, as they often do.

[2] Such a psychological account agrees well with the physiological theory which postulates the partial or incipient excitation of reproduction-tendencies to explain the occurrence of recognition without actual revival.

of a motion or distance, as soon as we appreciate the presence of these, as always to be able to refer a recognised state conceptually or otherwise to its first occurrence. We found this difficulty already in the case of feeling, where the apparent isolation of the integrated state with one side of its integrative basis is in some cases even more pronounced. Recognition, therefore, may be accompanied by the assurance of its correctness or by the knowledge of its point of reference in experience, or it may occur without these (20, pp. 39 ff.). Experimental investigation reveals the presence of a direct unmediated experience of recognition, which can occur alone and must be considered to be the only true form of recognition (11) in no way to be confused with the conceptual inference of "previous presence in experience" from certain "criteria" (20). It is impossible that recognition should always be based upon such criteria, formal or otherwise, as Meumann (*ibid.*) suggests, for there is in primitive experience no means whereby any formal or other characteristics of experience should be made to stand for previous presence, unless an experience which conveys the fact of recognition to the mind is first given. If this state is once given, all sorts of criteria or means of certainty may be found for it. This truth must be recognised once and for all, if psychology is to be freed from hitherto incessant fallacy of argument. Integrative processes which contain their full determination within themselves are absolutely necessary, if experience is to be explained; for experience is not the product of mere incoherent chances. Recognition and assurance are both integrative processes of a function and character different from the process of conceptual reference within experience. All three may take up different time-relations to one another.

Recognition is not a modification of the time-aspect of experience. To recognise may often mean to refer a present percept to a previous occasion, but it does not do so as a modification of the time-aspect. Recognition, as experienced, does not vary in the sense of "a little time" or "a long time." Although it may undoubtedly lead to a fixation in time, this time and the process of fixation are both conceptual, and not experienced modifications of the peculiar non-conceptual kind of recognition and feeling. Recognition conveys in immediate experience the fact that a given percept falls into a certain perceptual place or order. How that place is made explicit or conceptual, whether by circumstance of time, of name, or of thought, is quite immaterial in the present connexion.

It is important to notice, in the next place, that recognition presupposes the modification of order that is characteristic of the percept and its integration. It is unnecessary to go into the problem of the conceptual or general percept at the present. We may confine our attention to the particular percept, "that here and now." That the particular object of perception is a modification of order will hardly be put in question. Its full explanation presents peculiar difficulties, which, however, are not our present concern. Integration of the elements of experience to perceptual units must precede recognition. For the revival of order that might be evoked by the bare elements of experience, would be that of other forms of primitive, attributive place-order, and not that of secondary, recognitional order. The former, however, would give only some illusive increase of extensity or the like, and not recognition. If a bare element of experience is ever recognised, it must first become a percept and acquire the perceptual modification of order. The integration to the effect "that (tone, colour, object, face, word) here" must precede the integration to the effect "that here has been" or "that here is that there," both now, when recognition takes place, and then, when the experiences included in the recognition were first given.

Recognition implies simple revival, as we have seen. Once set up, revival may proceed, beyond the amount presupposed by recognition, along any lines open to it. Generally speaking, it will follow the lines of least resistance. In the case of the first recurrence of a percept which has not entered into any other integrative processes than perception, the freest line will be that of a revival of the circumstances of its first occurrence and it will therefore lead to recognition. But a percept which has been extensively manipulated in experience on the occasion of its first occurrence, may upon recurrence excite other lines of revival and may, therefore, be illuminated by the light of other modifications than that of recognition. The more these other lines of revival are strengthened, the more these other forms of integration are produced, the more should we expect to find that recognition recedes on the average, until it disappears entirely. This is confirmed by an introspective examination of the course of our experience. It would, of course, be absurd to extract from this statement the implication that I am, as a psychical actuality, unfamiliar with my most usual surroundings; for that would suggest that the statement made implies the presence of unfamiliarity in the absence of familiarity. There can be no such real implication. Really habitual surroundings are generally

modified in many ways other than that of recognition. The flush of familiarity is experienced not by the hearth-bound native, but by the returning wanderer, whose first concern is to recognise.

§ 12. CONCLUSION.

The classification of experiences. Our study of the two integrative modifications of experience, feeling and recognition, serves to demonstrate the method to be followed in the study of all those forms of experience which are not conclusively elementary. What is to be considered elementary will be decided in the first place by the standard of the sensational type. Forms of experience that show most or all of the characteristics of those modifications whose manner of integration has already been traced, will be considered to be the result of integration. But if they are not reducible to elements already catalogued, their integrative basis must be sought in hitherto undetected elements. Any states of mind which may remain thereafter may be elementary or integrated. Their exact classification will have to form the object of special inquiry.

Feeling and recognition represent for our study the two great fields of affective and intellectual states. Whatever limits may ultimately have to be set to our procedure, we have, at least, shown that it is applicable over a large range of experience. No effort has been made to conceal the difficulties which faced the complete explanation of feeling and recognition. On the contrary, the hope may be expressed that something has been done to make them more distinct and assailable. Several other difficult investigations will probably have to be made before the theory of feeling and recognition can be completed. For these reasons, it is, for the present, quite unnecessary to apply our method to forms of experience similar to recognition and feeling, however interesting the task would be. Having shown how the study of such experiences is to be approached, we may leave it to the reader to make further applications himself. If the value of our method has been appreciated, that will readily be done. Each integrative form of experience will call for special study. There can be little doubt that there are a vast number of these. Research has already begun to discriminate some of those which group themselves round the term "thought."

The gain for the experimental study of thought. In this connexion it is interesting to consider briefly what positive gain accrues to

psychological study from our method. Two items may be put to its account. The first concerns the experimental study of thinking. Although this has made much progress in the last ten years, it has, so far, been impossible to show conclusively upon what experiences certain special states of mind are founded. Thought itself, for example, without prejudice to any theory, may be called a peculiar form of experience, not obviously of the same type as sensation. It may, nevertheless, be held that it is reducible to sensation, and to this end all accompanying sensations will be carefully recorded. But, as we have already pointed out for feeling (§ 10), if any sort of discrimination is made between thought and sensation, it will always be impossible to reduce thought without a remainder to sensations or to other elements. Thought is either clearly an aggregate of sensations, in which case it will, at least, show all the characteristics of sensation; or there is obviously no such thing as thought, except in common parlance; or thought is a peculiar form of experience, irreducible on the basis of exhaustive experimental introspection alone. Our service to experimental research consists in showing how a connexion is to be traced between thought or any other peculiar experience and the distinguishable contents of the mind that accompany it. There is then some hope of mediation between an extreme sensationalism (28 a), which either reduces thought to a mere name for groups of experiences or utterly fails to explain those characteristics of it that are not evident in elementary sensation, and an extreme elementism, which discards all sensational accompaniments as irrelevant and builds solely upon the unity and peculiarity of thought (6, 7). We combine these two views by recognising both the relevance of the accompanying experiences and the peculiarity and unity of the thought.

The gain for genetic study. In the second place, our theory makes a positive contribution to genetic psychology. In showing how any complex modification of experience is integrated out of simpler forms, we are able to delimit that particular state very much more carefully from others closely related to it. Knowing fully its adequate conditions and its nature, we shall have more success in determining at what point of development it can arise. There can be little doubt, for example, that a large number of animals have particular percepts and recognise them. They need not, however, necessarily be able to locate these percepts in their past experience conceptually or have the assurance of the correctness of their memories and the like. We are,

therefore, freed from much of the restraint that is put upon comparative psychology by the fear of imputing some form of conceptual thought to the animal mind.

On the whole, finally, it may seem probable that sensations are the only elements of experience and that all apparently different states of mind are modifications which result from the integration of these sensations in respect of some common attribute. But we put no special value upon this conjecture at present. For the moment we would only claim careful attention to the method we have followed. Our work may be incomplete at every point. We have pointed out that our enumeration of the attributes is imperfect. Our enumeration of the characteristics of integrated modifications of experience may need amplification. And we have only selected the two most obvious and easy examples of these for study. There may be dozens of others. It is only in order to characterise and name our theory over against sensationalism on the one hand, and elementism on the other, that the word "modalism" has been appended to the title of this paper.

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THE RELATION OF MIND AND BODY[1]. II.

By HENRY J. WATT.

1. *The basis of the problem.* The scientific problems concerning the connexion between mind and body rest ultimately upon knowledge common to us all. One of the first tasks set to the growing mind is that of distinguishing between fact and fancy, between the present and the remembered. In psychology this practical task reappears in the theoretical difficulty of distinguishing sensation by definition from its virtual copy, the mental image. Sensation and image seem to differ from one another in respect of no aspect or attribute. They may be of the same quality; a remembered rose may be as red as a seen one. Their colours may be equally intense, equally extensive, similarly located—identical in all respects. Very often we fail to make a distinction between sensation and image, as in dreams, in hallucinations, and in many of the common perceptual processes of seeing and hearing. But at other times we distinguish them easily, whether by their different behaviour or by their different relations to the will and to attention. Sensations seem to behave in their own way; we must follow their leading: images come and go as we will; they appear

[1] Read before Section I at the Dundee Meeting of the British Association for the Advancement of Science, 1912.

and change at the bidding of our thought and attention. However this may be, it soon becomes clear to the mind just expanding into a knowledge of the world and of itself that sensations imply the stimulation of the body by some present object, whereas imagery is an inner vision which the mind retains and recalls without the aid of the body, even though the object remembered is gone for ever.

But a more minute examination of the facts inevitably shows that not only the mind's images but all memory and even the most rational processes of thought are in some crude way dependent upon the integrity of the body. Certain parts of the brain are found to subserve the processes of seeing and hearing, and injury to them will make the memory of sight or sound impossible. From this knowledge we may rush to the conclusion that every mental operation, however minute and special, is dependent upon the operation and cooperation of some special mechanism in the brain. But doubts began to rise when we find how difficult it is to say precisely upon what kind of cerebral mechanism the processes of thinking and reasoning depend. The problem then calls for the most impartial and careful study, in which hypothesis and inference are restrained as much as possible and all extraneous argument is excluded.

2. *Presuppositions of the problem.* It is evident that even a temporary solution of the problem *presupposes some sort of satisfactory knowledge of each of the two correlated fields*—the physical and the psychical. In the physical realm this knowledge may be said to have been attained. There uniform and more or less consistent schemes of arrangement and interconnexion of elements and other units have been adopted. We have some general schematic understanding of the anatomical and physiological dispositions of the central nervous system. Although every particularisation of that knowledge is extremely difficult and arduous, it may be presumed that further research will hardly yield results so strange and so surprising that they will not harmonize readily enough with what is known. This must be fairly obvious, I think, in spite of the fact, that we have detailed knowledge only of certain of the simplest and most mechanical of nervous processes—the reflexes—and that apart from certain facts of localisation we know next to nothing about the nervous processes which subserve our most usual mental events.

But if the outlook on the physical side is free and unbounded, it is as yet hardly so on the psychical side. Various causes contribute to maintain the obscurity which prevails. Very extreme views have been

held regarding our ability to know about the mind. Some have supposed that the mind is an open book to be read—by its owner at least—without effort or study. How could it have its characteristics at all, he would ask, without his being aware of them? Others have supposed that, far from knowing all, they know and can know nothing about the mind. Knowledge of it could not be expressed in systematic, general, scientific form. How could sensations, feelings, thoughts and efforts possibly be treated as natural objects, to be described, analysed, and classified? Both of these views are really untenable. A middle way must be followed. We must suppose that we are aware of all that passes through the mind, but that we attend to, describe and name mental processes only relatively seldom and then usually without much regard for systematic values. That is, of course, perfectly natural; for we use our minds, as we use the things around us, at first perceptually and practically, and only long afterwards conceptually and theoretically. Our scientific difficulty is, in fact, just this—to learn how to bring about any desired mental process experimentally, how to attend to it, to describe it repeatedly and fully, and to set it into systematic relation to all other mental processes.

This is the more difficult to do, as we naturally tend to notice first only those mental states which are relatively complex, e.g. emotions, thoughts, and memories. These states must first be analysed into their simplest parts before they can be brought into systematic relation to one another. To many the very idea of such an analysis is repellent; they maintain that no analysis is possible; it seems to them to dissipate its own object. To these thinkers the results of analysis seem to be discrete, independent particles, incapable of re-uniting to form the thought, emotion, or memory, from which they were derived. But such a view seems to me to be but the natural result of a method of analysis which proceeds without any sufficient attempt to maintain a corresponding theory of synthesis and interconnexion. There are many difficulties peculiar to such a theory, difficulties which are not at all like those with which we are familiar in physical science. And we must guard against applying to the results of psychological analysis the notions we entertain regarding physical elements. Being unsuitable in many respects, these notions only serve to form a prejudice against psychological analysis. We must establish our notions of psychical elements on a purely psychological basis.

Various schemes for the systematization of experience have been propounded; but none has been definitely accepted. The science of

psychology is at present in the unenviable position of having no concentrative hypothesis which is accepted as a skeleton for all text-books and as the ultimate motive of all detailed work and theory. The theoretical advance of psychology must, therefore, lead to results which will transform and enormously extend the outlook of present theory and which will lead to some unity of opinion upon the general lines of theory and exposition. The need for such a theory speedily becomes evident when we approach questions of detail regarding psychophysical correlation.

3. *Philosophical references.* The specially *materialistic* treatment of the mind as a sort of subtle by-product of cerebral activity may be dismissed, as it rests upon a totally mistaken and ignorant view of experience. It may safely be maintained that if there is any realm where interdependence of parts and systematization seem to be patent, that realm is experience. We are apt to look upon experience as a succession of unrelated particles, determined only from the side of the body, because a bodily counterpart or governing influence is often found where we might least expect it, and because experiences seem to affect one another for change little enough, so long as we are not actually enjoying them. After periods of forgetfulness they return to us much in the same relations as we left them in. But this feature need not indicate a lack of interaction between them. The interdependence of experiences may be largely static in character. The sphere of mental dynamics seems to be the consciousness of the moment, where new elements appear and where potent forces continue for a while, using their powers to produce vast changes. How far abroad from the present moment the influence of these forces extends is not yet exactly known.

We may also well refuse to make any reference here to philosophical problems concerning *the nature of reality.* We must accept as valid the naive view that there do exist things that are not wholly to be identified with the momentary contents of the individual mind and are thus far independent thereof. We may also accept the common distinction of this class of things as 'material' or 'physical' from the class of experiences or 'psychical' things. For the problem of the reduction of this distinction does not affect the problem of body and mind. The problem of body and mind is, and will always, from a preliminary point of view, remain the problem of the connexion of these two classes of things—physical, psychical.

4. *Correlation between the psychical and the physical.* Whatever

the nature of the connexion between body and mind may ultimately appear to be, it must rest upon some form of correlation between physical and psychical things. Both psychophysical parallelism and interactionism involve such a correlation, so far as they agree that some or all psychical processes are accompanied by or are evoked by physical processes or *vice versa*.

No one, I think, would venture to suggest, on the basis of positive considerations, that every single aspect of all the physical processes of a single class, no matter how restricted it be, is represented by an exclusive psychical correlative. Chemical and physical knowledge has grown so minute and so dense as to form an effectual barrier to any such attempt. Attempts have indeed been made to correlate molecular complexity with psychical relationships. The occurrence of consciousness itself is sometimes said to be dependent upon the occurrence of molecules of enormous complexity[1]. Hering's theories of adaptation also make some vague reference to processes of assimilation and dissimilation. And certain aspects of colour theory, especially the independence of white-grey-black vision, complementary relations, the facts of colour-blindness and of the distribution of colour sensitivity[2], sometimes elicit speculations regarding molecular relations. But these theories could hardly be said to offer any hope of doing justice to all the features of molecular constitution. The spatial arrangements of the relatively enormous units of the nervous system call, of course, for closer consideration; but even of these only the more central dispositions are usually brought into correlation with experience. The problem of correlation if it is to be in any sense exhaustively treated, must be stated from a psychical basis.

These various considerations make it clear that the first step towards statement and solution of the general psychophysical problem must be the formation of an exhaustive catalogue of psychical states of all kinds, properly classified as elements, compounds, or other kinds of derivatives. For every one of these and for every distinguishable aspect thereof we must ask whether some satisfactory correlative cannot be found among known or possible physiological processes and their predicable qualities. Unless this is done, I do not think that the problem of the connexion between body and mind can even be raised. Every setting of the problem presupposes at least a temporarily sufficient completion of that

[1] W. McDougall, *Body and Mind*, 279.

[2] Cp. C. L. Franklin, *Mind*, N.S. 1893, II. 473 ff.

task. The greater our success, the more extensive will be the psychophysical correlation be; the limits of correlation will be given by repeated failure to find or to conceive for each mental state a physical correlative. We must take heed, however, lest the problem of correlation change under our hands to the effort to identify the physical and the psychical or to resolve them into one another. The temptation thus to transgress the bounds of the problem is very great. After finding marked traces of correlation between psychical units and physical units, we are apt to look for a correlation between psychical laws and relationships and physical ones, forgetting that the problem of correlation only exists because psychical units differ radically from physical units and yet at the same time seem so to differ from one another in their own specific ways that their differences can be correlated with the steps by which certain physical units differ from one another in their specific ways. Neither the units of either side nor their absolute differences can be compared with one another, but only their relative differences in so far as these constitute a series of a regular nature on either side. If only the regularity, and not the differences themselves, can be compared, neither can any other laws nor relations on either side be brought into parallel except in respect of formal characteristics, such as regularity, unity in difference, etc.

No more facile and useful scheme of psychophysics could be imagined than that of the associationist psychology, which in its essential form must always hold an important place in the field of psychological theory, however far that may ultimately extend beyond the bounds set by the primitive forms of associationism. In the latter the only important distinctions were those of quality and of simultaneity or succession among sensations and images. Quality could be correlated with the varying localisation of function, familiar to common knowledge and later confirmed by the facts underlying the law of the specific energy of the sensory nerves. Different qualities were not thought to be separated by distance or by anything else; they were simply fused by aggregation into a percept; hence the separation by distance of the areas of localisation created no discomfort. If it came to view at all, it did so naturally in the time intervals between successive images. These intervals were, of course, to be correlated with the time taken for excitation to travel from one sensory area to another.

Whatever prominence may now be given to the notion of association, we have already gone far beyond the simplicity of the early psychology of this school. We are familiar with an enormous amount of detail,

especially in the field of simple sensation, which was then unknown. But attention has been concentrated mainly upon the discrimination of absolute and differential limits and the registration of the corresponding values of stimulus; the problem of the systematization of the simple sensations has been comparatively neglected. It has been thought impossible and useless; impossible, because the varieties of sensations we find seem so disconnected psychologically that only the accidents of biological development could give them some sort of explanation; and useless, because many ways of classifying attributes seem possible and none seems to add anything to our knowledge of sensation in general. But it must be evident that the true understanding of the physiology of the senses can only come when we have succeeded in classifying sensations and their attributes properly, so as to make them throw light upon the general constitution of experience. Even before we reach this point, we should find that the true classification of attributes makes the physiology of the senses more coherent and acceptable. For the psychological facts are just the key to the arrangement and interpretation of the physiological facts.

5. *The attributes of sensation.* The most direct attributes of sensation are commonly known as quality, intensity, extensity, local sign, duration, and position in time. The presence of intensive differences in all kinds of sensations, with the possible exception of vision, is undisputed. Differences of opinion exist regarding the quality of auditory, kinæsthetic, labyrinthine, and muscular sensations and regarding the extensity of many sensations, especially the auditory (where some recognise it in the form of voluminosity), and the olfactory, kinæsthetic, and muscular (where it seems to be absent). Nativistic and genetic views of the nature of local signature oppose each other and call for different physiological theories. The attributes of duration and position in time are at present perhaps completely in question. They seem at once the most obvious and the most obscure of all. The attribute of duration finds most general acceptance, which is the readier as this particular attribute is felt to be very harmless and unimportant. Position in time presents greater difficulties; as an attribute it invokes the same sort of suspicion as does a nativistic local sign.

The importance of these two attributes must be emphasized at this point. For the question of the simultaneity or succession of bodily and mental correlatives is bound up with them, and unless this alternative is resolved, there can be no hope, at least from the physical side, of

extending the theory of psychophysical correlation into a theory of psychophysical continuity. Correlative simultaneity is incompatible with the general principles of physical science and especially with the conception of energy, if we ignore for a moment the difficulty of considering consciousness as a form of energy at all. And if succession be the more probable view, the further question arises: is the succession of bodily and mental states of only one direction, or is it also reversible? But it must be abundantly evident that the alternative of psychophysical simultaneity or succession is not really resolvable. We can hardly hope to succeed in comparing the conscious position in time of two such events as an experience and its accompanying neural excitation. And even if we could, it would avail us nothing. For the presence of a regular interval of time between neural excitation and correlative experience would be absolutely undetectable. As a matter of fact an interval of time does elapse between stimulation of a receptor and the correlative sensory experience; but we are quite unconscious of it and fail to detect it, unless we infer it from the fact that the time interval for different receptors differs or from the latent time of muscular reaction.

Thus it is evident that we must include duration and position in time amongst the attributes of sensation, even if only to provide a basis for the general problem of correlation formulated above. The problem of the alternative of simultaneity or succession does not follow upon the problem of correlation, but must be merged in it. Hence it is possible to omit all reference to time in the statement of the latter problem.

6. *Some difficulties urged against parallelism.* Some form of parallelism may then be said to be by presumption the accepted doctrine. But the more restricted view of interactionism is not without its supporters. It is, curiously enough, at once the easiest doctrine to make plausible and the most difficult doctrine to prove. To make it plausible it is only necessary to pause before the difficulties of psychological analysis on the one hand and to underestimate the possibilities of neural complexity on the other. None of us can really avoid doing either of these things at some point or other. The difficulties of psychological analysis make us incline to believe that the brain sometimes yields us full-grown 'higher' mental states that are unanalysable, or weaves into a unity components that could not be supposed to produce that unity entirely by themselves. And if we succeed in our psychological analysis, we may perhaps too readily

concede that the brain could not possibly contain mechanisms of that peculiar kind which our analysis demands. Those who are sceptically or critically inclined will, therefore, find it hard to abandon the parallelistic view, however strong the evidence against it may be.

This evidence has been recently gathered by W. McDougall and has been admirably expounded in his works, especially in his paper "On the Relations of Corresponding Points of the Two Retinæ[1]," and in his book *Body and Mind* (Methuen, London, 1911). McDougall attempts with the help of the typical, and, of all, the best studied, example of binocular vision to show *that for certain aspects of psychical states—generally their unity amidst diversity of content—no physical correlative is known or conceivable.* I propose briefly to state his arguments and general conclusion in favour of interactionism, and to urge certain considerations which seem to me to make the facts still compatible with the demands for correlation and consequently with the broader views of parallelism.

The arguments are as follows[2]:

(1) "Any illuminated surface appears no brighter (or but very slightly brighter) in binocular than in monocular vision." [Independence and equivalence.]

(2) The facts of Fechner's paradox. [Reconciliation of differences.]

(3) An after-image is much more easily revived by stimulation of the eye it was formed in than of the other. [Independence.]

(4) Binocular flicker disappears at the same rate of alternation of phases as does uniocular flicker and is practically independent of simultaneity or alternation of phases in the two eyes. [Independence and equivalence.]

(5) The facts of flicker-rivalry and of the rivalry frequently observed in binocular colour-mixture and of the volitional predominance of either of two rival fields. [Failure or suppression of reconciliation.]

(6) The independence of the two eyes with regard to the after-effects of seen movement. [Independence.]

(7) The fusion of disparate points in binocular vision and the influence of practice thereon. [Reconciliation of differences.]

(8) The acquired readjustment of corresponding points in certain cases of squint. [Ditto.]

(9) "Perhaps the strongest evidence against the 'common centre' is afforded by the facts of functional blindness of one eye, whether occurring as a symptom of hysteria or induced by hypnotic suggestion." "But how is this dissociation or circumscription effected? The subject himself knows nothing of the anatomy of his brain[3]."

(10) "In certain rare cases a lesion of the visual cortex has produced a small area of blindness in one retina only: a fact fatal to the common view[4]." [Independence.]

[1] *Brain*, XXXIII. 371 ff.

[2] *Op. cit.* 372. The words in square brackets are added by me.

[3] *Op. cit.* 372. [4] *Op. cit.* 292.

(11) "It seems that the owl, the frog, the chameleon, and other beasts of prey enjoy binocular vision in spite of the fact that in them the decussation of the optic nerves at the chiasma is complete."

(12) "The hypothesis of the 'common centre' is founded upon a radical misconception of the conditions of fusion of effects of sensory stimuli"—viz. "That the sensation evoked by the stimulation of any sensory point or nerve-fibre comes into existence as an isolated or detached fragment of psychical existence, and that such fragments become compounded to form a consciousness" only in virtue of a corresponding fusion of subservient nervous conditions. The true statement may be formulated in the following way: "In so far as sensory stimuli affect consciousness, they produce partial modifications of the complex but unitary whole of consciousness; and when several stimuli simultaneously affect consciousness, their effects in consciousness can only be discriminated from one another in so far as there obtains some special ground of distinction. Such special grounds are of two principal classes—namely differences of quality and differences of local signature of the several sensory effects of sensations, as we commonly call them; and the power of distinguishing...sensation-elements by aid of either of these grounds of distinction depends largely upon previous practice in active discrimination."

"When the effects of two or more sense-stimuli appear in consciousness combined to a common resultant, this is because the separate cerebral processes act upon this one being [call it the soul or what you will] and stimulate it to react according to the laws of its own nature with the production of changes in the stream of consciousness[1]."

I think we may agree that these arguments are decisive against any view that holds that the excitations from the two retinæ impinge upon a unitary, common, centre—a sort of blob of undifferentiated jelly—and are there simply and entirely summated, merged or wrought into one another, as two drops of water that run together. But this view hardly needs such heavy condemnation. For if the unity of the individual consciousness does not involve a punctate cerebral seat for the soul—as the failure to find one seems to show,—neither should the lesser unities of consciousness necessarily imply the existence of corresponding punctate centres. Besides, it is obvious that the existence of such punctate centres of fusion would be the very strongest evidence against parallelism. Even if we suppose that in the common centre the two contributory excitations were merely superimposed without summation, such a centre would be useless, because it would offer no physical correlate to binocular stereoscopic vision. The neural basis of binocular vision is undoubtedly much more complex than has been often rashly supposed.

But having established that the two eyes are in certain respects functionally independent, in others functionally equivalent in spite

[1] *Op. cit.* 298.

of independence, in others again irreconcilable, and, finally, in others without doubt extensively and variably reconcilable, both with reference to the accompanying experiences and to the muscular outcome,—must we therefore conclude that the demands of no legitimate form of parallelism can be fulfilled? Are we not rather called upon first to systematize as concisely as possible the very various psychological facts adduced, and then to find or conceive some correlative neural basis for them. If we cannot pull the child's coat on to the man's back, we must cut a new garment from our cloth.

7. *The problem of psychical analysis.* It is a common objection which McDougall urges, that sensations of similar quality fuse in a way that defies analysis. They can be distinguished when they occur successively merely because of their succession. But we must be careful that we do not try to dictate the facts. One obvious limit is set to analysis. We cannot maintain binocular synthesis and at the same time somehow separate it for observation into its discrete parts. But that does not mean that when fusion of sensations takes place, there is no longer any evidence of the existence of the manifold that fused to unity. The fused unity does not differ radically and in every respect from its components, although suggestions are sometimes given to this effect. The rather narrow limits set to the reconciliation of differences in fusion show this most emphatically.

8. *The laws of psychical fusion.* We must simply recognise the peculiarities of psychical fusion. We must not expect them to be the same as those of physical fusion. The law of the conservation of physical energy involves the summation of fused components; it is in fact a quantitative law. If there is anything of which we may be certain it is that the laws of psychical fusion are not quantitative laws. Can we not recognise a law which might boldly be called the law of the conservation of psychical identity, and which might be formulated in the following words?—When two sensory experiences combine so as to produce a unity in which they are not separately distinguishable, all those attributes of which the same varieties are common to both experiences, are conserved identically, without prejudice to any divergent psychical attachments these identical attributes may possess. I know of no attribute of experience which offers any exception to this law. And I do not at all see that on any view whatsoever demand could be made for the existence of a parallel unification or identification of subservient neural processes. The psychical identification as such is quite compatible with physical

discreteness as such. Physical discreteness of the neural processes which actually subserve equal intensities psychically identified (if we have really established such a thing), would only involve the assumption that the neural correlative of intensity is not the same part of the neural unit, say a series of neurons, which subserves a given sensation, as perhaps the neural correlatives of colour-quality or local sign of that sensation. If the fused psychical complex is subserved by a co-ordinated neural complex, why should not the simple sensation of many concentrated attributes be subserved in the same way?

But the main interest of the systematic psychological study of binocular vision resides, not in this law of the conservation of psychical identity, but in the laws which govern the fusion of experiences in so far as they differ from one another in some one attribute. In binocular vision uniocular fields which differ in quality, intensity, or local sign are reconcilable under certain circumstances. Differences of quality are sometimes reconcilable, when we get the processes of binocular colour-mixture. Differences of intensity often produce lustrous effects and differences of local sign usually give us stereoscopic vision. All of these binocular effects can also be got uniocularly.

9. *The visual systemic sign.* Moreover, we must not omit to take note of the individual nature of the two fields of vision. It is a familiar fact that if we interchange the right and left eye views of a stereoscopic slide of a simple object such as a pyramid, the previously solid pyramid pointing its apex towards the eyes now seems to be a hollow pyramid whose open base is exposed to view. In both cases accommodation, convergence, and the sum total of excitation are the same. The only difference is the interchange of the two halves of the complex excitation. It is therefore clear that the two eyes or the two fields of vision are not indifferently interchangeable systems. We can, I think, hardly assume that the mere disposition of the cerebral components of excitation produces such a radical reversal of psychical effects without any intermediary being present in the uniocular components of fusion. I propose to call this intermediary—for want of a better name—the 'systemic sign.'

If this sign is conscious it should be introspectible, but it need not be readily so. Its existence is sufficiently guaranteed if it is detectable at all. I think this may be allowed, although the evidence is hardly yet clear. Apart from this, however, and as its existence seems to me to be implied as the ground of binocular reversals, I should like to

suggest its use as *a means of explaining the facts of functional blindness* referred to by McDougall in his ninth argument. These facts involve a physiological knowledge of areas of localisation only in the eyes of a theory which ignores or refuses the assumption of systemic signs. If there is a visual systemic sign, it is evident that a patient in hysteria or in hypnosis has a direct means of bringing the field of vision of one eye into relation to suggestive inhibition. The inhibition will naturally apply to all the contents of consciousness that are characterized by the systemic sign; this in turn may naturally be aroused by verbal suggestion or by touching one eye or the like. For it is evident that what is associated with a systemic sign can act as a vehicle to reach the contents of that system rather than those of another. To each visual system we must suppose to be linked in complex ways the muscular and tactual sensations from the same eye, as well as all the conceptual terms applied in intelligent life to these.

May we not further consider the systemic sign as the psychical correlative of the separate central localisations of the effects of stimulation of the two retina? I can see nothing but advantage in doing so.

When the contents of the two fields of vision are identical, the difference of systemic signs seems to be somewhat ineffective. The result of fusion gives chief prominence to the conservation of identity, except in so far as the appearance of flatness is concerned. But it would be rash to assert that when the fields of the two eyes are not in any way distinguishable, binocular vision is then completely identical with uniocular vision. There has been a tendency, I think, to presume upon this view in treating of the relations between uniocular and binocular intensities and the like. If there is no summation of intensities in binocular vision, it does not follow that the unitary binocular field which results is a unity without any included differences. It is only so as regards intensity. The same holds for binocular colour-mixture and for other attributes of visual sensations.

On the other hand, when the two fields of vision are extremely disparate in any respect, the systemic signs become again ineffective; they fail to reconcile these differences and rivalry results, be it rivalry of intensities, colours, or local signs. Reconcilable differences must lie apparently within a certain range, which may vary for each kind of difference, as well as for practice; and certain forms of reconciliation exert a strengthening effect upon the reconciliation of otherwise rival fields, as we find in lustre and binocular colour-mixture, which are both supported by identity of contours and by stereoscopic vision.

10. *Sufficiency of positive statements.* But it would be inopportune to pursue further matters which still await exact determination and formulation. Perhaps enough has been said to indicate methods which seem applicable to the systematization of experience. In face of the statement that a reasonable and sufficient analysis of experience is impossible, more than an indication of methods can hardly be expected. In so far as systematization succeeds, we do not need to go beyond the positive statement of the laws included within it. The law of the conservation of psychical identity does not seem to call for any operative agent. I do not see any reason why we should expect exact statements of the laws of the reconciliation of differences in fusion to involve the assumption of any intermediary. The 'soul' seems an unnecessary postulate, at least within the sphere of sensory experience. Whether it is necessary in other regions of experience it is at present impossible to say with positive assurance. But in so far as these regions of experience present features analogous to those of sensory experience, the postulation of the soul as the agent of the unification of experience hardly seems inevitable. For this purpose the soul seems to be as unnecessary in mental life as are in nature the agent 'forces' we so often tend to assume as the motive life of her laws.

But although the soul does not seem to me to be in this connexion as necessary and as useful as McDougall would have it, I am sure that in postulating the soul to explain the processes of fusion McDougall has emphasized the problem which on the psychical side first faces every attempt to solve the general psychophysical problem. There can be no doubt that the problem of the understanding of the psychical complex as such is in this connexion chief of all. It would be rash in a short paper like this to presume upon the solution of it. I can only indicate the lines of solution which at present seem promising and worthy. I do not think that we can yet afford to accept any conclusion that the satisfactory analysis of psychical complexes is impossible. Nor do we seem to be helped by postulating a most complex and wonderful agent to relieve us of our difficulties. We must face these difficulties boldly and hope for success in the positive systematization of experience and in the understanding of its complexes in terms of its elements. A quantitative understanding of them is excluded, it is true; but have we therefore in the psychical world no form of insight which convinces and satisfies? Surely we have! If we can spread out the physical world under the microscopic eye of science and gaze upon it through that vision with the full promise, if not already the gift of

satisfying conviction, can we not also hope to spread out the psychical world before us and leaven it all with the yet partial insight of our inner vision? We still see only with the eyes of childhood; we have not yet observed and pondered enough. But the practical reason of childhood is already the promise of man's purest understanding.

11. *Psychophysical correlation.* When we turn to the problem of correlation, we must ask at each stage in the progress of psychical analysis whether our results are compatible with what we know about the central nervous system from evidence other than psychological. It is of course permissible, where direct knowledge fails, to speculate on the probabilities of neural arrangements by inference from psychical facts. We might even under certain circumstances speculate upon the probabilities of a wider world of mind from consideration of the larger schemes of the physical world. But it should surely make us call a halt when we find that inferences made from psychical facts to physical probabilities are held to establish a partial lapse of the expected parallelism between the psychical and the physical. Even if we admit the validity of these inferences, must we not agree that they do not in principle really carry us beyond the knowledge of every-day life, that there are two eyes, but only one mind and one muscular response? We cannot suppose that the neural paths from the two eyes are entirely separate over their whole course, but only that they are not coordinated so soon or at the same points as we once believed they were. For coordinated they must be somewhere and somehow, not for the sake of psychical fusion, but merely for the sake of the unity of the muscular response.

This coordination of the muscular response is recognised by many as a fact of unique importance. But its importance must not be exaggerated. It cannot be supposed that confluence in the efferent system is the sole ground of psychical fusion and explains all the peculiarities thereof. For we should then be involved in all the confusions of a 'common centre.' Confluence for the purpose of motor coordination can only be supposed to be a partial condition of fusion, if we consider that the neural substrate of, say, intensity lies where the converging paths are still separate, while the neural substrate of local sign lies near the point of confluence. The neural correlates of the various attributes of one simple sensation would then be spread out in some sort of linear series. No objection would, of course, be offered to such a view from the side of psychological theory. Our only enquiry is whether the demands of correlation can be satisfied or not. It is for the physiologist to say

upon the basis of direct evidence whether any proposed neural scheme, devised to explain the facts of muscular coordination or to meet the demands of parallelism, is possible, probable, or necessary.

It is a significant fact that the feature of uniocular experience which shows by far the greatest extent of reconciliation of differences in fusion is its local aspect. There is also clear evidence in the cases of lustre and binocular colour-mixture that the reconciliation of differences of brightness and colour is very much supported both by the identification of local signs and by the reconciliation of their differences. The coordination of muscular response seems therefore to involve the existence of a neural basis which shall bind the efferent system to, or give it some sort of foundation in, the neural correlative of local signs; so that the modification or complication of muscular responses shall help to modify or complicate local signs. In this way we might give credence to all the facts and still deny that the motor coordination is the sole ground of fusion. *It would be a condition of fusion only in so far as it is based upon, and by its changes helps to modify* (other means of modification still being possible) *the local signs*, which, as originally given, or as integratively developed, enter as the attribute of sensations into the components of a complex process of fusion.

Therefore it still seems possible to correlate completely the complex psychical unity of binocular vision, fused according to the particular laws of psychical fusion, with the complex physical unity of binocular stimulation and response, coordinated according to the particular laws of neural coordination.

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