The main principles of sensory integration / by Henry J. Watt.

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THE MAIN PRINCIPLES OF SENSORY INTEGRATION[1].

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A. 1. *The systematization of the sensations.*
   a. Note on extensity.
   2. *The systematization of the integrative sensory modes.*
   a. Note on the word 'mode.'
   b. Note on the word 'integration.'

B. *The main principles of integration.*
   1. "*The mode which results from the integration of an attribute must bear an immediate introspective resemblance to it.*"
   2. "*The results of the integration of the same generic attribute in the different senses must be introspectively and functionally similar.*"
   a. The sub-principle of the explanation of apparent exceptions and limitations to this rule: "If a mode of experience does not occur where we might for any reason expect it, this can be explained only by the absence of the variant experiences upon which it is integratively dependent and for the latter the natural limitations of physical and physiological processes must be ultimately responsible."
   3. "*Every typical mode of experience must to some extent at least arise spontaneously and automatically and independently of such processes as will, attention, inference, proof, or the like.*"

C. *Conclusion.*

The formulation of principles is an important stage in the advance of any science. Its beneficial effects far outweigh its disadvantages and

[1] An abstract of this paper was read before the Sub-section (to Section I) of Psychology at the Meeting of the British Association at Birmingham, 1913.

dangers. It is the sign of an increasing unanimity, a concentration of criticism in various fields round one or two points of view, a growing sense of the inherent connexions of the subject-matter. It means the abandonment of extraneous principles of explanation most successful, it may be, in objectively neighbouring provinces of science, but really inapplicable to the one under consideration. It serves, moreover, as a guide to research and to theory, thus supplementing mere exhaustiveness by some degree of enlightenment. And it is perfectly safe, unless it is the outcome of a movement towards prejudice and bias.

The formulation of principles is highly necessary in psychology, for it is recognised by many to be a sphere in which the effects of the interaction of all the main forms of being—physical, physiological, biological, psychical, and social—are made patent. The introduction of extraneous principles of explanation is highly probable in this case, unless sufficient attention be given to the nature and applicability of the principles to be admitted. The principles of the natural and biological world do, of course, make themselves felt in the sphere of experience. But they do not provide a sufficient basis for the proper systematization of that sphere. The peculiar nature of the psychical itself must be emphasized and principles must be devised for its elucidation which are drawn from its own sources and may therefore be expected to do the only full justice to its particular difficulties. This claim is, in fact, an assertion of the priority of the psychical in the psychical realm. It is also an assertion of the possibility and necessity of a purely psychological systematization of the psychical.

A. A systematic psychology of sensory experience is perhaps the greatest need of our science at the present time. It has been very much neglected. That, no doubt, is due to the fact that the chief motive of the study of the senses has been physiological. There seemed to be so much to be gained by this physiological study and so little air to breathe in a purely psychological atmosphere. But surely there is no use in talking of a science of psychology at all, unless the realm of sensory experience can be properly systematized. The simplest and most fundamental problems involved in this task fall into two main groups.

1. *The systematization of the sensations* is the first of these. Some sort of a 'periodic table' of the sensations must be formed, which will serve as a framework and basis for any theory regarding the qualities of sensation; and the attributes of sensation must be reduced to a type. This psychological task is a necessary preliminary to any pure psychology

of the senses. I have attempted to fulfil it elsewhere[1]. Only a short summary and revision of the outcome of that attempt need here be given. Of the six attributes of sensation, quality and intensity stand somewhat apart from the others. Quality may be considered to occur only in single and discrete forms in all cases, except in the senses of vision and smell whose purely psychological treatment is still problematical. Hardly in any case is there any dispute or difficulty concerning intensity. The four other attributes—of extensity, order, duration, and position in time—may be arranged usefully in the following scheme:

Generic names of the various dimensions of sensation	Generic names of the attributes:	
	Extensity	Order
	These are inherent	
	WITHOUT	WITH
	variation, in all sensory	
(Intra-) Systemic	extents, masses, volumes	localisations, positions, pitches
Temporal	durations	positions-in-time

It is tempting to bring quality and intensity into parallel with this scheme, so as to reduce the six attributes of sensation to a triad of pairs, each pair being extensive and ordinal in its own peculiar dimension. But this is impossible for the following reasons[2]:

(1) Qualities cannot be treated as orders, for they give no distances or motions; even if that fact be ignored, it is introspectively evident that they do not bear the stamp of an ordinal attribute. Even the different colours we do not think of as points in a system; how much less then do we consider the qualities of the different senses in this

[1] "The Elements of Experience and their Integration; or Modalism," this *Journal*, 1911, IV. 135 ff., esp. 148 ff. *Psychology*, London, T. C. and E. C. Jack, 1913, 21 f. Cf. "The Psychology of Visual Motion," this *Journal*, 1913, VI. 26 f.

[2] Cf. my paper "Are the intensity differences of sensations quantitative?" This *Journal*, 1913, VI. 176 f.

way. And if quality is not an ordinal attribute, it is certainly not a merely extensive attribute.

(2) Intensity, likewise, can be treated, neither as an extensive attribute, for it is essentially variable and is not introspectively identifiable with the extensive form of attribute; nor as an ordinal attribute, for it is neither phenomenally nor functionally like one of these.

(3) If quality and intensity formed such a pair of attributes, they should prove readily adaptable to quantitative purposes, as do the attributes of extensity and order in combination with one another in connexion with the measurement of space and time. But this is not the case.

a. Note on Extensity. The critical point of any discussion of this attribute lies in the problem of its relation to the attribute of order. When extensity is present in a pure form, according to Stout, as in the case of the voluminousness of sounds, "it has no distinctively spatial character, no internal order of positions and distances[1]." It seems as if the quantitative aspect of space could exist without a spatial order[2]. Such statements suggest the following question, which may be expressed in various forms: Is extensity as an attribute really variable? Has it for example, a minimum, say the sensory 'spot'? Or we might ask: Is the extensity of the minimum different in variety or amount from that of a postage stamp? Is the voluminosity of a high tone different in variety or amount from that of a low tone? Surely it must seem absurd to suggest assent to these questions.

What, then, are we to understand by the differences referred to, *e.g.* the 'vast discomfort of a colic or lumbago,' the peculiarities of high tones and of low tones, the differences of the areas felt from the contact of a pencil point and of a postage stamp? If extensity and massiveness and voluminosity do not differ, extents and masses and volumes surely do; these are the things we distinguish in these cases. But obviously no part is played in their composition by quality or by intensity, not to mention the temporal attributes. The only other attribute besides these and extensity is order, which does vary.

We may, therefore, suppose that extents and masses and volumes of sensation differ in virtue of the varying number of orders included within them (or by the varying number of sense-organs of neighbouring

[1] G. F. Stout, *Manual of Psychology*, 1899, 337.

[2] *Op. cit.* p. 334. Cf. also p. 336: "We have all kinds of gradations between pure extensity and fully definite extension." "Typical cases of extensive diffuseness or massiveness are afforded by organic sensations" (p. 337).

position that have been excited). This conclusion is quite consistent with the psychology and the physiology of the cutaneous, gustatory, and visual sensations. Hesitation can only arise in connexion with the massive sensations, articular, muscular, organic, and auditory. But it must yield to a reiteration of the priority of psychological systematization and of the probable conformity of the results of physiological study thereto. If muscular sensations from muscles of different size, and articular sensations from joints of different size, differ in massiveness, surely there need be no hesitation in supposing that this difference is correlated with a difference in the number of receptors excited. The same remark applies to the sensations of colic, lumbago, hunger, thirst, and the like. The varying voluminosity of sounds suggests that each sound is really a mass or extent of sounds; high tones are thin and short, low tones are longer and perhaps bulkier, and, it may be, more tenuous as well. Such a view would explain why the pitch and the voluminosity of tones are fixedly correlated with one another. It is the psychological statement to which Ewald's theory of hearing[1] in many respects forms a most suitable physiological counterpart.

But although extensity is not variable, it is a true attribute of sensation, readily distinguishable from order. Without it we should have neither areas nor voluminosities. That is evident if we remember that a cognitive form of order[2] exists to which there is no accompanying extensity, so that it is impossible to make a series of concepts, such as those of number, adequately represent the real continuity of an objective line or area. It might be supposed to be a sort of sensory stuff, which is repeated and multiplied by the repetition of orders. But the same notion would apply equally to any of the other attributes. The quantitative treatment of extents and durations is possible, only in virtue of the close, psychical kinship between sensory orders and conceptual orders; in a certain respect the latter grow immediately out of the former, although they are extended very much beyond the range of the variations of sensory order. Measured extents are not measured extensities at all; for, as we have seen, extensity is not varied. But extensity can be involved indifferently in a statement of what is measured, because it is itself unvaried and can, therefore, introduce no confusion or complication into the comprehension of that statement. Extensity, for the same reason, seems to have a minimum only in relation to order. A distinction of orders within the 'spot' is, of

[1] J. R. Ewald, *Arch. f. d. ges. Physiol.* 1899, LXXVI. 147 ff.

[2] Cf. K. Bühler, *Arch. f. d. ges. Psychol.* 1907, IX. 357 f.

course, thinkable, but it does not exist in sensation. So extensity seems to be variable only in conjunction with orders, especially when the latter are all continuously adjacent and are given along with uniform quality and intensity. Then the fusional function of extensity comes into action and we get continuous extent or area. But the differing orders involved in this extent, though no longer separately distinguishable, are effectively present. It is just they which determine the extent of the sensational area or mass.

If orders are to be separately distinguishable under areal or massive conditions, they must evidently be accompanied by variation in some other attribute. The only other variable attributes are quality, intensity, and position in time; but there may be variation in more than one of these at the same time, of course. This consideration seems to be of some importance for the theory of orders and their complications[1].

It must be obvious that the above statements apply equally to the attribute of duration. It is essentially an unvaried attribute, which gives variable durations or stretches of time only in conjunction with the variable attribute of position in time.

2. *The systematization of the integrative modes* of sensory experience is the task that for a scientific psychology inevitably follows upon the systematization of the simplest sensations. In so far as these modes occur under different circumstances, they must be identified and reduced to types of graded complexity and referred to their typical conditions, so as to come within the purview of a general, systematic theory of the constitution and interconnexions of experiences. Of these modes there are two main groups—those which take place between sensations which belong essentially to the same sensory system and those which take place between sensory experiences which, like those of the two eyes or the two ears, belong to different systems. Of the former, intrasystemic integrations, distance, and interval of time are the simplest. In many cases they involve a difference in the sensations which make up the distance or the interval of time only in respect of the attribute of order or of position in time; and in those cases in which a variation in extent or in duration is noticeable without any accompanying discreteness or separateness of sensations in respect of order or of position in time, we are justified by consideration of the circumstances of stimulation in extending our statement and in assuming that, in these cases also, distance and interval of time are based upon sensations which differ only in respect of the attribute

[1] Cf. my discussion of "The Psychology of Visual Motion," this *Journal*, 1913, VI. 26 ff.

of order or of position in time. Moreover, distance occurs only in those senses whose sensations differ readily and obviously in the attribute of order. We are never called upon to distinguish hunger or thirst distances, or distances of muscular sensation, or smell distances. In these senses the variation that we notice is at most one of extent or of massiveness. In so far as distance occurs in different senses, however, we must expect and do find that it is phenomenally and functionally the same.

All experiences are qualified by position in time of some form; consequently we can experience an interval of time between any two experiences. But the interval is distincter when it is constituted by experiences belonging to the same sense, and still more so when it is given in those senses which are specially rhythmical, namely sound, vision, and the motor group of senses—the articular, the muscular, and the tactual. In these senses the stimulus can be readily manipulated so as to cause an experience to begin and to cease at any desired moment.

Distance and interval of time are, as modes of sensory experience, peculiarly simple, in that they are the only modes which necessarily involve a variation in only one of the attributes of the sensations upon which they are, or may legitimately be supposed to be, dependent. On the other hand, order and position in time are themselves the only two attributes of sensation which can vary apart from variation of any of the other attributes of sensation. Thus analysis confirms the introspective simplicity of these modes.

The sensory mode that stands next to these two in point of simplicity is motion. For many reasons it may be considered to be a combination of the modes of distance and of interval of time. It is therefore found in those senses which present the mode of distance. Its phenomenal and functional identity in these senses, especially in that of sound where it forms a part of what is collectively called melody, is a problem of great interest at the present time. But the study of motion presents peculiar difficulties[1]. For the present it may suffice to say that motion is a combination of the two modes of distance and of interval of time, involving simultaneous and continuous, though not necessarily concomitant, variations in the attributes of order and of position in time of the sensations which integrate to form it[2].

[1] Cf. "The Psychology of Visual Motion," this *Journal*, 1913, VI. 26 ff.

[2] For preliminary work towards the systematization of the modes of distance and of motion, see my paper in this *Journal*, IV. 172 ff. and 157 ff.

a. Note on the word 'mode.' I find the use of this word very convenient[1]. It serves, of course, in the first place to distinguish those experiences which we may legitimately suppose to be integrated out of simpler experiences, from experiences such as the simplest sensations which show no sign of such derivation. But if we may presuppose the systematic classification of these modes, we can then with the help of this word and of adjectives signifying the name of each class of modes indicate without any ambiguity or confusion exactly the kind or complexity of experience involved in any particular state of mind. That cannot be done with the commonly used word 'perception.' When we speak of the perception of distance, it is not clear what exactly is meant. Do we mean the perception of distance as an object for the mind or as an experience, or do we merely mean the presence and effectiveness of distance in our sensory experience? If we wish to study perception as distinct from any sensation or sensory mode, we can indicate that by speaking of the study of the perceptual modes of experience.

The word 'mode' will also translate the German word *Vorstellung* in many of its uses, for example in its application to the term *Gestalt*, which has been used to indicate distance and motion and many other experiences which differ from sensation in the same way as these do. But it can only be misleading to talk of the 'quality' of a mode or *Gestalt*. Every mode has its own introspective nature and affinities, but these have only seldom anything to do with quality. Although the unqualified use of the word 'mode' well translates the unqualified use of the word *Vorstellung*, the use of the latter word is apt to be as misleading as the English word perception, *e.g.* when we read in one sentence of the *Vorstellung der Zahl, Vorstellung der Distanz, Vorstellung der Aehnlichkeit,* and *Vorstellung der Verschiedenheit*[2]. There are such things as sensory number and difference, but they are surely not modes, the same things as are distance and motion; there is a sensory mode of distance and a conceptual mode of distance, but there is a great difference between them. We proceed unscientifically if we lose sight of these differences.

b. Note on the word 'integration.' This word indicates that the resulting mode unifies the sensations to which it refers and is attached and upon which it is psychically, if not also psycho-physically, dependent. The word may therefore be used generally to express the known relations

[1] Cf. this *Journal*, IV. 203; *Psychology*, 1913, chaps. II. IV.

[2] *E.g.* Witasek, *Grundlinien der Psychologie*, 1908, 222 ff.

between modes of experience and the simpler experiences upon which they rest. And an inductive study of these relations in various cases may be expected to lead us on to knowledge we could not gather from any one particular case. So the word integration may imply the general theory of the relation of a mode to its basis in experience, which psychology may hope some day to attain. If this is borne in mind, the use of the word can make neither for obscurity nor for confusion, but can only be the means of scientific concentration and inquiry.

B. After these preliminary statements we may now consider the main principles of sensory integration.

1. The first principle is as follows: *The mode which results from the integration of an attribute must bear an immediate introspective resemblance to it*[1]. Or: Among the attributes or features of the simpler experiences upon which a mode of experience is, or may legitimately be supposed to be, psychically dependent, there must be one to which it bears a much greater introspective resemblance or affinity than to any other. The latter statement is more inductive in outlook, while the former is more deductive. Only on the basis of such a principle as this can a theory of psychical derivation or causality be built up which will reveal in the world of mind that rationality and intelligibility which we naturally expect to find in all things. The position involved in this principle has been reached by psychology in three distinct steps.

a. For each variation in the derived or integrated state analysis and experiment must show an unambiguous complex of stimulatory or sensory data. This is an obvious and uncontestable truth. Only about the relation of the derived state to the experiences with which it is objectively correlated can there be any dispute.

b. Either: we talk in all cases only of stimulatory data, no matter what the experiences we are investigating may be, mere aggregations or unique modes. This position is taken by very many psychologists of the present time. It leaves, of course, no room for the principle stated above; but neither does it leave any room for a science of pure psychology. All we can then expect is a mere distinction of mental states from one another and a correlation of them with *physical or physiological data, that is to say, psycho-physics or psycho-physiology.* An inquirer of a logical turn of mind might well ask how we can have mere distinction without some trace of interconnexion by resemblance, and, thereafter, without some theory in explanation of this resemblance; but if this thought arises in the minds of those who remain at the

[1] Cf. my *Psychology*, p. 26.

position of this paragraph, it is rendered ineffective by some indefinite belief which makes any hope of constructing a reasonable explanation of the merely similar, or generally of the psychical, untenable. It must, of course, be obvious that if there can be no pure psychology of sensory experience, there can be no pure psychology of any kind of experience at all.

Or: we allow a resultance of certain experiences from others by association or by 'experience,' while denying the principle under discussion. This position is closely associated with the theory of local signs, but it is also in vogue with many in the treatment of cognitive and other experiences. But it must be clear that the effect of experience is unintelligible and association is impossible unless each of the associating elements already differs from every other, whether it be by its locality or order, or by its place in experience, or what not. A series of identicals cannot be differentiated by any association with a series of variants, if that association operates from the identical elements towards the variants. To allow this would be to deny the truth of the rule stated under (*a*) above. This alternative position, then, allows of a pure psychology, in the sense of a system of correlations of an objective kind between single experiences or between groups of experiences. But it blocks the prospect of an intelligible and reasonable science of experience. We must look for a corrective to its negative attitude in further insight into the origin and nature of association.

c. Association cannot be mere blind mechanism, a sort of bond that arises when experiences impinge upon one another in the mind and that requires no sort of counterpart or basis of origin in the experiences that become associated. The purely mechanical view of association prevails at the present time in the treatment of memory; for association can be treated systematically from a mechanical point of view. But this abstract theoretical procedure may be only a part of the whole truth. Purely mechanical memory involves the assumption that experiences associate when they come into contact in the mind in complete indifference to the affinity or dissimilarity of their 'contents.' The most reasonable constellation of ideas, then, has a greater coherence than any other grouping only because there are in it a greater number of frequently repeated and therefore strong associations. Meaning is just a general convergence of associations. But this is surely not confirmed by the facts. What is associated must surely cohere as conscious experience before the association arises. Of course

there must first be contiguity of a certain degree between the associating parts; they must occur within a certain stretch of time. But must we not suppose that having thus occurred they cohere because of their psychical affinity, and that having cohered and integrated they can then become associated to one another so that the one can revive the other? Mere mechanical memory means mental chaos and irrationality. Fortuitous contiguity would as easily produce a coherent mind, as fortuitous grouping of elements and natural selection would produce the biological world without the coherent basis of law given in the physical and chemical world. "A unitary mode of experience in which the associating experiences are integrated is always presupposed, although it is usually ignored[1]."

This principle is the outcome of all unsuccessful attempts to derive special experiences from the grouping of other kinds of experience with the help of association alone. Neither local sign, nor stereoscopic vision, nor perception, nor the concept, nor recognition, nor thought, nor any other unique and special kind of experience, can be satisfactorily explained in this way. And if we must return to a direct consideration of the basis of coherence or of integration in the introspective nature of the experiences that form the basis of integration in all these cases, must we not also look for an integrative basis in experience even in the case of the seemingly most mechanical of associations? We may be in doubt about thus generalising the result, but there can be no hesitation about accepting the principle in the case of all unique modes of experience. If the objective dependence of one experience upon others compels us to classify it as a special mode of experience, and if we may therefore hope for a theory of its derivation or integration out of some one or more features of the experiences it is psychically dependent upon, then it is clear that we can look for its integrative basis only among those features of the experiences upon which it is dependent which bear an introspective resemblance to the mode in question. The true basis of integration will bear a greater resemblance to the mode in question than any other feature of the integrating experiences. It is evident that such a principle will serve as a guide both to experimental research and to theory. Moreover, if a mode is variable, the components of its integrative basis must be variable, as in the cases of distance and feeling; but if it is invariable, as in the case of recognition, the components of its integrative basis cannot be variable.

Whatever is, is rational. In reference to the present position

[1] *Psychology*, p. 60. Cf. this *Journal*, IV. 130, 139, and esp. 149 f.

of integrative psychological theory, this means that if we are to suppose that dependent mental states are derived from the integration of those upon which they are dependent, it would seem to us more satisfactory and intelligible that there should be some degree, or the highest possible degree, of resemblance between the dependent state and the feature or attribute of the conditioning experiences upon which the former in the case of variable modes is known to be dependent and in the case of invariable modes may be supposed to be dependent. More than this we cannot expect. If unique types of experience do not bear quantitative relations to one another, the relations that exist between them cannot in all cases be those of the type of reasoning. For that would be a denial of their specific nature. A standard for the discovery of these relations can then be found only in some other general appeal which the typical form of these relations in known cases may make to our minds. One element in that appeal at least must be degree of resemblance between integrative basis and derived mode. What other elements it may contain inductive research will show. Only on these lines can we hope for a science of pure psychology.

2. The second principle of integration is as follows: *The results of the integration of the same generic attribute in the different senses must be introspectively and functionally similar*[1]. Stated more generally it reads: the introspective and functional nature of an integrated mode of experience is essentially independent of the attributive or other accompaniments of its integrative basis. Wherever the requisite integrative basis occurs, the same generic mode will result. This principle is a necessary step in the systematization which is to constitute a pure psychological science. I have attempted to establish it in detail in the case of the simplest sensory modes of distance and motion[2]. But it must also hold in such cases as feeling, recognition, thought, and the like, for these can be occasioned by the most varied sensory and other experiences. The integrative bases of any mode must be considered to be the same in all cases, no matter what the accompanying differences may be. Experimental research will undoubtedly lead to the confirmation of this principle in all accessible cases. Very often the similarities of modes are passed by as mere analogies. That may serve as a good maxim where there is no insight into the systematic nature of experience to act as a guide. But it would be wrong to block the outlook

[1] Cf. my *Psychology*, p. 27.

[2] See this *Journal*, IV. 157 ff.

and progress of systematization by an ascetic cult of this idea of analogy.

If this principle be granted, we can hope to establish general rules for the relation of generic modes to the generic attributes or features of the experiences from which they are integrated. For example, "motion is found developed upon every group of sensations which show distinct variations from one another in order[1]"; and, "we find distance in all those senses which show order and are capable of the modification of motion[2]." Rules may also be expected to hold for the limits of time within which alone the integration of those modes that are based upon successive experiences can take place. For we have reason to believe that in so far as all experiences are qualified by the attribute of temporal order, all integrative processes which involve successive experiences are subject to certain limits of difference of temporal order.

This principle would also lead us to expect that if a certain mode of experience can be integrated from simultaneous components it should also result from the integration of components which follow one another within the time limits just mentioned. Conversely we should be able to transfer our expectation in a similar manner from successive to simultaneous integration of the same mode, unless, of course, differences in either of the temporal attributes be an essential part of the foundation of its integration, as is the case in the integration of motion. If the temporal attributes are not the essential basis of an integration, it is clear that any differences in them that fall within the time limits of integration, should be as irrelevant to the integration as is the presence of identical or unvaried attributes.

It cannot, of course, be evident in detail how far this irrelevance of accompanying differences, such, for example, as those of quality in the case of distance and motion, extends. But it is assured by a broad consideration of the conditions of occurrence of the various experiences hitherto distinguished by psychology. We must therefore be on the look-out for it; and if it is not forthcoming as we should expect, we must find good objective reasons for its absence. It is fortunate that in the finding of these good reasons we can accept the guidance of a minor principle of explanation.

a. The sub-principle of the explanation of apparent exceptions to this law. If a mode of experience does not occur where we might for any reason expect it, that can be explained only by the absence of the variant experiences upon which it is integratively dependent and for

[1] This *Journal*, IV. 157. [2] *Ibid.* 173.

this the natural limitations of physical and physiological processes must be ultimately responsible.

It is the task of science to expound with the utmost detail the nature of the coherence that binds events into unitary systems of greater and greater extent. Each particular science is concerned with a part of the whole that more or less obviously forms a unitary system. If it discovers in its sphere that kind of coherence that characterizes another sphere of science, it thereby joins with that other to form a system of greater extent than either. But it does not therefore identify its subject-matter wholly with that of the cognate science. The two remain distinct in so far as the forms of coherence that characterize them differ. Now no one would deny that the forms of coherence that characterize the psychical world differ very much from those that characterize the physical and the biological worlds. But they are not wholly independent; something is common to them all. For on any view whatsoever it is clear that our knowledge of the physical world is dependent, not only upon the actual occurrence of physical processes, but also upon the transmission of these in some form or other through the sense-organs to the central nervous system. We can know of a physical process only if the differences of the parts and the manner of the arrangement it involves can be brought into correlation with those involved in a unitary psychical process. This holds, not only for cognition, but also for any kind of adaptation that may exist between the physical and the psychical realms. Such adaptation can occur only in so far as by some means or other a correlation of process can be carried through the three kingdoms of the physical, the physiological, and the psychical. In so far as physical processes occur at a slower rate of change than the minimum required for psychical integration, we cannot become aware of them, unless we can secure some means of bringing their rate of change within the narrow compass of the mind. If a physical change cannot be made to affect a physiological organ appropriately, we must remain ignorant of it, unless we transfer it through some medium which we understand so as to obtain the appropriate effect. And so on.

The mode of distance, for example, cannot be produced apart from variation of the attribute of order; it is therefore practically absent from the organic, muscular, and olfactory senses. In the organic senses there may be a certain variation in massiveness, involving difference of orders, but we do not have a hunger distance or a thirst distance in any proper sense of the word. Similarly we notice that the muscular

sensations from different muscles differ in massiveness and are localised at different parts of the body, but the sensations that come from one and the same muscle do not seem to vary in massiveness or in localisation. Thus a muscular distance, which might be constituted by the simultaneous occurrence of sensations from different muscles can hardly occur without the simultaneous excitation of such tactual sensations as would form a tactual distance. The latter for various reasons, such as variation, frequency, and correlation with other senses and modes, have a cognitive value that the former can never acquire for want of variability. Muscular distance will therefore be so obscure or so blended with tactual distance as to be hardly noticeable. In the sense of smell, distance seems to be quite lacking. If there is any olfactory order or localisation it seems to be so unvaried as to be useless. And even if smell has its order in some other form than localisation, in us at least the sense is so sluggish that the variations of order necessary for distance cannot occur within the time limits of integration. The same reasons as prevent the occurrence of distance prevent *pari passu* the integration of motion.

Interval of time is found under all possible circumstances, in all regions of experience. Only in the form of rhythm is there any restriction to its occurrence. The reason for that fact has been already mentioned: only certain experiences can be made to begin and to cease at any desired moment or periodically. So we cannot have rhythms of taste, temperature, smell, organic sensation, feelings, ideas or thoughts.

The peculiar correlation which is found in the sense of sound between pitch and voluminosity is responsible for all the limitations of integration which specially characterize this sense. Pitch is an aspect of sound which represents the individuality of the sounding object much better than does its spatial localisation. Besides, it seems clear that if the latter had been maintained at all costs on the basis of simple sensation as a sort of local sign, the former would never have been developed. The greater advantage lay in the attainment of a discrimination of pitch even at the temporary or permanent sacrifice of a direct auditory form of localisation. But two more or less efficient methods of localisation have been secured—the mobile-ear-funnel method of many animals and the binaural method of man. As a consequence, however, of the preferential development of pitch we have no true experience of auditory solidity and the smaller variations of tonal interval are rendered highly unclear or even impossible by the presence of beats and intertones.

It is of interest in this connexion to recall a remark made by Ewald. He wrote[1]: "Man begeht immer gewisse Fehler wenn man die Funktionsweise eines Sinnesorganes mit der eines anderen vergleicht." "Wenn der physikalische Anlass für eine bestimmte Empfindung sich in irgend welcher Weise ändert und dadurch eine Veränderung der Empfindung bewirkt, so scheint mir keine Uebereinstimmung im Wesen der beiden Veränderungen bestehen zu müssen." But this is a principle of apology which cannot be accepted from Ewald. For the merit of his theory, apart from its experimental foundation,—a merit that is brought forward into the light by his own sixth argument against Helmholtz's theory—is the facility with which the phylogenetic development of hearing can be traced with its help. For it is just because and in so far as the physical variants of sound have always been the same and the physiological apparatus they play upon has gradually changed in the course of the development of the race, that the psychical results have gradually developed. The peculiar nature of the physiological apparatus has secured for it, not a fragmentarily specialised development, but an equalised development. The system of sounds which results is just as equalised and balanced in its nature. Besides, Ewald does assume that there must be some agreement between physiological and psychical changes; for he postulates a special physiological means of getting round the necessity for this agreement in the case of the ear:—his coupled-buttons theory[2]. This, however, is a forced and artificial way of overcoming his chief difficulty, which is to explain why, on his theory, we do not hear a series of identical tones for each component of a tone picture, instead of only one tone. In the light of his criticism of Helmholtz's theory, this part of Ewald's theory is just as fantastic as is Helmholtz's. For what *deus ex machina* is to make all these coupled-buttons-connexions for the organism? How are they to begin and to be progressively developed?

If we can once decide in what manner any mode of experience varies, we thereby obtain an index to the integrative basis of that mode. This guidance is of great importance in those cases in which the integrative basis of a mode stands in a complex psychical environment from which it is not easily distinguished or isolated. If the variation of a mode is restricted or if there is none at all, its integrative basis should consist of only one pair of unchangingly different experiences. Such a case may perhaps be exemplified by the mode of recognition.

[1] *Op. cit.* 181 f. [2] *Op. cit.* 183 f.

A problem of considerable magnitude is presented in the case of the absence from certain minds of experiences known to other minds. Animals, for example, do not reason. Probably they also lack the general concept and all those cognitive experiences which involve it; they can hardly be supposed to localise their memorial experiences in their past. With all other simpler experiences they may well be presumed to be equipped. But if they can see and hear and smell and feel as well as we can, perhaps in varying ways better, why does their experience not develop upon this sensory basis to the heights it reaches in the human mind? The answer to be deduced from the principle here stated denies that the animal possesses the full integrative basis of the experiences it lacks. It would be presumptuous in the present state of knowledge regarding the higher cognitive states to attempt to indicate what is lacking or why it is lacking. An alternative view refers the limitation to restrictions set by the level of development that the brain of the animal has reached. But that explanation is either psychically blank and valueless, or it implies that a further development would add some experiences to those the animal already has and so make the appearance of the higher cognitive states possible. Thus either the view stated above is conceded, or it is assumed that the higher modes of experience come into being by direct dependence on the development of the brain, not through the medium of the simpler experiences of whose integration the modes in question may legitimately be supposed to be the result. On the alternative view a pure science of psychology is, of course, impossible. Such a conclusion can hardly be entertained seriously for long, whatever divergence of views there may be regarding the kind of elementary experiences that are lacking in the animal.

3. The third principle of integration is as follows: *Every typical mode of experience must to some extent at least arise spontaneously and automatically and independently of such processes as reason, thought, determining purpose, and the like, unless these processes themselves are the modes in question.*

If it be borne in mind that a mere aggregation of experiences presents no problem and that every mode of experience worthy of that name must make some new addition to experience, it might hardly seem necessary to state this principle explicitly. It might seem so obvious as to be trite. But much of the past and current theory of the growth and development of the mind so thoroughly ignores the problem of the unique modes of experience that the principle may seem

to contain a new and startling truth. There can be no universal guide to the development of the mind, be it called reason or thinking or self-realisation or teleology, or what not. The mind must develop when it can, when the conditions for that development have been given; and what then happens is really development, a step forwards, something new, no mere unmasking of the obscure. The only guide to mental development, if it can be properly called by that name, is the illumination each step of integration brings with itself. It is itself its own coherence and justification. It reveals its own necessity, in part at least, when it comes; but it cannot be foreseen. In the light of the preceding two principles, integrative processes are most reasonable and intelligible, and with increasing knowledge they will appear still more so. But they are not themselves the product of reasoning; they must arise spontaneously. It is important to emphasize this in view of the fact that thought and purposive determination and such other processes are not only the instruments of science, but are themselves also modes of experience which must arise spontaneously. As the instruments of science, reason and thought provide us with standards of coherence in the form of identity and repetition, approximation and similarity, and these are our favourite tests for the manifold forms of coherence we find in the various spheres of being, including the relations of modes to their integrative basis. But while retaining these tests even in these last cases, we must not lose sight of the fact that each unique integrative process is and remains unique, and therefore contains a justification of its own, which we can never hope to extract from it by any inductive or other cognitive procedure. That justification is simply the coherence and insight the integrative process itself is.

The higher cognitive and the conative processes bear another important relation to the integrative processes in that they may serve to extend the conditions under which they take place, to support them by making these conditions more enduring, more compatible with the limitations of integration, and therefore virtually wider in scope. Once an integrative process has occurred, its signs or criteria can be established for indirect use. "But unless our minds recognised, or thought, or felt spontaneously, we could never even begin to collect tests for the recurrence of experiences, or for the truth or falsehood of asserted relations or for the justification of beauty. Nothing but the direct insight of experience can set the mind the larger task of extending that insight to the uttermost bounds of reason[1]."

[1] See my *Psychology*, p. 27.

In the case of certain *nova* of experience it is relatively easy to show that they are integrative modes, but it may be very difficult to show from what features of the experiences upon which they are, or may legitimately be supposed to be, dependent in an objective psychical sense they are integrated. This difficulty may be supposed to be due partly to the complexity of the experiences which regularly accompany the essential integrative basis, partly to the fact that the *nova* are *nova* and can draw the attention and be compared and generally be the basis of new integrative processes, as if they were independent elements. From another point of view, however, this peculiarity is of great advantage; for it maintains the same freedom of mind for all stages of development. As integrative processes are originally spontaneous, the mind can accept their product without making special reference by attention or otherwise even to those experiences that form the essential basis of the integration. We can compare distances, tonal intervals, motions and melodies, without troubling to compare the orders and times that constitute them. We are immediately aware of the identity or difference of the mode itself in the various instances given. Thus the subjective efforts of the mind can be applied to any level or to any one of all the integrative processes which arise spontaneously upon any given occasion. This statement is absolutely thorough-going, as we have already noticed that every integrative process, no matter what its nature, must, to some extent at least, be spontaneous and automatic. Effort and attention may have to be applied indirectly to procure its appearance, as when we adjust our sense-organs, our body, our actions, our memories, our thoughts, in order to maintain a certain stream of experiences. But that stream of experience must, to some extent at least, flow spontaneously. The attention may then be applied to any point of it, usually its highest, in order to aid the spontaneous integration which is taking place at that point. The aid given may consist in rendering the integrative basis stabler, or in reducing the differences which present themselves to within the limits of spontaneous integration by means of special manipulation of the corresponding stimuli, or in repeating the series of integrating experiences so that the binding power of associations derived from simpler forms of integration may extend the integration in question over a longer stretch of time than that natural to the integration. What cannot be brought simultaneously within the compass of the mind, so as to integrate spontaneously there, may be taken in successive series and made to pass through the mind so

rapidly that it will then spontaneously reveal all its integrative secrets.

C. Conclusion.

The first principle of integration is, by growing consent, almost agreed to already. In one form or another, sensory or motor, it is the only acceptable conclusion of the long-drawn-out discussion of the origin of local signs. They cannot be thought to originate out of the association or combination of anything that is not already local sign. What is derived is therefore not primitive local sign, but only the complications and modifications of local sign that arise under varying circumstances, on the basis of a correlation of the local signs of experiences of different systems, such as eyes, ears, vision and touch, touch and sound, vision and sound, etc. The same conclusion appears to be inevitable in the discussion of other important problems. The outcome of Jaensch's extensive investigation of depth is: "Die Tiefenwahrnehmung hängt aufs engste zusammen mit Wanderungen der optischen Aufmerksamkeit und den mit ihnen verknüpften Impulsen, also mit einer dem Gesichtssinn eigentümlichen Funktion. Hieraus erklärt sich, dass Tiefenwahrnehmung des Gesichtssinnes in keiner Weise mit Empfindungen und Vorstellungen, welche einem anderen Sinnesgebiet entstammen, identifiziert werden kann, sondern einem eben nur dem Gesichtssinn eigentümlichen Inhalt darstellt[1]." A similar remark may be quoted from a discussion of the various theories that have been given for the state of recognition. In criticising Rabier's theory, Katzaroff says: "Pourquoi ces divers sentiments qu'invoque Rabier, sentiment d'absence d'effort et de nécessité qui caractérise le souvenir par opposition à la fiction, sont-ils permutés dans la conscience en un sentiment de déjà vu, au lieu de rester ce qu'ils sont originairement[2]?" So also Titchener: "Wundt's theory is open to the objection urged against his theory of space. The blending of affective process with sensation means, elsewhere in the mental life, not time but feeling; and we cannot understand how, in this particular case, the new product should arise[3]." Every criticism of the insufficiency

[1] E. R. Jaensch, "Ueber die Wahrnehmung des Baumes," *Ztsch. f. Psychol. Erg.-bd.* 6, 1911, 357.

[2] D. Katzaroff, "Contribution à l'étude de la Recognition," *Arch. de Psychol.* 1911, xi. 15, cf. also p. 19 and elsewhere.

[3] E. B. Titchener, *Textbook of Psychology*, 1910, 347.

of mere association and the hopelessness of all attempts to come through with its aid alone are founded on this first principle of integration. Reid's answer to Hume's scepticism is the first step towards recovery from failure to do justice to the facts. The facts must be recognised. But this acceptance cannot now be framed so as to exclude further inquiry. For if some plausibility of derivation, some sort of resemblance, is what we desire, on finding it we necessarily accept the task of making an inductive study of these resemblances and of furnishing as adequate a theory of derivation as possible.

The second principle of integration is not by any means generally conceded. In fact it is usually implicitly denied. But whatever beliefs or prejudices may oppose it, it is the inevitable consequence of a systematization of the sensations and an essential part of any scientific psychology. It calls, of course, for the fullest experimental study of each mode of experience, both in respect of phenomenology and of function. The greater the disinterested devotion applied to its study, the more likely is it to be confirmed. For it promises the coincidence of broad rational demands with the facts, if only we treat the facts exhaustively enough. The psychology of the day presents many cases of difficulty and of opposition between reason and fact which call urgently for resolution.

The insight into the third principle is clouded by all sorts of philosophical generalities regarding continuity which do not attempt to define or to delimit precisely the mode of operation of the principle of continuity or to reconcile the demand for continuity with other legitimate demands. But the continuity and coherence are there. We do not need to create them; we have only to recognise them as they are, and to explain them. Recognising them for what they are cannot, however, mean attempting to maintain that experience brings no progress, no enrichment, nothing new, nothing more than was already within its compass. It is equally futile to barter the facts for a notion of self-development, or of the realisation of an end, as if that were a form of process in which all that is finally attained were already there from the lowliest form of consciousness, and so satisfied a craze for barren continuity. For purposive process in experience is itself undoubtedly a unique form of process, which therefore no more offers a standard for all other forms of integration than does any other unique process. If the continuity is there, we must just study it as we can and by inductive procedure extract from it what secrets it has to yield. Similarity is surely a kind of continuity. Whether it will suffice to cover the facts,

only detailed study can tell. But that it plays an important part in them, cannot be denied.

This third principle is indispensable in the formation of any theory that exceeds the bounds of sensationalism or its analogues. But it would be one-sided without the balance of the other two principles. Mere *nova* are inexplicable, whereas *nova* within a matrix of similarity offer the hope of an approximation towards completeness of theory. Even if distance were procured by a sort of sensory presentation of the orders intervening between those which bound it[1], it could not be thought, as distance, to be a mere aggregate of orders, for it is more than that. It integrates these orders in a special way, which can only progressively be exhausted by knowledge.

This principle has another important aspect. It offers a basis for the separation of the objective mind and its processes from the subjective mind of effort, assent, attention, and the like. If we know that we have the objective mind before us at any point, we can hope to determine its scope progressively by following out the various steps of its integrative development. There is evidence that the processes of integration can be influenced in various ways more or less extensively by the attention, but it must be just as erroneous to suggest that they originate in the processes of attention[2], as it would be to adopt the view that the mind involves only processes of integration of the kind found in the senses or in the cognitive states. If attention is involved in integration, it can only be supposed to support or to oppose the process of integration. It is not likely that the objective mind is a sort of image or parallel of the subjective mind of attention. Such a thing would not only be hardly intelligible, but it would refer or transfer all the problems of the objective mind to a shadowy world of subjective attention without any prospect of ultimate solution.

[1] Cf. Jaensch, *op. cit.* chap. 6.

[2] Cf. Jaensch, *op. cit.*, especially chap. 5.

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