THE HUMAN MIND

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THE HUMAN MIND

A TEXT-BOOK OF PSYCHOLOGY

BY

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PREFACE.

The present work is an expansion and further elaboration of the doctrine set forth in my *Outlines of Psychology*. Although the mode of arrangement and of treatment will in the main be found to be similar, the book may be described as a new and independent publication. It is specially intended for those who desire a fuller presentment of the latest results of psychological research than was possible in a volume which aimed at being elementary and practical. Hence much more space has been given to the new developments of "physiological" and experimental psychology, to illustrations of psychological principles in the phenomena of racial and animal life, of insanity and hypnotism. At the same time, an effort has been made to illustrate the obscurity and debatableness of many of the problems of the science, and to aid the reader in arriving at a judicial conclusion on these points by historical references to the main diversities of doctrine. In this way it is hoped that the treatise will find its proper place beside the *Outlines*, the success of which would have made it a fatuity on my part to try to supplant it.

With respect to the fuller references to nervous conditions to be found in the new work, a word of explanation may perhaps be needed. In thus admitting the claims of the neurologist to be heard within the psychological domain, I have no intention to repudiate my former conviction that nervous physiology will never usurp the place of psychology proper, as the science which has to disentangle and reduce to simplicity the web of consciousness. On the other hand, this larger admission of physiological matter may be taken to mean that I am far from the standpoint of that psychological asceticism, which, disowning the poor body altogether, seeks at this time of day to elaborate a theory of mind-action *ab intra*, and without any reference to the system of organic forces which is conditioning this action at every point.

Among many valuable recent contributions to the science, I would acknowledge my special indebtedness to the writings of Professor Wundt, Professor Ribot, Dr. Ward, Professor Ladd, Dr. Münsterberg, and Professor W. James, to all of which numerous references will be found in the course of my exposition. To the full, vital, and eminently modern *Principles of Psychology* of W. James I wish more particularly to tender warm acknowledgments.

I would also acknowledge my personal obligations to my friend Dr. W. C. Coupland, who has generously assisted me by reading through the sheets of my work. But for his fine critical judgment and his kindly solicitude the blemishes of my workmanship would be far more numerous than they are.

HAMPSTEAD,
December, 1891.

ERRATA.

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Page 39, 7th line from bottom, for "nervous" read "mucous".
" 40, 6th line from bottom, for "centro-" read "cerebro-"
" 124, footnote 2, for "Mack" read "Mach".
" 139, for "Weissmann" read "Weismann".
" 164, 12th line, for "do" read "does".
" 196, 1st line, delete "contracting".
" 213, 2nd line from bottom, for "the previous chapter" read "a," etc.
" 225, 10th line, delete "by".
" 280, footnote 2, for "Lehrmann" read "Lehmann".
" 283, footnote, for "effective" read "affective".
" 284, footnote, for "Willensbundlung" read "Willenshandlung".
" 357, footnote, for "Pierri" read "Pierre".
" 358, footnote 2, for "*Essay on the*" read "*Essay concerning*".
" 391, 13th line, for "early" read "easy".

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ERRATA.

Vol. I., page 74, footnote [2], *for* "Appendix B" *read* "Appendix A".
" page 283, footnote [1], line 3, *for* "effective" *read* "affective".

PART I.

INTRODUCTORY.

CHAPTER I.

AIM AND SCOPE OF PSYCHOLOGY.

§ 1. *Provisional Definition of Psychology.* Psychology (from ψυχή soul, and λόγος reasoned account) is commonly defined as the science that investigates and explains the phenomena of mind, or the inner world of our conscious experience. These phenomena include our feelings of joy and sorrow, love, etc., our processes of imagination and thought, our actions so far as they are ours, that is, involve our conscious impulses and volitions, our perceptions of external objects as *mental* acts, and so forth. Psychology or Mental Science seeks to supply a general theory or doctrine of this group of phenomena. That is to say, it aims at giving us an accurate description of the phenomena themselves in their main varieties, and a precise statement of the general laws by which we may understand and account for these phenomena.[1]

§ 2. *Relation of Psychical to Physical Phenomena.* As soon as we begin to think about this class of phenomena, we find ourselves compelled to bring them into relation to the other great group of phenomena which are (in most cases at least) studied before psychical phenomena, that is to say, physical phenomena, or the qualities and actions of material objects. It must be evident that to speak of a region of mental activity at all

[1] On the origin and history of the term Psychology, see Sir W. Hamilton's *Lectures on Metaphysics*, i. p. 130.

is implicitly to mark it off from the region of physical operations. The inner world of feeling and thought stands over against the outer world of figured material bodies with their movements, sounds, etc. The first is marked off as the subject-world, or as the domain of the conscious subject or ego; the second as the object-world, or the domain of the non-ego.[1] Without at present inquiring wherein exactly the difference consists, it is enough to call attention to the radical distinction which we instantly become aware of as soon as we try to form a clear conception of a mental fact.

But, in the second place, it is no less evident that the phenomena with which the psychologist deals are closely attached to those of the material world. And the medium by which this connexion is effected is the bodily organism, and more particularly certain parts of it, which stand in a peculiarly intimate relation to our mental life, *viz.*, the Nervous System and the organs of Sense and Movement. Wherever we discover mind or mental activity, whether in ourselves, in other men, or in the lower animals, we find it closely conjoined with the functional actions of such bodily organs.

§ 3. *Historical Development of idea of Mind.* This double relation of the psychical to the physical has always been apprehended with varying degrees of distinctness since the human mind first began to think about itself. But sometimes the one side of this relation, sometimes the other, has occupied attention to the partial exclusion of the other. In the first crude ideas of mind reached by the lower races, we may discern an effort at once to set mind in antithesis to material objects by conceiving of it as something unsubstantial and intangible, *e.g.*, breath, smoke, an attenuated material image of the body, and also to connect it with the bodily organism as the cause of its movements. At this stage of its development, however, as these ideas of breath, etc., show, the human intellect was unable to form the abstract idea of mind as something radically unlike material things. A clearer conception of mind or soul was developed in connexion with early philosophic thought, and under the influence of religious feelings and aspirations. The soul was now conceived of as a separate essence or substance only temporarily and accidentally connected with the body. Here, it is evident, the difference rather than the connexion between mind and body was the point specially emphasised. In opposition to this *spiritualistic* tendency we find a *materialistic* tendency to absorb mind into the body, and to regard the activities of thought and volition as identical with, or at least as directly arising out of, the physical actions or movements of the body or of certain of its organs.

[1] Subject (subjective) refers to the conscious individual who knows, is affected, and so forth; object (objective) to the thing external to the mind which is known by it or which affects it. See Hamilton's *Lectures on Metaphysics*, i. p. 159.

As just hinted, the quasi-material form which man's first idea of the soul assumed is explained in part by the fact that a clear conception of the mental as such, and in its difference from the material, was impossible to the undeveloped intelligence. A child's first ideas about the soul are necessarily derived from, or fashioned after, material things. As a further reason, it is evident that in trying to account for the phenomena of life, such as self-initiated movement and phonation, man naturally thought of the soul or vital principle under a material form. It is not, however, to be supposed that this was the only or even the main motive. Phenomena, like shadows, images in water, dreams, and lastly death, must very early have suggested the idea of something residing within the body that is fashioned like the same, and yet is unsubstantial and capable of free egress through the solid frame.

The philosophico-religious idea of the soul as a separate principle or essence, only temporarily and accidentally associated with the body, which arises at a higher stage of thought, appears in the ancient philosophy of India, and in the theology of the New Testament. It also presents itself very distinctly in Greek philosophy, more especially in the writings of Plato.

In modern philosophy the opposition of mind and matter has become much more distinctly apprehended. Descartes took the lead by making mind the subject of the most direct, and therefore certain knowledge, and subsequent thinkers agree in the main in approaching the problem of knowledge by a preliminary examination of the mind that knows.

At the same time the opposite tendency to materialise mind has been illustrated, not only in the avowedly materialistic systems of Hobbes, Helvetius, and others, but less manifestly in the attempts of modern biology to class mental activities with the functions of the organism, and to view them as the outcome of special organs, the nerve-centres of the brain.[1]

§ 4. *Modern Psychology and Philosophy.* The modern science of psychology exhibits, like this prae-scientific thought about mind, traces of each of the two tendencies: the spiritualistic and the materialistic.

The first thing to note about this modern branch of inquiry is that it has separated itself, in a measure at least, from philosophy. As a positive science, it aims merely at studying observable facts or phenomena, and drawing inferences from these, according to properly scientific methods of investigation, respecting their laws. As a science of mind,

[1] On the history of the terms, soul, mind and the connected conceptions, see Sir W. Hamilton, *Lectures on Metaphysics*, i. p. 133; Tylor, *Primitive Culture*, i. chap. xi.; Siebeck, *Geschichte der Psychologie*, especially i., *Einleitung*, and ii., 2er Abschnitt, 1es Kap (Die Lehre vom Pneuma); Volkmann, *Lehrbuch der Psychologie*, § 9. The parallelism between the development of the idea of mind in the race and in the individual is brought out by Höffding, *Psychology*, i. 485. The bearing of psychology on the metaphysical question of Mind and Body will be best taken up at the end of our study.

it does not discuss the question of the ultimate nature of spiritual activity, or the substance of mind, and the related question of the immortality of the soul. These it hands over to the branch of philosophy or metaphysic known as Rational or Inferential Psychology,[1] reserving for itself the more modest title of Scientific or Empirical Psychology.

Again, modern psychology has, as a positive science, separated itself from philosophy in another way. As already hinted, the central problem of modern philosophy is the nature and certainty of knowledge. The investigation of this problem was for a time, especially in England by Locke and his successors, carried out by an examination of the contents of mind (ideas and impressions). But it has now come to be recognised that a study of mental processes, *e.g.*, the way in which perceptions and ideas arise, is distinct from a critical inquiry into their validity. As a science, then, psychology confines itself to studying what we call thinking or reasoning as it actually takes place, that is, as a psychical process, determined by certain conditions. The problem of testing the objective validity or truth of our thoughts it hands over to Philosophy or Theory of Knowledge.[2]

§ 5. *Points of Contact between Psychology and Physical Science.* In thus separating itself as a positive science from philosophy, psychology has placed itself more on the level of the physical sciences. Its conceptions of mental phenomena, and of laws to be ascertained by induction from these, have in fact been modelled on the pattern of conceptions reached by physical science. More particularly in its consistent determination to deal with all mental processes as subject to the great law of causation, modern psychology has tended to assimilate itself in one important respect to the physical sciences. Not only so, a distinct approximation of psychology to physical science has recently been effected by the growing recognition of the interaction of mind and body. Our knowledge of the way in which mental activity is connected with the bodily life has been greatly advanced by the recent development of the

[1] See Hamilton, *Lectures on Metaphysics*, i. p. 121, etc.; and Wundt, *Physiol. Psychologie*, p. 8, etc.

[2] The relation of psychology to philosophy is discussed by Prof. Croom Robertson in *Mind*, vol. viii. p. 1.

biological sciences, and more particularly neurology, or the science of the normal functions and functional disturbances of the nervous system. As we shall see presently, a great deal of new and valuable information has been acquired quite recently respecting the nervous conditions of mental activity, and we are now able to conclude with a high degree of probability that every psychical process or *psychosis* has its correlative nervous process or *neurosis ;* and psychologists, while insisting on the disparity of mental and physical processes, have shown themselves ready to acknowledge and profit from all that physiologists discover with respect to the nervous accompaniments of mental states, and the way in which variations in the former affect the latter.

§ 6. *How Psychology separates itself from Physical Science.* While the development of the modern science of psychology has thus involved an approximation of this branch of inquiry to physical science, it has not by any means tended to the absorption of the former into the latter.

The modern scientific psychologist follows the tradition of philosophical spiritualism so far as to insist on the radical disparity of the psychical and the physical. He contends that mental phenomena differ, in the nature of their elements and in the mode of their grouping, from physical. A sensation is something intrinsically dissimilar to any form of physical movement, such as presumably takes place in the nervous system. Consequently psychical processes cannot be included in and studied as a part of the functional activities of the bodily organism. However closely connected with these last, they form a group of phenomena of a quite special kind, and needing separate study.

Again, the modern psychologist contends not only that psychical phenomena are different in kind from physical, but that they have to be approached by a different mode of observation from that which is employed in physical investigation. We cannot study thoughts, sentiments, or desires by means of the senses as we study bodily movements. They have to be inspected by what is called internal observation or introspection, a process to be more fully explained in the next chapter. This self-observation has, as we shall see, its own peculiar difficulties, and as the history of the science fully illustrates, the successful handling of it presupposes particular gifts and a special training in the investigator.[1]

§ 6*a*. *Special interest of Psychology.* Lastly, the modern psychologist contends that his science appeals to a peculiar interest. Every branch of scientific study, as botany, astronomy, geology, derives a special interest from certain peculiarities of its phenomena, *e.g.*, the beauties of plant form and colour, the sublimity of astronomical space and geological time. But the sources of interest which psychology makes use of differ still more widely from those employed by the physical sciences than these last differ one from another. It is our interest in man as contrasted with nature, in human character, life and experience as contrasted with the march of events in the physical world. Psychology, even as positive science, still links itself with that group of studies long since marked off as the moral sciences. A scientific study of the thoughts, passions, impulses of the mind is clearly connected with the solution of the old and ever-interesting problems whether man can reach assured knowledge, what is his place and destiny in the universe, what constitutes his duty, and so forth; and while it thus joins on to high speculation, it no less firmly attaches itself to every-day interests, the feeling for all things human, to which modern art and especially fiction appeals, and the practical concern of influencing the thoughts, feelings, and actions of others, as in the work of education and the business of politics.

The term psychology was, according to Sir W. Hamilton, first used by Rudolphus Goclenius of Marburg (1594). The province of empirical psychology was roughly indicated by Bacon when he distinguished a science of the faculties of the soul from the science of the soul itself or substance. It was, however, first definitely marked out by Wolff, whose two principal works (pub. 1755) were *Psychologia Empirica* and *Psychologia Rationalis*. In England the idea of a scientific account of the facts of mind gradually detached itself, more especially in the associational doctrine of Hartley and his followers, from the general body of philosophic speculation. The thorough-going and consistent study of mental phenomena in their connexion with physiological processes (which was hastily pushed in advance of physiological science in the speculations of the materialists of last century, including Hartley) belongs to quite recent times.

§ 7. *Standpoint of Psychology: characteristics of Mind.* After this brief historical introduction to the subject, we

[1] It is well remarked by Maine de Biran that, owing to this fundamental difference in outer and inner observation, men of the world and physical inquirers are rarely apt in philosophical discussion. *Oeuvres inédites*, i. p. 87.

may proceed to consider more at length the standpoint and the province of the science of psychology as it is now understood.

(*a*) *Negative characteristics.* As already implied, the phenomena with which psychology deals are distinguished by clear marks or characteristics from physical phenomena. In this fact lies the main peculiarity of the science. We have now to attempt to define these characters more precisely.

In the first place, then, what we call a mental state or process is marked off negatively from material objects and their actions by the *absence* of certain properties. All phenomena of the external world are phenomena in space, and have the space-attributes of position and extension. The phenomena of the internal world are said to be in time only, and not in space; or, in other words, to be unextended.[1] An idea does not arise in some point of space, nor does it present a surface made up of points lying side by side, one to the right of the other, and so forth. Our perceptions, recollections, longings, and efforts are events or processes in time; and the relations between their several elements are time-relations—that is, concomitance and succession.

This negative characteristic insisted on by Kant is clear enough in most cases. What makes it ever doubtful is the fact that the properly psychical phenomenon is apt in certain cases to be confused with a physical fact. Thus our so-called bodily sensations are apt to be thought of as arising at a definite locality in the body. This, however, as will be seen by and by, is an illusion involving a confusion between a mental fact, a sensation, and a physical fact, *viz.*, an action in a particular region of the body which is known to occasion the sensation. So, too, our perceptions of external objects are not extended *as perceptions*, *i.e.*, as mental operations. It is not the sight of a tree, but the tree, *i.e.*, the external thing or object seen, which has position in space, an extended surface, and so forth.[2]

(*b*) *Positive characteristics of Psychical Phenomena : meaning of "facts of consciousness"*. If now we ask by what positive marks psychical phenomena are distinguished from physical, the

[1] The reader must carefully note that the terms internal and external in this connexion do not involve space relations. A tree is not outside a mind that perceives it in the same way as the tree is outside an adjoining house.

[2] This negative determination of psychical phenomena is emphasised by Dr. Bain, *The Senses and the Intellect*, Intr. ch. i. 1. It is criticised by Brentano, *Psychologie*, p. 113, and by Dr. Ward, *Encyclopædia Britannica*, art. "Psychology," p. 38.

answer is less easy. To define the common attributes of mind presupposes that we have made a careful examination and comparison of all the main varieties of its manifestations. Hence it would naturally come at the end rather than at the beginning of our inquiry.

There is, nevertheless, one characteristic involved in our common way of speaking of mental phenomena which may be referred to at once. We have already described this region of phenomena in a measure by calling it the inner world of conscious experience, or the region of subjective, as distinguished from objective fact. What, it may be asked, is involved in this use of the term consciousness or subjective experience?

The least inspection of the phenomena here classed together as "mental states" discloses the fact that they are not isolated events. A perception of colour, a feeling of wonder, does not occur by itself, but only as a member of a continuous series or flow of events which together constitute somebody's conscious experience. The very idea of such a conscious experience implies that the variety of mental phenomena which form its elements are somehow capable of being brought into relation one to another and grouped as a unity. This applies to the very lowest conceivable types of consciousness in the animal world. We only attribute mind to an animal when we see the rudiments of such organising activity in the weaving together of a number of sense-elements into what we call experience.

In the case of the human mind we have as the full outcome of this relating or organising process the bringing together of present and past mental events in what is known as "Self-Consciousness". Here a multitude of psychical elements are at once distinguished and combined by being referred to a common centre, self. Hence the practice among psychologists of marking off psychical from physical phenomena as "states of consciousness" or as states of which the subject or ego is immediately conscious as its own.

Here then we seem to have a real differentia or distinguishing mark of psychical phenomena. The actions of a material body are not distinguished and arranged by that body. Still less are they known to it as its own actions. Our feelings, thoughts, and desires, on the other hand, are directly apprehended, or capable of being apprehended, as ours.

§ 7*a*. *Relation of psychical phenomena to Subject or Ego.* Consciousness in the sense just defined is wider than self-consciousness. We are often conscious, *e.g.*, when tracing out connexions of events in the physical world by the help of present and past observations, without any distinct consciousness of self. At the same time, as Lotze has pointed out, our psychical states if not always actually apprehended as our states are capable of being so as soon as we go back upon them and reflect on them. In this sense, therefore, we may say that all psychical changes are modifications of a conscious subject.[1]

If the distinguishing mark of mental processes is reference or capability of reference to a subject, it might seem the simplest mode of differentiating these processes to describe them as activities of a conscious subject or ego, and this has frequently been done. It has been said by more than one writer that the psychologist has to posit or assume such a subject in order to give any intelligible account of his phenomena. There is no doubt that our common ways of talking about mental events, *e.g.*, 'I feel,' 'The mind attends,' and so forth, suggest this way of envisaging the matter. This view has been recently urged with great force by Dr. J. Ward. According to him we cannot represent psychical occurrences except under the form of a subject reacting on certain matter presented to it, *e.g.*, colour-impressions. He is careful to point out that this presupposition does not imply that self-consciousness or consciousness of itself on the part of the subject necessarily enters into all states of consciousness. And, further, he tries to distinguish between the psychological subject and the spiritual substance of the metaphysician.

It may, however, be said that the assumption of such an ego or subject is after all extra-psychological. By making it we place ourselves nearer the popular point of view, but do not gain in scientific precision. No psychologist seeks to explain the phenomena of thought and feeling by the aid of such a conception, which consequently becomes a purely formal one. Even in the system of Mr. Ward it remains a psychologically barren idea; for it is the processes of attention themselves, not the active subject which is supposed to initiate them, that form the real key to the intricacies of the mental workings. It seems better, therefore, so long as we are merely psychologists to deal with the ego or self only when it becomes a factor of consciousness, that is to say, in self-consciousness. Of this as psychical phenomenon the psychologist has to give an account. And in so doing he will find a psychological meaning for the familiar modes of speech 'I think,' etc. For the rest the relation of psychical processes to a subject is a question to be reserved for philosophy, together with the connected question of the relation of this subject to what we call object.[2]

This reference to consciousness as the organising activity which discriminates and combines the multitude of particular mental phenomena, and which in its clearest form becomes self-consciousness, appears to be the best way of marking off mental phenomena. An attempt has been made by Dr. Brentano to differentiate mental phenomena at the outset by the positive characteristic of reference to a content or object, or, as we may perhaps express it, apprehension more or less

[1] *Metaphysic*, i. p. 423.

[2] On the need of postulating an ego or subject on the threshold of psychological inquiry see Waitz, *Lehrbuch der Psych.*, § 7; Volkmann, *Lehrbuch der Psych.*, § 10; Lotze, *Metaphysic*, bk. iii. ch. i.; Ward, *Encyclopædia Britannica*, art. "Psychology," p. 39.

distinct of an object.[1] Dr. Ward's view that the simplest mental process has the formal characteristic of presentation of some content to a subject, may perhaps be also described as making apprehension of object the essential circumstance in all mental activity. Other writers, as Dr. Bain, appear to hold that no one common character distinguishes mental phenomena from material, and that the only way to define mind positively is to enumerate those fundamental properties into which all the variety of mental phenomena can be resolved, *viz.*, the commonly recognised triad of distinct and irreducible mental functions—feeling, will and intellect.[2]

§ 8. *Range of Psychical Phenomena.* Psychology, as a general theory of mind, takes account of all varieties and grades of mental life. It occupies itself primarily and mainly with the human mind, as being not only the most highly developed, most interesting, and of the greatest practical importance, but also that nearest to and best observable by us. At the same time it is bound to notice all lower forms of consciousness as well. Thus all the actions of animal life which plainly manifest the rudiments of a consciousness as just defined properly fall within the scope of psychology. When, for instance, there appears the clear and unambiguous manifestation of an act of discrimination and choice, there the psychologist finds a proper subject of study.[3]

Within the limits of human life mind must be viewed as coextensive with consciousness in its most comprehensive sense. That is to say, it will include not only that region of distinct consciousness in which attention is directed to the contents of mind at the moment so as to define and discriminate them, but also that obscure region of sub-consciousness, as it has been called, in which impressions and feelings are only imperfectly separated out and related one to another. Thus our mental life covers the dim region of bodily or organic sensation in which numerous elements are massed together in a vague feeling of comfort or discomfort. Such feelings are properly included in the phenomena of our mental life, inasmuch as they will be found to be connected with and to perceptibly influence the flow of those thoughts and emotions which make up clear consciousness, and are, moreover, capable of being rendered more distinct by a deliberate effort of atten-

[1] See *Psychologie*, buch ii. cap. i. § 5.

[2] See Bain, *The Senses and the Intellect*, Intr. ch. i. 2.

[3] See Romanes, *Mental Evolution in Animals*, chap. i.

tion. Similarly all fugitive impressions which disappear too rapidly to be fixed by a process of attention are psychical phenomena, in so far as they momentarily enter into and can afterwards be seen to have influenced the current of conscious life. On the other hand, purely physiological processes, *i.e.*, those which have no discoverable psychical concomitant do not come within the scope of the psychologist.[1]

§ 9. *Problem of Psychology.* We are now in a better position to define the special aim or problem of psychology. Its main concern is to give an account of the phenomena of the developed consciousness as it manifests itself in man. Such a scientific account will include a proper arrangement or classification of the various distinguishable factors that enter into our mental life, and also an explanation of their origin and development. The aim of psychology is thus not merely to describe mental phenomena, but to trace back their genesis and history. By what modes of investigation and methods of reasoning this aim is to be best realised will be discussed in the following chapter.

§ 10. *Place of Psychology in the System of Sciences.* In concluding this account of the scope or purpose of psychology we may seek to define somewhat more fully and systematically its relations to other departments of knowledge.

(*a*) To begin with then, as a positive science dealing with a special group of phenomena, psychology is to be co-ordinated with the physical sciences. And if, as is commonly done, we arrange the special sciences in a scale of decreasing generality or increasing speciality and complexity, we shall place psychology at the end, after biology. Thus the main departments of science will stand as follows: Mathematics, physics, chemistry, biology, psychology.[2]

(*b*) But, again, psychology as the theory of mind stands out from and in antithesis to the group of physical sciences. Among the phenomena of which it seeks to give an account the men-

[1] Concomitant must here be taken for simultaneous accompaniment or at least immediate consequent. The remote organic antecedents of psychical events, *e.g.*, the changes in the retina which precede a sensation of colour, are only of secondary consequence to the psychologist.

[2] On the best way of classifying the sciences see Bain, *Logic*, vol. i., Appendix A; and Masaryk, *Versuch einer concreten Logik*, buch i.

tal processes which make up knowing or cognition occupy a foremost place. And in this account of the process of knowing it embraces every form and variety of knowledge, the mathematician's, chemist's, and so forth, *on its subjective side, i.e.*, as the activity of some particular mind or minds. In this way psychology is coextensive with and supplements the work of all the special sciences. It takes the objective facts and truths reached by the sciences and views this certified knowledge as the outcome of certain mental processes which constitute knowing.

(*c*) We may now define the relation of psychology to philosophy. As already pointed out, modern psychology has asserted a position for itself as a science by separating itself in a measure from philosophy. At the same time this separation cannot, in the nature of the case, be complete. The scientific study of mind, though capable of being carried out independently of any metaphysical suppositions as to its ultimate nature or substance, necessarily leads up to the problems of rational psychology, the substance of the soul, its immortality, and so forth. So too, while it is right and important to distinguish, as we have done, the psychology of cognition, which confines itself to giving an account of the process of knowing, from the Theory of Knowledge, which deals with the objective truth or validity of our so-called cognitions, it must be evident that the two are connected. It may be safely said indeed that a psychological study of the process of cognition is a necessary preliminary to the discussion of the problems of the nature and the criterion of true cognition.

Turning now to sciences which have the more distinctly practical function of guiding action, we see at once that psychology will furnish the necessary foundation for those systems of rules by which we may direct and control mental activity. If, to anticipate our exposition, we adopt the common distinction of three psychical functions—cognition, feeling, and volition—we find a regulative science corresponding to each. Thus the psychology of cognition forms the basis of the regulative science of Logic, which aims at giving us rules by which we may know that we are thinking or reasoning correctly. The psychology of the feelings underlies Æsthetics as the regulative science which seeks to determine the true objective standard of what is beautiful and worthy of admiration. Lastly, the psychology of the will connects itself with the regulative science of Ethics which aims at fixing the grounds of moral obligation and the standard of right conduct.[1]

In addition to these comprehensive regulative sciences there are others of a more distinctly practical character, having a more narrow and special end, which are also based on psychology. Thus the whole work of education, or of aiding in the development of others' minds, is clearly grounded on a knowledge of the mental processes. And the sciences of jurisprudence, political government, and so forth, which aim at controlling or otherwise influencing other minds, have to borrow their principles from the science that supplies a general theory of the workings of the human mind.[2]

REFERENCES FOR READING.

On the Standpoint and Scope of Psychology see Hamilton, *Lectures on Metaphysics*, i. lect. vii. and viii.; Lotze, *Metaphysic*, bk. iii. chap. i.; Volkmann, *Lehrbuch der Psych.*, *Einleitung*, § 1; Brentano, *Psychologie*, bk. i. chap. i.; G. H. Lewes, *The Study of Psychology*, chaps. i.-iii.; Dr. Ward, *Encyclopædia Britannica*, art. "Psychology".

[1] Hamilton recognised these regulative sciences under the head Nomology of Mind (*Lectures on Metaphysics*, i. p. 122).

[2] On the relation of psychology to the other sciences see the article by Prof. Croom Robertson already referred to (*Mind*, vol. viii. p. 1); Prof. Bain's article, *Definition and Demarcation of the Subject Sciences* (*Mind*, xiii. p. 527); and Masaryk, *Versuch einer concreten Logik*, 3es buch, vi.

CHAPTER II.

THE DATA AND THE METHOD OF PSYCHOLOGY.

§ 1. *The Mode of Inquiry proper to Psychology.* In the preceding chapter we have found that the phenomena with which the psychologist deals are unlike all other phenomena, and that owing to the peculiarity of its subject-matter the science occupies a unique position among the sciences. It has already been suggested that the distinguishing characters of psychical phenomena necessitate a mode of inquiry dissimilar in some respects to that followed in the physical sciences. We have now to consider this mode of investigation somewhat carefully.

As already pointed out, the psychologist has to collect and arrange his facts and then seek to explain them by the help of general principles or laws. Hence two main questions present themselves in connexion with psychological procedure: (1) How is the psychologist to obtain his facts? (2) In what way or by the help of what principles are the facts to be explained?

§ 2. *Different ways of approaching Psychical Facts.* There are two sources of psychological knowledge, or two ways by which we may approach psychical facts. We may first of all seek to observe them as they present themselves in our own individual mind. Thus a man may inspect the several operations of thought as they go on in his own consciousness. This is the direct, internal, or subjective study of mind. Or, in the second place, we may inspect the mental processes of others so far as they disclose themselves outwardly, as in expression, language, and action. Here it is evident we are not as in the first case directly observing the mental phenomena themselves; we are using our senses and observing certain facts of the external world (*e.g.*, facial movements, articulate sounds). Hence this mode of study is to be distinguished as the indirect, external, or objective mode.

Some writers employ the expression the "objective investigation" of mind with special reference to the study of its physiological conditions (nervous processes). This, however, is an undue narrowing of its meaning. All inquiry into psychical processes is objective which transcends the immediate observation of our own mental processes (introspection), and has consequently to proceed by an examination of physical processes, whether these are the outward expression of mental activity (*e.g.*, looks, words) or its determining conditions (nervous processes).

§ 3. (1) *Introspection.* Psychology is distinguished by the peculiarity of its one direct way of observing its phenomena. While the physical sciences dealing with objects and processes of the external world employ observation through the senses, and the apparatus by which sense-perception can be extended and rendered more minute and exact, psychology has to make use of a quite different channel of knowledge. In observing any part of the current of our mental life we are drawing our attention away from objects of sense and bending it inwards on ourselves in what Locke called Reflection. This act of concentrating attention on any part of the internal sphere of mind is known as Introspection, or looking within.

Introspection is the primary and as such the most important source of our knowledge respecting mental facts. Whenever we find out what is going on in other minds we do so by help of our own individual mental experience. Thus we understand savage and animal ways just so far as they are analogous to our own feelings and impulses. And when this individual experience fails us a knowledge of foreign mental states is rendered impossible. It is for this reason that one born blind cannot acquire from others' descriptions an idea of sensations of colour, and that we are often unable to interpret the actions of children, savages, animals, and idiots.

§ 3*a*. *Value of Introspection.* It is evident from this that the claims of psychology to be a science whose propositions have a high degree of certainty will turn mainly on the value of introspection as a mode or instrument of investigation.

The most conspicuous characteristic of introspective observation is its directness or immediacy. Our own mental states, for example, our emotions of joy or sorrow, are directly cognisable to us as outer physical facts are not. We are all liable to illusion in using our senses, and to take for actually seen what is only vividly imagined. But we cannot well imagine that we are thinking or suffering when we are not actually doing so.[1] Psychology has in this respect a clear superiority over physical science, inasmuch as its facts so far as they are known by internal observation are comparatively free from inference, and therefore liability to error. At the same time this advantage, great as it undoubtedly is, is considerably diminished by certain counter-disadvantages. The very directness of the inspection gives rise to special difficulties. For all accurate and scientific observation requires a certain aloofness of mind and absence of all but a purely scientific interest in what is observed. When, however, we are called on to observe our own mental states we cannot put ourselves into this cool scrutinising attitude. The same person whose mind is agitated by a passion is required to dispassionately inspect its characteristics. Thus in the very process of observing we necessarily change the phenomenon to be observed. This objection has seemed to some, *e.g.*, Kant, Auguste Comte, and Dr. Maudsley, fatal to the pretensions of psychology to be a distinct science. This conclusion is plainly a paradox, for everybody has some power of watching and describing his mental processes; and this power may, like other powers, be so trained and improved as to yield more and more exact results.

The difficulty is met in a measure by saying that in self-observation we are not strictly speaking at the same instant subjects affected and scientific observers of such affection. Thus, for example, in trying to detect the characteristic features of an emotion like remorse I choose a moment when the feeling is not at its maximum intensity, but has undergone a certain subsidence, yet a moment when its features are still clear to view. Skill in introspecting depends very much on the ease and rapidity with which the mind throws itself into this reflective or retrospective attitude.

In addition to this fundamental objection to introspection there are others which have been emphasised by some writers: (*a*) Unlike external phenomena, the facts of mind are only

[1] As I have pointed out elsewhere even introspection is not *absolutely* free from the contamination of illusion. See *Illusions*, chap. viii.

directly observable by the mind that experiences them or is their subject. Hence there is no possibility of one observer verifying another's observations as in the case of physical investigation. This difficulty is largely obviated by saying that though my feelings cannot be directly observed by anyone except myself others may observe in themselves feelings which I have good reason to suppose to be like mine. And in this way we do practically secure a comparison and a verification of our psychological observations.

This same line of remark meets too another objection closely related to the foregoing, *viz.*, that self-observation never enables one to transcend the limits of the individual consciousness and so reach that generality which science requires. Strictly speaking this is true. By pure introspection alone nobody can know anything of mental phenomena save those of his own mind. At the same time, since different minds can observe their respective phenomena and afterwards compare these through the medium of language we do in practice secure *general* results. In spite of the uncertainties of the science the methodical self-observation of psychologists has resulted in a fair number of commonly accepted facts and truths of mind.[1]

(*b*) Self-observation is limited to a very small portion of our mental states, *viz.*, our recent feelings. In seeking to recall distant experiences, *e.g.*, those of childhood, we are not, strictly speaking, observing at all, but remembering and inferring. This is a real objection, and points to the need of supplementing internal observation by other sources of knowledge.[2]

(*c*) Lastly, it has been contended, *e.g.*, by Kant, that even if we can obtain certain results by self-inspection these can never

[1] This, though an organising of *subjective* introspective research, involves at the same time *objective* interpretation, *viz.*, of one another's words. Consequently the certainty of the results depends on the assumption that language means precisely the same for different minds. As we shall see presently, all objective study of other minds, even through the most perfect medium, *viz.*, language, is in a measure uncertain. At the same time these uncertainties are in the case of trained scientific observers reduced to a minimum.

[2] On the objections brought against the introspective or subjective investigation of mind see Mill, *Auguste Comte and Positivism*, p. 63, seq.; Dr. Maudsley, *The Physiology of Mind*, chap. i.; G. H. Lewes, *The Study of Psychology*, chap. v.; Brentano, *Psychologie*, buch i. cap. 2; Wundt, *Physiologische Psychologie* (3rd ed.), p. 6.

be *quantitatively* exact. We cannot ascertain the precise dimensions of a feeling of pain as we can measure a material body or its movement; although we can say that one pain is more intense than another, we cannot say by how much more. This difficulty, which is real, will have to be dealt with by and by in connexion with certain attempts to measure the intensity and duration of some of the more elementary mental phenomena.

§ 4. (2) *Indirect or External Observation of Mind.* The difficulties that beset the process of internal inspection of mental processes, though not fatal to it, show the desirability of supplementing this mode of investigation by another. Such an auxiliary and supplementary mode of studying psychical facts is provided in external or indirect observation. Here we have to watch the manifestations of mind in others, and to interpret these by the aid of our own conscious experiences.

§ 4*a*. *Remarkable Minds.* Such external or objective study of mind includes, first of all, the careful noting of individual minds, whether personally known to us, or heard or read of from others. In selecting our examples we should be careful to "vary the circumstances," that is, take minds widely unlike one another in their natural tendencies and conditioning circumstances. Thus we should choose our instances from the two sexes, from different races, and so forth. Not only so, we must be careful to take account of minds of exceptional power, or those which exhibit a high degree of individuality. Thus the lives of great men are particularly instructive to the psychologist as displaying mind or certain of its activities in a specially distinct and striking manner.[1] So, again, the history of minds which have been subjected to the influence of an unusual environment, as the alleged cases of boys who have cut themselves off from society and lived a solitary and half wild life, would have a special significance for the psychologist.

§ 4*b*. *Study of Infant Mind.* One department of this external investigation of mind requires special mention, *viz.*, that which has recently come to be called Infant Psychology, and which is concerned with the careful and methodical observation of the first manifestations of mind in the human individual. This line

[1] A valuable contribution to this branch of psychological observation has been made by M. Henri Joly in his volume, *Psychologie des Grands Hommes.*

of inquiry is especially valuable as bringing us face to face with a much simpler state of things than we meet with when we observe our own developed minds. The careful objective observation of the early stages of individual mental development is now coming to be recognised as an essential condition of any adequate scientific theory of the nature and laws of this process. And though this sphere of observation has only just begun to be taken possession of by the psychologist, the results already reached are full of promise.[1]

§ 4c. *Abnormal States of Mind.* Lastly, the external study of mind should include abnormal instances, that is to say, those which deviate most widely from the normal and average type. Thus, for example, cases of irregular mental development caused by a defective organisation at birth or acquired in early life, as of those born blind, are of special use as throwing light on the connexion of our intellectual products with the senses. The absence of a sense simplifies matters for the psychologist. It satisfies one of the main conditions of scientific inquiry, "varying the circumstances," and enables us to understand the effect of a particular class of sense-impressions by supplying a 'negative instance,' that is, a case in which the antecedent whose effect we are studying is removed. Thus the now famous case of Laura Bridgman who, at the age of 26 months, lost sight, hearing, and to a large extent taste and smell also, and who nevertheless reached, by the aid of a scientifically conceived and carefully carried out plan of education, a fair intellectual and moral development, is perhaps the most instructive instance that has ever been brought under the notice of psychologists.[2]

Similarly the disturbed and irregular forms of mental life arising from diseases of the nervous system are full of instruction to the psychologist. Such cases of abnormal psychosis often supply the place of experiment by varying the circumstances, breaking up fixed psychical combinations, and displaying the action of psychical forces in a much clearer because

[1] The most important contributions to the observation of childhood are those of Taine, *Mind*, vol. ii. p. 252; Darwin, *Mind*, vol. ii. p. 285; Preyer, *Die Seele des Kindes*, and Perez's *First Three Years of Childhood*.

[2] The case of Laura Bridgman is carefully described by Prof. G. S. Hall in *Mind*, vol. iv. p. 149. Compare the account of a somewhat similar case in *Mind*, vol. xiii. p. 314.

much freer form. The phenomena of mental disease, by showing the effect of certain tendencies of normal mental life, *e.g.*, the mastery of the thoughts by a feeling as terror or self-esteem, when unchecked or uncontrolled by other forces (the will), substitute for the complexity of normal consciousness a relative simplicity.[1]

The study of abnormal mental activity belongs to a distinct branch of inquiry known as Mental Pathology. As such mental aberrations are studied in connexion with diseased conditions of the nerve centres of which they are at once the effect and the symptom, this branch of inquiry connects itself very closely with physiological psychology, and forms one main branch of the modern science of Neurology.

§ 5. *The Collective Mind.* In addition to such wide and varied observation of individual minds, the objective study of psychical phenomena should include manifestations or products of the collective mind, that is to say, of the mind of the community or society, as, for example, traditional religious and other ideas, works of art, and so forth. More particularly, the psychologist may gain valuable material from the results of recent anthropological research into the early manifestations of mind among the lower races and in the beginnings of human history, such as the rudimentary forms of language, primitive beliefs (myths), sentiments, customs, etc. This study of the infancy of the race connects itself closely with that of the infancy of the individual.

This branch of psychological research has not received a special name in this country, but is included under the general head of Anthropology (see Tylor's *Introduction to Anthropology*). In Germany it has been developed by Lazarus and other psychologists into a separate branch of psychological study under the name *Völker-psychologie* (psychology of peoples), which, while it includes the study of myths, customs, etc., has specially concerned itself with the problems of the origin and early forms of language.

§ 6. *Study of Animal Mind.* Although the main concern of the psychologist is with the developed consciousness in man, he must, in order to understand and account for this, view mind in all the various stages of its development. And the attempt to observe and interpret animal actions, habits, etc., has received a new impetus of late years from the growing interest in the

[1] The value of this investigation to the psychologist is well brought out by Brentano, *Psychologie*, p. 51.

question of man's descent from an animal ancestry. In truth, Animal or Comparative Psychology has now begun to assume the form of a distinct branch of research.[1] It is evident that the observation of the animal mind, owing to its points of dissimilarity to our own, is attended with peculiar difficulty. While in the case of the higher animals we find points of community between their experience and our own, *e.g.*, similar senses and impulses, we also find well-marked points of contrast. The region of animal instinct still remains, to a large extent, a psychological puzzle. When to this is added the fact that we have in the case of animals very imperfect outward manifestations, language being wholly wanting, and emotional expression being often unlike our own and highly ambiguous, it will be seen that our knowledge of the animal mind must always be largely a matter of precarious inference.

The scientific observation of the animal mind has been carried out with great energy during the last half century, mainly under the stimulus of the problem of man's descent. In our own country it is Charles Darwin, and next to him his disciple, Mr. Romanes, who have done most to elucidate animal ways. The general tendency of this modern research has been to bring the animal nearer the human mind, and so to favour the theory of kinship between the two. See especially Darwin's *Descent of Man*, and Romanes' *Animal Intelligence* and *Mental Evolution in Animals*. The difficulties in the way of certain knowledge of the animal consciousness have been pointed out by myself, *Sensation and Intuition*, p. 15, etc.; G. H. Lewes, *Study of Psychology*, p. 131, etc.; and more recently by Prof. Lloyd Morgan, *Mind*, vol. xi. p. 174, etc. (*Cf.*, however, his later publication, *Animal Life and Intelligence*.)

§ 7. *Value of Objective Study of Mind.* As already remarked, the objective study of mind can never have the directness and the certainty that belongs to subjective observation. As Kant pointed out, others' mental states are not accessible to direct investigation. Whenever we are studying another mind, we are carrying out a process of interpreting signs which is always to some extent precarious. It has been noticed by more than one writer that there is special danger of *reading into* the mind observed our own peculiar modes of thought, etc.[2] Even in

[1] Strictly speaking, Comparative Psychology is wider than Animal. It includes not only the comparative study of the human and the animal mind, but also of different varieties of the human mind itself, *e.g.*, the mind of the adult and of the child, and of the civilised and the uncivilised man.

[2] This danger is well brought out by W. James in his account of the "Psychological Fallacy". See his *Principles of Psychology*, i. p. 196 ff.

the examination of minds similar in their constitution and their expression to our own we are aware of an element of uncertainty. We cannot be certain that similar outward manifestations, *e.g.*, facial and bodily movements, indicate perfectly similar feelings in the case of two individuals. We have to make a careful study of a person before we can tell the worth of such expression in his particular case. And even when others describe their feelings in words we are exposed, if not to the risk of simulation and dissimulation, at least to that of unconscious misleading through the vagueness, ambiguities, and fluctuations of meaning of words. These sources of error become much more serious when we try to interpret minds widely unlike our own, as those of children and of members of lower races, and in the case of animals they are, as we have seen, almost fatal to true knowledge. It follows that the objective study of mind, though of immense value by reason of its wide range of phenomena, can never become the chief source of our knowledge of mind, but must be resorted to merely in order to widen and complete the view gained by self-scrutiny.[1]

§ 8. *Observation and Experiment in Psychology.* We have thus far assumed that our only way of getting at psychical facts is by passive observation as distinguished from active observation or experiment. The biological sciences are not experimental to the extent to which the "experimental sciences," *e.g.*, physics and chemistry, are so, and it is the absence of experiment on a wide scale that accounts for the backward condition of these sciences. This drawback psychology shares with the biological sciences. Experiment has only a very limited range in the science.

A beginning has, however, recently been made at psychological experiment which may possibly mark an epoch in the history of the science. Thus attempts have been made and with a considerable measure of success to experiment on the inquirer's own mind, and still better on other minds, by finding out what ideas are called up by words and what modes of intellectual association they illustrate. In addition to this purely psychological experiment a whole new branch of inquiry has lately been opened up in

[1] On the scientific value of this study of others' minds see Volkmann, *Lehrbuch der Psychologie*, i. § 7; Brentano, *Psychologie*, p. 45 *seq.*; *cf.* my volume *Illusions*, p. 217 and following.

the experimental measurement of simple psychical phenomena, and especially sensation, and also the estimation of the rapidity of mental processes in connexion with the accompanying physiological processes, and by the help of special physical apparatus. This domain of *psycho-physical* experiment will be referred to later on.[1] Lastly, a bare reference may be made to that new and curious branch of psychological experiment, which has come to be marked off as Hypnotism. This line of inquiry directs itself to the experimental production and examination of a peculiar cerebro-psychical condition (hypnotic sleep or trance), the precise nature of which is as yet but imperfectly understood.

§ 9. *Method of Psychology—Subjective Analysis.* Having now considered the means at our disposal for ascertaining mental facts, we have to inquire what method we are to pursue in arranging and explaining these facts.

As already pointed out, the special aim of the psychologist is to resolve the complex facts of our mental life into their elements, and to show, by the help of properly psychological laws, how these elements group themselves into the variety of complex forms which we find in the human consciousness. This suggests at once that we start with a complex state of things, and have to find our way back to a more elementary. Scientific knowledge of mind necessarily begins with self-inspection, and at an age when the mental life has reached a high degree of complexity. Hence the method which all psychologists agree to be the first and main method of the science, is known as Psychological Analysis.

When we talk of analysing mental phenomena, we are, it is obvious, using the word in another sense than that in which it is employed by the chemist. In chemical analysis a compound substance is actually separated into its elementary constituents so that these can be viewed apart. Such actual separation is not possible and is not aimed at in psychological analysis. What the psychologist attempts is an ideal or logical separation only, such as is carried out in physical observation when we limit our attention to the form of a flower, or the odour of a chemical substance. That is to say, the psychologist analyses a thought or a feeling when he is able to discriminatively attend to its several features or elements.

[1] The importance of experimental psychology as a means of exact research is dwelt on by Wundt, *Essays*, v. (Problems of Experimental Psychology); W. James, *Principles of Psychology*, i. p. 192 ff.

§ 9*a*. *Difficulties of Analysis.* The work of psychological analysis can only be understood by a reference to the form of the mental life. To begin with then, our consciousness is a continuous flow which cannot be divided into distinct "states" without altering its character. Thus every successive thought is coloured by its relation to preceding thoughts, so that the whole psychosis is a transition. Analysis into constituent elements or factors is thus always in a measure artificial, and its dangers must be kept in view.[1]

Again, so far as we are justified in resolving the concrete movement of consciousness into discrete parts, we find that this is rendered difficult by the complexity of the phenomena and intricate interweaving of the several constituents, *e.g.*, the elements of sensation (chill, trembling, etc.), imagination, etc., in a state of fear. The constituents, moreover, are in a constant state of flux, some rising, others falling in intensity from moment to moment. Hence a peculiar difficulty in singling out for special attention any one of these constituents. This difficulty, as we shall see by-and-by, is fully illustrated in modern investigations into the nature and structure of our sensations, *e.g.*, those of musical sound.

In spite of such difficulties, however, psychological analysis has proved itself practicable within certain limits. The discovery and singling out of particular constituents in our complex psychical states has been greatly aided by the circumstance that the same, that is, perfectly similar, elements occur *in other connexions also*. In other words, we detect a constituent in a whole, *e.g.*, a flavour in a dish, because we are able to identify this as like what we have before experienced apart from its present concomitants. To analyse is thus, as we shall see, to assimilate or *classify*.

The limits of analytical division of complex wholes into parts are fixed partly by the original structure of our organism, partly by association and habit. The most striking examples of incapacity to analyse meet us in the region of sensation. Thus, as is well known, many persons cannot pick out the partial tones which enter into musical clang. In some cases it is certain that the nervous processes answering

[1] On this feature of consciousness as a continual movement in which no discrete divisions are discernible see W. James, *Principles of Psychology*, i. chap. ix. He would distinguish the contents, ideas, thoughts as the *substantive* parts, the relational features as the *transitive*.

to the constituents themselves coalesce so that no separation of psychical parts is possible. The whole sensation must in this case be regarded as a new, indivisible unity.[1]

§ 9*b*. *Results of Analysis.* By such a mode of investigation the psychologist, improving on the rough analysis and classification of mental states embodied in everyday language, is able to reduce the complexity and variety of the psychical scene to something like order and simplicity. Thus he separates out the thought-element in mental processes as something radically distinct from feeling (pleasure and pain). The division of mind into three main functions—feeling, intellection, and conation—which is now commonly adopted in psychology, is the result of such introspective analysis. Our analysis may carry us still further, and help us to reduce each of these functions to its simplest form or expression. Thus it has been by introspective analysis carried forward to a higher degree of perfection that recent psychologists have improved on the old account of intellect as made up of distinct faculties, as observation and imagination, and resolved all processes of intellection into one or two elementary forms of functional activity.

§ 10. *Analysis and the Search for Primitive Elements.* As already suggested, the psychologist has not merely to regard the phenomena of his complex mental experience as the resultant of certain elementary forces, functional activities, viewed as operating at the moment. A given thought, say that of physical force in general, is a product of *past* agencies. It has been developed out of a mass of experiences, *e.g.*, of moving our limbs, grasping material objects, etc. In other words, the psychologist has to regard a psychical phenomenon as formed or developed by the aid of certain materials or elements supplied by antecedent experience. Thus he has to supply a history or a geology of mind, and in the first instance he has to find his way to the elemental experiences or facts out of which the products are developed.

It has been the common assumption of psychologists that it is in all cases possible to resolve psychical products into

[1] On the nature and limits of psychological analysis see Hamilton, *Lectures on Metaphysics*, ii. pp. 21, 22; G. H. Lewes, *The Study of Psychology*, chap. xi.; Volkmann, *Lehrbuch der Psychologie*, p. 6; Stumpf, *Tonpsychologie*, i. p. 96 ff. and more fully, ii. p. 3 ff.; *cf.* also James, *Principles of Psychology*, i. p. 156.

their historical elements. Thus they have endeavoured to read in such presumably complex formations as the idea of space, and the feeling of moral disapprobation, the record of their mode of production. The unprofitable prolongation of discussion on the origin of our ideas suggests that psychical formations do not thus clearly disclose their history to the introspective eye. It must be evident, indeed, that the process of psychical formation, being one of organic change, must differ from a mechanical combination of parts. It is essentially a process of development in which elements are elaborated into more or less *new* forms determined by the organism, and in which consequently their individual characteristics become disguised.[1]

Here then it would seem we come to the limits of subjective analysis, and must eke it out by other methods of research. At first the idea suggests itself that in trying to get back to rudimentary mental experiences we may avail ourselves of objective observation, and especially that of the simpler grades of mental life in children and uncivilised races. And there is no question that such objective observation has been of real service here. Thus the study of the origin and mode of composition of our visual perception of space has been materially aided by observation of the crude perceptions of infants, and still more of children born blind and afterwards coming into possession of the sense.

At the same time it must be evident from what has been said above respecting the precarious and inferential character of such objective observation that it is unable to supply us with a clear apprehension of *ultimate* psychical elements. What the simplest sensations entering into the most rudimentary forms of consciousness are really like, it is impossible for us ever to say. So inextricably are our simplest feelings interwoven with products of experience, that in trying to read the first mental experiences of infants we find ourselves unable to separate the two so as to conceive of pure sensations of sound and colour absolutely free from all associations or

[1] The process is likened to chemical composition by J. S. Mill, *Logic*, bk. vi. chap. iv. § 3. But, as Brentano points out, the process of transformation is rarely if ever as complete as in the case of chemical modes. *Cf.* James, *Principles of Psychology*, i. p. 158 *seq.*, who well brings out the fact that psychical products are transformations, that is, new psychical phenomena.

suggestions. Hence in seeking to get back to psychical elements we have to carry out a process of ideal construction analogous to that which the physicist carries out in constructing his material atoms. That is to say, we invent a kind of hypothetical fiction as a necessary presupposition of the knowable psychical phenomena.

§ 11. *Analysis and Induction.* In close connexion with this analytical inquiry into the constituent elements of mind we have the inductive investigation into the laws of mental activity. Thus we try to discover how the different functional activities work, on what conditions their operation depends, and what are the causes of their variations; and in addition to this we endeavour, in connexion with the historical analysis of mental products, to ascertain the general laws of psychical combination, or, to speak more correctly, psychical development. Thus we seek to determine those relations of psychical phenomena which produce association or cohesion, the conditions under which such combining elements fuse into an indistinguishable mass, and so forth. It is by this properly inductive investigation that the psychologist has reached the most valuable principles of his science, more particularly the Laws of Association. Such general laws, though they may not be ultimate, are of a sufficient degree of comprehensiveness to serve as a starting-point in the explanation of the concrete phenomena of mind.

While psychological induction thus grows out of subjective analysis, it is by no means confined to the department of subjective research. The newest developments of psychological method lay stress on a wide *objective* comparison of psychical phenomena as a basis of sound scientific induction. Thus in the branch of infant psychology the general characteristics of the child are being ascertained by an inductive comparison of a number of separate observations. The latest indication of this tendency to place psychology on an objective inductive basis is the introduction of *statistical* inquiry into the science. The inquiries of Mr. Galton into the visualising powers of a large number of persons of various ages, etc., and the more recent investigation into the frequency of hallucinations among normal persons illustrate this new direction of statistical investigation.

§ 12. *Synthesis in Psychology and the Genetic Method.* It is evident that we require a knowledge of these psychical elements and of the laws of their combination in order to account for the complex products of the mature human consciousness. Now, the perfect account of a thing means the history of that thing from its first crude to its completed form. When the psychologist has succeeded by analysis, aided by objective observation and hypothesis, in obtaining the requisite data he proceeds to reconstruct the course of psychical development. In so doing he supplements Analysis by Synthesis. That is to say, he sets out now at the other end, with a simple instead of a complex state of things, and by gradually introducing new factors, new forces, seeks to show how the main stages of the process of development have arisen. This historical unfolding of the course of psychical development is most properly described as the Genetic Method, that is to say, the method which exhibits the genesis or becoming of things.

The logical method or form of reasoning followed in this supplementary synthetic process will, it is evident, be deduction. That is to say, from a knowledge of the elements and of the laws at work the psychologist seeks to deduce the successive phases of the typical mental history. Thus he attempts to show how our common perceptions of objects about us are developed out of sense-experiences elaborated by psychical activity, and how our generalised knowledge is developed out of the knowledge of particular things, and so forth. In carrying out this process of deductive reasoning he will throughout compare his conclusions with the observed facts of mental development, more especially of its earlier stages as they are presented to us in the objective study of the child and of primitive man.

§ 13. *Historical Note.* It has here been assumed that a scientific explanation of mental phenomena is possible apart from any metaphysical presuppositions as to their inherent nature. By some, as by Volkmann, this is denied. They consider that the principles by which we are to account for the observable facts must be derived from metaphysics. In saying that by a process of inductive investigation, carried out on the observed facts, we can reach a knowledge of psychical laws, we do not imply that these are ultimate. They may afterwards be seen to flow from essential principles of mind as the metaphysician conceives of it.[1]

In the history of the science analysis has played a foremost part. The primary motive to psychological investigation was a philosophical one. Descartes set himself to a methodical analysis of his ideas into their simplest parts, in order, as he

[1] On the supposed necessity of setting out with metaphysical principles, see Volkmann, *Lehrbuch der Psychologie*, § 3.

thought, to discover what was innate and proof against the solvent of sceptical doubt. Locke and his followers, Berkeley and Hume, carried out a far more extensive analysis of ideas with the view of showing that they could be all traced back to elements of experience. The clearer differentiation of psychology from philosophy effected by the work of Hartley and James Mill led to the methodical use of analysis as the proper instrument of psychological research. The complementary work of systematic synthesis, that is, of setting out with the elements of sensation and building up the various complex products, naturally added itself to this as soon as a sufficient knowledge of the elements and of the laws of their combination was reached. Thus in Dr. Bain's system of psychology we find a fairly systematic attempt to expound the course of mental development. It is, however, only since the idea of biological development has come to be applied to mind that the synthetic treatment of the subject has become completed. The importance of this synthetic treatment of the subject is very well illustrated in Mr. Herbert Spencer's system of Psychology. In Germany it was Beneke who first systematically attempted a genetic treatment of mind on a positive or scientific basis. Discarding the metaphysical presuppositions with which Herbart had set out, and postulating only certain primordial modes of sensibility, Beneke tried to trace out the process of psychical formation in its several directions.

§ 14. *Reference to the External Conditions of Psychical Events: the Physiological Method in Psychology.* Thus far we have regarded the aim of the psychologist as the construction of a theory of the activities and the development of the human mind by a consideration merely of the mental life as something complete in itself or self-contained, and without any reference to extraneous conditions. And there is no doubt that it is possible in this way to determine up to a certain point the general course of psychical events.[1] At the same time it must be evident from what has been said above that a complete scientific explanation of the mental life of the individual requires us to travel beyond the bounds of this life, and to take note of its connexions with other operations and series of operations.

And here, it is evident, there comes in that reference to the bodily organism with which, as has been pointed out, the activities of mind are so closely united. Modern psychology, though claiming for the processes of conscious life a place apart from physical actions, fully recognises that the former are vitally conjoined with and influenced by the latter. The course of the mental life of the individual, though capable by a process of abstraction of being detached from the bodily

[1] This is sufficiently evidenced by Ward's recent treatment of the subject in the *Encyclopædia Britannica*.

organism and studied as a process complete in itself, remains after all from its commencement to its close interwoven into the sum of activities which constitute the life of the organism. Hence the psychologist must continually supplement his introspectively acquired knowledge of the psychical process itself by a reference to the determining and modifying conditions which exist in the bodily organism, and more particularly the organs composing the Nervous System.

This reference to nervous conditions is a necessary completion of the work of psychological analysis. To analyse any phenomenon we must include in our view *all* the co-operating circumstances or conditions which help to determine it. Such an inclusion of nervous conditions is specially necessary in giving an account of the more elementary psychical phenomena as sensations and conscious movements. It is evident that the sensations of pressure, light, colour, etc., which constitute the material of all our knowledge of external objects, can only be accounted for by a reference to the bodily mechanism, or organs of sense, by the medium of which they are excited. A consideration of the physiological conditions of sensation may indeed in certain cases help us to anticipate the results, and so to widen the scope, of subjective analysis, by resolving what seem to us perfectly simple sensations into simpler components.

§ 14*a*. *Psycho-physical Experiment.* The importance of thus combining psychological and physiological research is abundantly illustrated in the new domain of experimental psycho-physical research already referred to. It is by help of a careful observation of physical processes that experiment has acquired its present firm footing in psychology. Such experimental research into the facts of consciousness brings with it the great advantages of special physical apparatus, enabling us to estimate exceedingly small variations in the quantity of the force or stimulus acting on the organism, and in the duration of psycho-physical processes. Hence it has tended to give to psychical research something of that exactness the absence of which Kant deplored.

Psycho-physical research in its widest sense embraces a good deal of what is called experimental physiology, *e.g.*, electrical stimulation of different areas of the cortex of the brain with a view to determine correlated *mental* functions.

In a narrower sense "psycho-physics" concerns itself specially with experimental inquiry into the psycho-physical processes in *Sensation*. This branch connects itself closely with the physiology of the sense organs. Thus one aim of these experiments has been to determine precisely how changes in the intensity or strength of a sensation vary with changes in the quantity of the external stimulus and the intervening nervous process. This series of investigations was started by the famous labours of Weber, supplemented by those of Fechner who named this department *psycho-physic*. Similar inquiry has been directed to the connexion between the quality of sensation and changes in the mode of neural excitation. As already suggested these researches go to eke out the purely subjective analysis of sensation. Thus a great deal of experimental work has been directed to resolving more complex sense-phenomena, *e.g.*, space-perceptions of the eye, perceptions of musical clang, into their constituent elements.

Another important line of experimental investigation into psycho-physical phenomena is marked off by the name "Reaction-time," or the experimental determination of the *duration* of psycho-physical processes. These researches consist in determining, by means of very special apparatus, the precise interval—measurable in thousandth parts of a second—between the occurrence of a sense-signal, *e.g.*, a sound, and the motor reaction or movement which the subject of the experiment has to carry out immediately on perceiving the same. This line of investigation has proved particularly fertile in helping us to understand the duration, not merely of the elementary processes of sensation itself, but of higher mental operations (*e.g.*, comparison, choice) which can be easily interposed in this kind of experiment.[1] Other lines of psycho-physical experiment have to do with the determination of the time-interval which can be most accurately estimated and reproduced, with the number of consecutive impressions, *e.g.*, sounds, which can be temporarily retained or embraced as a single series or group, and so forth.[2]

[1] A short account of reaction-time experiments is given by James, *Principles of Psychology*, i. p. 85 ff.; *cf.* Ladd, *Elements*, part ii. chap. viii.

[2] On the general aim of psycho-physical research, see Wundt, *Physiol. Psychologie*, i., *Einleitung*, i.; Ziehen, *Leitfaden der physiol. Psychologie*, pp. 1 and 2.

§ 14*b*. *The Evolutionist's Extension of the Genetic Method.* It is to be noted that such a reference to the concomitant physiological processes enables the psychologist to greatly extend the range of the genetic or historical method as applied to the individual mind. While the older psychologists set out with the first vague manifestations of the individual mind as an absolute beginning, the modern evolutionist views the nervous organisation of the infant as embodying the results of ancestral mental experience. This theory sets out with the fact that the repeated carrying out of a certain line of action modifies the nervous structures so as to produce an organic disposition to that particular mode of action, an effect which is illustrated in what we call habit. By supposing such organic registrations to be transmissible by heredity the evolutionist reasons that the child inherits from its series of progenitors, woven into the texture of its nervous system, a number of dispositions representing ages of ancestral experience. In this way we are able to view the mental life of the individual as conditioned by, that is, genetically related to, the larger life of the species and of its predecessors in the zoological series.[1]

The doctrine of evolution enlarges the psychologist's "genetic method" in another way. Darwin and his followers have familiarised us with the idea that particular organic variations which are found to be useful tend by natural selection to become permanent. This theory enables us to introduce a *quasi*-teleological point of view into the organic world, and to interpret what we find to be permanent as owing its stability to its utility or adaptation to life-circumstances. Applying this conception to those psycho-physical arrangements which constitute the common instinctive base of our mental life, the psychologist can suggest how, in the course of the evolution of man and his progenitors, certain arrangements may have been built up. This *biological* or *teleological* view of psychical phenomena will be illustrated from time to time in the course of our exposition.

[1] This is the common supposition of evolutional psychologists, though, as we shall see by-and-by, it is a matter of dispute whether any acquired characters, and consequently any results of experience, can be transmitted by heredity. It is important to add that this hypothesis does not imply that the child has antecedently to its experience *conscious* states which are a kind of vague recalling of ancestral experience, but only that it has certain organic arrangements which prepare the way for particular psychical processes when individual experience is added.

§ 14*c*. *Limits of Physiological Explanation.* It is important to add, however, that while the psychologist is thus compelled to refer to the bodily organism if he would give a complete account of all the circumstances which condition psychical phenomena he cannot make such a reference a substitute for properly psychological explanation. It follows from the essential disparity of psychical and physical phenomena, emphasised in the last chapter, that we cannot in any case derive a fact of consciousness from the nervous actions which are its physical substratum. This applies even to that elementary department of mental phenomena, sensations, in which the reference to nervous conditions is most obvious and inevitable. In naming the nervous processes which precede and accompany a sensation of taste or smell, we do not look on this last as a mere transformation of the molecular movements of which the first are supposed to consist. We cannot account for the specific nature of any sensation, whether of taste, hearing or other sense, by the fullest knowledge of its nervous conditions. As a mode of psychosis it is something wholly foreign to the world of moving masses and particles with which physical investigation is concerned. To this it must be added, that with respect to the higher mental phenomena, as thought and volition, we have only a vague and incomplete knowledge of the nervous conditions involved. So that physiology gives the psychologist less and less help as he advances from the elementary facts of consciousness to its more complex forms.

This position is by no means universally granted. It is obvious that those who, like Comte and Dr. Maudsley, would include psychology in physiology tacitly deny that there is any radical disparity between psychical phenomena, our conscious sensations, thoughts and feelings, and the physical movements which constitute the actions of the bodily organism. One recognises the same tendency in those who, while they concede an independent existence to psychology, are given to introducing physiological considerations in place of properly psychological ones. Lastly, this tendency is betrayed in a less manifest form in the idea put forth by Horwicz and others that our psychological inductions are empirical and not ultimate laws, and that they will have hereafter to be connected with and deduced from more general biological principles.[1]

[1] On the limits of physiological explanation in psychology, and the question of resolving psychological into physiological laws, see J. S. Mill, *Logic*, bk. vi. chap. iv. § 2 ; Brentano, *Psychologie*, buch i. cap. iii. § 4 and following.

§ 15. *The Sociological Factor in Psychology.* In the second place, the psychologist's reference to the external conditions of mental activity and mental development must include not only the bodily organism and even the objects of the physical environment which act upon this, and through it on the mind, but also that social environment or community in interaction with which the individual thinks and acts. We cannot understand an individual human mind in abstract separation from the community of minds. Each of us feels, thinks and acts as he does under the constant influence of social relations. The human mind is human, that is, superior to the animal mind, just because of the reciprocal action of mind on mind in social life. Thus, to understand human thought we must consider its necessary accompaniment, language, and view this as the outcome of social needs and impulses (the need of mutual expression and understanding). The highest manifestations of mind, *e.g.*, the fully developed conscience, are essentially the product of that sum of social conditions which we call civilisation. The individual is enriched by the race, not merely by means of a hereditary transmission of some of the results of its experience, but to a far larger extent by means of social traditions, and all that we call the education of the individual by the community. Hence to understand the growth of a mind we must refer to those processes of sociological evolution and historical progress by which this sum of traditional and educative influences has been established. In other words, we must study mind by what has been called "the historical method".

It is in this more complete and historical study of the human mind that the knowledge of the psychical characteristics of backward races acquires its main value for the psychologist. It is by a study of the cruder manifestations of mind in primitive man and his living representatives that we come to see what social evolution and the traditional influences involved in a civilised community effect in furthering the intellectual, emotional and moral development of the individual.

The recognition of a "sociological factor" in psychology raises the question as to the true relation of psychology and sociology. As commonly understood, *e.g.*, by J. S. Mill, psychology necessarily precedes sociology: we must understand the laws of the individual mind before we can understand the more complex phenomena resulting from the interaction of mind on mind in a social community, such as the moral sense. At the same time more recent writers, and especially G. H. Lewes, have insisted on the necessity of taking into account the sociological factor in studying the development of the individual mind.

A reconciliation of these views may perhaps be found in distinguishing the more abstract principles of psychology from their concrete applications in explaining the actual development of the typical mind. The former, for example the laws which govern the formation of ideas in general, can be reached without any reference to the 'social organism,' and by a purely abstract consideration of the individual mind. On the other hand, to account for the actual forms of the mental life as it shows itself in civilised man, we must, it is evident, pay regard to social conditions. The ideas. the emotions, and the conduct of the individual at our present stage of social evolution are determined by the past stages of this social evolution. To understand this action of one mind on another, the mind of the community on that of the individual, we must, it is true, make use of purely psychological laws gained by an abstract consideration of the processes of the individual mind. In other words, any effect of social circumstances in furthering the development of the individual mind, *e.g.*, of social custom in forming ideas of what is right, must conform to and illustrate the universal laws of psychical development. And to this extent psychology it undoubtedly prior to sociology. Nevertheless it is true that the psychologist must assume these social circumstances and forces among his data if he is to attempt to deal with the processes of the individual mental life in any other than the most abstract and fruitless manner.[1]

REFERENCES FOR READING.

On the whole subject of the Method of Psychology see J. S. Mill, *Logic*, bk. vi. chap. vi.; Lewes, *Study of Psychology*, chap. iv. and following; Bain, *Logic: Induction*, bk. v. chap. v.; Brentano, *Psychologic*, buch i. cap. ii. to iv.; James, *Principles of Psychology*, chap. vii.

[1] On the relation of psychology to sociology see J. S. Mill, *Logic*, bk. vi. chap. vi.; G. H. Lewes, *Problems of Life and Mind*, third series, i. (The Study of Psychology), chap. iv., *cf.* first series, vol i. p. 152; and Prof. H. Sidgwick, *Mind*, vol. xi. (1886) p. 211 and following.

CHAPTER III.

PHYSICAL BASIS OF MENTAL LIFE.

§ 1. *Phenomenal Connexion of Mind and Body.* As pointed out above, a very slight examination of the processes making up our conscious mental life suffices to show that they are closely conjoined with that sum of physical actions which constitutes the life of the body. The science of psychology has to take note of this connexion, and to present it in the clearest light possible. In doing this it views the relation merely as a connexion of phenomena, *viz.*, of physical movements and mental processes running on concomitantly in time. It does not raise the question how it comes to pass that these two radically dissimilar modes of activity are thus associated, a question which, as we have seen, belongs to metaphysical or rational psychology.

§ 2. *Range of Interaction of Mind and Body.* A hasty and superficial observation might suggest that all parts of the physical organism are directly connected with our mental life. Thus an injury to any one of the bodily structures, except the insensitive portions, the hair, nails, etc., gives rise to a feeling of pain. So again our mental states produce effects throughout the bodily frame. Great mental agitation, for example, affects the breathing, the circulation, and so forth. We seem too to be able, by an effort of attention, to get into mental touch with any part of the body, making it the object of direct mental apprehension through certain localised sensations, as when we concentrate attention on the breathing apparatus or one of the fingers.

Yet further inquiry soon shows that this connexion of mind with body is not equally close throughout. Thus it is evident that the vital functions, which minister to the maintenance of the organism, as digestion, circulation, etc., are but loosely and remotely connected with consciousness. Under healthy conditions these vegetative functions of the body affect mind only on its dim sub-conscious side, contributing psychical elements in the shape of a pleasurable sense of well-being. Only serious disturbances of these functions produce marked and distinct psychical effects. And conversely it is only certain exceptional forms of mental activity, and more especially emotional excitement, which modify in a clear and striking manner these vital actions.

If now we turn from these organs of the vegetative life to those which subserve distinctly animal functions we find a much closer union with mental activity. Thus the structures which most obviously subserve movement and sensation, *viz.*, the muscular organs and the organs of sense, as the eye, the ear, etc., seem to be very closely connected with the higher strata of mental life, *viz.*, clear consciousness. Under normal circumstances our limbs are never moved save in obedience to a voluntary command. And the activities of the sense-organs are the chief occasion of mental activity, at least in its earlier forms, such as the perception and comparison of external objects.

§ 3. *Special Organs of Mind.* Even here, however, further reflexion makes it evident that the connexion is not immediate and constant. We can reflect, reason, and so forth, when both the organs of sense and those of movement are apparently inactive. In sleep the mental life may continue under the form of dreaming without any co-operation from these organs. They thus seem to be the exterior mechanism by which the mind occasionally puts itself *en rapport* with the external world, not the organs whose activity directly sustains the flow of consciousness. Such an organ of mind or "seat of the soul" would seem to be rather in some central, as distinguished from peripheral, region of the body. And, indeed, we find that already in an early stage of human thought such a seat was assigned to the soul, sometimes in the heart, at other times in the head. These vague conjectures have been rendered definite and precise by the discoveries of the modern science of physiology. We now know that there are certain organs of the body constituting in their *ensemble* the Nervous System which specially subserve the processes of our mental life. This system supplies in the centres of the Brain a definite substratum or 'seat' of mental activity. Moreover, since it stands in close connexion with the organs of sense and movement we are able to explain by means of it the indirect connexion between these and mental activity. Finally, inasmuch as it has ramifications in all parts of the body we can by its help account for the far-reaching interaction and sympathy of mind and body.

§ 3*a*. *History of Views on the Bodily Seat of the Soul.* The history of the attempt to find a special organ or seat of mental activity in the body forms one of the most curious chapters in the development of human thought. At the outset when man could not form a clear idea of mind as something non-material, it was, as we have seen, specially identified with the breath or warm air (πνεῦμα) which circulated throughout the body and was at once the source of heat and activity. According to this view the soul was diffused throughout the organism. At the same time we see a tendency to assign special centres to mental activity. Thus we find in Homer the heart figuring as the seat of the mind's passions. The idea of a special connexion between the heart and the mental life which still survives in popular language was supported in part by the doctrine of πνεῦμα, the warm air being supposed (even by Aristotle) to be developed out of the blood, and partly no doubt by the observed effects of strong emotion on that organ. Plato, in his scheme of mind, referred the inferior operations to the abdomen and the thorax, reserving the cranium for reason. But, the nerves not having been discovered, he seems to have thought that impressions were transmitted to the brain by the blood-vessels. Hence we need not be surprised at finding Aristotle rejecting the cranium as the seat of mind, and referring it to the heart. The stubborn persistence of the old doctrine of πνεῦμα is curiously illustrated in the fact that even so late a writer as Galen thought the warm air in the ventricles of the brain constituted the true seat of mental activity. It is only through the stricter methods of physiological research adopted in modern times that we have come to understand the real nature of the connexion between mind and body as mediated by the mechanism of the Nervous System. This improved modern research includes a more careful anatomy of the finer structures of the body, a more extended comparison of their variations in different species of animals (comparative anatomy), fuller medical knowledge of the effects of injuries to the nervous structures, and lastly, carefully arranged experiments with a view to discover the precise functions of the several bodily structures.[1]

[1] On the historical developments of our knowledge of the physical basis of mind, see Siebeck, *Geschichte der Psychologie*, i. 207, ii. 46, 130 *seq.*, and 266 *seq.*; *cf.* Whewell, *History of Inductive Sciences*, bk. xvii. ch. i. and ch. v. The complicated process of inference by which each of us comes to connect his own states of consciousness with a nervous system in his own body of which he has no direct knowledge, is well described by Mr. Spencer, *Principles of Psychology*, pt. i. ch. vi. (Æstho-physiology).

THE NERVOUS SYSTEM.

§ 4. *Structure of Nervous System.* Since the nervous system is thus in a peculiar manner related to our mental life it is important to have made a study of it before coming on to the consideration of mental phenomena. This the reader is supposed to have done by aid of one of the easily accessible text-books of physiology.[1] All that is offered here is a *résumé* of some of the more important points which appear to have a psycho-physical significance.

The nervous system is primarily divisible into two portions. The one is a group of compact masses known as nerve-centres lying within the bony covering of the skull and vertebral column, and constituting the cerebro-spinal axis or brain and spinal cord; the other consists of thread-like ramifications running from these nerve-centres to all parts of the body and known as nerves.

§ 4*a*. *Nerves.* The nerves are found to consist of bundles of minute white fibres. The more important class of these fibres have as their essential element a central pith (axis-cylinder), enclosed in a sheath (medullary sheath), which probably serves to insulate the fibres.

The nerves fall into two classes, which, though they appear to have the same structure, are marked off one from another by their mode of attachment at the periphery and at the centre, and as a consequence of this subserve distinct functions. Of these the first class are connected at their peripheral termination with some sensitive structure, as the skin, the nervous membrane of the stomach, and so forth. They are put into a state of activity at their peripheral end by a process of stimulation, and have as their function to convey nervous action to the centre. Hence they are called afferent or in-carrying and also sensory nerves.

The more important of these afferent nerves for the psychologist are the nerves of special sense which connect the peri-

[1] The reference here is principally to that higher and more important group of structures known as the Cerebro-Spinal System. The lower sympathetic system which regulates the vegetative functions, though involved in certain psychical phenomena, *e.g.*, the organic sensations and emotions, affects mind indirectly only through its connexion with the higher system.

pheral organs of sense, the skin, the retina, and so forth, with the nerve-centres. The fibres of these nerves tend to separate towards the peripheral termination, and each fibre has its own terminal appendage, the several terminal appendages making together a sort of mosaic work. These appendages, which differ greatly in the case of the different organs, constitute the proper "end organ" of the sense. It is these, as we shall see, that are acted upon by the outer stimulus (as mechanical pressure, light) which excites the organ to activity.

The second class are, for the most part, attached peripherally to the muscles—those bundles of fibres by the contraction of which movements of the limbs, the heart, etc., are brought about—and have as their function to convey nervous excitation from the centres to these organs. Hence they are known as efferent or out-carrying and also as motor nerves.[1] The most important of these motor nerves, again, for the psychologist are those which run to the striated or "voluntary muscles," as those of the limbs.[2]

While these two classes of nerves are thus differentiated by their peripheral attachments they appear also to have a different mode of attachment at the nerve-centres. Thus it has been known since the researches of Sir Charles Bell that of the two branches or roots which go to form a spinal nerve the one issuing from the anterior half of the column (anterior root) consists of efferent or motor fibres, the other starting from the posterior half (posterior root), of afferent or sensory fibres.[3]

§ 4*b*. *Nerve-centres*. The chain of nerve-centres or centro-spinal axis consists of masses of greyish and of white substance arranged in a very intricate manner. The essential element in the grey matter is the nerve-cell, or more correctly "ganglionic nerve-cell," a minute sac-like structure with neck-like projections or "processes". With these cells or corpuscles are mixed

[1] The term "motor" has been objected to on the ground that the efferent impulse does not always issue in muscular contraction, but sometimes, *e.g.*, in the case of the salivary and other glands, in a change in epithelial cells. See Foster, *Text-Book of Physiology*, pt. i., p. 184.

[2] The striated and voluntary muscles do not strictly coincide: but the exceptions need not here be considered.

[3] These classes of nerves are also distinguished as centripetal and centrifugal. But the terms afferent and efferent seem the most convenient.

fibrous elements, and these last constitute the main constituent of the white substance of the nerve-centres.

Recent anatomical investigation renders it probable that nerve-cells are connected by their processes with nerve fibres, and that in this way structural continuity is maintained between one nerve-cell and another, and one region of the nerve-centres and other regions. The fact that motor fibres are attached to the anterior portion of the grey matter of the spinal cord, sensory fibres to the posterior portion, suggests that the central substance is throughout divisible into motor and sensory regions. Experiment tends on the whole to support this conjecture. Anatomical examination, too, appears to favour the idea of certain differences in the size of the nerve-cells corresponding to this division of sensory and motor regions in the nerve-centres.[1]

This chain of nerve-centres falls into a number of divisions, easily distinguishable by their shape, size, and the arrangement of the grey and white substance. The most obvious division is that of the narrow cylindrical spinal cord, and the bulbous globular mass known as the brain. In the cord the grey matter constituting the central organ forms the pith or axis, being surrounded by strands of nerve-fibre. The cord thus serves both as a centre to connect the sensory and the motor fibres of spinal nerves one with another, and also as a prolongation of these fibres towards the higher centres of the brain.

The transition from the cord to the brain is formed by an expansion known as the medulla oblongata. Then follow the different organs of the encephalon or brain itself. These are roughly divisible into (1) a group of inferior organs, *viz.*, the cerebellum or little brain, and certain smaller masses called the basal ganglia, and (2) the cerebral hemispheres forming the larger part of the brain. In these last we have the reverse arrangement of grey and white substance to that found in the cord. The grey matter forms the rind or cortex, and is arranged somewhat after the manner of foliage about a branching system of nerve-fibres.

[1] This distinction between sensory and motor cells is however denied by certain physiologists, *e.g.*, Münsterberg (see *Die Willenshandlung*, p. 141), and cannot be said as yet to be fully established.

These highest nerve-centres in the cortex are connected by means of intricate arrangements of nerve-fibre with the lower centres, basal ganglia, medulla, and cord, but the precise mode of these connexions is not yet fully ascertained. So far, anatomists have failed to trace the exact course of the fibres of the cord up to the cortex. One thing however is known, that they undergo a more or less complete crossing or decussation, so that fibres coming from one of the right limbs pass to the left hemisphere. The same thing is true of the cranial nerves, those which enter the skull and attach themselves directly to one of the lower centres of the brain, and which include the nerves of special sense whose end-organ is in the head, *viz.*, the eye, ear, organ of taste, and smell. The two hemispheres are moreover closely connected one with another and with the intermediate centres (basal ganglia).

It is to be added that the nerve-centres are richly furnished with blood-vessels. More particularly the brain is surrounded by a minute network of vessels by which its substance is amply supplied with arterial blood.

§ 5. *General Plan of Nervous Structures.* It is evident from this slight sketch of the Nervous System that it is a system of closely conjoined parts by means of which action at any one point, say of a sensory nerve, may be propagated in a number of definite directions so as to affect other and distant regions of the system itself, and the end-organs connected with this system. Not only so, we see from the arrangement of the nerve-centres that they form a series of organs of growing complexity, admitting of more and more intricate and varied connexions between one point of the organism and other points. Thus the grey matter of the cord is a meeting point for comparatively few paths afferent and efferent, and consequently its actions are marked by a high degree of simplicity and invariability. The higher centres on the contrary contain meeting points for a much larger system of nervous paths, and consequently provide a field for more intricate and varied actions.[1]

§ 6. *Function of Nerve-fibres.* The nerve-fibres are, we are told, pure conductors. Their sole function is to transmit

[1] Mr. Spencer has illustrated in a very interesting way this effect of growing complexity of structure by comparing the higher and lower types of nervous system in Man and Animals. See *Principles of Psychology*, pt. i. chap. ii.

nervous excitation from one point of the nervous system to another. But of the exact nature of this nervous activity little is known beyond the fact or common assumption that it is some form of molecular movement. It is found to have some important affinities with electrical action, but it must not be confounded with this. For one thing, the process of transmission is relatively slow, being about 100 feet per second.[1]

As already pointed out, the two classes of nerves marked off as afferent and efferent have a marked difference of function. Under normal circumstances afferent nerves are only excited by way of their peripheral attachments (sensitive structures, end-organs), and have to conduct the state of nervous excitation or 'nerve-commotion' from the periphery to the centres.[2] Efferent nerves, on the other hand, are stimulated or 'innervated' by way of their central connexions, and have to transmit the process of excitation outwards to the muscles.[3]

§ 6*a*. *Specific Energy of Nerves.* It was formerly supposed that each nerve had its own peculiar and unalterable function. This view is known as the doctrine of the specific energy of the nerves. The doctrine was supported, not only by such facts as these just mentioned, but by experiments which show that when a sense-organ is stimulated by an unaccustomed stimulus, as when by pressing on the eye-ball we mechanically irritate the retina, the psychical consequent is still a sensation proper to that particular sense. Nevertheless recent investigation has tended to show that the function of nerve-fibres is not unalterable. Thus it seems to have been proved by experiment that under certain exceptional circumstances afferent and efferent nerves may exchange functions.[4] Further, there is, as we shall see later on, every reason to believe that in the case of the nerves of

[1] For an account of what is known of the process of conduction along nerve-fibres, see Ladd, *Elements of Physiol. Psychology*, pt. i. chap. i. § 32 and following, and chap. iii.; and Wundt, *Physiol. Psychologie*, 1er Abschnitt, 6er cap. 2. and 3. *Cf.* Foster, *Text-Book of Physiology*, part i. chap. ii.

[2] This generalisation as we shall see later when dealing with the psycho-physical process in attention is not perfectly certain. There may be a reverse central stimulation in certain cases.

[3] Or, in the case of the glands, to the epithelial cells which certain efferent fibres are known to influence directly, and independently of any action on the muscular fibres of the arteries.

[4] See G. H. Lewes, *Physical Basis of Mind*, p. 280 ff.

special sense the same fibres exercise under normal circumstances a variety of functions, that is, transmit unlike modes of excitation, answering to different colours, different tones, and so forth, according to the form of the stimulus that acts upon them. Such facts go to establish what has been called the "functional indifference" of nervous elements. According to this last view the difference of customary function that we find *e.g.*, between the nerves of taste and of touch, is due, not to any inherent differences in the nerves themselves, but simply to the difference in their peripheral connexions or end-organs. At the same time it is allowed that owing to long continuance in one mode of function the nerves of special sense have acquired a habitual disposition to function only in that way.[1]

§ 7. *Function of Central Elements.* The function of the central element, the nerve-cell, seems to differ from that of the fibre. It is not purely conductive. The propagation of nerve-commotion along an afferent fibre suffers a retardation when it reaches the central cellular substance. And this delay is followed by an increase in the energy or intensity of the excitation when it issues from the grey substance. This increase in intensity is said to be due to a liberation of energy, which is an accompaniment of the breaking down of complex and unstable chemical compounds into relatively simple ones. This liberation of cell-energy or cellular discharge depends on the presence of oxygen in the blood, the supply of which is effected by the system of capillaries already referred to.

In addition to thus strengthening the incoming excitation the central elements discharge the important function of directing its after-course. Owing to the continuity of the central substance such excitation may be propagated in various directions. The tendency of nervous excitation to diffuse itself over the central area is spoken of under the name of irradiation or diffusion. We shall see a striking example of this in the known motor accompaniments of emotional excitement. Such diffusion, however, is limited from the first by special anatomical arrangements, and becomes more and more so as the

[1] For a full discussion of the question the student is referred to G. H. Lewes, *Physical Basis of Mind*, problem ii. chap. iii., *cf.* p. 280 and following; Ladd, *Elements of Physiol. Psychology*, p. 353 and following; Wundt, *Physiol. Psychologie*, cap. vii. § 4; and Stumpf, *Tonpsychologie*, ii. p. 106 ff.

brain develops by the formation of lines of customary propagation or connexion between one part of the brain and other parts.[1]

§ *7a. Inhibition.* This restriction of the process of excitation within a definite circuit is closely connected with another function of the central organs, *viz.*, Inhibition. The activity of one region of the nerve-centres may, when restriction has been effected, interfere with or check the activity of another region. Thus when two centres are simultaneously stimulated there is a conflict of excitations.[2] Such interference is known as inhibition. Thus the process of motor innervation resulting on an incoming sensory stimulation in the cord, and known as spinal reflex, is greatly intensified when the higher centres of the brain are detached by decapitation. And this shows that the higher nerve-centres in the brain exercise an inhibitory influence on the lower centres. The same phenomenon of inhibition seems to be the physical correlative of certain well-known psychical processes, as when we withdraw the thoughts from an attractive subject, or restrain an impulse to do something.

The precise nature of inhibitory action, its range, and the conditions on which it depends, are very imperfectly understood. The old idea that there are certain nerve-centres having inhibition as their special function is now abandoned in favour of the idea that any centre may inhibit another centre. But how this is effected, and how the form of such inhibitory action differs from that of stimulatory or excitatory action, is not clear. It has been suggested, by Dr. Lauder Brunton, that inhibition is analogous to the interference of light, the molecular vibrations propagated from one region interfering with those of another.[3]

§ *7b. Reflex and Automatic Functions of Nerve-centres.* We have so far supposed that the nerve-centres are always stimulated as the result of an excitation of

[1] On the relation of irradiation to restriction, see Lewes, *Problems*, third series (ii.), p. 41 ff. The relation of the two is illustrated in the fact (shown by Goltz and others) that by intensifying the sensory stimulus in calling forth a reflex movement this motor reaction becomes more complex involving more and more muscles. See Foster, *Text-Book of Physiology*, pt. iii. p. 906 f.; and Ziehen, *Leitfaden der physiol. Psychologie*, p. 76. On the functions of the central substance, see Ladd, *Elements of Physiological Psychology*, pt. i. ch. i. § 34; and Wundt, *Grundzüge der Physiol. Psychologie*, cap. vi.

[2] See G. H. Lewes, *Physical Basis of Mind*, p. 293 ff.

[3] On the nature of inhibition, see Lewes, *Physical Basis of Mind*, chap. viii.; Hermann, *Human Physiology*, pp. 48 and 52; Mercier, *The Nervous System and Mind*, p. 76 and following; and *Brain*, Oct. 1888; Ladd, *Elements of Physiol. Psychology*, p. 143 and following.

some sensory or incarrying nerve. And this is no doubt the typical form of nerve action. In its simplest form, as seen in the actions of the lowest animals and in the more mechanical actions of man, it is reflex, that is to say, a sensory stimulation transmitted by a nerve-centre as a process of motor innervation; or to describe the whole process by its first and its last stage, a stimulation of an end-organ followed by a muscular contraction. And a large part of brain-activity is merely an expansion of the intermediate central phase of this reflex type of nervous action. At the same time, physiologists now recognise a variety of central activity, that is, independent of such incoming stimulation. This is marked off as the *automatic* functions of the nerve-centres. Such automatic activity is said to be due to the action of "internal stimuli," which probably consist in changes in the composition of the blood.[1]

§ 8. *Mode of Working of Nervous System.* We thus see that the Nervous System has for its main work or function the transformation of sensory stimulation into motor excitation through the medium of a nerve-centre. Since the process of sensory stimulation is attributable directly or indirectly to the action of some external agent on some part of the organism, we may say that the nervous system is a mechanism by which the organism is able to carry out actions of adjustment or adaptation which bring it into correspondence with its environment.

The lower parts of this system subserve those responsive acts of self-adjustment which, being required frequently in precisely the same form, are carried out mechanically (spinal reflexes), such as movement of a limb away from some irritant substance.[2] The higher parts subserve responsive actions which are more complex and variable in their form, and have more of the character of special adaptations, as in walking along an unfamiliar path in the dark.

This work of the higher nervous mechanism involves a certain control over the lower parts. Thus in combining a new group of movements, as in learning to swim, the higher centres must be supposed to stimulate the lower to a new mode of co-ordinate action, which in time becomes mechanical. On the other hand, any variation of customary grouping of movements, as when a recruit tries to walk backwards, implies

[1] On the distinction between the reflex and the automatic functions of the nerve-centres, see Ladd, *Elements*, pt. i. chap. iv.

[2] This is a rough distinction only, since even spinal reflexes are not wholly unmodifiable.

an inhibitory action of the controlling centres on the lower centres, by which the customary co-ordination is mechanically carried out.[1]

NEURO-PSYCHICAL CORRELATIONS.

§ 9. *The Immediate Neural Concomitants of Psychical Processes: "Seat" of Consciousness.* After looking into the working of the nervous system as a physical mechanism, just as if there were no conscious life attached to it, we have now to consider its relation to the psychical activities which constitute consciousness. Here our special object will be to determine first of all, at what points, and secondly in what precise manner, the current of physical action which we call nerve-commotion is brought into relation to psychical action.

Our first problem concerns itself with the so-called "seat" of the mind. As pointed out above, this idea of a definite seat has been handed down to us from the days when men were still thinking of mind as a substance having certain quasi-material attributes. As soon, however, as we think of it as non-extended, the idea of seat taken literally becomes absurd. Thought is not at some point of space in the head, nor does a feeling cover a certain amount of surface, or fill a certain volume. All that the scientific psychologist can mean by the phenomenal connexion of mental and bodily processes is a relation in time. Some processes going on in the body are immediately accompanied by psychical phenomena, sensations, thoughts, etc., and the question of the seat of the mind becomes, What actions of the nervous system are thus immediately related to psychical activity?

It has already been pointed out that the idea of a special connexion between the cranium and mental activity was reached by antiquity. Modern investigation confirms this belief. Experiment has shown not only that the stimulation of the peripheral region of a nerve precedes by an appreciable interval of time the appearance of a conscious sensation, but that if the

[1] On the proper significance of nervous action as the mediating work of adjustment of organism to environment see Herbert Spencer, *Principles of Psychology*, pt. i. chap. ii. The controlling function of the higher centres is well illustrated by Dr. Mercier, *The Nervous System and Mind*, p. 133.

connexion between end-organ and brain is sundered the outer half of the nerve may be stimulated without the production of any conscious phenomenon. Hence we conclude that the psychical result of exciting a sense-organ occurs only when the effect of this is transmitted to the central organs.

Not only so, modern research has established the proposition that psychical activity is not immediately associated with the action of the lower centres of the spinal cord. These actions, as has been shown by stimulating the nerves of decapitated animals, are reflex in form, mechanical, and of the minimum degree of adaptability. Hence they are assumed to be unconscious, that is, unaccompanied by conscious activity.[1]

It appears to follow that psychical processes are specially related to the actions of the higher nerve-centres in the cranium. And this position has been well established by a chain of positive evidence.

§ 10. *The Brain as Organ of Mind.* That the phenomena of our conscious life are connected with the actions of the brain is suggested by the fact that mental excitement, strain, or fatigue is apt to induce sensations which we commonly localise in the head. It is still more distinctly suggested by the common observation that an injury to the brain produces unconsciousness. When to such common observations science added the fact that the brain is the great central station or meeting-point of the nervous system, the inference that it has a special significance as an organ of mind became inevitable. The full proof of this connexion has, however, only been supplied by recent physiological research.

These investigations furnish a mass of consilient evidence of the most convincing kind in support of the proposition that the nerve-centres of the brain have a special significance as the organ of mind. Among these proofs may be instanced: (1) the demonstration that peripheral stimulation must be transmitted to the brain before sensation arises; (2) the discovery that mental activity is accompanied by an increase of temperature in the brain; (3) the fact that mental activity is followed by an increase in those waste-products which are

[1] The term reflex action is commonly used to imply absence of consciousness. It may however be employed as above, merely to indicate the form of the whole nervous process.

known to be elements of nerve-cells (their phosphorised constituents); (4) a mass of facts (the outcome partly of pathological observation, partly of experimental destruction of different portions of the nerve-centres) going to show that injury to the brain is attended with some interruption of the psychical activities making up normal consciousness; (5) the important fact that any interruption of the supply of blood to the brain by means of one of the great arteries running to the organ is followed by a profound disturbance if not a suspension of consciousness; (6) the confirmation of this physiological evidence by the results of comparative anatomy, which show that the development of the brain and the degree of intelligence vary in a direct ratio among different species of animals, races of mankind, and individual men.

This relation is clearer in the case of man than of animals as a whole. Though the relation of size and weight of brain to those of the body is in general an index of the intelligence of an animal, there are certain exceptions. As between man and man the size, weight, and specially the degree of structural complexity, as shown by richness of convolutions, answer clearly to the degree of mental power manifested.[1]

§ 11. *Special Connexion of Mental Activity and the Cortex.* Modern physiology has not only fully established the connexion between the brain and mental activity, but it has gone some way to make it probable that it is the highest centres in the cortex of the cerebral hemispheres which form the immediate physical basis of our mental life, so far at least as this involves clear consciousness. According to this view, it is only when sensory impulses are transmitted to the termination of the afferent fibres in the cortex that a distinct sensation arises. And all volitional initiation of movement takes its start in the cortex.

Recent investigations into the functions of the lower intercranial centres (cerebellum and basal ganglia), while clearly establishing special connexions between these organs and certain classes of sense-impressions and groups of movements, leave us much in the dark as to their exact functions. It is

[1] On the relation of size and weight of brain to intelligence, see Bastian, *The Brain as Organ of Mind*, esp. ch. xviii. and following. The evidence in favour of the brain being the organ of mind is well summarised by Ladd, *Physiol. Psychology*, pt. ii. ch. i.

probable that so far as consciousness is concerned they are to be viewed as a subordinate mechanism by which more complicated adjustments of efferent to afferent impulses than are possible in the case of the spinal cord and its expansion the medulla are carried out, but adjustments which, owing either to original paths of connexion or to connexions built up by experience and repeated action, do not involve any accompaniment of clear consciousness.

The conclusion is so far only a probability. The idea that the sensorium, in the basal ganglia of the brain, is the seat of conscious sensation is still entertained by some physiologists. It is conceivable that the activities of the lower centres of the brain may contribute elements to the sub-conscious region of our mental life. It may be added that the very texture of the brain, involving a network of open communication between one part and another, appears to exclude the idea of a definite boundary to the circle of nervous action constituting the physical basis of consciousness.[1]

§ 12. *Localisation of Distinct Mental Functions.* After thus marking out roughly the boundaries of the "seat" of mental life, there remains the question whether different parts of this region are specially connected with distinct varieties of mental activity.

The attempt of Gall and Spurzheim to connect different faculties—intellectual, emotional, and moral—with definite localities on the surface of the brain has been condemned both by psychologists and physiologists. Their 'phrenology' involved unscientific ideas both of mind and of the functional activities of the brain.[2]

More recently the subject has been approached from the physiological side under the heading, the Localisation of cerebral functions. A series of experiments (supplementing the results of anatomical and pathological observation) has been carried out for the purpose of connecting definite regions of the

[1] The evidence in favour of making the cortex the seat of conscious activity is summarised by Ladd, *Elements*, pt. ii. chap. i. The opposite view is urged with much emphasis by G. H. Lewes, *Problems of Life and Mind*, third series, prob. iii. chap. xiv.

[2] On the scientific value of phrenology, see Sir W. Hamilton, *Lectures on Metaphysics*, i. p. 404, Appendix ; Lotze, *Microcosmus* (Engl. trans.), i. p. 339 following; Dr. Bain, *On the Study of Character*, chaps. ii.-vi.; Volkmann, *Lehrbuch der Psychologie*, § 30.

cortex with particular classes of sense-impressions and particular groups of movements.[1]

Such experiments have undoubtedly established special correlations between certain regions of the cortex and particular groups of psychical elements (sensations and conscious movements) and enable us to speak of particular centres of this and that order of sensations and movements. Thus physiologists are able to mark off, roughly at least, a particular centre for visual sensations, auditory sensations, the movements of the eye-balls, of articulation, and so forth.[2]

This mapping out of the functions of the cortex, interesting and valuable as it is to the psychologist, has not, so far, sought to assign definite cerebral concomitants for what he distinguishes as distinct psychical activities, *e.g.*, discrimination and assimilation or consciousness of resemblance. Hence the newer cerebral physiology does not as yet furnish the psychologist with a complete substitute for the phrenological scheme, which, bad as it was, boldly aimed at indicating the cerebral counterpart of recognised psychological distinctions.

The close structural connexion of the different portions of the cortex, including the multiform commissural attachment of the two hemispheres, supports the idea that in all modes of conscious activity a considerable area of the cortex is involved. Our conscious life consists, as already pointed out, in complex processes of combination, in comparing and uniting a multitude of elements. And though, as observed too, this process of psychical unification differs from all physical processes, we appear to find the closest physical analogue to it in such a local approximation of a number of sensory and motor impulses as is effected by the complex structural arrangements of the cortex. Thus we may say with some degree of probability that the physical substratum

[1] These experiments, carried out on monkeys and other animals, consist on the one hand in stimulating certain well-defined regions by an electrical current and noting the results, and on the other hand in extirpating certain portions and observing what functions are thereby lost. (See Ladd, *Elements of Physiol. Psychology*, pt. ii. chap. i. § 11 and following; *cf.* Dr. Ferrier, *The Functions of the Brain*, 2nd ed. chap. vii. and following; Wundt, *Physiol. Psychologie*, 5er cap. § 6; and W. James, *Principles of Psychology*, chap. ii.)

[2] How far definite demarcation of cortical area answering to particular groups of sensations and movements is possible is a matter of dispute.

of conscious activity is in every case a complex of nerve-processes involving a more or less extended area of the cortical centres.

§ 13. *Correlation of Nervous and Psychical Processes.* Having thus conjecturally mapped out the physical substratum of psychical processes, we may inquire into the general correlations between the two sets of operation involved. In what way or ways, it may be asked, does change in the nervous action affect the psychical action? What are the most definite aspects of the concomitance between the two sets of phenomena?

In seeking to answer this question we must clearly bear in mind that the two classes of phenomena are disparate, and that we can only expect to find a certain amount of correspondence or parallelism between them. It is to be added that, although scientific observation and experiment have shown that a certain correlation obtains between the two, the precise extent of this correlation is as yet unknown. We are thus compelled to eke out fact with conjecture.

§ 13*a*. *Correlations between Elements.* In the first place then we may trace out a certain measure of correlation between the elementary psychical and physiological processes involved. That is to say, we may seek to connect differences in the elementary psychical phenomena with certain differences in the underlying physiological actions.

1. Of these correlations the most obvious are quantitative co-variations. Changes of magnitude in the psychical phenomenon appear to be conditioned by similar changes in the nervous process. These quantitative co-variations are resolvable into three, *viz.*, in respect of (*a*) intensity or strength, (*b*) extent or range, and (*c*) of duration. A word or two on each must suffice.

Our psychical states have the attribute of intensity. Thus the sensation answering to a loud sound has greater strength or intensity than that produced by a faint sound. It has been ascertained that all differences in intensity in our sensations are conditioned by changes in the strength of the stimulus at work, and therefore presumably by differences in the intensity or energy of action of the central elements involved.

Again, our psychical states exhibit differences in volume or extensity. Compare the two sensations of heat where a small part of the bodily surface is touched by a heated body and where a large area is touched. It is obvious that this difference is connected with the number of nervous fibres engaged, and so with the range of the central excitation.

Once more, our psychical processes occupy time, and it seems probable that their duration is conditioned by that of the connected nervous action. Sensations last in general just as long as the peripheral process of stimulation, and presumably therefore as the central excitation ensuing on this.[1]

The exact limits of these quantitative correlations will be touched on later. Suffice it to say here, by way of avoiding misapprehension, that the co-variation is not known to be perfectly simple and to obtain in all cases. Thus it is known in the case of sensations that there is a certain intensity of stimulus below which no psychical effect is produced (liminal intensity). And there is evidence that a similar threshold obtains generally in respect of extent and duration. That is to say, a nervous process which involves fewer than the minimal number of central elements, or a shorter than the minimal duration of the process of excitation, is unaccompanied by a psychical concomitant. In what precise manner above these limits changes in the intensity, etc., of the nervous process affect the corresponding aspect of the sensations will have to be spoken of later on.

2. In addition to these quantitative correspondences we may point out a certain qualitative correlation. The qualitative aspect of a psychical phenomenon, *e.g.*, of a sensation, is illustrated in the difference between a smell and a taste, or between a bitter and a sweet taste, a difference of kind which cannot be resolved into a merely quantitative difference. It is probable, as we shall see by-and-by, that these differences correspond to differences in the mode or form of the peripheral stimulation, and consequently of the central excitation.

It follows from this general correlation between psychical and physiological action that the degree of complexity of a psychical state is conditioned by that of the underlying physiological process. Highly complex states of mind, such as mixed feelings, would thus involve a number of unlike nervous processes and numerous changes with respect both to the particular central elements engaged and the relative intensities of their action.

[1] As we shall see by-and-by, the central process may be prolonged beyond that of the peripheral stimulation, as when we go on having a sensation of light or sound after the external agent has ceased to act.

Here again we are not to expect a perfect correspondence at all points. As we shall see, apparent simplicity of the psychical phenomenon may go with a considerable complexity of the physiological process. As has been already hinted, every sensation probably involves the action of more than one sensory fibre. Not only so, there is good reason to suppose that, since every sensory process calls forth some motor reaction, even the simplest sensations are really complicated by the addition of the psychical equivalent of a motor or muscular action.[1]

§ 13*b*. *Correlation in Mode of Combination.* In the second place, we have to inquire whether the mode in which psychical elements combine in what we call our mental life has its correlative in the physiological sphere. As we have not yet entered upon our analysis of consciousness so as to be able to define its precise form, we can only at this stage indicate in a rough manner the nature of this correlation.

Our mental life may be provisionally defined as a continuous succession of psychical states, of which the ultimate elements are sensations and other apparently simple phenomena. These combine in complex wholes, and one whole is succeeded by another whole without break and by a gradual process of transition, the successive continuity being commonly described by the figure of a stream. In this flux it is noticeable that certain elements are wont to stand out distinctly, whereas others remain obscure. Lastly, the higher developments of mental life imply a still more complex form of psychical activity, a reflective going back on the successive contents, the discrimination of these one from another, and the grouping of them according to their relations of similarity, etc. This reflective elaboration enters into all clear thinking, which, as we shall see, is relating and uniting, and underlies what we call the permanent consciousness of self.

The totality of the nervous processes concerned in mental life, different as it undoubtedly is from this, yet appears to supply a certain physical basis for it. As we have seen, the brain is a great meeting-place of the results of nervous stimulation. Its manifold connexions with the peripheral (including the internal vital) organs ensure a continuous supply of excitation, and change in the form of excitation. Again, the continuity of its structure seems to supply a physical

[1] It follows that to talk as certain physiologists do of a sensation or idea having its own particular cortical cell is unwarranted.

condition for the processes of psychical elaboration. In order to make it serve still more completely for a physical basis of conscious life, we have to assume two additional features. First of all we must postulate in the structure of the brain a special apparatus, by help of which particular psychical constituents may be intensified and raised into distinct consciousness. Such an apparatus is now supposed to be supplied by a group of motor centres which, as we shall see, specially subserve the process of attention. Secondly, we must assume as the physical basis of all that we mean by the retention and reproduction of psychical elements that the brain substance is endowed with a conservative property, by help of which the effects of peripheral stimulation are somehow stored up so as to enable the structures to afterwards re-enter upon the state of excitation independently of peripheral stimulation. Such a conservation of the traces of former action is now supposed to be a common property of living organs.

While we may thus recognise a certain correspondence between the general form of cerebral action and that of our mental life, we must not seek to force the correlation to the point of overlooking the disparateness between the two. Just as a sensation, say of tone, is something totally dissimilar to the molecular vibrations in a nerve which condition it, so the complex processes of thought differ in kind from any conceivable arrangement of physical actions. Thus, as we shall see when we come on to consider the work of intellectual elaboration, we cannot expect to find among physical movements an analogue to what we call a consciousness of difference or of likeness between two impressions, or a recollection of something as past. These psychical actions are *sui generis*, and cannot therefore be brought into analogy to movements of a material substance. All that we can say is then that just as the multiplicity of psychical elements (sensations, etc.) is somehow conditioned by a multiplicity of disparate nervous actions, so the organic unity and form of our mental life is somehow maintained by the presence of certain nervous arrangements.[1]

§ 14. *Practical Bearing of the Correlation.* The correlations between psychical and physical action just traced out have an obvious practical bearing. The fact that every psychical process is correlated with and conditioned by a physical one, that our mental life is made up of a group of psycho-physical processes, makes it imperative that in guiding, controlling, and economising the mental activities we should constantly

[1] On the correlations of psychical and cerebral action, see Ladd, *Elements of Physiol. Psychology*, p. 579 and following.

refer to the physiological conditions. Since the amount of mental activity at any time depends directly on the amount of disposable cerebral energy, it becomes a matter of the first consequence in order to secure the most efficient thought and action that we should satisfy the conditions of vigorous cerebral action. Brain-power may be lowered by want of nutrition, by insufficient supply of oxygen, by any organic cause tending to enfeeble the body generally, as also by fatigue of the brain itself. The old maxim, 'A sound mind in a sound body,' becomes in modern scientific language, "A vigorous discharge of the mental functions has for its immediate physical basis a healthy and well-nourished condition of the brain".

§ 15. *Cerebral and Mental Development.* Again, the general correlation of brain-action and mental process becomes of importance to the psychologist in tracing the course of psychical development. There is good reason to suppose that the brain and the mind develop *pari passu.* The growth of the brain as compared with that of the whole body follows a curious course. As common observation tells us, the brain at birth is greatly in advance of the body both in size and in weight. It almost reaches its maximum size by about the end of the seventh year. After this it undergoes a prolonged process of development, in which its elements (cells and fibres) multiply in number, more numerous connexions between cell and cell are built up, and the several distinctly-marked regions (folds or convolutions) become better defined. There is, moreover, a certain order in the development of the different cerebral organs, the parietal and frontal lobes appearing to develop latest.[3] This development of the cerebral organs presumably keeps pace with and serves to determine the advance of mind. It is highly probable that all mental progress, all acquisition of new ideas and new capabilities, involves the formation of new nervous paths, connecting one region of the centres with another, and facilitating the co-operation of these in single complex processes.

As we shall see by-and-by, the whole movement of psychophysical development may be regarded as a double one. In the first place repeated or recurring processes of thought and

[1] So Bischoff, *Das Hirngewicht des Menschen*, p. 171.

action become more perfectly organised, and as a consequence more rapid and unconscious or automatic. This result is expressed by the term *Habit*, a principle which obtains in the whole of our mental life, and which will be specially studied in connexion with movement and action. This transformation of conscious into semi-conscious or automatic action depends, it is evident, on the perfect co-ordination of certain central elements. In the second place there is a continual advance to new psycho-physical acquisitions. Thus so long as development goes on we move on to new combinations of ideas, more complicated processes of thought, and so forth. This involves on the physiological side the prolonged plasticity of the cerebral substance, the capability of developing new nervous elements, and new organic attachments between these. The development of the nervous mechanism is thus seen at once to diminish the sphere of distinct consciousness in certain directions (the familiar and habitual) and to a much larger extent to extend this sphere in other directions (the new and more complex forms of psychical activity).

§ 16. *Physical Substrate of Individuality: Temperament.* While the nervous system thus subserves the common typical form of the mental life, it constitutes also the basis of individual character. It is a fact familiar to all good observers of children that clearly-marked differences in mental aptitude and disposition show themselves within the first years of life. These facts, which point to an original and connate idiosyncrasy or individual character, appear to necessitate the supposition that the nervous system, though exhibiting the same typical plan in all human beings, differs to some extent in its proportions in the case of different individuals. Observation has shown that exceptional powers of intellect are correlated with special richness of convolution; and it is probable that such extraordinary complexity of structure is predetermined by the congenital conformation of the brain. Not only so, there is little doubt that differences of mental disposition, as that between the quick, lively and the slow, tenacious mind, have their physiological counterpart in functional differences of the nervous system. The old doctrine of Temperament was a crude attempt to fix the physical substratum of such individual differences. A more complete knowledge of the nervous system and its mode of action may one day enable the physiologist to substitute a truly scientific doctrine of temperament.

Modern science has familiarised us with the idea of a hereditary transmission of mental as well as of physical character. The nature of such hereditary transmission will be considered later on. Here it is enough to point out that the transmission of any special aptitude, taste, or moral inclination from parent to child takes place through the medium of the nervous system. To every distinct inherited trait or tendency of mind there corresponds presumably some peculiarity in the original constitution or set of the individual's nervous system. In this way we all bring into the world, wrought into the very texture of our brain-centres, the physical basis of our future individual character, mental and moral.

The doctrine of temperaments, which we owe to Galen, classified the observable differences of disposition under four heads, thus: (1) the sanguine or "full-blooded" temperament, which is warm, impressionable, and changeable; (2) the phlegmatic or "full-phlegmed," which is quiet, slow, and persistent; (3) the choleric or "full-biled," which is energetic, with predominant objective attitude; and (4) melancholic or "black-biled," which is sentimental, with a marked tendency to subjectivity. It is needless to say that this classification, so far as the physical bases are concerned, is scientifically valueless. At the same time, it served to mark off some well-recognised differences of disposition; and recent writers on the subject have made Galen's classification their starting-point, and endeavoured to account for the manifold differences of disposition by variously combining the four features here distinguished.[1]

REFERENCES FOR READING.

For a fuller account of the Nervous System in its connexions with mind the reader is referred to the elaborate treatise of Ladd, *The Elements of Physiological Psychology*. Among the best recent accounts (in English) of the Brain and its functions are Ferrier's *Functions of the Brain;* M. Foster's *Text-Book of Physiology*, part iii. chap. ii.; and the *résumé* given by W. James, *The Principles of Psychology*, vol. i. chap. ii. Other authors worth consulting are Bastian, *The Brain as Organ of Mind;* G. H. Lewes, *Physical Basis of Mind;* and Maudsley, *The Physiology of Mind*. Interesting illustrations of the interaction of Body and Mind are given by Lotze, *Microcosmus* (English transl.), book iii. chap. iii.

[1] For an account of Galen's doctrine of temperaments, see Siebeck, *Geschichte der Psychologie*, ii. 278. On the problem of classifying temperaments, see Lotze, *Microcosmus* (English transl.), book vi. chap. ii.; Ladd, *Elements of Physiol. Psychology*, p. 574 and following. An ingenious attempt to build up a classification of temperaments on Galen's basis will be found in a recent work, *Our Temperaments*, by A. Stewart.

PART II.

GENERAL VIEW OF MIND.

CHAPTER IV.

ANALYSIS OF MIND: MENTAL FUNCTIONS.

§ 1. *Problem of Dividing Mind.* The objects of Psychological Analysis have been indicated with sufficient fulness above (see p. 23). As was there pointed out, the immediate purpose of a general analysis of mental states or operations is the discovery of certain fundamental types of mental activity, certain simple and comprehensive *functions* of mind, of which all the concrete facts of our mental life may be viewed as various modifications. In seeking for such radical and comprehensive distinctions we are commonly said to be *classifying* or arranging mental states under general heads, or to be *dividing* mind into distinct modes of manifestation.

§ 2. *Triple Function of Mind.* By help of such a process of analysis carried out on a variety of psychological phenomena psychologists have come to distinguish between three radically distinct mental functions. These, which are pretty clearly recognised in our everyday distinctions, are known as Feeling, Knowing, and Willing.

In order to illustrate the difference between these modes of mental manifestation, we may select almost any example of a familiar mental experience. For instance, I see an apple on a tree. I may be affected by the beauty of its colour glowing in the midst of its cool green surroundings. Such a mental state of delightful admiration would be properly described as a feeling or *affective* state.[1] Or, again, if I happen to be a connoisseur of apples my mind may be stimulated by the sight of the object to note its peculiar characteristics with a view to recognise the particular variety to which it belongs. Such a direction of mental activity would come under the head of knowing, cognitive process or intellection.[2] And, lastly, if I happen to be hot and thirsty the sight of the apple may very likely excite a desire to pluck and eat it and prompt the corresponding actions. And in this case what goes on in my mind would be a process of willing, volition, or conation.

It may easily be seen that there is no mental process which cannot be brought under one or more of these three heads. Whatever state of mind we happen to be in, we shall always find that it is fully described by help of these three fundamental or primary functions. To be affected by some feeling, as wonder, love, or grief, to be following out some process of intellectual inquiry, or to be actively engaged in doing something or preparing to do something, this seems to exhaust all known forms of mental operation.

§ 2*a*. *Mental States and Processes.* We find the terms mental state and mental operation used indifferently in describing the phenomena of mind. There seems good reason however to adopt the second as the more suitable. As already pointed out, psychical facts are events in time. They have an appreciable duration, and exhibit a series of changes. They are thus most accurately described as processes. That all examples of intellection and volition are such processes must be evident. To think, to carry out a voluntary action, is a progressive operation in which we can easily distinguish successive stages. And though the case of feeling may at first seem to be an exception, it will be found to illustrate the general rule. For every feeling, however momentary it seems, really goes through a process of rise and fall.

It may be necessary in certain cases to distinguish between the mental process and the completed state or final psychical product. Thus we distinguish the process of perception and the product, the percept, the process of conception and the product, the concept, and so forth. But though we may by a device of abstraction distinguish thus between a process and its result, a productive operation

[1] The reader will note that there is no adjective cognate with the substantive "feeling". We are thus compelled to resort to another word, as "emotional". This last is the one generally adopted, though it is open to the objection that the cognate substantive "emotion" is confined to the higher order of feeling. The term "affective" seems on the whole the best for covering all varieties of feeling.

[2] The reader should note that we use the word Knowing and not Knowledge in order to mark off the psychical process as such, without any reference to the objective worth or validity of its result.

and its product, we must remember that they are only two aspects of the same phenomenon. An idea is merely the last stage of a process of ideation, a desire merely the consummation of a process of desiring, and so on. Hence it seems more scientific to describe the result of our general analysis as the division of mental processes into three fundamental comprehensive types of process.[1]

§ 3. *Elementary Functions.* Having now reached the most comprehensive types of mental operation we may carry our analysis a step further, and seek to reduce each of these modes of functioning to its simplest form. That is to say, we may endeavour to discover the essential element or elements in each of the three processes, feeling, knowing, and willing. And here we may conveniently set out with the process of knowing.

(*a*) *Primary Intellectual Functions.* The mental operations classed under the head of knowing or intellection exhibit a wide variety of form. This variety is indicated in the everyday mode of describing them as the faculty of memory, imagination, reason, and so forth. It is the object of scientific analysis to penetrate below the superficial differences here marked off, and to discover more fundamental distinctions of functional activity. The object of such analysis is to determine the fewest elementary functional activities from the varied activity of which all the observable diversity of operation in our mental life can be derived.

In order to reach these primary functions let us examine a simple case of knowing. A letter is brought to me. I glance at the address and recognise the handwriting of a friend. In this apparently simple operation it is easy to recognise a combination of factors. There is (*a*) the initial stage, *viz.*, the presentation of an object to sense and the fixing of the attention on this, and (*b*) the stage of intellection proper, the act of perceiving, interpreting, or recognising what is presented.

Each of these stages seems to be necessary. We cannot carry out a process of knowing unless some material is presented to the mind on which it can fix its attention. Such material is supplied in the first instance by the senses. Hence the impressions received through the senses are a necessary factor in the process of intellection. They are the material out

[1] On the distinction of process and product, see some remarks by Dr. Ward, *Mind*, vol. xii. p. 50. Mr. Shadworth Hodgson has suggested the expression "process-content" (*Brain*, No. liii. (1891) p. 7).

of which cognitions are elaborated. And equally essential is the act of Attention, by which the mind reacts on the presentation. As we shall see more fully presently, every process of intellection depends on this exertion of activity under the form of attention, or restriction and delimitation of consciousness to a definite object.

Coming now to the stage of intellection proper, we find that it consists of processes of segregation and aggregation, analysis and synthesis. Thus in the very direction of attention now to this, now to that feature of the handwriting the mind separates, isolates, or differentiates the presented materials. This process of analysis is supplemented by a process of synthesis in which the several characters of the handwriting thus individually observed are taken together as constituting a single whole, *viz.*, a particular person's penmanship.

Looked at from a slightly different point of view this process of separation and combination resolves itself into the discernment or establishment of certain *relations* among the presented material. It is commonly said that knowing consists in this consciousness of relations, or, as it has been called, the process of relating or referring.[1] In the above example we may see that the mind is throughout engaged in apprehending relations. Thus in the very process of analysis by which a particular feature of the handwriting is selectively attended to there is a rudimentary consciousness of *difference*—of difference between this and the other features momentarily neglected. Further, the whole group of characters as synthetically co-apprehended is virtually distinguished as different from other groups corresponding to other correspondents' writing. This discernment of difference is the most fundamental and constant element in all intellection. It is known as *Discrimination.*

In addition to this isolating and discriminating activity there is a conjoining or combining activity. And this shows itself under two apparently distinct forms. In the first place the presented material is connected with other *like* material. In identifying the handwriting I obviously become aware of its similarity to other specimens previously seen. The most

[1] For a full illustration of this position, see Lotze, *Metaphysic*, bk. iii. chap. iii.; H. Spencer, *Psychology*, pt. ii. chap. ii.

general name for this connecting of like with like is *Assimilation.* Assimilation or Consciousness of Resemblance is the second elementary intellectual function co-ordinate with Discrimination or Consciousness of Difference.

In the second place this integrating activity shows itself under the form of connecting a number of materials by relations of time and place. This form of integration appears in the apprehension of those relations of line to line, letter to letter, which constitute the peculiar form of the handwriting itself, and still more plainly in the conjoining of the handwriting with a particular writer. This connecting of a given material with its concomitants or belongings in time and place may be conveniently marked off as *Integration*, or, when we want to distinguish it from Assimilative Combination, as *Associative Integration.*

Each of these elements will be found more or less distinctly present in every intellectual operation. Hence we may say that the processes of intellection are resolvable into more elementary constituent activities, which may be briefly summarised under the two heads of Analysis and Synthesis (isolation and combination), or more fully under the three heads, Discrimination, Assimilation, and Associative Integration.

In order to complete this account of the work of intellection it is necessary to point out that these processes of isolation and combination depend on and are rendered possible by a peculiar power or property of mind that has been named Retentiveness. Thus in identifying the handwriting as that of a particular friend I must, it is evident, have retained the impression of the previously seen writing, as well as of the writer. Since, indeed, this person is not at the moment presented as an object to the mind, I must distinctly reproduce a past impression of him under the form of a mental *representation.*[1] This power of retention, which in its highest form appears as reproduction of past impressions or representation, is a necessary condition of all processes of intellection. More particularly it is the chief support of the work of integration.

[1] Presentation refers to what is directly presented to the mind and immediately apprehended, as when we see an object; representation is the idea or mental image which stands in place of the presentation when this is wanting, and by help of which we indirectly or mediately cognise the object.

To connect a presented material with its proper adjuncts or belongings is pre-eminently to clothe it with *represented* concomitants.

Retentiveness has been assigned a fundamental importance in the systems of some psychologists, as Beneke in Germany and Dr. Bain in this country. The latter regards it as one of the three primary attributes of intellect co-ordinate with Discrimination and Assimilation.[1] It is however to be observed that in its most comprehensive form retention is not confined to the phenomena of intellect, but underlies the processes of feeling and willing as well. Every feeling we experience, every action we carry out, bears traces of past feelings or actions, and so illustrates retentiveness. Not only so, even in its specialised intellectual form of representation it does not fill quite the same place as the primary intellectual functions. The rise of a representation in consciousness differs no doubt from the presentation of a sense-impression in that it involves a peculiar activity of mind (reproduction). At the same time such a representation is, just like a sense-impression, nothing but material for the process of intellection. Knowing or cognition only begins when the representation is attended to, and so brought into relation to other representations (or presentations). Further, this revival of past impressions takes place, as we shall see, according to certain Laws of Association, which laws will be found to be closely connected with, and indeed to govern, the processes of Assimilation and Integration.

(*b*) *Elementary Form of Feeling.* Having analysed roughly at least the process of intellection, let us examine the processes which fall under the head of Feeling. The term feeling is one of considerable ambiguity. It is first of all the name of a particular group of sensations, *viz.*, those of touch (*cf.* German, *fühlen, Gefühl*). Again, it is often used as a generic term for all varieties of mental states, and more particularly the raw materials of consciousness before they are elaborated by processes of intellection. Used in this signification it includes all sense-impressions. Lastly, in a stricter sense it is confined to those modes of consciousness which are in a peculiar sense affections of the subject, and which do not, in the same direct way as our thoughts and volitions, involve a clear reference to to objects, such as joy and sorrow.[2]

[1] See *The Senses and the Intellect*, Introduction, chap. i.

[2] On the different meanings of the term Feeling, see Hamilton, *Lectures on Metaphysics*, ii. p. 417, and following. The above mode of marking off the feelings as subjective states *par excellence* is not recognised by all. Thus, Brentano, who regards feeling under the form of love and its opposite, considers that all feeling has, like presentation, its objective aspect (*Psychologie*, i. p. 115). As we shall see by-and-by, the higher feelings or emotions, as moral approval, æsthetic admiration, have their

This last is the meaning which the psychologist attaches to the word when he erects feeling into one of the three primary phases of mind. Joy, grief, love, etc., constitute in a special manner *subjective* experiences. In many cases our feelings are unaccompanied by any distinct presentations or representations, the whole psychical process being vague or confused. This applies to many forms of fear, as dim presentiment, of self-content and discontent, and so forth. Our states of feeling lack, too, the active directive element which appears in intellection as voluntary attention or control of the thoughts. They are thus passive phenomena, and so opposed to the active processes of volition, and the semi-active processes of intellection.

Feelings are of very different grades of complexity. At the one extreme we have such simple feelings as hunger, skin-irritation, which are the mere effect of a stimulation of the nerves of sense, and at the other extreme highly composite and many-sided emotions or emotive processes, as the humane feelings, æsthetic admiration, and so forth. If now we inquire into the constant and essential element in all these states, we appear to find this in a tendency to a distinctly agreeable or disagreeable mode of consciousness. Whenever we are consciously affected, that is, experience an appreciable modification of our inner or subjective state, whether as the result of physical change or of some process of intellection, we can by reflexion discern that it is in the direction either of pleasure or agreeable consciousness, or of pain or disagreeable consciousness. When the process of feeling is fully developed and rises into distinct consciousness, it assumes the form of a realisation of our subjective state as bettered or worsened, that is, as happier or less happy. We may thus say that the elementary or root-function in feeling is sensibility to pleasure and pain.

object; but this objective reference is best regarded as appertaining to the *presentative* factor in these emotional states. It may be observed, finally, that in speaking of the feelings as subjective states we do not mean that self-consciousness is a constant concomitant of feeling, but merely that, *when reflected upon*, our feelings come in a peculiar manner to be referred to the subject as its affections or changes of condition.

That the terms pleasure and pain used in their most extended meaning cover the larger part of the phenomena of feeling seems to be allowed. There is however a question as to whether there are not some modes of mental excitation, as surprise, properly described as feeling, which are neutral or indifferent as regards pleasure and pain. This point may be conveniently postponed till we take up the special consideration of the feelings.

(*c*) *Elementary Function in Willing.* As the third primary phase of the mental life we have active impulse, which in its higher form becomes willing or conation. This aspect of consciousness is clearly marked off from each of the two others. We are in a different state of mind when we are doing something, *e.g.*, lifting a weight, copying a picture, from that in which we find ourselves when we are affected by pleasure or pain, or when we are following a train of ideas. This specific form of consciousness can only be distinguished as *active* in a special sense.[1] Whenever we do a thing or try or resolve to do a thing we are consciously active, or energising. In all planned, deliberate action, moreover, we are energising in a definite direction, *i.e.*, towards the attainment of some object of desire. In the fully-developed form of this volitional process we experience a new form of self-consciousness, *viz.*, a consciousness of ourselves as agents or as realising certain active powers.

This movement of active impulse or conscious exertion follows one of two main directions. The first of these has already been touched on in connexion with the processes of intellection, *viz.*, that of attention to the presentations and representations that arise in consciousness. This direction of active impulse is, as we shall see presently, as comprehensive as the contents of mind itself. By the voluntary fixing and concentrating of the attention we actively change, modify, and control the whole field of consciousness. More particularly it is by this channel of activity that we are able to bring definiteness into the flow of impressions and ideas, and so to render possible the specific processes of intellection. The other main direction of active impulse is seen in the initiation and general control of bodily

[1] The reader must note the double employment of the expression mental activity, now comprehensively and somewhat loosely to include all manifestations of mind, and now more strictly to mark off a distinctly active phase of mind.

movement. This is best marked off as Motor Action or Voluntary Movement.

These two directions of conation are not, however, ultimately distinct, but may be reduced to the same elementary constituents. As we shall see later on, all attention involves muscular adjustment, and the "effort" of attention is determined by this muscular element. On the other hand, a voluntary movement on its psychical or conscious side is the direction of attention to a particular kind of idea, *viz.*, a *motor* representation. We set our muscles going by fixing in consciousness certain ideas of movement. All voluntary action or conation is thus a process of attention to presentative elements, which process again receives its characteristic colouring from the psychical concomitant of muscular action. In what we call "attending" the muscular constituent is less prominent, and the intensification of some presentative element is the most striking feature of the process. In voluntary *movement*, on the other hand, as in lifting a weight or in running, the sensation accompanying the muscular process (sense of strain, of exertion, of movement) is the predominant element.[1]

§ 4. *Relation of the three Functions one to another.* Our analytic investigation of the three modes of psychical functioning, feeling, knowing, and willing, leads us to view them as primordial distinctions. We cannot reduce them to any common elementary form, nor can we resolve any one of the three processes into the others. The innermost and essential process in each variety of operation is something perfectly simple and unique. Hence we may say that knowing, feeling, and willing are the three primary functions of mind. Our explanation of mind must consequently set out with these as equally primordial functional capacities or dispositions.

(*a*) *Apparent Separateness of Action of the Functions.* A further question remains: Do these functions which we can thus logically distinguish one from another act separately and independently one of another?

At first sight this might seem to be the case. If we compare our mental states at different times we find, as already

[1] On the historical development of the present triple division of psychical function, see below, Appendix B.

hinted, marked differences in respect of the preponderance of feeling, intellection, and willing. It has been pointed out by more than one psychologist that feeling and the activities constituting intellection (discrimination, etc.) tend to exclude one another.[1] We cannot at the same moment be emotionally excited and nicely discriminative. When, for example, we are suffering from the pangs of toothache, intellectual consciousness appears to be suppressed and our mental state to be reduced to one of pure feeling. Again, in following a demonstration of Euclid, we seem to approach the state of pure passionless intellection imagined by the Greek philosophers as the ideal and divine form of existence.

If, again, we follow the course of mental development in the individual, and in sentient creatures collectively, we find apparently that certain functions come into play before others. In the infant consciousness, and in the lowest forms of animal consciousness, feeling appears to be paramount and hardly to leave any place for the processes of intellection.

(*b*) *Uniform Co-operation of Functions.* Such variations in the proportionate manifestation of the three functions must not however mislead us into supposing that they ever act singly, that is, in perfect isolation. If we closely examine an instance of what seems pure feeling or pure intellection we shall always find that the other functions are co-operating though in a less conspicuous manner. Thus a state of physical suffering is always attended by some degree of intellection, if only the reference of the pain to a part of the body, and is immediately provocative of active impulse (willing). Similarly in following a chain of reasoning the mind is always affected in some degree, agreeably or disagreeably, according as the demonstration is clear and easily followed or seems intricate and perplexing.

If, once more, we scrutinise as closely as the circumstances allow the consciousness of the infant during the first weeks of post-natal life, and of the lower animal types, we appear to detect along with a preponderance of feeling a germ of the cognitive function. The dim life of sentience, in which the bodily

[1] On the opposition between Knowing and Feeling, see Sir W. Hamilton, *Lectures on Metaphysics*, ii. 98, following.

or organic sensations preponderate, may be supposed to contain from the beginning a rudimentary process of intellection in the vague discrimination of the qualities of the sensations which succeed one another.[1]

It seems certain that in the case of human consciousness at least the three functional activities are always present *in some degree of strength,* though the *proportion* of strength varies very greatly. Thus, as will be seen more fully by-and-by, there is a close interaction between feeling and intellection. Most if not all presentations have some feeling-accompaniment or "affective tone," while it is the strength of this element of feeling which determines that maintenance and intensification of the presentation through the process of attention on which all distinct cognition depends. Intellection and willing again are closely connected. The intellectual processes involve attention, which in its higher form is volitional. On the other hand, willing or conation is always guided by a cognitive element, a representation of some object of desire and of an action fitted to realise the same. Lastly, feeling is intimately connected with willing, constituting indeed its immediate stimulus.

§ 4*a*. *Form of Triple Process in Psychosis.* If the three functions are thus found always to co-operate, we may, it is evident, say that every completed mental operation is constituted by the activities of the three functions. In other words, we may view every concrete mental state or psychosis as a "triple process," and various attempts have been made to represent the form of this compound process as one and the same in all cases. The more common form is that of the Herbartian psychologists, a presentation exciting feeling and leading to desire and so to conation. This scheme has recently been developed by Dr. James Ward. It rests on the assumption that presentation is, in a unique sense, fundamental and primordial, and that feeling and conation, if not derived from this, are at least dependent on it. That this order represents many of the processes of our more developed consciousness is indisputable. Our higher feelings are the concomitants of and are excited by intellectual elements (presentations or representations), and, as has been pointed out, feeling in many cases leads on to desire and voluntary action. Nevertheless the scheme by no means accurately represents all our concrete mental experiences. For one thing, feeling in its lower forms does not seem to follow or

[1] The priority of feeling in animal consciousness is maintained by Horwicz, *Psychologische Analysen*, theil i. abschnitt vi., and theil ii. hälfte i. The presence of a germ of intellection in the lowest types of consciousness is well argued by Schneider, *Der menschliche Wille*, kap. ix. p. 190 *seq.;* and by Ward, *Encyclopædia Britannica*, art. "Psychology," p. 40.

to depend on presentative elements. The initial phase in mental processes arising out of bodily (organic) sensations is distinctly one of feeling. A twinge of toothache or of muscular cramp is not first apprehended under its qualitative aspect, a twinge, and then felt as pain. It is this fact which gives support to those who, like Horwicz and Körner, regard bodily feeling as prior to intellect. Even in the case of the higher feelings it is not uncommon to find feeling preceding representation. This applies, for example, to sudden and disturbing sense-impressions which affect us disagreeably before they are objects of apprehension, and to worrying thoughts, *e.g.*, of some omitted duty, which give us trouble before they emerge into clear consciousness. Moreover, attention to presentations, as we shall see, appears in all cases to follow feeling, which here assumes the form of interest, and it has been pointed out that there is no process of intellection without attention. It seems to follow that the forms of combination of the three functional activities are more complicated and admit of more variation than any such simple scheme would imply. More particularly such a scheme overlooks the fact of the interaction of the elements. This interaction may be illustrated in the case of looking at any attractive object, say a pleasant or curious face. Here we have the development of a presentation under a stimulus of feeling which excites the attention, and the reciprocal action of this developed presentation on the feeling. Similarly there is an interaction between intellectual and volitional processes, and between feeling and volition.[1]

§ 5. *Nature of Psychological Classification.* The division of mind into feeling, knowing, and willing is commonly spoken of as a classification of mental states. If, however, all our concrete states are constituted by a co-operation of the three factors, it is evident that we cannot classify these by referring them to one or another of the heads. Thus, if an emotion always contains intellectual elements, we cannot refer it to the head of feeling as if it were a feeling pure and simple. The ordering or arranging of psychical phenomena differs from that of material things, such as minerals or plants, which are thought of as detached objects, and are logically grouped in particular classes because of a number of important and decisive similarities.

[1] The common Herbartian view of the dependence of feeling on presentation and of conation on feeling may be studied in Lotze. (See *Microcosmus*, bk. ii. chap. ii.) *Cf.* Wundt, *Physiol. Psych.* i. p. 541, etc. Ward has introduced more complication by his double act of attention, without however materially altering the order of dependence of the three elements. (See *Encyclopædia Britannica*, art. "Psychology," pp. 40-44.) That this order of dependence is not obviously apparent in all cases may be seen by the form of the triple process put forth by the late G. H. Lewes, *viz.*, Sensible Affection (which includes pleasure and pain), logical grouping (intellection), and motor impulse (volition). (*Problems of Life and Mind*, third series, vol. ii. p. 240 and following.) *Cf.* on this same subject Bain, *Mind*, xiv. p. 101 ff.

In other words, psychological classification is not what logicians call a natural classification.

In speaking of a phenomenon of feeling or of intellection it must always be understood that we are resorting to the logical artifice of abstraction, and singling out for special consideration some particular factor or aspect of a concrete mental state. And theoretically every concrete state can be considered thrice by a reference to each of its three factors. At the same time, as already hinted, there are broad differences among our concrete mental experiences answering to these distinctions. Thus there are mental operations, such as following a train of thought or reasoning, where the intellectual factor is so much more important than the emotional that we can disregard this last without appreciable error. And the same is true of states of mind which we should all describe as feelings or emotions, or as volitions. Hence the psychologist is able to consider apart and trace the separate development of what we distinguish as the life of thought, of feeling, and of action. And no harm comes from this so long as it is remembered that we are abstracting, *i.e.*, viewing an element apart from other conjoined elements, and that we must supply the omitted reference to other co-operant factors when we come on to specially consider these.

The objection recently taken by Ward and others against the use of the word classification in psychology is perhaps not quite so convincing as it looks. It seems to be forgotten that any separating out of a concrete psychical state or psychosis is an arbitrary proceeding. Our conscious life is a continuous flow of changes, and it is impossible to divide this off into sections or slices and call these complete mental operations. This being so, it is only a step slightly more arbitrary at the worst to make our sections still smaller and distinguish between *successive moments* of feeling, intellection, and conation (as Ward himself indeed does), and make these our psychological units instead of the supposed 'concrete states' which are compounded out of these.[1]

§ 5*a*. *Theory of Mental Faculties.* The attempt to reach elementary functions of mind and to exhibit all concrete mental operations as compounded of these is comparatively recent. The tendency of psychologists has been to separate as sharply as possible different modes of operation by referring them to distinct *faculties*. Thus will was viewed as a faculty distinct from intellect; and within the domain of intelligence, observation a faculty distinct from imagination, this distinct from judgment, and so forth. The extreme form of the faculty-theory was

[1] On this point see article "Psychology," *Encyclopædia Britannica*, p. 44, and *Mind*, vol. xiii. p. 80.

a view of mind as made up of a number of separate powers, each of which carried on its operations with supreme indifference to all the rest, and as having no more organic unity than a number of sticks fastened together in a bundle. The faculty-hypothesis was severely criticised by Herbart, who endeavoured not only to reduce all intellectual operations to one simple type, representation (Vorstellung),[1] but to make this the fundamental form of mental activity and to regard feeling and conation as based upon, if not indeed derivable from, the Vorstellung and its laws. The tendency of psychologists to erect abstract distinctions into separate existences has received a blow in this country also from the Associationists from Hartley downwards. For, by regarding all forms of cognition as the product of association working on sense-elements, and by showing the operation of the same laws of association in the domain of feeling and of volition, they have brought prominently into view the identity of texture of all parts of our mental life. The precise relation of faculty to function has been well illustrated by G. H. Lewes. (*Study of Psychology*, p. 27 and following.) According to him faculty is the special modification of a (native) function, which modification is brought about by education.[2]

§ 6. *Psychical and Physiological Functions.* Thus far we have sought to distinguish between the elementary psychical functions by a process of purely subjective analysis, and without reference to their physiological accompaniments. But if there is a general correlation between psychical and certain physiological phenomena, we may expect it to show itself in respect of these distinctions of function. That is to say, to the tripartite division of psychical function we may expect to find corresponding a tripartite distinction of nervous function.

Now, as was pointed out above, the functions of the nervous system are broadly divisible into two, sensory and motor. And this bipartite division appears to apply to all the cerebral processes. Moreover, every nervous process may be viewed as compounded of these as its factors. The simplest type of nerve-process (the reflex action) is a sensory stimulation followed by a motor discharge (see above, p. 46); and this form appears to be the common one in the case of the highest cerebral actions.[3]

[1] The reader must remember that the German psychologists do not distinguish presentations and representations as we do, but include both under the term Vorstellung.

[2] On the defects of the Faculty-theory, see Lotze, *Microcosmus*, book ii. chap. ii.; *cf.* Stout's exposition of Herbart's view in *Mind*, vol. xiv. p. 322; and Wundt, *Physiol. Psychol.* Einleitung, 2.

[3] It has recently been shown that every process of thought is attended by a slight motor discharge. See a remarkable paper by Dr. Ch. Féré on "Sensation and Movement" in *Brain*, July, 1885.

It is thus evident that the physiological division of cerebral function does not correspond with the psychological division of psychical function. It would roughly answer to the old bipartite division of mind into a cognitive and a conative factor. The tripartite division is thus in a peculiar manner the outcome of subjective analysis, unaided by objective (physiological) considerations.

While we are thus unable to make out a close correspondence between psychological and physiological distinctions of function, we may with some degree of precision determine the nervous concomitants of the three psychical factors.

Intellection evidently involves the sensory side of the system, *viz.*, the peripheral organs of sense, by which are received the impressions that supply the material for thought. The processes of elaborating this material into thought further involve as their physiological basis that network of nervous connexions which we find in the higher centres of the brain. It must be added that a subordinate motor element is also involved in these processes of intellection, *viz.*, in the accompaniments of the act of attention.

Feeling, again, involves the sensory side of the nervous system, since it is through sensory nerves that the simplest modes of pleasure and pain are excited. In addition to this feeling engages the motor organs. The peculiar physiological concomitant of feeling is indeed a widely-diffused discharge from the centres on the voluntary muscles and on the internal organs of circulation, respiration, etc. Violent contraction or extreme laxity of the muscles, changes in temperature, in the action of the heart, and so forth, are the known attendants of strong emotion, and contribute, as we shall see, an important characteristic colouring to our emotional states.

Lastly, Willing or Conation involves a restricted or selected motor discharge or system of discharges. In carrying out a voluntary action certain movements have to be carefully co-ordinated, and other movements inhibited. Such a result can only be brought about by the excitation of a definite group of motor centres, and this again takes place as the consequent of a co-ordination between certain sensory regions and the particular motor regions concerned.

The attempt to connect definitely the results of psychological and physiological function was made by G. H. Lewes. (*Problems*, third series, ii., prob. iii. chap. ii.) His analysis of the psychical process into three factors, sensation, grouping, and motor action, was obviously reached by help of physiological considerations; for sensation corresponds to the afferent apparatus, logical grouping to central nervous connexions, and motor action to the motor organs. This division is, however, open to the objection that it confuses elements of feeling and of intellection under the first factor (sensation or sensible affection). A like objection applies to the attempt of Horwicz to base psychological on physiological division by returning to the bipartite conception of mind as compounded of thought and desire. (See *Psychol. Analysen*, theil i. sect. 24.)

It may be added that pathological observations bear out the supposition that the physiological correlatives of feeling, thought, and volition, though not identical, overlap, so to speak. While the pathologist may distinguish forms of mental disturbance that have their primary source in a perversion of feeling (*e.g.*, of the organic sensations), or of the intellectual functions (*e.g.*, of the perceptive powers as shown in liability to hallucination), he tells us that there is no such thing as an isolated disturbance of any one of the three functions.[1]

The above analysis of mind into a number of co-ordinate functional activities is a "geographical" as distinguished from a "geological" view of mental action. The geological view considers mind in its process of development, and distinguishes between lower and higher forms of psychosis corresponding to different stages of this development, as Sensation, Imagination, and Thought. These distinctions have, as we have seen, been erected into fundamental ones in certain systems of psychological classification. But, as will be shown presently, they are *secondary* differences, explicable by means of the fundamental distinctions here considered.[2]

§ 7. *Strata or Grades of Consciousness: Attention.* No analysis of the constituents of mind can overlook the fact that they present themselves in different degrees of distinctness or perfection. Our thoughts, our actions, take on according to circumstances more or less of the conscious attribute. Thus we have distinct or clearly-conscious ideas and ideas which are indistinct and but imperfectly grasped.

We may say then that there are different levels or heights of mental life, according to the degree of consciousness involved. And this way of dividing mind may be regarded as supplementary to that qualitative division into dissimilar kinds of activity or function just dealt with. The lowest level of mental life properly so called is that of indistinct consciousness.

[1] This is well contended in the case of the feelings and the cognitions by Mr. Mercier, *The Nervous System and Mind*, p. 228.

[2] This division according to height seems to do duty for a division according to breadth in the psychological scheme of Dr. Thos. Brown, who divides mind into External Affections (sensations) and Internal Affections (intellectual and emotional states). *Cf.* below, Appendix B.

This includes all that mass of vague sensation, thought, impulse, and feeling which forms the dim background of our clear mental life. Thus, for the most part, the sensations which accompany the organic processes, as digestion, respiration, and circulation, remain below the level of distinct consciousness. We are at almost every moment aware of the presence of vague feelings and thoughts, some of which may afterwards emerge into the full light of consciousness. This region may be marked off as that of the sub-conscious.

The distinguishing factor in all clearly conscious states of mind is the fixing and rendering definite of a particular mental content by an active direction of the attention. Thus I only have a clear and distinct perception of an object present to sight, or a well-defined bodily feeling, when I make this in a manner the object of attention. The act of attending is thus one main condition of vivid and clear consciousness. We have, then, two broadly-marked-off divisions of our mental life, the region of vague consciousness or the sub-conscious, and the region of clear consciousness or of attentive consciousness.

§ 7*a*. *Unconscious Psychical Processes.* The relations of consciousness to the sub-conscious have given rise to much discussion. According to some writers there is a region of the unconscious, that is to say, of psychical processes which do not enter into our conscious life in any measure. This region is apt to be identified by physiologists with those nervous processes which have no distinct psychical concomitant. From a psychological point of view however, as was remarked above, a nervous process merely as such does not come within the view of the psychologist at all. It is only as it has some rudiment of sensation or other properly psychical phenomenon attending it that it concerns the student of mind. Now it is presumable that there are psychical equivalents of many nervous processes connected with the lower regions of life (vegetative functions) which never, or only under exceptional circumstances, distinctly emerge into consciousness. At the same time they enter into and colour our mental life taken in its widest extent. Thus, as we shall see, the so-called organic sensations, to which we hardly ever distinctly attend, are the main constituent in what we call tone of mind or 'spirits'.

Others, like Sir W. Hamilton, urge from a strictly psychological point of view that we must postulate "unconscious mental modifications," *i.e.*, unconscious sensations, thoughts, and so forth, in order to account for the phenomena of distinct consciousness. Thus they say we cannot explain the revival of a sense-presentation, *e.g.*, a colour, under the form of an image without assuming the continued existence of the presentation as an unconscious mental state or content during the interval between its original occurrence and its revival. Such a supposition would doubtless aid us in explaining, by help of properly psychical processes, obscure facts of our mental life. But it is open to the grave objection that the idea of a *mental* phenomenon, having no relation to our conscious life, is self-contradictory. This difficulty seems overcome in a measure by saying that all psychical phenomena lying beyond the confines of clear consciousness are constituents of the sub-conscious region of our mental life. As such they already exist as raw material for mind, and are susceptible by a special direction of attention of being brought into the texture of our distinctly-conscious life.[1]

§ 7*b*. *Consciousness and Self-Consciousness.* Consciousness is a troublesome word in psychology, and but for the need of a term to mark off the more vivid and distinct region of our mental life might well be dropped altogether. Among other drawbacks it is apt to be confused (*e.g.*, by Hamilton) with self-consciousness. Now it is no doubt true that all our feelings, thoughts, and actions are affections or states of ourselves, and can under certain conditions be recognised as such. But it is not necessary that when thinking, acting, or feeling one should reflect on the fact that it is I or the Ego that does so. This reflective or introspective consciousness is a secondary and more complex variety of consciousness, involving an idea of self. Hence it does not appear distinctly in early life, and it holds but a very subordinate place in the mental life of many adults. We can only understand this variety of consciousness after we have traced the growth of the idea of self. According to our present view we may have clear consciousness without self-consciousness, as when, for example, a scientific man directs intellectual activity outwards in observing some physical process. Such a person is intensely conscious, that is, his mind is preternaturally active, and yet he may for the moment be wholly oblivious of self.

Consciousness, as the etymology of the word suggests, popularly refers *par excellence* to intellectual activity. To say I am conscious is another way of saying I am aware, or I know. Now such intellectual activity (as Hamilton has shown) enters into all those fully-elaborated processes of the human mind which involve the idea of self. Thus when we feel pain or will to do a thing we commonly have a more or less distinct intellectual awareness of the fact. But it is undesirable to confine the term consciousness to this complex and mature form. A pain so intense as to exclude all intellectual activity is still consciousness for the psychologist. The blind instinctive impulse that agitates a bird at the time of migration may contain no rudiment of *reflective* consciousness; yet it is a fact of consciousness. In the evolution of consciousness, as we shall see, all varieties of mental state tend to be reflected on, related one to another, and referred to a central meeting point or self. But we must not take this elaborated and intellectualised form of consciousness for consciousness in all its forms, crude as well as mature.

§ 7*c*. *Function of Attention.* It is evident from what has been said that Attention plays an important part in the economy of our mental life. The precise nature of its action, and of the mechanism by which it directs the mental processes, will

[1] On the difficult question of the unconscious, see Sir W. Hamilton, *Lectures on Metaphysics*, vol. i. lect. xviii. (*cf.* J. S. Mill, *Examination of Sir W. Hamilton's Philosophy*, chap. xv.); G. H. Lewes, *Physical Basis of Mind*, prob. iii. chap. iv.; W. James, *Principles of Psychology*, i. p. 162 ff.; Wundt, *Physiol. Psychologie*, vol. ii. 4er abschnitt, 15er cap. 1, 2; Brentano, *Psychologie*, 2es buch, 2er cap.

appear more plainly later on. It will be enough at this stage to briefly indicate its general function.

In the first place, then, the process of attention adds something to each variety of psychical phenomenon which it embraces. In the case of the presentations and representations which make up so large a part of the contents of our mind it secures increase of vividness and of definition or distinctness. In listening to a sound I secure a more forcible and more distinct impression. Hence, as we shall see presently, attention stands in a peculiarly close relation to the intellectual processes. It is by attending to the presentations which arise that we are able to "relate" them for purposes of knowledge.

At the same time, special directions of attention serve to reinforce the feelings and the active impulses. We can intensify a pain or a pleasure by attending to it as such. The directions of attention thus serve to modify and to determine our affective states. By refusing to attend to a bodily pain of slight intensity we may practically put an end to it. In volition, as already pointed out, attention is a main conditioning factor. In all new and unfamiliar actions, as we can see in watching children learning to execute movements, attention is deeply engaged.

According to Dr. Ward attention acts directly on the intellectual material of presentation, and the effect of attention on feeling is an indirect result of the intensification of the presentative element. This seems an exaggeration of the fact. No doubt most if not all feeling occurs along with some presentative element, and in attending to the feeling we necessarily embrace this also to some extent. But what we commonly call attending to our feelings differs from that mere attention to presentation for its own sake which subserves cognition. In the case of bodily feeling indeed, *e.g.*, the pain of indigestion, it would often be difficult to say that attention is directed to any presentative element. And even in the case of the higher feelings the attention which intensifies feeling differs from the attention which furthers cognition. To listen to a musical sound so as to note its pitch, etc., and to listen to it solely for the sake of enjoying it, illustrate two different directions of the attention.

In the second place, the regulative function of attention serves to bring about a simplification and orderly arrangement of our mental life. The process of attention is selective, and helps to give prominence at the moment to some particular mental content. In this way, as will appear more plainly by-and-by, the successive movements of attention, so far as they enter into our psychical processes, tend to reduce the multiplicity of sensuous and other elements which present themselves to a single thread of connected events which we can afterwards more or less completely retrace, and by retracing which we develop that highest form of consciousness marked off as self-consciousness.

While, however, we thus at the outset assign so unique a place and so prominent a function to attention, we have to admit that in all its more energetic degrees it is but an occasional ingredient of consciousness. Not only does the region of organic life but rarely become the object of such close attention; the higher plane of conscious life, including sensation, voluntary movement, and the intellectual processes, involves less and less of the concentrative element as these processes recur and grow familiar. In other words, though attention is an essential ingredient in all acquisitive stages, where new impressions have to be assimilated, new movements to be mastered, new relations of ideas to be distinctly apprehended, it can be dispensed with in proportion as the psychical process grows habitual by repetition. In this case the nervous mechanism with which our mental life is correlated comes into new prominence. Actions which involved concentrated consciousness at first, when the appropriate nervous connexions were imperfectly established, may lapse out of clear consciousness altogether when these nervous connexions are complete.

§ 7*d*. *Biological View of Attention*. If, as the biologist would say, all psychical processes are a part of the adjustive action of organism to environment in which life consists, we may regard the specialised form of consciousness that we call attention as a necessary condition in all the earlier and more difficult stages of this adjustment. The less familiar, the less customary, the action to be performed, the closer the attention required. As the adjustment advances, through repeated performance of the new action, this last grows smoother, easier, and more rapid, involving less and less of conscious effort, till at last it may become, as in the case of walking and other habitual actions, almost completely mechanical and unconscious. That is to say, the nervous system has more completely adjusted itself to the new demand of the environment by the formation of firmly-established co-ordinations or connexions among the several central elements involved.

By this arrangement it is evident nervous force is economised. The highest nerve-centres which are presumably energetically at work in cases of concentrated attention are able to cast off, so to speak, work in the degree in which it grows customary, so as to be free to engage in new tasks.

This biological view of the function of attention suggests that our internal life is bound up with mental progress or development. It is only as we acquire new experiences, knowledge, and powers that our mental activity is kept at full tension. Accordingly when life becomes wholly or almost wholly a thing of routine, as in the case of the uneducated and still more of the old, it necessarily grows less conscious. It follows further that those who to special readiness in mastering and reducing by practice to a customary semi-conscious form add an abundant interest in new acquisitions (as Goethe) will have the richest conscious experience. By rapidity and perfection of adjustment they liberate more power for new adjustments, and their rich and varied interests continually prompt them to such new adjustments.[1]

REFERENCES FOR READING.

On the Analysis or Division of Mind and its Constituent Functions, see Hamilton, *Lectures*, i. lect. xi.; Bain, *The Senses and the Intellect*, Introduction; Ward, art. "Psychology," *Encyclop. Britann.* p. 39 ff.; Lotze, *Microcosmus*, i. book ii. ch. ii.; Höffding, *Psychology*, iv. The common tripartite division of psychical function is dealt with historically and critically by Drobisch, *Empirische Psychologie*, 5er abschnitt ii.; Brentano, *Psychologie*, 5er cap.; Wundt, *Physiol. Psychologie*, Einleitung, 2.

[1] *Cf.* what was said above, p. 56 f. The fact here insisted on, that distinct consciousness occurs only as the concomitant of incomplete, that is, not fully-organised nervous adjustments, suggests a teleological view of the function of consciousness as a factor in the life of the organism. According to this view, consciousness, with its discriminative and selective element, comes in as a modifying force in the chain of nervous processes where new lines of adjustive action have to be struck out. This question, however, necessarily raises the whole problem of the causal relation of psychical to nervous action, a problem that can only be profitably taken up later on. (See W. James, *op. cit.*, i. p. 138 ff.)

CHAPTER V.

PRIMITIVE PSYCHICAL ELEMENTS.

§ 1. *Elements, Processes, Products.* In the preceding chapter we have distinguished between the ultimate constituents of Mind. These affective, intellective, and conative factors indicate different phases of the mental life and different directions of mental development. We have now to trace the development of each constituent, so far as this is possible, apart from the others, from its most rudimentary to its mature form.

This exposition of the threefold movement of development will necessarily begin with an account of the elements, or those simplest psychical phenomena with which the mental life of the individual begins. These are to be found, as already observed, in sensations and other simple phenomena closely conjoined with these. In the present chapter we shall be concerned with these. In a succeeding chapter we shall inquire into the processes by which these elements are combined into higher and more complex forms. At the outset we shall be concerned more especially with the processes of intellective elaboration already referred to. The development of feeling and of conation will be more readily understood when once the process of intellectual elaboration is mastered.

When we have thus grasped the elements with which we set out, and the processes of elaboration which they undergo, we shall be in a position to follow out the stages of production in the case of intellect, feeling, and conation. The working out of this part of the subject will fall into three distinct divisions.

This distinction of element, process of formation, and product which has grown common in recent works must be regarded as an artifice necessary for orderly exposition, but not corresponding to any real distinctions in our mental life. We know nothing of psychical elements which are not constituents of a process. A sensation, as ordinarily understood, *e.g.*, a sensation of pressure, or of heat, is, strictly speaking, the result of a process of formation. Again what by an artificial abstraction we mark off as a product, *e.g.*, an idea, is nothing but a completed process. Element, law of combination, product, are thus only three distinguishable factors or features in one and the same psychical event or process.

(A) SENSATIONS.

§ 2. *Definition of Sensation.* The term Sensation, as commonly used, has a certain ambiguity. In every-day language we apply the name to those simple mental affections which are connected with variations of bodily state, as sensations of cold, of hunger, of cramp. We hardly describe the mental effect of light, sound, and so forth, as sensations. Psychologists have long since extended the denotation of the term so as to include all the simple psychical phenomena arising immediately out of the action of the senses.

A sensation, being an elementary mental phenomenon, cannot be defined by being resolved into anything more simple. Its meaning can only be indicated by a reference to the nervous processes on which it is known to depend. Accordingly, a sensation may in a manner be defined as a simple psychical phenomenon resulting from the stimulation of the peripheral extremity of an afferent nerve when this is propagated to the brain (psychical centre or 'seat of consciousness'). Thus the stimulation of a point of the skin by pressure, or of the retina of the eye by light, gives rise to a sensation.

The more important of our sensations, these of the five senses, are produced by the action of some external agent, as pressure or light, on the end-organ. But it is not desirable to refer to this in our definition. In the case of many of our "organic" sensations, those due to changes in the vital processes, as hunger, thirst, there is no such external agent at work. The same applies to the "subjective sensations" of the special senses which, in abnormal circumstances arise from a process of *internal* stimulation, *e.g.*, the action of the congested capillaries of the retina on the optic nerve. The case of the so-called "muscular sensations" to be considered presently offers special difficulties to a comprehensive definition of sensation.

As already pointed out, a pure elementary sensation according to this definition is, so far as we know, non-existent, and is only postulated as a necessary starting-point. What seems a pure sensation to us in mature life when we begin to study it is really complicated by residua of past sensations, the result of rudimentary processes of assimilation and integration. Even if we could divest sensation of this representative element we should have the difficulty to be spoken of presently, that sensations which seem to introspection perfectly simple are known in many cases to be complex, the result of a coalescence of sensation-units.

This reference of sensations to their physiological antecedents and conditions enables us to deal with them at the outset. Although a distinct and vivid sensation, *e.g.*, of a musical sound, is, as we shall see, determined in part by a simple mode of central reaction, it is primarily conditioned by the peripheral process of stimulation, and may be studied with advantage at the beginning under this aspect.

§ 3. *Sensation and Sensibility.* Another term correlative with Sensation must be referred to here, *viz.*, Sensibility. This is the abstract term corresponding to the more concrete name sensation, and properly signifies the capacity of experiencing or being affected by sensations. It is to be noted that sensibility, like sensation, refers to the conscious effect, and not to the physiological process. It is true that we are wont to attribute sensibility to the portion of the organism in which the process of stimulation is set up, as the hand. But this is due to that unalterable habit of projecting and localising our sensations, the origin of which will be dealt with by-and-by. Strictly speaking, sensibility is not a property of the skin, or of the nerve, but of the mind, though of course the co-operation of these physiological structures is necessary to the maintenance of this sensibility.

We here come across a difficulty that meets us all through in dealing with the simpler psychical phenomena, *viz.*, that of distinguishing the psychical from the closely-involved physical process. The same word often refers ambiguously to each. Thus, sense-impression means now the *physical* action going on in the retina when stimulated by light, now the *mental* result or sensation proper. Similarly the term movement means now the physical process, now the psychical accompaniment of this.

§ 4. *Presentative and Affective Element in Sensation.* If we examine our sensations we may, in most cases at least, easily distinguish two elements or aspects which clearly contrast one with another. Thus a sensation of taste, say that of a pear, has a particular character (or characters) by means of which we come to know what this sensation stands for, *viz.*, the pear. This element may be called the intellectual element since it subserves cognition, or the presentative element inasmuch as it enters into the "presentations of sense" or sense-perceptions to be explained hereafter. But the flavour of a pear has a second and distinct aspect, *viz.*, a pleasantness or agreeable-ness, in consequence of which it is liked, prolonged, and desired. This is a properly affective element, and may be marked off as sense-feeling, that is to say, that elementary phase of feeling which is immediately involved in sensation. As we shall see presently, the relative proportion of these two elements varies greatly in the case of different classes of sensation.

Here, again, the need of clear verbal distinctions is greatly felt in psychology. The same term sensation has been commonly used to include the element of feeling as well as of presentation; and by some writers it has been used (as in common life) with a special reference to the affective aspect. By denoting this last by the special term sense-feeling we may use "sensation" to indicate the presentative side, or when we want to be more precise may mark this off as the presentative element.[1]

§ 5. *General or Common Sensation: Organic Sense.* All parts of the organism supplied by sensory fibres from the cerebro-spinal system give rise to sensations. These fall into two main classes: Common or General Sensation, and Special Sensation. The former involve no special structure (end-organ) at the peripheral termination of the nerve-fibres, the latter do involve such a structure. The common sensations together make up what has been variously called the organic or the systemic sense.

Common sensation includes certain sensations which result from changes in the skin and the outer region of the body generally, including the special organs as the eye and the muscles, and also other sensations connected with the internal vital organs. The former include such sensations as those of tickling, tingling, shivering, certain muscular sensations, as cramp, and the painful sensations resulting from severe pressure and laceration of tissue.[2] The organic skin sensations have to be carefully distinguished from the sensations of touch proper. The internal sensations are those which accompany special conditions, and particularly all disturbances, of the vital functions, as respiration, circulation, digestion. In this way arise such familiar sensations as tight-breathing, hunger, indigestion, local inflammation and heat, etc.

[1] A like ambiguity is noticed in the abstract terms sensibility and sensitiveness which are used with reference to the presentative element and also to the element of feeling. On the different meanings of the term sensation, see Hamilton's Edition of Reid's Works, Note D. *Cf.* also J. Ward, article "Psychology" (*Encycl. Brit.*), p. 41, col. 2.

[2] It is not certain whether the sensations of muscular fatigue should be included under organic sensations, or whether they belong to the class of *special* muscular sensations to be spoken of presently.

These common sensations are apt to blend in a mass, so that it is exceedingly difficult by analysis to single them out for careful observation. So far as this is possible we find that they have very little of a definite presentative aspect. They exhibit no distinct qualitative differences such as we find among the sensations of the special senses. They have much more of the affective than of the presentative aspect, so that we are apt to speak of them as pains, *e.g.*, of indigestion, of cramp. So far as we are able to define them it is through differences in the range or extent of nervous element involved, changes of intensity from moment to moment, and localisation or assignment of a particular local seat. In this way we speak of pricking, stabbing, shooting, deep and pervading sensations, and so forth. Organic sensations of the skin are, for reasons which will appear later, better localisable than those arising from internal changes.[1]

Owing to their lack of distinct presentative character and to the fact that they are not the direct effects of the action of external objects but involve a change of condition of the part affected, the common or organic sensations give us no knowledge of the external world. They can no doubt inform us to some extent of the condition of the organism itself, and hence they have been described as the "barometer of our life-process". Yet even this they do, with any degree of exactness, only when we are able to definitely localise them, that is, refer them to a particular locality in the body. Hence these sensations will occupy us more fully by-and-by when we take up the affective side of sensation.[2]

[1] Some of the organic sensations are far more circumscribed than others. Those of heat and cold are widely diffused, involving probably the whole of the skin. Muscular fatigue again, though originating in the over-work of particular muscles, is apt to become diffused. Such diffusion of sensation may be viewed as an illustration of the process of irradiation spoken of above.

[2] Common sensation was only gradually distinguished from the sensations of the special senses, and more particularly those of touch, with which, as we shall see, it is very apt to be confused. This common sensation has been variously distinguished as cænæsthesis, or *sensus communis*, the vital-sense, and more recently the organic or systemic sense. See, on the historical development of the distinction, Sir W. Hamilton's *Lectures on Metaphysics*, i. lect. xxvii. For recent accounts of organic sensation, see Bain, *The Senses and the Intellect*, p. 102 ff.; Horwicz, *Vierteljahrschrift für wissen. Phil.* iv. 3; and Beaunis, *Les Sensations internes*.

§ 6. *Specialised Sensibility: Special Senses.* The specialised varieties of sensations arising through the stimulation of the eye, the ear, and so on, are marked off one from another by great definiteness of presentative character. This peculiarity, as already pointed out, is connected with the fact that each sense has its own specially modified structure or organ, as the eye or the ear, which structure is peculiarly adapted to the action of a particular variety of stimulus (light-vibrations, air-waves, etc.). Owing to this definiteness of character the special sensations are much more susceptible of being discriminated, assimilated and integrated than the organic sensations. Moreover, these sensations are (in ordinary cases) brought about by the action of *external* agents or objects lying outside the organism, for which reason they are often spoken of as sense-impressions or impressions of sense. Hence they are fitted to yield us knowledge of the external world. It is the special senses which will chiefly occupy us in tracing the development of intelligence.

The term sense, in its complete meaning as special sense, refers to a particular aggregate of psychical experience qualitatively marked off from other aggregates, as the sensations of sight or of hearing. This aggregate of experience is connected with a specially-differentiated structure known as the sense-organ, as the eye, the ear, and its connected nerve-tract. Hence it is convenient to define a sense by a reference to this physical groundwork. Thus we may say that a sense is the aggregate of simple mental states arising by way of the stimulation of some particular sense-organ. In doing so, however, we must be careful not to fall into 'a circle in defining' by going on to define a sense-organ in its turn by a reference to the group of sensations of which it is the groundwork. This may be avoided by giving a purely physical definition of sense-organ. For example, we might define it thus: A sense-organ is a structure or group of structures consisting of the peripheral termination (end-organ) of a sensory nerve, together with this nerve itself and its central attachments (nerve-tract), the whole of which has been physiologically specialised or differentiated from other structures so as to react on a particular variety of stimulus, as light.[1]

The special senses are the well-known five, sight, hearing, touch, smell and taste. They each involve a special mode of sensibility, and a particular kind of 'end-organ' or terminal structure, fitted to be acted on by a certain kind of stimulus.

[1] On the gradual differentiation or specialisation of the special sense-organs in the scale of animal beings, see Wundt, *Physiol. Psych.* cap. vii. § 3. *Cf.* what was said above on the specific energy of nerves, p. 43 f.

The only apparent exception to this is touch. This, as sensibility to mechanical pressure, is very closely related to common sensibility. Indeed, touch has been called the fundamental sense out of which the other and special senses are developed.[1] But what we distinguish as touch proper involves a highly specialised variety of sensation which is exclusively related to certain portions of the skin, as the lips and the finger-tips, where certain modifications of nervous structure are found to exist. Hence we may speak of a special sense and a special organ of touch.

§ 7. *Distinguishable Aspects or Characters of Sensation.* The importance of the special senses depends, as we have seen, on their possessing certain presentative aspects or well-defined characters, whereby they are fitted to be signs of qualities in external objects, as well as of the changes which take place in these. The sum-total of our knowledge of things is limited by the number of distinguishable characters among our sensations. We will first enquire into these distinguishable characters generally, and then briefly indicate their varying importance in the case of the different senses.

§ 8. *Intensity.* One obvious difference of character among our sensations is that of intensity. The difference between a bright and a dull light, a loud and a soft sound, is appreciated through what we call a difference of intensity in the respective sensations. The subjective differences correspond to objective differences in the strength of the stimuli. If, as the physicist tells us, every form of stimulation, whether ether or air vibrations, or mechanical pressure, is a variety of movement, we may say that the intensity of a sensation is specially correlated with the breadth or amplitude of movement in the stimulus. This amplitude of movement may possibly modify in a corresponding manner those molecular vibrations in which nervous action is supposed to consist; but, as pointed out above, we know too little of the nature of this nervous action to determine the point.

[1] See Sir W. Hamilton's *Lectures on Metaphysics*, vol. ii. lect. xxvii. ; and H. Spencer's *Principles of Psychology*, vol. i. part iii. chap. iv. ; J. Ward, however, tracing the process of sense-differentiation in the individual and the race, thinks the organic sense, rather than touch, should be regarded as the fundamental one (Article "Psychology," p. 50, col. 2).

All classes of sensation, including the organic, exhibit differences of intensity. Those of the special senses exhibit them in greater number or finer gradation than other sensations. We cannot distinguish two shades of hunger as nicely as we can distinguish two degrees of intensity in the sensations of light and of sound. Such minute differences are intellectually important as a clue to the precise nature or structure of bodies, the degree of force exerted by them, their exact distance from us, and so forth. Thus a sensation of light of given intensity indicates (according to circumstances) a particular degree of brightness in an object (*e.g.*, a flame, a mass of snow), or its degree of proximity to the eye.

It is natural to ask whether these differences can be exactly estimated. Such a quantitative measurement of sensational intensity would, it is evident, serve to give to psychology something of that quantitative exactness which Kant and others have desiderated. Of late an attempt has been made to do this. This has been by noting the correlations between intensity of sensation and strength or intensity of stimulus.

§ 8*a*. *Relation of Intensity to Strength of Stimulus.* As the student is no doubt aware, the physicist has special apparatus by which the exact quantity of certain at least of the stimuli of our senses, *e.g.*, luminous rays, can be estimated and varied. By help of such apparatus it has been found possible to apply a graduated series of stimuli to a sense-organ, and to note the precise effect of successive increments of the stimulus on the resulting sensations. These researches belong to the department of psycho-physics, a new and somewhat intricate branch of psychology requiring special study. Here it will be enough to indicate some of the more important of its results.

Every stimulus must reach a certain intensity before any appreciable sensation results. This point is known as the threshold or liminal intensity of sensation.[1]

The situation of this point determines what has been called the *Absolute Sensibility* of an organ or part of an organ. Thus if two portions of the skin, A and B, differ in respect of their sensibility to pressure in such a way that a slighter force of

[1] It is sometimes spoken of as the threshold of consciousness, it being supposed that below this point there is an 'unconscious' sensation.

impact (mechanical pressure) causes a sensation in the case of A than in that of B, we say that A has greater absolute sensibility than B.

When the threshold is passed an increase of the stimulus does not always cause an increase in the intensity of the sensation. A very slight increase (increment) may produce no appreciable effect. It is further found that the amount of increase of stimulus required to produce an appreciable difference in the sensation varies with the *absolute* intensity of the stimulus. Thus a very slight addition to a light-stimulus which would be sufficient to produce an increase of intensity in the case of a feeble sensation would produce no effect in that of a powerful one. Thus, let us suppose s and $5s$ to represent two stimuli of unequal intensity, and i a small increase. Then though the sensations produced by s and $s + i$ would be felt to differ the sensations produced by $5s$ and $5s + i$ might remain indistinguishable. The greater the intensity of the stimulus already at work the greater must be the increase of stimulus in order that a perceptible difference in the resulting sensation may arise. It is found that (within certain limits in the median region of the intensity scale) the required increment is directly proportionate to the intensity of the stimulus. Thus, whatever the value of s, in order to produce an increase in the intensity of the sensation, s must be increased by ks, where k stands for some constant fraction, as $\frac{1}{10}$.

These results may be expressed as follows: In order that the intensity of a sensation may increase in arithmetical progression, the stimulus must increase in a geometrical progression.[1] This is known as Weber's or Fechner's Law. The law has been found to hold good only within certain limits. It is much more clearly illustrated in the case of certain sensations, *e.g.*, those of light, than in that of other classes. Moreover, it is found that towards the higher and the lower extreme of the scale considerable deviations occur.

The famous generalisation of Weber, amplified and further tested by Fechner under the title of the Psycho-physical Law, has been since subjected to considerable discussion in the light of newer experimental researches. The result of these has been, on the one hand, to upset the claims of the Law to be a perfectly exact and

[1] This fraction differs considerably for different sense-organs.

universally valid principle, and, on the other hand, to establish the induction as *approximately* true within certain limits of intensity, the deviations at the two extremes being accounted for by special physiological circumstances.

In addition to testing the validity of the principle, much discussion has been devoted to the interpretation of it. Fechner himself, as the name "psycho-physical" shows, gave it a psychological significance. That is, he supposed the nervous process to be simply proportional to the stimulus, so that the law formulates the relation of the former to the sensation. Wundt follows the same line, and seeks to bring the phenomenon under the psychological law of Relativity, *i.e.*, that our sensibility is of differences, not of absolutes. On the other hand, most recent writers on the subject adopt the alternative view that the law expresses a *physiological* relation, that is to say, that the need of greater increase of stimulus as the intensity rises in order to effect an appreciable change in the sensation is due to the properties of the nerve-structures. According to this way of envisaging the subject, the molecules offer greater and greater resistance to external stimulation as this goes on increasing. That is to say, the peculiar relation formulated by Fechner's law is the result of what has been called the friction of the neural machine.[1]

Fechner, by taking the least perceptible difference between two sensations as his unit of intensity, and considering this to be identical in the case of all classes of sensation, supposed that he could quantify our sensations by regarding them as multiples of this unit. Such an attempt is now generally viewed as futile. We shall never be able to regard a given sensation as made up of so many units as we can regard a linear length or a mechanical force. Every sensation viewed in itself is an indivisible whole. What we are able to do is to compare different intensities and estimate the amount of their difference, and this can be done to some extent, but not in the exact way attempted by Fechner. Thus one may, judging by his own sensations alone, roughly place a weight, W^3, midway between a heavier and a lighter, W^1 and W^2, so that difference between W^1 and W^3 shall appear about the same as that between W^3 and W^2.[2]

The magnitude of the fraction representing the increment of stimulus necessary to produce an increase of sensation determines what has been called the *Discriminative Sensibility.* The smaller the fraction the greater the discriminative sensibility. Thus the discriminative sensibility of the finger-tip to pressure is about twice that of the sensibility of the shoulder-blade, the fractions being approximately $\frac{1}{6}$ and $\frac{1}{3}$.

When the stimulus is increased up to a certain point any further increase produces no appreciable increase in the sensation. Thus a very powerful sound may be increased without our detecting any difference. Similarly in the case of a light-

[1] On the statement and interpretation of Fechner's Law, see article "Weber's Law," *Encyclop. Britann.*; Ward, *Mind*, i. p. 452 ff.; Ladd, *Elements of Physiological Psychology*, pt. ii. chap. v.; James, *Principles of Psychology*, i. p. 533 ff.

[2] On this aspect of Fechner's measurement of sensation, see Stumpf, *Tonpsychologie*, i. p. 397 ff.; Münsterberg, *Beiträge*, heft iii.; James, *op. cit.*, p. 545 ff.

stimulus. We do not notice any difference in brightness between the central and peripheral portions of the sun's disc though the difference of light-intensity is enormous. Wundt calls this upper or maximum limit the height of sensibility of a sense. The higher this point in the scale the greater, according to him, the receptivity (Reizempfänglichkeit) of the organ.[1]

Finally, by taking together the threshold and height we have what Wundt calls the range of sensibility (Reizumfang). The lower the former or minimum limit, and the higher the latter or maximum, the greater the range of sensibility. That is to say, the relative range is measured by a fraction, of which the numerator is the height and the denominator the threshold. It is important to add that these aspects of sensibility to stimulus do not vary together. Fechner ascertained that parts of the skin equal in respect of absolute sensibility to pressure differed considerably in discriminative sensibility. Nor does a high maximum limit or height necessarily indicate a proportionately large number of perceptible differences of degree. Discriminative sensibility is thus an independent aspect of sensibility, and by far the most important for intellectual purposes (knowledge of things).

§ 9. *Quality of Sensation.* In addition to differences of intensity in one and the same kind of sensation, we have differences of kind or quality among our sensations. The group of sensations making up a particular sense, as those of sound, are marked off from other groups by a broad difference of *generic* quality. This is the most obvious difference, and the one first distinguished. Owing to this disparateness or heterogeneity, the sensations of different senses cannot be compared one with another as different tones or colours can. It is only in rare cases, and more particularly in that of taste and smell, that such disparate sensations are ever confused one with another. These subjective differences answer to the broad differences in the process of physical stimulation and nervous excitation involved.

Next to these broad differences there are finer differences of *specific* quality within each sense. Thus there are the differences of quality answering to different colours in sight, to

[1] See *Physiologische Psychologie*, cap. viii. § 1.

sounds of different pitch and of different timbre or musical 'quality' in hearing, and so on. These subjective differences are, in certain cases at least, known to be correlated with differences in the *form* of the movement of the stimulus, *viz.*, rate of vibration or wave-length; and it is possible that these differences in the mode of stimulation produce corresponding differences in the form of that vibratory movement which constitutes the process of nervous excitation (see above, p. 53). These differences of quality are much sharper or more definite in the case of some sensations than in that of others. They are only very vague in the region of organic sensations, and are much less definite and easily distinguishable in the lower senses (taste and smell) than in the higher. Such differences, like those of intensity, serve as a clue to the properties of external objects. The difference between gold and iron is partly a difference of colour. Musical instruments, including human voices, are distinguished in part by their peculiarities of timbre.

As suggested above, it is doubtful what number of ultimate qualitative differences among our sensations we ought to assume. Certain sensations, as those of clang, which appear to the ordinary ear perfectly different one from another, are now known to have a common qualitative element (partial tone). These are cases where physiological analysis (resolution of the nervous conditions into a complex of processes) supplies what psychological analysis fails to supply.[1]

It must not be supposed, however, that the mere discovery of a plurality of physiological processes proves the sensation to be made up of partial or constituent sensations. Thus the sensation of white may be produced by combining two luminous stimuli which separately would produce the sensations blue and yellow; yet we cannot say that the sensation of white *contains* the sensations blue and yellow. The two nervous processes may combine or fuse in a total process which gives rise to a new kind of sensation.[2]

It follows that the attempts of Mr. H. Spencer and M. Taine to carry physiological or 'objective' analysis so far as to resolve all differences of quality, generic as well as specific, into differences in the mode of combination of the same ultimate psycho-physical units ("nervous shocks") must be viewed as extra-psychological. For the psychologist those qualities are simple or ultimate which we cannot further consciously subdivide even with the help of a previous experience of the sensa-

[1] *Cf.* above, p. 30 f.

[2] *Cf.* what was said on the limits of psychological analysis, p. 24.

tions which are known to correspond to a separate production of certain constituents of the whole nerve process involved.[1]

§ 9*a*. *Physiological Conditions of Quality.* The physiological conditions of quality have already been touched on. The generic differences, *e.g.*, those of sensations of smell, of sound, etc., are correlated with important differences in the mode of stimulation, as that between the action of ether vibrations or light on the retina of the eye and mechanical pressure on the skin. These physical differences in the external stimuli correspond, as we have seen, to physiological differences in the special organs. Each organ is specially constructed so as to react on a particular kind of stimulus.

Although we may in general regard the external process of physical action and the physiological process of nerve-excitation as correlated, the correspondence is closer in some cases than in others. Thus in the case of the so-called mechanical senses (touch and hearing) there is a closer correspondence between the course of the physiological process and the physical process than in that of the chemical senses (smell, taste, sight and thermal sense, or sense of temperature). In the case of these last the terminal apparatus at the peripheral end of the nerves appears to involve a more profound chemical process of transformation.[2]

With respect to the physiological equivalents of specific differences of quality, we know certainly in the cases of sight and hearing that qualitative change in the sensation answers to a certain amount of change in the form (wave length) of the stimulus. And it seems reasonable to suppose that there are analogous differences answering to different olfactory and other special-sense stimuli.

A further question already touched on is whether, and if so how far, qualitative differences involve distinct nervous structures. We may suppose that the difference between red and blue, sweet and bitter, is correlated either with the separateness of the nervous elements (peripheral and central) involved, or merely with a difference of functional activity in the same elements. Modern research has gone to show that in

[1] On the question, what are the ultimate elements of sensation, see H. Spencer's *Principles of Psychology*, vol. i. part ii. chap. i. ("The Substance of Mind") § 60; M. Taine's work *On Intelligence*, part i. book iii. chap. ii. § 5; and my volume, *Sensation and Intuition*, chap. iii. p. 57, etc.; also James' *Principles of Psychology*, i. chap. vi.

[2] See Wundt, *op. cit.*, cap. vii. § 2.

certain cases, *e.g.*, sensations of hearing and of sight, there is a multiplicity of nervous elements engaged. On the other hand, it cannot be said that separateness of structure has been made out in the case of every ultimate difference of quality.[1]

§ 10. *Relation of Quantity to Quality.* A difference of quality must be carefully distinguished from one of quantity or intensity. In some cases popular language appears to confuse the two. Thus we are apt to speak of a difference not only between gray and black, but between two shades of the same colour as if it were a difference of colour. In the region of touch it is probable, as we shall see, that differences in intensity of sensation give rise to the supposition of qualitative differences.

Quality is clearly distinct from quantity, and may in general be regarded as independent of it. That is to say, we can vary intensity without affecting the quality. This would appear to follow from the assumed dissimilarity of the underlying nervous conditions. At the same time this independence is not complete. After a certain increase in intensity quality becomes less distinct. Thus as all colours grow very bright they approach one another and tend to become whitish. It has often been remarked that the extremities of great heat and great cold tend to be confused one with another. On the other hand, where the intensity of a sensation is very weak its specific quality is apt to be disguised. Thus faint sensations of heat and pressure are difficult to distinguish one from another. It may be said generally that differences of quality only appear clearly when the sensations have a medium intensity.

This variation of quality with quantity is partly dependent on a change in the nervous process involved. Thus, in the case of colours, as we shall see, great intensity appears to reinforce certain elements of what is really a complex nervous process, and so effects a qualitative change in the resulting sensation. At the same time, the fact that quality is only clearly distinguishable in the median region of

[1] The problem as to the ultimate number of nerve-elements required as the groundwork of our sensations is closely connected with that of specific energies. (See Hermann, *Human Physiology*, p. 344.) The difficulties in the way of supposing distinct nerve-elements for all distinguishable sensations are touched on by Ladd, *Elements of Physiol. Psychol.* part ii. chap. iv. § 25, and more fully dealt with by Wundt, *Physiologische Psychologie*, cap. vii. § 4.

the scale of intensity is connected with the greater facility of the adjustive process of attention in this case.[1]

§ 11. *Extensity : Local Distinctness.* Next to intensity and quality the most important feature of sensation is massiveness or extensity. It has already been pointed out that sensation varies quantitatively with the number of nervous elements stimulated. The extreme difference shows itself between an 'acute' sensation, as that arising from the pressure on the skin of a pin point, and a 'massive' sensation, as that arising from an extended pressure on the skin. Differences of extensity must be carefully distinguished from those of intensity. It is one thing to increase pressure at a point of the skin, another thing to spread a given degree of pressure over a larger surface.[2] Extensity is thus a new quantitative aspect or dimension of sensation. There is more or less of sensation according as a larger or smaller sensitive area is acted upon. In certain cases, especially that of sensations of touch and sight, this extensity or extensive magnitude becomes definitely appreciable or measurable.[3]

In this experience of a continuous extensity or spread of sensation we appear to have implicitly a number of distinguishable sensations.[4] And common observation tells us that when two points of the skin sufficiently far apart are stimulated we

[1] On the relation of Quantity to Quality, see Ladd, *op. cit.*, pt. ii. ch. iii. § 5 ; Stumpf, *Tonpsychologie*, ii. pp. 417, 420. Münsterberg seeks to minimise the distinction between intensity and quality, as when he writes (*Beiträge*, iii. p. 10), "Quality and Intensity are not two particular properties of the one sensation, but only the directions in which the one sensation can be compared with other sensations". That is to say, intensity and quality are two aspects on either of which we can separately fix attention for comparing purposes.

[2] Increase in intensity is known to be commonly attended by some increase in extensity, as when toothache grows intenser and spreads at the same time ; but the two effects can in general be readily distinguished.

[3] Attempts have been made by Weber and others to show that the discrimination of extensive magnitude, *e.g.*, of linear magnitude, conforms to the psychophysical law ; but the attempts have not been very successful. For an account of Weber's experiments in the region of retinal discrimination of extensive magnitude, see Münsterberg, *Beiträge*, ii. p. 125 ff.

[4] On the contrast in this respect between intensity and extensity, see Ward, *op. cit.*, p. 54. As he says, extensity is a kind of latent or merged plurality, whereas a sensation of great intensity is not thought of as containing or made up of sensations of weaker intensity.

do experience two sensations which have no tendency to coalesce one with another. This shows that sensations received by way of distinct and isolated nerve-fibres are (within certain limits at least) distinguishable one from another. This fact we will call the local distinctness of sensation. The physiological basis of the distinction is to be looked for partly in the fact of the insulation of the several nerve-fibres, and partly also in certain differences in the whole nerve-process which appear (in the case of the skin at least) to characterise stimulation of different points of a sensitive surface.

In order to understand this original aspect of sensation, extensity together with local distinctness, we must mark it off from that later *local* or spatial consciousness, which, as we shall see, is largely a product of experience. When we talk of primitive extensity we must not be taken to mean that an extensive sensation of colour or heat at the skin gives originally a consciousness of spatial extent or area. Nor must we include in the primitive "local" distinction of sensations a consciousness of spatial position or locality. It is probable that, with the firm layers of subsequent experience to pierce through, we cannot get down to this primitive aspect so as to imagine what it is like. Hence it is to be regarded not as a fact reached by analysis, but as a hypothesis which has a certain physiological support, and which is adopted as helping us to understand how the space-consciousness is developed.

That there is some primitive difference in sensations (alike in intensity and quality) connected with the fact that separate nervous elements are involved seems to be generally allowed. It is a question, however, whether these differences are correlated merely with the isolation of nervous elements, or whether they involve differences in the mode of stimulation as well. It seems reasonable to suppose that the excitation of distinct central elements should make a difference in the correlated sensations; a difference not to be confused with that brought about by an increase in the amount of stimulation of one and the same element, such as we have when a sensation is increased in intensity.[1] At the same time it is probable that a further physiological difference is involved. Thus it is said that when a taste-stimulus is spread over a larger area of the organ we get, not a greater extensity, but merely a greater intensity. The same holds good, according to Goldscheider, with an expansion of a thermal stimulus.[2] These observations, if confirmed,

[1] Stumpf seems to question the force of this reasoning, *Tonpsychologie*, ii. p. 125, footnote.

[2] Ziehen, *Leitfaden der physiol. Psychologie*, pp. 41, 48.

show that the effect of a mere multiplication of nerve-elements is not clearly differentiated from an increase of intensity.[1] Hence it is reasonable to suppose that the phenomena of extensity and local distinction of sensation involve some further psychical difference analogous to a qualitative difference, which unknown difference may be called one of 'local colour'. A physiological ground for this supposition is found in the probable fact that in the case of the tactual nerve-fibres there are unlike anatomical connections with the peripheral terminations at different points of the sensitive surface. Thus the structure, mode of folding, etc., of the skin are not perfectly uniform. Hence pressure at one point may be supposed to differ from pressure at another by reason of such peripheral differences as unequal stretching of skin, and so forth. In the case of the retina, anatomical knowledge does not help us as yet to conceive of such differences. Yet it is perhaps allowable to suppose that no two nerve-fibres exercise precisely the same function, but that even in the case of the retinal fibres the peripheral connexions differ and introduce differences into the attendant sensations. The importance of this assumption of original local differences among our sensations will appear when we come to examine the growth of our space-perceptions.

Extensive magnitude and local distinctness of sensation are only found in a definite and precise form in the case of two senses, touch and sight. We do not appreciate extent or distinctness of points with any degree of clearness in the case of the organic sensations, the sensations of taste and smell, or even those of hearing. The probable reason for this seems to be that in the case of touch and sight we have special physiological arrangements which are wanting in the case of the other senses. These consist in the existence of a sensitive surface supplied by a system of isolated nerve-fibres arranged in a mosaic-like order, and so capable of being separately stimulated by properly-placed stimuli. The skin and the retina of the eye form such surfaces. In the case of the ear, although, as we shall see, there is probably some apparatus for securing a difference of sensation according to the direction of the sound, there is nothing answering to the retina with its multitude of points, any one of which can be acted on separately by a definitely-placed and rigidly-circumscribed light-stimulus.[2]

[1] Stumpf appears to treat this as an illusory confusion of the judgment, *op. cit.*, ii. pp. 445, 446.

[2] The question of the existence from the first of certain aspects of sensation here marked off as extensity and local distinctness or discreteness, which however contain no distinct consciousness of space (area, position), has been hotly disputed. Thus Bain, who makes space-consciousness a product of experience, appears, while recognising massiveness or volume of sensation as original, to regard the sensations produced by stimulating different portions of the skin (if otherwise alike) as quali-

§ 12. *Duration: Protensive Magnitude.* One other aspect of sensation may be just mentioned, *viz.*, duration or, as Hamilton has called it, protensive magnitude. Every sensation has a certain duration, being either momentary or persistent for an appreciable time. This duration constitutes a third dimension or direction of quantitative variation in addition to intensity and extensity. That is to say, we have more or less of a sensation either by altering the intensity, the extensity or spread, or the duration.

While, however, all sensations (as indeed all psychical states) exhibit this aspect of duration, they do not exhibit it with the same degree of precision or definiteness. Thus some sensations, as for example those of taste and smell, are less sharply defined in respect of their termination, and probably also of their commencement, than the sensations of the higher senses. In the case of sensations of touch, hearing, and sight, we know precisely the protensive length or time-magnitude. It is only when owing to the action of an unusually strong stimulus or some abnormal modification of the nerve the central excitation and the sensation outlast the process of stimulation, as in the case of optical after-images, that the time-boundaries of these higher sensations become indistinct.

The want of sharp temporal definition in the case of the lower sensations is partly connected with the mode of stimulation. The chemical stimulus acting in the case of taste does not cease to act at a precise moment, as the stimulus of external light or sound ceases to act. Hence we cannot have a series of rapidly succeeding taste-sensations which are sharply distinguished, as we can have a series of touches, and still better sounds. It is a question how far the survival of the central excitation after the cessation of the peripheral stimulus, giving rise to what is known as 'after-sensation,' interferes with a sharp temporal definition in the case of the different senses.

As already pointed out, there is a relation between the duration and intensity of sensation. To begin with, a very short application of a stimulus may fail to produce any sensation; whereas, if this is repeated, there arises by what has been

tatively indistinguishable. (*The Senses and the Intellect*, p. 396 ff.) Similarly Münsterberg denies all locally-determined original differences, at least in the case of visual (retinal) sensations. (*Beiträge*, ii. p. 138 ff.) The emphasising of this primitive prae-spatial aspect of sensation is due to Lotze who made use of the hypothesis in developing the theory of Local Signs to be spoken of by-and-by. Those who, like Stumpf and James, regard space-consciousness as sensational and primordial allow of course the aspects here referred to, only they insist upon their spatial implications.

called the "summation of stimuli" a sufficiently intense central process to generate a sensation.[1] On the other hand, a continuous stimulation, if prolonged, produces the effect known as nervous fatigue, as a result of which the sensation loses in intensity. Thus luminous sensations grow less intense when prolonged. It follows that when we speak of the normal intensity of a particular sensation, that is, one corresponding to a particular external stimulus, we refer to *short* periods of stimulation.[2]

§ 12*a*. *Organic Variations of Sensation.* Closely connected with the subject of duration of sensation is that of subjective or organically-produced fluctuations in the psychical effect of stimulation. It is assumed in physiological psychology that a given stimulus always produces the same psychical effect. But this assumption is not perfectly accurate. Thus, as we have just seen, a sense-organ tends to be temporarily modified by the effect of previous stimulation, so that a subsequent stimulus produces another kind of effect from that which would follow in other circumstances. If the positive effect of the previous stimulus survives as after-sensation this combines with and disguises the qualities of the new sensation. Examples of this are common in the region of taste. With a bitter taste "in the mouth" we taste all other things as bitterish. On the other hand, a nerve-structure may be temporarily fatigued by the action of a preceding stimulus, and so rendered less sensitive to a second stimulus of the same kind. After tasting a strong saline solution a substance moderately salt does not taste salt at all. Sensations of temperature show, as we shall presently see, these momentary fluctuations in a marked degree. In addition to such temporary modifications our sense-organs may be more permanently modified. Thus the senses of smell and taste are liable to be seriously disturbed by a cold and other causes. Though these disturbances are not confined to the lower senses, they are much more distinct and prominent in this region. The sensations of taste, smell, and temperature are pre-eminently "subjective," that is, liable to such organic variations.[3]

Not only is the quality of the sensational result of a particular stimulus thus affected by a preceding stimulation of the organ, it is in certain cases modified by a simultaneous activity of other parts of the organ. The best known instance of this is the phenomenon of simultaneous colour-contrast, as when two shades of gray or a blue and yellow modify one another in the neighbourhood of their common boundary. The explanation of this effect is not quite clear.

Lastly, it is to be noted that in certain cases the quality of our sensations is modified by simultaneous disparate sensations. In other words, the qualitative result of a given stimulus is affected by the concurrent action of other stimuli. Thus Weber pointed out that a thaler laid on the skin of the forehead feels heavier

[1] On the phenomenon known as summation of stimuli, see W. James, *op. cit.*, i. p. 82 ff. In addition to this summation of successive stimuli, there is a summation of simultaneous stimuli, as when two sound-stimuli—each too weak to produce a sensation—are applied to the two ears, and result in a sensation. See Stumpf, *op. cit.*, ii. p. 438 f. *Cf.* what was said above on the effect of increasing the area of stimulation.

[2] A further connexion between duration and intensity is seen in the rhythmical rise and fall of intensity with prolonged stimulation. This phenomenon, however, seems to involve the reaction which we call attention, and had better be discussed later on.

[3] For a fuller account of these modifications of sensibility see my work, *Illusions*, chap. iv. pp. 64-69.

when cold than when warm. Other facts, including the curious phenomena of coloured hearing, *viz.*, the seeing particular colours on the production of particular sounds, point to a more general tendency in the stimuli of one sense-organ to interfere with or modify the ordinary results of the effect of a stimulation of another organ. Such modifications illustrate the effect of nervous irradiation, that is, the transmission of the state of excitation from particular nervous elements to other and connected ones.[1]

THE SERIES OF SENSES.

Coming now to the senses in detail we see that they do not exhibit the same degree of definiteness or the same number of distinct presentative aspects or characters. We usually speak of taste and smell as the coarse or unrefined senses, because we cannot sharply discriminate their sensations, whereas hearing and sight are called highly-refined senses for an opposite reason. By attending merely to the number and fineness of the presentative differences we may arrange the senses in the following ascending order: taste, smell, touch, hearing, sight.

A detailed account of the senses, including, as it must do, a description of the peculiar physiological structures involved, would be impossible here. For this the reader can be referred to one of the easily-accessible text-books in Physiology or Physiological Psychology. Here we must content ourselves with a brief *résumé* of the psychical elements.

§ 13. *Sense of Taste.* The sense of taste has its own specialised nerve (gustatory nerve) and end-organ, which last has its special seat on a particular posterior area of the tongue and the soft palate. The proper stimulus to the organ of taste (sapid substance) is in every case one of the chemical substances known as crystalloids, which are either liquid or soluble in the mouth. This fact suggests that the immediate excitant of the gustatory end-organ is a chemical process. Hence taste is commonly spoken of as a chemical sense.[2]

The sensations of taste must be carefully distinguished from other sensations which are wont to accompany them.

In the first place then, true sensations of taste are commonly

[1] *Cf.* above, p. 44 f. On this whole subject, see James, *op. cit.*, ii. p. 28 ff.

[2] The proper sensation of taste may be excited not only by a sapid substance, but also by electrical stimulation of the peripheral organ. It is doubtful whether mechanical agencies, as by pressing and rubbing the tongue, are capable of exciting the sensation. See Ladd, *Elements of Physiol. Psychology*, pt. ii. ch. iii. § 12.

accompanied by and confused with organic sensations resulting from the stimulation of the nerve-fibres ending in the alimentary canal or œsophagus. Thus the sensations of relish and disrelish are not pure sensations of taste, but partly organic.

In the second place, sensations of taste must be distinguished from those of touch. The tongue is supplied by nerve-fibres and end-organs of touch proper, and the tip of the tongue is indeed finely discriminative of tactile stimuli. When we take food, whether solid or liquid, into the mouth we obtain along with sensations of taste proper tactual sensations (including thermal), by which we know the size, shape, softness, grittiness and temperature of the substance. Some of the sensations commonly included among gustatory probably involve a tactual element, as the pungent effect of pepper and other condiments.

Lastly, sensations of taste mingle with, and are not easily distinguished from, those of smell. This is due to the proximity of the organs, and to the fact that many sapid substances give off odorous particles. The impairment of the sense of smell by a cold brings home to us how much the supposed sensations of taste owe to the sister sense.[1]

The common classification of sensations of taste proper is into four varieties, *viz.*, sweet, bitter, salt and sour. This classification is not, however, universally accepted, some (as Wundt) adding alkaline and metallic, while others (as Valentin) would reduce the number to two, sweet and bitter. These, though undoubtedly characteristic sensations of taste, are probably not the only ones. At the same time it is possible that further analysis may reduce the number of simple gustatory sensations.

Salt and sour in strong solutions involve the nerves of touch and common sensation, but whether they do so in weak solutions is disputed. Different regions of the tongue appear to be specially connected with different sensations. Thus sweet and sour are said to be tasted chiefly with the tip of the tongue, bitter and alkaline chiefly with the root.[2]

[1] Another element which occasionally combines with gustatory sensation is muscular sensation, or the sensation that accompanies the contraction of the muscles. Any strong stimulation of the nerves of the tongue excites reflex action of the muscles, and so occasions muscular sensation.

[2] On the physiological conditions of sensations of taste, see Ladd, *op. cit.*, pt. i. ch. v. §§ 6, 7, and pt. ii. ch. iii. §§ 12-15.

The recent researches of Œhrwall appear to show that certain papillæ responded to sour and sweet but not bitter, others sour and bitter but not sweet, others to sweet but not sour or bitter, and so on.[1] This goes to support the hypothesis that there are distinct nervous structures corresponding to difference of quality in our sensations of taste.[2]

It is to be noted that there is no passing from one sensation to another by gradations in the case of sensations of taste. Sweet and bitter are commonly said to be opposed to one another, but this opposition turns largely on the contrast of the agreeable and disagreeable involved. We cannot pass from sweet to bitter by a graduated series of intermediate sensations, as we can from one colour or one musical tone to another. We could only produce an artificial transition from the one to the other by mixing the two in such a way that the one taste grows gradually stronger, the other fainter. Still less would it be possible to arrange tastes collectively in a series, as we can arrange colours and tones.

This short account of the sense may suffice to show that it has a very limited value as a knowledge-giving sense. The position of the organ at the entrance of the alimentary canal, and the fact that only a certain number of substances, and these only under definite conditions, are sapid, suggest that the original and main function of the sense is to act as a kind of sentinel, testing beforehand the suitability of substances to be taken into the system as nutriment. By our artificial habits of life the range of sensation has been materially extended, but this has been done mainly in the interest not of knowledge but of enjoyment. It is only in restricted lines of observation, as chemical investigation, that this sense becomes an important aid in the discrimination and recognition of objects.

§ 14. *Sense of Smell.* The sensations of smell, though apt, as we have seen, to be confused with those of taste, are in general sufficiently marked off from other sensations. This differentiation is connected with the peculiarity of the organ involved. The end-organ in which the olfactory nerve terminates and which is situated in a certain region of the nasal passage (*regio olfactoria*) consists of certain fine appendages

[1] *Skandinav. Archiv für Physiol.* ii. s. 1-69.

[2] On the whole subject of the sensations of taste, see Ladd, *op. cit.*, pt. i. ch. v. §§ 6, 7, and pt. ii. ch. iii. ; *cf.* Ziehen, *Leitfaden der physiol. Psychologie*, pp. 39, 40.

that are acted upon in a way not yet fully understood by the odorous particles or effluvia borne thither by the current of air in the act of inspiration. Only such substances are odorous as exist in a gaseous form or are vaporisable under given conditions of temperature. The process of stimulation being connected with the entering of the current of air is intensified by a voluntary augmentation of the inspiration, as in sniffing.

As in the case of sensations of taste we have to mark off those of smell from others with which they are apt to be confused. Thus a sensation of smell is distinct from the organic sensation given by fresh or stuffy air, and which involves the nerves terminating in the respiratory cavity. Again, olfactory sensations must be distinguished from these mixed sensations which involve elements of tactual and common sensation, as for example those obtained by sniffing ammonia, snuff, and so forth.[1]

The qualitative variety of odours seems to be far greater than that of tastes; yet the detection and classification of the elementary sensations is even more difficult here than in the case of the latter. Common language contains no words such as sweet, bitter, sour, which point to certain easily distinguishable simple sensations answering to widely-distributed qualities in things. Such verbal distinctions as are found, as 'fragrant,' point to the concomitant effect of feeling. For the rest we only name sensations of smell by connecting them with particular objects or substances, as the rose, the lilac, the sea, sulphuretted hydrogen, and so forth. There seems so far no possibility of analysing these effects into a few elementary sensations, still less of connecting the manifold variety of olfactory sensation in some simple graduated arrangement, as we can do in the case of colours and tones.

The organ of smell occupies a position at the entrance of the respiratory cavity analogous to that of the organ of taste at the entrance of the alimentary cavity. And the original function of the sense may well have been that of a judge as to the quality of the air inspired as fitted or unfitted for the respiratory organ. This function has, however, in all the higher

[1] It is probable that, as in the case of taste, muscular sensations combine with the intenser and more violent forms of olfactory sensation.

animals become a subordinate one. As we may see in the case of some of the lower animals, notably the dog, a fine olfactory sense may become an important means of discriminating and identifying objects. In the case of man this knowledge-giving use of smell is greatly limited owing to the dulness of the sense; which dulness again is connected with the higher development of other senses, more particularly touch. Hence it is only a comparatively small number of objects and substances that we commonly recognise through the sense of smell. And of these, again, it is more particularly those that produce a sensation of smell with a strongly-marked adjunct of agreeable or disagreeable feeling, as certain flowers, garlic, common gas, etc., which come to be customarily recognised and described by means of their characteristic odour.

SENSE OF TOUCH.

§ 15. *General Nature of Tactual Sense.* The sense of touch, which has for its main element sensibility to pressure, from its higher degrees to bare contact, is in some respects the least specialised of the special senses. It has no definitely circumscribed area of the peripheral surface for its end-organ. All parts of the skin are sensitive to pressure and give us corresponding sensations. Hence touch has been regarded by some as the fundamental mode of sensibility out of which the more specialised kinds have been differentiated.

This view, however, overlooks that highly-specialised form of human touch which is to be found in certain regions of the skin, and particularly the more mobile organs, as the hand and pre-eminently the finger-tips. This special function of certain regions of the skin as the organ of touch is probably connected with the presence in these parts of certain specialised structures or end-organs which are compressed or made to expand as a body presses on the skin or is drawn over it, or, which amounts to the same thing, as the skin is pressed against or drawn over the body.

The precise nature of this terminal apparatus is not clear. Anatomists distinguish among the sensory nerves running to the skin those with free endings which are probably connected with common sensation, and those which end in special terminal structures. These end-organs again have been divided into a number of forms, each of which has its particular name. The mode of distribution of those throughout the skin does not enable us to say as yet which of them are specially concerned in the different kinds of tactual sensation (pressure and temperature).[1]

Tactual sensations are to be carefully distinguished from common sensations which are apt to combine with them. Sensations of tickling illustrate the tendency of the two to coalesce. In the experience of being tickled there is a certain element of true tactual sensation, that of gentle contact, which is rapidly intermittent and which commonly shifts from one point of the skin to adjacent points. But the whole effect with its large element of feeling involves the action of the nerves of common sensation as well.[2]

§ 16. *Degrees of Pressure.* The fineness of the tactual sensibility proper is seen in the estimation of degrees of pressure. Here a whole mass of experiment comes to our aid.

It is found, first of all, that different parts of the skin are very unequal in respect of absolute sensibility, or capability of reaction on very weak stimuli. This variation of absolute sensibility, moreover, does not appear to correspond exactly with what we know otherwise of the local variations of tactual sensibility.

Thus, according to Aubert and Kammler, the lightest weight which produces a tactual sensation is ·002 grammes for the forehead and temples, and ·005 – ·015 for the volar side of the fingers.[3] The measurement of absolute sensibility has been carried further by Goldscheider's experiments. By using a very fine point, and applying this gently, he ascertained that a true sensation of pressure is only obtainable at certain minute spots within a given area of the skin, which spots he calls pressure spots. These seem to be most numerous in what we otherwise know as the most sensitive parts of the organ.[4]

The second and more important mode of tactual sensibility is the discriminative sensibility to different degrees of pressure. Here definite results are difficult to obtain, owing to the fact

[1] For a full account of these terminal organs, and of what is known as to their functions, see Ladd, *op. cit.*, pt. i. chap. v. § 8 and following, and pt. ii. chap. iv. § 19 and following.

[2] On the distinction between elements of common sensation and tactual sensation proper in our experiences of touching or being touched, see Wundt, *op. cit.*, cap. ix. § 1.

[3] A gramme is about 15·4 grains. For a fuller account of the facts here touched on, see Wundt, *op. cit.*, i. p. 367 ff.

[4] For a full account of these experiments, see Ladd, *op. cit.*, p. 346 and following.

that in ordinary cases where we estimate higher degrees of pressure, as in lifting a weight, the tactual sensibility is greatly assisted by the muscular sensations, to be spoken of presently. By supporting the arm or other part experimented on, and then successively applying different degrees of pressure, it has been found possible to some extent to measure the discriminative tactual sensibility of different regions of the skin. Among the results obtained is that the discrimination of pressure pure and simple is much less acute than when the muscular sensations co-operate. The inequalities at different dermal regions, as measured by the smallest difference discernible, correspond to some extent at least to known variations of tactual sensibility.

The experiments have been carried out by Weber and Fechner. A certain weight is laid on the hand or other part, and the experimenter then tries how much must be taken away or added in order that the subject may note a difference in the sensations. As might be expected, the discrimination of pressure is much finer when the same part is used successively than when two parts are used. Among the differences in different regions of the skin, one may mention that the anterior surface of the finger detects one-half of the smallest difference appreciable by the posterior surface (one-sixth as compared with one-third). These differences of discriminative sensibility do not, as already pointed out, correspond to differences of absolute sensibility in the same regions.[1]

§ 17. *Qualitative Differences of Tactual Sensation.* The differences of quality among sensations of touch are less numerous than those among sensations of smell. The most important differences, next to that of sensations of pressure and of heat and cold, are those of soft and hard, and rough and smooth.

Here, as already hinted, we have to do with differences of intensity. The contrast between hard and soft, as known purely by touch, is simply that between great and little pressure. It is obvious, moreover, that the terms are relative; the same object being called hard or soft in relation to different objects. The difference between smooth and rough, so far as dependent on pure touch, apart from movement, is connected with continuity and uniformity of pressure in the one case, and discontinuity and inequality in the other. In laying the hand upon, and letting it glide over a polished table, the pressure is uniform at all points of the skin involved and at successive stages of the movement. In laying it on a rough newly-sawn piece of wood there is no such uniformity, but rather a congeries

[1] See Ladd, *op. cit.*, p. 367; Wundt, *op. cit.*, i. cap. viii. § 2.

of discrete prickly sensations. Thus the impressions of rough and smooth are closely connected with the two modes of local discrimination already touched on, *viz.*, separation of points and continuous mass or extensity. Lastly, the sensation of moist or wet, regarded by Aristotle as a primary sensation of touch, is probably compounded of a sensation of smoothness and one of cold.[1]

§ 18. *Extensity: Local Distinctness.* Touch, as already pointed out, is characterised by a fine appreciation of extensive magnitude, and of local distinctness of sensation. The discriminative sensibility to separateness of point or locality, which is measured by the smallness of the distance between two points, say those of a pair of compasses, just distinguishable as two, is found by the classical experiments of Weber, aided by those of more recent investigators, to vary considerably at different parts. In general, it is finest in those regions, as the fingers and lips, which are known by every-day observation to have high tactual sensibility. It is much finer in the mobile parts, hands, feet and lips, than in the comparatively fixed parts (the trunk). It is about twice as fine on the anterior as on the posterior surface of the fingers. In the former the minimum distance between the points sinks as low as ·2 millimetres.[2] It falls off as we go from extremities (fingers or toes) towards the trunk.

These experiments were initiated by Weber, who employed a pair of compasses, varying the distance between the points. Weber himself explained the results by help of a system of 'sensation-circles' which cover the skin. These circles are supposed to vary greatly in size, and to some extent also in form, and to overlap one another in a somewhat intricate manner. More recently, Goldscheider, who has tested the dermal discrimination of points by experiments of his own, explains the fact by supposing that we obtain two distinct sensations only when two 'pressure spots' are stimulated. If, on the other hand, one point touches a pressure spot and the other some contiguous area free from such spots, two tactual sensations do not arise.

Reference may also be made here to some experiments made by Prof. G. Stanley Hall on the "motor sensibility" of the skin, that is to say, the capability of judging of the movement of a point over the skin by dermal sensations alone. Here too considerable differences were found to exist at different parts, though the differences did not accord with those of local discrimination as measured by Weber.[3]

[1] On the question whether roughness and smoothness, sharpness and bluntness, etc., involve qualitative difference, see Wundt, *op. cit.*, cap. ix. § 1.

[2] A millimetre is $\frac{1}{1000}$th part of a metre, and is equal to ·0393 of an inch.

[3] For a fuller account of Weber's experiments, see Ladd, *op. cit.*, p. 405 and following; Wundt, *op. cit.*, ii. cap. xi. § 2, p. 6 ff.; Goldscheider's and Stanley Hall's experiments are described by Ladd, *op. cit.*, p. 410, etc.

§ 19. *Thermal Sensations.* The sensations of hot and cold obtained by contact of different parts of the skin with bodies of various temperatures constitute a second main group of sensations usually included under the sense of touch. Sensations of heat and cold may arise in any part of the organism, and are in this respect closely allied to common sensations. More particularly they are experienced through variations in the temperature of the skin. In certain dermal areas they are finely distinguishable in their degree, and in this respect they constitute, along with the specialised discriminative sense of pressure, a special mode of sensibility. There is good reason to suppose that, just as they differ qualitatively from sensations of pressure, so they involve distinct nervous fibres.

The mode of stimulation in the case of thermal sensations is not precisely ascertainable. The common supposition is that they depend on an expansion or contraction of certain nervous elements with the rise or fall of the temperature of the part. That thermal sensations are the same in kind as sensations of pressure has been hastily assumed on the ground that in certain cases we are apt to confuse the two, as when we take a cold body resting on the skin to be heavier, and a warm body to be lighter, than they really are. The fact of the differentiation of special nervous structures for the sense of temperature has been established with some certainty by the experiments of Goldscheider and others to be spoken of presently.

The sensations of temperature received by way of contact of bodies with the skin present a clearly-marked contrast of quality, *viz.*, that of hot and cold. As already pointed out, the extremes of heat and cold tend to approach one another: that is to say, in the case of very hot and very cold bodies we are no longer able to recognise the qualitative peculiarity of the sensation. Between these extremes many degrees of hot and cold are distinguishable. In this way we get a scale of thermal sensations analogous to that of rough and smooth, and hard and soft, with a neutral or indifferent point, known as the zero-point, in the median region of the scale.[1]

This zero-point appears to be related to the normal temperature of the part of the skin stimulated. Bodies having the same temperature as the skin yield us no distinct sensations either of hot or of cold. It may be added that the discrimination of temperature is only fine in the median region of the scale near the zero-point.

[1] See Ladd, *op. cit.*, p. 347.

The discrimination of temperature, like that of pressure, varies considerably at different parts of the skin. These variations do not run parallel with those of sensibility to pressure. Since, moreover, the normal temperature of the skin varies at different parts, *e.g.*, at the finger-tips and the inside of the mouth, the zero-point is not the same for all dermal areas.

The sensations of hot and cold are known to be highly subjective or relative. Thus they vary with the changing temperature of the part affected. Weber showed that if the hand be held in water of the temperature 54·5° Fahr. and then plunged in water at 64·4°, it will feel this last to be hot, whereas if the hand had been put into the second at the outset it would have felt it to be cold.[1]

Weber's explanation of these facts was that when the temperature of the skin is rising we have a sensation of heat; when sinking, a sensation of cold. Hering, on the other hand, connects the sensations of heat and cold, not with change in the temperature, but with differences of temperature above or below the zero-point of the part affected.

Our knowledge of the thermal sensations of the skin has been recently increased by some experiments of Goldscheider and others. These have elicited the fact that there are temperature-spots distributed over the area of the skin analogous to the pressure-spots, but not coinciding with these in their mode of distribution. Hence localities highly sensitive to pressure may be dull in thermal discrimination, and *vice versâ*. Still more curious, it has been ascertained that these temperature-spots are of two kinds, *viz.*, 'heat spots' and 'cold spots,' some being sensitive to heat and not to cold, others exclusively to cold. Thus the forehead, though highly sensitive to cold, is only moderately so to heat. These researches leave the question how the nerves are stimulated in the case of thermal sensations very obscure.[2]

§ 20. *Value of Sense of Touch.* Our examination into the sensations of touch shows us that this sense is capable of yielding us a variety of finely-graduated differences. In spite of the few qualitative dissimilarities, as compared with those of the higher senses, hearing and sight, it furnishes us with an exact knowledge of some of the more important qualities of bodies. This result depends first of all on its fine discrimination

[1] The relativity of these sensations is further seen in the fact that the temperature of a body was found by Weber to vary with the extent of dermal surface acted upon. Water at 29½ R. seemed to the whole hand warmer than water at 32° R. to a single finger. This fact is curious as illustrating the effect of extensity in modifying quality.

[2] On these researches, see Ladd, *op. cit.*, p. 348, etc.; *cf.* 370. Also Wundt, *op. cit.*, cap. ix. § 1.

of degrees of pressure, and then on its clear separation of local characters. Finally, it may be observed that owing to the sharp definition of tactual sensation with respect to commencement and termination we may compare them in rapid succession, as we are unable to do in the case of sensations of taste and smell. This knowledge-giving value of touch is further increased by the constant co-operation with tactual sensations proper of the muscular sensations to be spoken of presently. There is little wonder, then, that from the time of Aristotle downwards touch has been regarded as a sense of the first importance. More than one writer has attributed man's intellectual superiority over the lower animals in no small measure to his possession of a pair of hands capable of deriving such a variety of distinct sensations from the objects with which they are brought into contact.

HEARING.

§ 21. *Characteristics of Auditory Sensations.* Hearing and sight are universally recognised as the highest senses. Here we see for the first time a perfectly differentiated complex organ. The peculiar form of the stimulus (air or ether vibrations) allows of the action of bodies on each of these organs at considerable distances. And just as they stand alone in respect of the delicacy and complexity of the physical apparatus involved, so they are marked off from the other senses by the rich and delicately-graduated variety of their sensations.

The peripheral organ, the ear, consists of the end-organ proper, that is, the special structures in which the nerve-filaments terminate, and a mechanical apparatus for collecting and bringing to bear on these the air-vibrations which form the stimulus.

The structure of the ear is too complex for one to attempt a brief description of it here. The auditory fibres are distributed in a somewhat intricate way over the internal ear or labyrinth, and their terminal structures differ in different regions of this labyrinth. It is still very doubtful what the precise functions of these several nervous structures may be.[1]

[1] For an account of the ear and its known functions, see Ladd, *op. cit.*, p. 185 and following.

Sensations of sound exhibit numerous and definite differences of intensity. In the case of sounds of moderate intensity we can recognise fine distinctions of loudness or strength according as the stimulus increases in force or amplitude of movement.

A number of experiments have been carried out by Volkmann, Vierordt and others with a view to determine the threshold of intensity in the case of sounds, as well as the least noticeable difference of intensity. The results are not very definite. It may, however, be said with some probability that, with respect to the least noticeable difference of intensity, this corresponds roughly (according to Weber's Law) to the ratio 3 : 4 in the objective stimulus. That is to say, an objective sound must be strengthened in the proportion of about one-third in order that an increase of intensity in the resulting sensation may ensue.[1]

The superiority of hearing to the senses already considered is most plainly evident in respect of the qualitative differences of the sensations. The ear presents to us a rich variety of sensuous quality. All ordinary sounds yield complex sensations; and the ear, unlike the senses of taste and smell, is capable of easily distinguishing (within certain limits) the several constituent parts of its complex impressions. This power of analysis, aided by objective research, enables us to classify the sensations of sound with something like completeness.

The first division of sounds is into musical sounds or tones and non-musical sounds or noises. This distinction is known to be connected with a clearly-marked difference in the mode of stimulation. Musical sounds depend on regular or periodic vibrations, noises on irregular or non-periodic vibrations.

Physiologists have attempted to connect sensations of noise and those of tone with different parts of the auditory structure. There is some plausibility in the hypothesis that sensations of tone are brought about by the stimulation of the rods of Corti or the membrane on which these rest in the cochlea. But the precise physiological process involved in the case both of noises and of tones is a matter of uncertainty.[2]

[1] On the measurement of the intensity of auditory sensations, see Ladd, *op. cit.*, p. 370 ff.; Wundt, *op. cit.*, i. cap. viii. § 2; Stumpf has shown in a curious way that the discrimination of intensity is modified by the quality of the sound. Thus sounds of a high pitch are judged as louder than those of low pitch. See Stumpf, *Tonpsychologie*, i. § 15, p. 354 ff.

[2] See Ladd, *op. cit.*, pp. 195, 196; *cf.* Stumpf, *Tonpsychologie*, ii. p. 87 ff.

§ 22. *Musical Sensations: (a) Pitch.* The most important characteristic of a tone is what we call pitch or height. Every musical sound or tone has its particular pitch, without which it would cease to be musical. Differences of pitch constitute the most important qualitative differences among musical sensations. There are as many distinct varieties of musical sensation or tones as there are distinguishable pitches or heights. These differences are known to depend on the rate of vibration of the medium (the atmosphere). A tone of high pitch corresponds to a rapid series of vibrations, one of low pitch to a slow series.

Although for good reasons our modern scale recognises only discrete tones separated by at least a semitone, the ear can distinguish much finer differences of pitch. If the rate of vibration be gradually increased or decreased, we experience a continuous change of sensation in respect of height or pitch. Hence the scale of pitch is spoken of as a continuum of one dimension, represented by a straight line.

This scale of pitch is closely analogous to that of intensity. Thus there is a lower threshold below which the slow atmospheric vibrations no longer produce a continuous sensation of sound, but rather a succession of non-musical sensations. At the upper extremity of the scale there is a point of maximum pitch above which any further acceleration of the vibrations is followed by a non-musical effect of grating sound. Once more, within these extremes the least noticeable change of pitch-quality corresponds roughly with one and the same proportionate increase or decrease of the stimulus in respect of rapidity. The discrimination of pitch, it may be added, is much finer in the median region of the scale than towards the extremes.[1]

Individuals are known to vary greatly in their discrimination of pitch, and it is this which determines the musical capacity of the individual. Some persons are called 'note-deaf' because they do not distinguish tones even when separated by a semitone interval and more.[2]

[1] On the nature of the scale of pitch the student should consult Ladd, *op. cit.*, p. 317 ff.; and Stumpf, *Tonpsychologie*, ii. § 10.

[2] These variations come out in the results of experimental inquiry into the scale of pitch. Thus one person's discrimination of pitch is represented by the ratio 440 : 439·636; another person's by the ratio 1000·5 : 1000. According to the experiments of Stumpf unmusical people are less certain than musical in their discrimina-

(*b*) *Timbre.* In addition to this scale of pitch-quality, there are the differences known as timbre or 'clang tint'. These are the qualitative differences in sensations of tone answering to differences in the instrument, as the piano, the violin, the human voice. These differences have been explained by Helmholtz as due to differences in the mode of composition of the several kinds of tone. Musical clangs, such as those produced by the human voice, the violin, etc., though appearing to subjective observation simple sensations, have been shown by objective (physical and physiological) analysis to be compounded of a number of more elementary sensations. These correspond to a fundamental or ground tone and subordinate upper tones. The pitch, the number, and the relative intensity of these last determine the particular timbre of the clang.[1]

(*c*) *Musical Harmony and Dissonance.* Lastly, in considering musical sensations reference must be made to the important fact of harmony or consonance and dissonance among tones. This is mainly a difference of feeling, that is, of an agreeable and disagreeable effect. Yet there is a difference of presentative character involved. In the case of consonant and dissonant tone-groups alike the ear is able to distinguish the constituent tones. Hence the effect is subjectively recognised as a complex sensation. In the case of consonance, however, there seems a partial blending of the constituent tones, whereas in that of dissonance the constituent tones remain more distinct. In addition to this, dissonance involves a rough grating character in the total sensation. This has been attributed by Helmholtz to the substitution for a smooth uniform mode of stimulation of an intermittent series of violent shocks or pulsations of sound.

tion of pitch; but he sets down their differences to want of judgment rather than to want of discriminative sensibility (*op. cit.*, i. § 14). Grant Allen gives an account of a remarkable example of note-deafness, where a person failed to distinguish the pitch of a tone from that of another tone a third and even a sixth above it. (See *Mind*, iii. p. 157 ff.)

[1] For a fuller account of the sensations of clang the reader should consult Helmholtz's great work, *The Sensations of Tone*, translated by A. J. Ellis. The recent investigations of Stumpf have brought to light the fact that clang-tint is not an ultimate difference of quality in sound, but is constituted by differences in the pitch and intensity of the constituent partial tones. See his elaborate examination of the subject, *op. cit.*, ii. p. 539 ff.

It is not certain wherein consist exactly the physical and physiological substrata of sensations of musical harmony. According to the older theory it was supposed that since in the case of tones which accord well, as those constituting an octave or a fifth, the vibrations stand in a simple numerical ratio one to another, the sense of harmony involves a sort of unconscious reckoning. Translated into physiological language, this might mean that the periodic coincidence of the vibrations would be favourable to the nervous elements involved. According to the researches of Helmholtz, musical harmony depends on a purely negative condition, *viz.*, the absence of 'beats,' or those alternating augmentations and diminutions of tone-intensity which, in place of uniform strength of stimulation, accompany dissonant combinations, and produce the characteristic effect of roughness. Such beats may occur by the interference of the partial tones (upper-tones) of any two compound tones or clangs. According to this view, these beats produce a disagreeable effect by acting unfavourably upon and fatiguing the nerve. More recently attempts have been made by Lipps, Wundt and others to re-discover a positive condition of musical harmony.[1]

§ 23. *Noises.* In addition to this wide range of musical sensation the ear distinguishes a vast number of non-musical sounds, the characteristic 'noises' of different substances, such as the roar of the sea, the rustling of leaves, and the crack of a whip. Although the precise nature of noises is not fully understood, it seems probable that they involve a rapid and irregular variation of sensations of sound. The peculiar character of a noise, as grating, crashing, seems to depend on the number, relative intensity, and mode of variation of these constituent sensations. At the same time just as ordinary tones, say those of a violin, have an accompaniment of noise, so most noises involve elements of tone, and owe a part of their character to this circumstance (*e.g.*, the roar of the sea or of a crowd). This remark applies, among others, to articulate sounds. The researches of Helmholtz go to show that different vowel sounds are characterised by peculiarities of timbre and thus approximate to true musical sounds.[2]

§ 24. *Value of Sense of Hearing.* Enough has been said to show the high degree of refinement characterising the sense of hearing. The delicate and far-reaching discrimination of

[1] See Helmholtz, *Sensations of Tone*, pt. ii. especially chap. x. ; Th. Lipps, *Psychologische Studien*, p. 92 ff. ; and Wundt, *op. cit.*, ii., p. 63.

[2] The relation of noises to musical tones, that is, sounds of even or unchanging pitch, is well brought out by Stumpf, *op. cit.*, ii. p. 498 ff. Stumpf's reasoning goes to show that noises are only partially distinguishable from tones. At the same time this partial difference favours the view that noises implicate another set of nerve-structures, peripheral and central, than those engaged in the production of tones.

quality just illustrated is, moreover, as we shall presently see, aided by an exceptionally fine discrimination of duration, which allows of a nice discrimination of sounds in rapid succession. In this way we are able through the sense of hearing to acquire a good deal of exact information, as well as a considerable amount of refined pleasure. The delight of music sums up the chief part of the latter. The former is most strikingly illustrated in the wide range of knowledge derived by way of that system of articulate sounds known as language.

As a set off against these advantages, it must be borne in mind that in the case of hearing the appreciation of extensity and distinctness of points exist in only a very faint and germinal form. The very structure of the organ and the way in which the stimulus is applied exclude a definite discrimination of extensity and number of points such as we find in the case of touch and sight. It is commonly supposed that we are able to distinguish a massive sound, such as that produced by a large area of water, from an acute one. Recent experiments, moreover, go to show that the ear possesses considerable power of distinguishing direction of sound (within certain limits). This suggests that in the case of hearing there is a germ of local discriminations, not only in relation to sounds entering different ears, but in relation to sounds of unlike direction entering the same ear.

The assertion that we distinguish degrees of volume or massiveness of sound made by Dr. Bain and others has been cautiously disputed by Stumpf, who is inclined to resolve 'massiveness' of sound into compositeness, *i.e.*, the addition of new qualitative elements by the extension of the sounding area. At the same time he allows that sounds of *low pitch* have an aspect analogous to massiveness or spatial extent.[1]

The discrimination of the direction of sound has been elucidated by the recent experiments of Preyer, Münsterberg and others. The tendency of these experiments seems to be to connect the appreciation of direction with the action of the three semi-circular canals, in the dilatations of which (ampullae) a part of the auditory nerve is known to terminate. There is good reason to suppose that the varying pressure of the fluid contents of the canals with changing positions of the head is a factor in the sense of equilibrium. It is further argued by Münsterberg that owing to the different position or lie of the canals sounds of unlike direction would stimulate their respective fibres with different proportions of intensity. But the whole question of the precise functions of this part of the ear is still undecided.[2]

[1] See Bain, *Mental and Moral Science*, p. 53 ; and Stumpf, *Tonpsychologie*, i. p. 210, and ii. p. 51 ff.

[2] On the functions of the semi-circular canals consult Ferrier, *Functions of the Brain*, p. 127 ff.; Wundt, *Physiol. Psychologie*, ii. p. 25 ff.; and Münsterberg, *Beiträge zur exper. Psychol.* ii. p. 182, etc.

SIGHT.

§ 25. *Characteristics of Visual Sense.* The sense of Sight is by common consent allowed the highest place in the scale of the senses. The stimulus, ether-vibrations, greatly exceeds in point of subtlety the stimuli which (under normal circumstances) operate in the case of the other sense-organs. It is owing to the nature of this stimulus, moreover, that the sense of sight is capable of being acted upon by objects at enormous distances, as the heavenly bodies. Conformably to this subtlety of the stimulus, we find that the structure of the eye shows a greater delicacy than is observable even in the organ of hearing. This applies both to the end-organ itself, the retina with its several layers, more especially the finely-moulded structures known as the rods and cones in which the fibrils of the optic nerve terminate, and also to the optical apparatus, the lens, and other contents of the eye-ball, by means of which the luminous stimulus is brought to bear on these.

The eye, though under normal circumstances stimulated by light, is capable of being excited by other stimuli as well. Thus an electrical current sent through the eye gives rise to a sensation of light. Mechanical pressure produces the same effect, as is illustrated in the well-known "phosphenes" or discs of light produced by pressing a finger on a corner of the eye-ball. Lastly, the retina is susceptible to the action of certain internal stimuli, its nervous elements being for the most part in a state of 'tonic' excitation. This effect of internal stimulation is marked off by German physiologists as the eye's 'own light' (Eigenlicht).[1]

§ 26. *Scale of Luminous Intensity.* The scale of intensity in the case of visual sensations is obviously a very extended one. It answers to all distinguishable degrees of luminosity, from the brightest self-luminous bodies which we are capable of looking at without temporary blinding down to the objects which reflect a minimum of light, and are known as black. The eye's capability of recognising at a glance the particular nature of an object, as well as of discriminating a multitude of unlike objects in a scene, rests in part on this delicate discriminative sensibility to degrees of light.

[1] For a fuller account of the structure and function of the eye, see Ladd, *op. cit.*, pp. 171 ff. and 325 ff.

Here again careful experiments have been conducted in order to ascertain the limits of intensity. The threshold of absolute sensibility is specially difficult to determine owing to the constant presence of the Eigenlicht. With respect to discriminative sensibility, it is found that (in the median region of the scale) the eye distinguishes two stimuli having the ratio of intensity (about) 120 : 121. These experiments were carried out by Bouger, Volkmann, Aubert, Masson and others, partly by means of two lights throwing a double shadow of a rod on a white screen, and partly by means of rotating discs having circles of unequal brightness. The results differed in different series of experiments. Some investigators make the fraction much less (*e.g.*, Aubert $\frac{1}{180}$). This fineness of quantitative discrimination belongs only to the central area of the retina (or area of perfect vision). On the side parts of the retina it is much less. The discrimination of degree is much less fine when, instead of white, coloured light is employed.[1]

It is to be added that the sensibility to light not only varies as between individual and individual, but undergoes considerable changes in the case of the same individual. There seems to be a periodic variation during the twenty-four hours. According to Hubert and C. P. Müller, an object appears only half as bright in the evening as in the morning. The eye further accommodates itself to various degrees of luminosity. Thus in first going from a softly-lit room into the sunlight there is a temporary inability to distinguish objects as brighter or less bright, but after a time the eye adjusts itself to its new surroundings.

§ 27. *Colour-Sensations: (a) The Chromatic Scale.* The stimulus of the eye, like that of the ear, varies according to the rapidity of its vibrations. The analysis of solar light into its constituent rays in what is known as the prismatic spectrum separates the different kinds of rays, that is to say, those of different rates of oscillation. The red rays at one end of the spectrum are the slowest, making about 456 billion of vibrations per second, whereas the violet rays at the other extremity make about 667 billions. These variations in the rapidity of the vibrations occasion (within certain limits) differences in the quality of the resulting sensations. In this way we obtain a scale of chromatic quality resembling that of pitch in the case of musical sensations. Beginning with the rays of slowest vibration, we have the series red, orange, yellow, green, blue and violet, together with intermediate hues not so commonly distinguished by separate names. The colours at the red extremity are known as the warm colours, those at the other the cold colours. It is to be added, however, that in the case of violet there seems to be a return to a warmish hue. As may be seen by a glance at the solar spectrum, these colour-sensa-

[1] For a fuller account of these investigations, see Ladd, *op. cit.*, p. 374 ff.; and Wundt, *Physiol. Psychologie*, i. cap. viii. § 2, p. 357 ff.

tions form, like the sensations of pitch, a perfect continuum, or series of perfectly gradual transitions. The scale of colour-sensations further resembles that of tone-sensations in that the series of effects is limited at each extremity. Rays of slower vibration than the red rays, or of more rapid vibrations than the violet rays, fail to produce a proper sensation of colour.

The several colour-sensations here spoken of are only clearly distinguished by the central region of the retina (yellow spot). Towards the periphery colour-discrimination falls off more rapidly than discrimination of intensity. These facts, taken with the anatomical fact that the (retinal) cones are most numerous in the central region and fall off relatively to the other elements (the rods) towards the periphery, suggest that the cones are the structures specially engaged in colour-sensation, while the rods are concerned merely in the appreciation of the intensity of light.[1]

While there are these points of analogy between the scale of colour-sensations and of pitch-sensations, the two differ in important respects. To begin with, the quality of the colour-sensation does not change continuously in close correspondence with the changes of the stimulus, as in the case of tone-sensations. In some parts of the spectrum considerable changes in the rate of vibration occur without producing any appreciable effect on the sensation. Hence we cannot speak of a colour-scale in precisely the same sense as we speak of the tone-scale.[2] Again, the series of colour impressions, instead of assuming the form of a straight line, each successive member being further removed from the starting-point than its predecessor, rather assumes the form of a bent or curved line. As already observed, the extremities red and violet seem to approach one another. This affinity between the extremities of the spectrum is seen in the fact that if the rays are combined we have an intermediate sensation, that of purple, which forms a connecting link between the terminal sensations red and violet. These and other differences show that the tone and colour scales cannot be assimilated in the way attempted by those who seek to establish *quasi*-musical relations, harmonious interval, etc., among different members of the chromatic scale.[3]

(*b*) *Saturated Colour.* The sensations occasioned by the separated homogeneous rays of the spectrum are spoken of as pure or saturated. Our ordinary colour-sensations produced by light reflected from objects are never perfectly saturated. The

[1] See Ladd, *op. cit.*, p. 182 and p. 335.

[2] It follows that there is no constant ratio in the region of colour-discrimination, as is found (within certain limits) in the case of pitch-discrimination. Dobrowolsky has estimated the least perceptible difference at different points of the colour-scale. At the red end it is as much as from $\frac{1}{113}$ to $\frac{1}{167}$; whereas in the region of the yellow it falls to $\frac{1}{772}$.

[3] The points of difference between the tone and colour scales are brought out by Helmholtz, *Physiologische Optik*, p. 236 *et seq.*, and Fechner, *Elemente der Psycho-physik*, ii. p. 267 ff.; *cf.* Stumpf, *op. cit.*, ii. p. 49.

opposite of a saturated colour is a whitish hue, caused by the admixture of white or mixed light. By altering the degree of saturation we obtain for each colour a special scale of purity. It is to be noted that in some cases an alteration in the degree of saturation is popularly spoken of as a change of hue. Thus a whitish modification of purple is ordinarily marked off as pink. Such whitish modifications of hue must be carefully distinguished from change of brightness or tone, due to an increase in the intensity of the light.

(*c*) *Different Modes of Producing Colour-Sensations.* The distinguishable colours of the spectrum are not the only possible colours. By combining different kinds of rays new mixed modifications of hue may be obtained. It is found further that by taking rays at a certain distance one from another and combining them in definite proportions of intensity an intermediate hue may be produced similar to that produced by unmixed or homogeneous light. Lastly, it is known that by mixing light of different kinds white may be obtained in a number of ways. Thus if we place purple between the extremes red and violet and represent the series of colours as a closed circle instead of as a straight line, it is found that any two kinds of light standing opposite to one another at the extremities of the same diameter if combined in certain proportions occasion the sensation of whiteness. All such pairs of colours are known as complementary. It follows that colours cannot, like tones, be represented by a straight line or a continuum of one dimension. We must think of them as distributed over a space of two dimensions, *viz.*, that of a circle of which the circumference represents the series of the spectrum and the connecting purple, and the centre, white.

There are three ways in which colours may be said to be mixed. One is that familiar to painters by a mixture of pigments. Here the result (*e.g.*, green by mixing blue and yellow) depends on certain physical properties of the pigments themselves, and does not involve a compounding of colour-sensations. Colour-sensations can be compounded either by combining different kinds of rays, or by compounding effects on the retina, as when a disc with different coloured sectors is made to rotate rapidly, so that the successive sensations, owing to the fact that each persists as an after-sensation beyond the moment of actual stimulation, overlap and combine.

It follows from what is known of the effects of compounding colour-sensations that these cannot be equally elementary or fundamental. Thus white which popularly, and even by some *savans* as Goethe, is regarded as a distinct colour is really composite, at least so far as the underlying nervous process is concerned. Not only so, we may account for all the known variety of tint by assuming three or four fundamental colour-sensations. The colours which subjectively appear most distinct and elementary are red, yellow, green, and blue.[1]

(*d*) *Other Peculiarities of Colour-Sensations.* Among the many facts brought to light by modern physiological research in the domain of colour-impression, one or two of special psychological significance demand a bare mention. Of these the first is the relation of intensity to quality. A hue may be modified not only by an admixture of white light but even by a mere increase in the intensity of light. Thus at the maximum intensity all varieties of light tend to have a whitish appearance, at the minimum a blackish hue, which change is evidently a qualitative one. In some cases change of intensity gives rise to a modification of tint which is marked off by a separate name. Thus 'brown' is merely the effect produced by yellow or red light of a weak intensity.[2]

Again, colour-sensations are known to be modified by the previous activity of the nerve-elements engaged, as well as by the simultaneous activity of other and adjacent elements. These effects are dealt with under the head of colour-contrast, successive and simultaneous. After the stimulation of the retina the sensation does not instantly cease. It may continue in the form of a positive 'after-image,' as when we retain an impression of a very bright object, an effect which illustrates the general fact that the nervous excitation set up may outlive the process of external stimulation. This positive image may then give place to a negative one where instead of the original

[1] Such elementary colour-sensations must not be confounded with the 'primary colours' recognised by workers with pigments.

[2] Qualitative changes also occur when the duration of the stimulation is varied. Thus when the intensity is low more time is needed to produce a sensation of saturated colour than when it is high. The range of nervous elements acted upon appears also to affect the quality of the sensation. (See Ladd, *op. cit.*, p. 334.) The fact that colour-quality depends in part on intensity has led Wundt to represent the colour continuum as one of three dimensions, *viz.*, as a sphere (*op. cit.*, i. p. 471).

colour we have the complementary hue. This last effect, "successive contrast," illustrates the action of nerve-fatigue. The process of stimulation has paralysed for a moment the function of the retina answering to the positive colour-sensation, so that it is only capable of functioning in the opposite way. Simultaneous contrast occurs where one colour modifies a contiguous hue by rendering it more unlike, or sending it further away in the colour-scale. The exact physiological significance of this is not understood. Finally, reference must be made to the great variations in colour-discrimination that occur among different persons. Some people are colour-blind, that is, incapable of distinguishing colours. Such colour-blindness is known to exist in various degrees.

27*a*. *Elementary Colour-Sensations*. The attempt to derive the multiplicity of colour-sensation from a few fundamental impressions, and at the same time to explain the phenomena of colour-contrast, colour-blindness, etc., has given rise to various physiological hypotheses respecting the structure and mode of activity of the retina. Among these the most popular is known as the Young-Helmholtz theory. According to this, the nervous elements of the retina consist of three kinds of fibre. These are acted upon more especially by the red, the green, and the blue or violet rays respectively. These three colours would thus be in a peculiar sense elementary colour-impressions, while other colours, as purple, bluish green, together with white, would be composite. These three classes of nervous element must be supposed to be unequally distributed over the retina, being only fully represented in the central region, and also to be incomplete in the case of the colour-blind. According to a second theory, that of E. Hering, there are two kinds of nerve-element. These structures, again, are capable of two antagonistic modes of activity, to each of which a distinct colour-impression corresponds. Thus we have four simple or leading colour-sensations. One kind of element is concerned in the sensations blue and yellow, and another in the sensations red and green. In addition to these two varieties of nerve-element Hering postulates a third, the two opposed processes in which underlie sensations of white and black. This hypothesis aims at obviating some of the difficulties of the Young-Helmholtz theory. It is recommended by the circumstance referred to above, that it erects into elementary or fundamental colour-impressions four varieties which we are all accustomed to regard as leading and distinct colours. In its turn, however, it gives rise to special difficulties.[1]

These hypotheses have rather a physiological than a psychological importance. The fact of a colour-sensation being shown to be the psychical product of the stimulation of a number of nervous elements is psychologically unimportant so long as the colour-sensation itself remains indivisible. This is certainly true of

[1] Another hypothesis, not easy to explain in a few words, is given by Wundt *op. cit.*, i. p. 493 f. The several rival hypotheses are carefully compared by Ladd, *op. cit.*, p. 338 ff.

particular results of such nervous compounding, *e.g.*, the sensation white, for in this case no amount of separate experience of "constituent sensation," *e.g.*, blue, yellow, enables us to recognise them as present in the "compound". The physiological hypothesis only becomes psychologically significant when it helps us to account for observable differences in the sensations, an advantage which, as just remarked, appears to distinguish Hering's hypothesis.

§ 28. *Extensity and Plurality of Impression.* In addition to these numerous differences of intensity and quality, the sensations of sight are characterised by a fine discrimination of points and extensive magnitude. And it is this circumstance, together with another to be spoken of presently, which gives sight so distinct a superiority to hearing as an intellectual or knowledge-giving sense. The retina is an extended surface, on any point of which (owing to the peculiar structure of the eye) an isolated optical effect may be produced. The sensations received by way of different points of the retina are, as already pointed out, supposed to be from the first distinct one from another in 'local' character or colouring, and it is by means of this separateness that we are able to estimate so nicely the extensive magnitude of a visual impression. The fineness of this discrimination is, like that of colour-discrimination, greatest in the central region, the area of perfect vision. With a view to measure this aspect of retinal sensibility in this region, experiments were carried out by means of two lines placed at a certain distance from the eye and brought gradually nearer one another. These show that in the case of a practised eye two points are distinguished when the visual angle is from sixty to ninety seconds, that is to say, when the retinal images are from ·004 to ·006 millimetres apart. In the side portions of the retina this fine local discrimination rapidly falls off.

This may be seen in the following table, in which the results of looking at two squares one metre from the eye are recorded:—

Distance of retinal image from centre of retina.	Minimum distance of two images.
2° 40′	3′ 27″
5°	17′ 11″
7°	34′ 22″

This decline in discriminative ability does not progress with perfect regularity, and is not equally rapid in all directions. An attempt has been made to connect these limits of discrimination with the magnitude of the terminal appendages of the optic fibres, *viz.*, the rods and cones. Since the cones are densely packed in the area of perfect vision while they become less numerous and give way to rods towards the periphery, it seems probable that the former are the structures specially concerned in the discrimination of points. Measurement of these cones goes to show that their diameter corresponds (roughly) to the limits of this discrimination.[1]

MOVEMENT AND MUSCULAR SENSE.

§ 29. *Demarcation of Muscular Sense.* Sensations are supplied us not only by way of the familiar sense-organs when stimulated by external forces, but also by our own muscular actions. Such actions are important elements in conation, and as such will have to be spoken of presently. Here we are concerned with them merely as contributing presentative elements, analogous to those of tone, colour, etc., which enter into our intellective processes.

Muscular sensations may be defined as those characteristic modes of consciousness which are specially connected with the stimulation and the contraction of the voluntary muscles, as those of the limbs, the eyes, the vocal organ. If, for example, I flex my arm or turn my eyes to the right, or exert my vocal and respiratory organ in the act of shouting, I have a peculiar sensational consciousness by means of which, independently of any *mediately* resulting changes of tactile, visual, or auditory sensation, I know that I am making a muscular exertion or am actively energising and also something respecting the special character of this exertion. Muscular sensations are thus, though closely conjoined with sensations of the special senses, more particularly those of touch and of sight, sensations *sui generis.* They are marked off from other sensations as *active* from *passive* states. Sensations of light, sound, and so forth precede and call forth muscular action: muscular sensations, on the other hand, are the concomitant or result of such action.

These sensations, though in the adult consciousness apparently simple, are in reality highly complex. They probably consist in part of the psychical concomitants of the process of innervation or motor stimulation itself, *viz.*, "sensations of innervation," which presumably contribute something of its

[1] For a fuller account of the experiments respecting the discrimination of points by the retina, see Wundt, *Physiol. Psychologie*, ii. cap. xiii. § 1, p. 86, etc.

characteristic quality to our muscular experience, *viz.*, conscious activity or active consciousness, a factor to be considered fully later on.

At the same time, it is now certainly known that these sensations of innervation, even if they are a co-operant factor at all, are by no means the only one involved. The large part of our conscious muscular experience, as when we move a limb, is made up of the sensational results of *afferent* nervous processes. That is to say, our muscular, like our other sensations, are, in all normal cases, partly the product of a stimulation of peripheral organs. It is known that whenever we use our muscles a number of sensitive peripheral organs are engaged. Among these may be named the tendons, the joints, the skin which is stretched or folded during movement, and possibly also the muscles themselves into which certain physiologists think they have traced sensory nerve-fibres. According to this view, muscular experience is a complex, made up of the psychical correlatives of efferent and afferent nerve-processes.[1]

§ 29*a*. *Theory of Muscular Sense.* The precise nature and physiological conditions of muscular sensations are as yet only very imperfectly understood. The sensations being so closely connected with those brought about by stimulation of the nerve-fibres of the skin, it has been held by some that there is no distinct muscular sense at all, but that the so-called muscular sensations are really skin-sensations. Opposed to this view is the theory that muscular sensations are sharply marked off from passive (afferent) sensations by being the concomitants of the process of central motor innervation, and so efferent. This view, advocated by Dr. Bain and others as supplying a physiological ground for the fundamental distinction between active experience (consciousness of exertion, strain, etc.) and passive experience, has been affected by recent researches, pathological and experimental. The former consist of inquiries into the power of patients suffering from loss of skin sensibility or anæsthesia to carry out movements of their limbs, distinguish weights, etc., and also into the survivals of the muscular consciousness under the form of a sense of effort, and even an illusory consciousness of movement when the muscles are paralysed and contraction rendered impossible. The latter have as their object to vary the conditions of muscular action, *e.g.*, in exciting muscular contraction artificially by means of a galvanic current, or in producing passive movements, as when another person flexes our arm, and to note the results. These researches, though the results are by no means free from discrepancies, go, on the

[1] As brought about in part at least by a re-entering sensory process, muscular sensations are sometimes spoken of as 'reflex' phenomena. They are, however, the exact reverse of reflex action proper. In the latter, sensation occasions movement by means of a central arrangement: in the former, movement gives rise to sensation (partly, at least) by means of a peripheral arrangement.

whole, to show (1) that muscular discrimination involves an afferent element, (2) that this is distinct from ordinary tactile sensibility, and, though commonly including skin sensations, *e.g.*, those due to the stretchings and overlappings of the skin which accompany movements of the limbs, involves also the stimulation of nerve-fibres running to the tendons and to the surface of the joints, and possibly also of these fibres which are supposed to end in the muscles themselves. There is, however, no agreement as yet respecting the exact parts played by each of these varieties of afferent sensation. Whether these afferent elements are the sole constituents, or whether an efferent element, *viz.*, a sensation of innervation immediately attending the process of central innervation, is not also involved, is still a matter of keen dispute, and cannot as yet be said to be determined by the known facts.

In this condition of things it seems better that the psychologist should take up the conciliatory position that our muscular sensations are at once the correlative of efferent and of afferent processes. The existence of separate motor structures and organs in the brain itself suggests that the process of central discharge is one part of the neural substrate of our psychical life.[1] Not only so, the fundamental distinction between the process of afferent stimulation and of efferent discharge supplies, as already pointed out, an adequate physiological counterpart for the unquestioned psychological contrast (probably the deepest-reaching within the circle of our experience) between passive and active consciousness. Hence the psychologist does well not to abandon the idea of a consciousness attached to the outgoing current till some crucial experiment not yet devised shows this to be non-existent.[2]

§ 30. *Varieties of Muscular Sensations.* The action of the voluntary muscles gives rise to a considerable variety of sensational experiences. This variety of sensation is connected partly with differences in the muscular and other peripheral structures involved, partly with differences in the mode of action of these structures.

(*a*) *Differences depending on particular Muscles, etc., engaged.* To begin with then, it is evident that since our (voluntary) muscular system, unlike a special sense-organ, extends over the whole area of the body and certain of its cavities, and is made up of very unlike organs or structures, differences of peripheral

[1] It must be conceded, however, that some who adopt the theory that muscular sensation is wholly afferent deny the existence of separate motor central structures. This helps their theory, but is not generally supported by anatomists.

[2] Among recent discussions of the muscular sense the best are Bain, *The Senses and the Intellect*, p. 76 ff.; Wundt, *op. cit.*, i. p. 397 ff.; Bastian, *The Brain as an Organ of Mind*, Appendix; Ferrier, *The Functions of the Brain*, p. 62 ff. and p. 382 ff.; Beaunis, *Les Sensations internes*, p. 61 ff.; Mack, *Die Bewegungs-Empfindungen;* T. Lipps, *Psychologische Studien*, p. 6 ff.; Münsterberg, *Die Willenshandlung*, p. 78 ff., and *Beiträge zur exper. Psychol.* i. p. 152 ff.; and James, *Principles of Psychology*, ii. p. 189 ff. and p. 494 ff. The *a priori* psychological argument in favour of an efferent nervous substratum is well put by Fouillée, *Revue Philosophique*, xxviii. p. 561 f.

structure will produce differences in the psychical concomitant. A difference of calibre, as between the muscles of the leg and of the fingers, will affect the *quantity* of the muscular sensation, making it more or less massive or extensive; not only so, difference in the attachments of the muscles and adjacent tissues will modify the *quality* of the accompanying sensation in various ways. Thus the psychical correlative of the action of the muscles of a limb will be "coloured" by the peculiar articular sensations connected with the pressure of the joint-surfaces, and movements of the same, an element which is wanting in the case of the ocular muscles, and the vocal muscles. So the psychical concomitant of the action of the muscles of the jaw will be differentiated by the presence of the peculiar element of reciprocal pressure of the teeth, etc.

These qualitative differences would, it is evident, serve to differentiate the sensations corresponding to the action of particular groups of muscles by *quasi*-local differences.[1] It is a point of dispute whether the mere fact of the several muscles having each its own motor and probably also sensory elements would serve to give distinctness to the resulting sensations. This position might be maintained on the ground already indicated, *viz.*, that to (numerical) difference of nervous structure engaged there corresponds in general some difference in psychical concomitant. It seems, moreover, to be involved in the fact that we have a more massive or bulky sensation when a large number of muscular structures is engaged.

This postulate might be adopted on either of the views of the nature of the nervous process in muscular experience set forth above, *viz.*, that the process is an efferent or an afferent current. It is fairly certain, however, that the local distinctions among our muscular sensations always involve as a principal factor other elements, *viz.*, the analogues of "local" differences in the sensations of articular surface, skin, etc., which enter into and colour the whole muscular experience.[2]

(*b*) *Differences Arising from Mode of Muscular Action.* We may now pass to the differences of muscular experience connected with dissimilarities in the mode of action of the muscles engaged. Here we may confine ourselves to those groups of

[1] It is to be noted that so far as we know a muscle is never at work in isolation. All muscular action is a resultant of the functional activities of groups of muscles, as a flexor and its antagonist extensor.

[2] Wundt (*op. cit.*, p. 299), the most important of the latest exponents and defenders of the 'efferent current' theory, appears to allow that the mere fact of the process of innervation discharging into this or that particular motor channel would not affect the character of the accompanying 'feeling,' *i.e.*, sensation of innervation.

muscles which are of chief importance as a source of knowledge, *viz.*, those by which our limbs are moved.

The most obvious contrast in the domain of muscular experience is that between action issuing in movement and action not issuing in movement. Since movement is the normal result of muscular contraction in the absence of all counteractives, it would seem proper to begin with an account of this. There will, however, be a certain advantage in proceeding in another way. We may set out with the comparatively simple case of a momentary experience, *viz.*, that answering to a particular position of the limb. We may then consider the more prolonged experience of movement itself, and finally take up the complicated case which arises when movement is impeded by the presence of an obstacle. Thus we have (1) Muscular Experience without Movement: Sensations of Position; (2) Experience of Movement; and (3) Experience of Impeded Movement.

These types of motor experience are not absolutely marked off one from another. Since any particular position of a limb is taken up by some movement it follows that the sense of position is connected in the closest way with the experience of movement. On the other side, the active maintenance of a position, as in keeping the arms outstretched, or the head erect, is carried out by an opposed action of certain muscles and their antagonists, so that the experience has something in common with that of impeded movement. Again, even free movement is apt, when we are fatigued, to be attended by a sense of obstacle in the shape of the weight of the limb itself. The transition from this experience to the full experience of impeded movement is supplied by the loading of the limb, as when we lift a weight.

(*b.* 1.) *Experience without Movement: Sensations of Position.* The experience answering to a particular position of the limb may arise either passively or actively. A person may support my outstretched arm, or I may myself hold it out. The former situation, position passively induced, is obviously the exceptional one, at least in later life. It is complicated by the skin-sensations of pressure, while, on the other hand, it does not involve the characteristic action of the muscles as made known in active consciousness or sense of exertion. We may then dismiss this case, and confine our attention to the normal experience of actively-induced position.

It follows from what has been said respecting the probable constituents of the muscular sense that varying positions of a limb, say the arm, will have varying psychical concomitants. We can infer from the mechanism of muscular action that the relative position and direction of pressure of the articular surfaces, the condition of the tendons and of the muscles themselves, as also that of the enveloping skin, will vary for every successive position as I flex the fore-arm; and these changes will bring on corresponding psychical changes. These differences of positional sensation are of the greatest importance, as we shall see, for the acquisition of a knowledge of the spatial relations of our own body and of our surroundings.

It is important to note that the muscular action corresponding to a particular position of the arm is not a fixed quantity, but varies according to the amount of exertion employed. I can use a comparatively little, or very much, effort in holding out my arm. The explanation of these differences is that given by Münsterberg, *viz.*, that one and the same effect of a muscular action, maintenance of position, or movement, may result from different amounts of muscular work, so long as the ratio between the amounts of work of the muscles and their antagonists remains the same.[1]

It is to be added that the varying position of our limbs makes itself known by passive experience also. Thus, when on lying down my arm lies lengthwise on the trunk, the position is known mainly by help of the skin-sensations of pressure. Muscular consciousness is, however, not wholly absent here; for it must be remembered that this is supposed to attend all conditions of the muscles, and to vary characteristically for states of relaxation as for those of tension.

(*b.* 2.) *Experience of Movement.* In the case of movement we have, it is evident, a prolonged experience, made up of a continuous *change* or succession of sensational accompaniments. This feature of change is essential and characteristic. Movement is not merely that by which we bring about indirectly changes in our surroundings, *e.g.*, the visible scene, it is itself an experience of change. It is reasonable to suppose that the delicacy of our sense of movement depends on the fineness of our discrimination for these successive sensational differences.

[1] See his *Beiträge*, i. p. 155.

The discriminative delicacy characterising motor sensibility or sense of movement has been estimated in the case of the ocular muscles which bring about movements of convergence. Here it is found to be very great. Thus a movement of the eyes (or the optic axes) through an angle of 68 seconds, answering to a contraction of the inner muscle of the eye-ball amounting to about ·004 millimetres, was detected. And a difference in the range of movement, corresponding (on the average) to the fraction $\frac{1}{31}$, was perceptible. According to some recent experiments of Münsterberg, Weber's law holds good of the least noticeable differences of linear magnitude as appreciated by the sensations of the ocular muscles. See his *Beiträge*, heft ii. p. 180 f.

In considering these experiences of movement it is important to keep them separate from that spatial interpretation which, as we shall see, comes later. Motor experience, like experience of position, may arise passively, as when another moves my arm, or actively, as when I move my own arm. We will touch on the difference between these two experiences presently, after considering the general characters of movement.

Movement as consciously experienced, as we shall see by-and-by, is, along with the original local distinctions of passive sensation, a main source of our knowledge of space. As already suggested, the normal result of the action of our muscles is movement. Position is taken up and altered by movement. It is by movement that we explore the surface of our own bodies, as also environing space and its objects.

In order to explain the genesis of our perceptions of position, distance, etc., by help of motor experience, it seems necessary to assume two presentative characters in our motor experience: (*a*) that answering to direction of movement, and (*b*) that answering to range of movement. With respect to the psychical concomitant of direction, it has been already pointed out that the action of one group of muscles will consciously differ from that of another. In this way the movement of the right arm and of the left would affect our consciousness differently. Not only so, movements of the same arm in different directions would, for a similar reason, have different psychical concomitants. Thus the flexing and extending of the fore-arm would differ in consequence of the difference in the *order of succession* of the sensations attending the changing positions of the articular surfaces, tendons, skin, etc., in the two cases.[1]

[1] Whether the sensations of innervation which we have supposed to be a constituent of the consciousness of movement would differ in these two cases is, as already suggested, doubtful.

In the second place, all movements will differ on their conscious side according to other characters which have to do with their range or *extent*. To begin with, then, the motor experience, like passive sensation, varies according to its *duration*. This is an important circumstance, for, as we shall see, it is partly by help of this feature of duration that we come to know how much movement we have carried out in any given case.

Again, our motor experience varies according to the *velocity* of the movement. Thus we have one kind of muscular experience in moving the arm or the eyes slowly, another in moving it rapidly. This sense of velocity is, it is manifest, connected with the rapidity with which the successive phases of the movement on their conscious side succeed one another. We are capable of discriminating fine shades of velocity, and this greatly helps in the development of an intellectual consciousness of movement.

Duration and velocity would in themselves constitute sufficient sense-data for reaching a perception of range or extent of movement. But, as already pointed out, there are other data given us in the scale of sensational differences answering to successive stages of a movement. Thus a flexing movement of the arm carried to the extreme point is accompanied by characteristic cutaneous and other constituents of the muscular sensations which might serve as signs of range or amount of movement.[1] Our perception of range or extent is, as we shall see, built up by help of all these sense-data.

A word in concluding this account of our sensations of movement on the difference between the active and the passive experience. The latter is illustrated when we have our arm flexed by another person.[2] Here the characteristic of the active

[1] That is to say, the range of a particular movement. It is evident, however, that, so far as these positional sensations are employed, we cannot so accurately compare the range of different stages of the same movement. It is probable that when a movement takes an extreme range other muscles become involved, which supply a differentiating psychical concomitant. (See Münsterberg, *Beiträge*, iii. p. 67, and *Die Willenshandlung*, p. 81.)

[2] The experiences being carried by another, riding, and so forth, sometimes called passive movements, differ from passive movement of a limb through the absence, or at least considerable reduction, of the muscular element. In indolently swinging I know I am swung mainly by the change of visible scene, the current of air, etc.

consciousness is wanting. There is no sense of exertion, such as attends our self-initiated movements, so that the movement is not regarded as our own. At the same time it is clearly a motor experience. The sensations connected with the altering positions of the joints and the skin are similar to those which attend active movement. It is possible that a certain amount of contraction of muscular fibre is also involved. Hence the explanation of the surprising fact that we can estimate the extent of movement almost as well in passive as in active movement.[1]

(*b.* 3.) *Experience of Impeded Movement: Sense of Resistance.* The remaining variety of muscular experience is that which arises when our impulse to move is counteracted by some obstruction; an experience which has been marked off as "dead strain" (Bain) and as consciousness of resistance. This experience may be given either by our own body, as in pressing the arm against the side, the chin against the chest, or by foreign objects. It is these last which are commonly thought of in connexion with obstructed movement. As examples of this experience of resistance we may take pressing against a heavy body, supporting or lifting a weight, pulling or dragging an object.

Here it is evident muscular sensations are complicated by ordinary tactile sensations, *viz.*, sensations of pressure. The experience is, indeed, made up of a muscular and a tactile experience, the latter being dependent on and varying in degree with the muscular exertion or strain. As we shall see by-and-by, it is by means of this complex experience varied in different ways that we come to perceive the fundamental qualities of material things, *viz.*, impenetrability in its various modes, hardness and softness, density and rarity, etc., as well as weight and inertia, *i.e.*, immobility and momentum.

[1] This is the conclusion reached by Goldscheider from some recent experimental investigations. (See James, *op. cit.*, ii. p. 192.) The passive movement here referred to must be distinguished from that which arises through an electric stimulation of the motor nerve. Here, too, though muscular contraction is evidently involved, there is a falling off in the muscular discrimination which accompanies normal contraction. Münsterberg considers that this is due to the fact that fewer muscles take part. (*Die Willenshandlung*, p. 82.)

The measurement of the discriminative delicacy of this aspect of the muscular sense (sense of resistance) has been carried out by Fechner with respect to the estimation of weight. His experiments consisted in a series of liftings of weights of different magnitudes by one hand, and also by both hands. According to these experiments, when a small weight was taken (300 grammes) a difference of $\frac{1}{26}$ was recognised (in a certain proportion of trials). When a heavier weight was taken the discriminative sensibility showed itself to be finer. As in the case of the passive appreciation of weight by touch, the discrimination by one and the same hand was more delicate than that by the two hands. In these experiments touch-discrimination is, of course, not eliminated. But a comparison of the results with those which we just now saw to be gained in the case of touch-discrimination alone (apart from muscle-discrimination) shows that we have here to do mainly with muscular sensibility. And this conclusion is borne out by the observations of Leyden and Bernhardt, according to which the sensibility of the skin can be partially or even wholly destroyed without affecting materially the discriminative appreciation of weights.[1]

§ 31. *Active Sense: Touching, Seeing, etc.* The muscular sense, though sharply distinguished from passive sensation in its character and mode of production, is, as already suggested, conjoined in our experience with such passive sensation. As pointed out above, all sensory stimuli tend to excite some amount of muscular action, and it is probable that all passive sensation is complicated by a factor of muscular sensation.[2] Not only so, since all our sense-organs are supplied with muscles by the action of which they are moved (wholly or in some of their parts), we may say that each class of special sensation has its own motor concomitant. Thus the movements of the tongue enter into active tasting, those of the nostrils and respiratory organs into active smelling or sniffing, while certain muscles of the ear, and, to a larger extent, those of the head, co-operate in active hearing or listening.

It is, however, in the case of the two most highly mobile sense-organs, those of touch and sight, that we see the co-operation of muscular action most plainly manifested. Touching and seeing or looking are pre-eminently active processes involving movements of the organs concerned, as stretching out

[1] See Wundt, *Physiol. Psychologie*, i. cap. viii. p. 370.

[2] This universal concomitance of a muscular element in passive sensations has been recently insisted on by Münsterberg, who has made a number of new and striking applications of the fact, as to the phenomena of attention, the measurement of the intensity of sensation, and so forth. (See his *Beiträge zur exper. Psychol.* iii. 1.) He seems, however, to be going too far in referring *all* difference of sensational intensity to the muscular factor.

the hand, running the fingers over a surface, directing the eyes to a point. This co-operation of muscular action with passive sensation is known as Active Sense. The service thus rendered by muscular action to the special senses is a complex one. In the first place, it is evident that the movements of a sense-organ greatly increase the number or range of passive sensations. Just as the mobility of an insect's antennæ enables it to have many more impressions of touch than it would have if the organs were fixed, so the mobility of the human arm, hand, and fingers greatly extends the range of our tactile impressions. By such movements we are able to bring the most sensitive part of the organ, *e.g.*, the finger tips, the area of perfect vision on the retina, to bear on the several portions of a wide area of objects.

A second advantage closely connected with this is the introduction of *change* of impression. The importance of this will appear when we consider the bearing of change or contrast on the distinctness of our sensations. Movement introduces change in more ways than one. Thus when a person moves his eye over the objects constituting his field of vision, the shifting of the several luminous stimuli to new retinal elements serves to strengthen their effect, that is, to render the sensations more vivid and impressive than they would be if the eye were fixed.[1] Of still greater importance is the change which is secured by means of rapid movement between successive impressions received by way of the most sensitive part of the organ. It is by transferring the fingers rapidly from one surface to another (*e.g.*, from a rough to a smooth, from a cold to a warm) that the corresponding qualities are nicely distinguished. Similarly, it is by passing the eye quickly from one colour to another that the finer discrimination of colour is carried out.

But this increase in the range and the comparability of our passive impressions is only one part of the gain resulting from the mobility of the sense-organs. A third and no less important service rendered to the special senses by their muscular apparatus is the addition of the muscular experience itself

[1] As we shall see by-and-by, this shifting further subserves the differentiation of the several local characters answering to different points of the retina and the skin.

which accompanies the workings of this apparatus. This experience, as we shall see by-and-by, supplies the two senses of touch and sight with a specially complete means of ascertaining the position of objects in space. The local discrimination of the skin and of the retina acquires its later importance because of its intimate association with muscular discrimination.

Finally, as has been pointed out, the muscular sensations of resistance come into the closest connexion with passive touch. In touching objects we commonly exercise our muscles, not only in moving the organ, but also in pressing against the objects. The muscular sense is thus in a very special way associated with touch, and is on this account dealt with by some psychologists under the head of touch.

(B) ELEMENTS OF FEELING.

§ 32. *Primitive Affective Phenomena.* In this general account of the elements of mind a brief reference must be made to the other two groups of elementary psychical phenomena, *viz.*, feelings and movements regarded as active or conative phenomena.

With respect to affective elements, that is to say, simple modes of agreeable and disagreeable feeling, it is evident that, like presentative elements or sensations, they are given as the immediate psychical concomitants of nervous stimulation, and are predetermined by the very structure of the child's nervous system. Thus we find them, under normal circumstances, experienced within the first weeks of life. They are, moreover, closely connected with presentative elements or sensations. As examples of these affective elements or Sense-feelings we may take the familiar pleasures and pains of the bodily or organic life, such as the recurring cravings and satisfactions of appetite, the feelings connected with changing temperature of the body, with digestion and indigestion, with obstruction and furtherance of respiration, etc., with the exercise and fatigue of the muscular system, and, lastly, with the activities of the special senses, *e.g.*, the sensations of sweet and bitter in taste, of smooth and rough in touch. A fuller investigation of these sense-feelings and of their precise relation to the presentative elements will have to be made later on, after completing our account of the growth of mind on its intellectual side.

(c) ACTIVE ELEMENTS: PRIMITIVE MOVEMENTS.

§ 33. *Primitive Conative Phenomena.* In addition to sensations and the feelings which are so closely conjoined with these, we have as primordial psychical phenomena certain active tendencies. The structure of the nervous system, as already set forth, prepares us for the fact that movement is proper to the child, and that it is from the first excited reflexly, that is, in response to sensory stimulation. We may instance the movements of the limbs, head, etc., in response to tactual, auditory, and other stimuli. These movements, as we shall see later, include those by help of which attention to sense-impressions, *e.g.*, turning the eyes or head in the direction of an object, is effected. Other primitive movements probably take their rise through a process of central "automatic" excitation.

In speaking of these primordial movements as *active* phenomena, we must carefully distinguish between the presentative aspect of movement considered above and the conative aspect. A movement, say of the right arm, is presentative in so far as it supplies me with certain sense-data by which I come to know something, *e.g.*, the distance traversed, the weight lifted. On the other hand, it is active or conative since it is a conscious exertion or is characterised by the feature marked off above as active consciousness. Now, these primordial experiences of movement, although they are not volitional processes in the full sense, that is, consciously purposive, are accompanied by the active consciousness, and they constitute, as we shall see, an important stage in the first development of voluntary or conative power.

(d) PRIMITIVE PSYCHO-PHYSICAL COMPLICATIONS.

§ 34. *Primitive Conjunctions of Psychical Elements.* While in order to trace the development of the child's mind we have to assume under each of its three phases a group of elements, or simple original phenomena organically connected with primitive and predetermined modes of nervous action, we have further to take note of certain primordial connexions between these elements. The nervous system is, as we saw above, an organic whole, with its parts variously and closely interconnected, and these connexions predetermine corresponding connexions in the child's mental life. A glance at some of the more important of these original psycho-physical arrangements must suffice.

To begin with, the formation of our various intellectual products, our perceptions and ideas of things, are determined not merely by the connexions of the individual's experience, but to some extent by the original configuration of his brain. Thus it is presumable that that complexity of sensation which we everywhere find when we begin to analyse it (*e.g.*, in our gustatory and auditory sensations) is determined not merely by the habitual co-excitation of different sensory elements, but by primitive cortical connexions between these. One of the most important and universal of these sensation-complexes, the complication of passive with muscular sensation, which will be more fully illustrated hereafter, is clearly based on the original organic continuity of the sensory and motor tracts. There is some reason to suppose, further, that the conjunction of sensations belonging to disparate senses, *e.g.*, those of touch and sight in the perception of objects, is favoured to some extent by primitive nervous connexions or original dispositions in the corresponding cortical centres to act conjointly.

Still more plainly are such original psycho-physical complications seen in the domain of feeling. Owing to the preformation of the nervous system, sense-feelings are from the first rarely, if ever, perfectly simple. The agreeable or disagreeable stimulation of a nerve of special sense, when of sufficient intensity, gives rise to a secondary excitation of other nerves, and more particularly the motor fibres which run to the so-called voluntary muscles and to the viscera or vital organs. This radiation or diffusion of the nervous current gives rise to a number of secondary sense-feelings. In this way feeling is by the very structure of our nervous system a complicated phenomenon. The effects of this complication will appear more plainly by-and-by, when we come to consider the structure of the more complicated feelings or emotions.

Lastly, we have the complications involving a conative factor. These include, first of all, all the original organic connexions of feeling and movement already spoken of. The tendency in all sensory stimuli, in the degree in which they excite feeling to call forth motor reactions, will be found to have important psychological consequences. As we shall see by-and-by, we require as our starting-point in the development of conation an instinctive connexion between feeling and action. In addition to this fundamental connexion, there are other arrangements favouring particular combinations of movement. Thus the uniformities in the movements of the limbs among normal children, the alternations of forward and backward swing, the alternative movements of the legs, the corresponding or symmetrical movements of the eyes (and probably the arms), show pretty plainly that a certain rhythmic succession and co-ordination of simultaneous factors in movement is predetermined by the original constitution of the neuro-muscular mechanism.

In addition to these constant and important primitive connexions there are others of a more exceptional and variable character. It has been pointed out that owing to the principle of irradiation or diffusion of nerve-currents the stimulation of any particular cortical area tends to pass over into other areas. It is probable that from the first special lines of discharge (or lines of least resistance) favour particular directions of the radiative process. Thus in the curious phenomenon known as concomitant sensation (Mitempfindung), such as the excitation of an organic sensation of nausea by certain olfactory and other stimuli, of "setting the teeth on edge" by certain scratching sounds, we may suppose the effect to be predetermined by the special structure of the nervous centres. It is probable further that the phenomenon known as "coloured hearing," that is, the co-excitation with a particular sensation of sound of a definite (subjective) sensation of colour, a phenomenon observed in a number of persons and traceable back to early life, is dependent on a peculiar preformation of the nerve-centres.[1]

§ 35. *The Range of Instinct in Man.* The precise range of such primitive psycho-physical arrangements in the case of man is very uncertain. It is a commonplace in biology that the higher we go in the zoological scale the less is the individual's life mechanically predetermined and the more subject

[1] On the effect of irradiation in giving rise to concomitant sensation, see Lewes, *Problems of Life and Mind*, 3rd series (ii.), p. 280 ("Double Sensation"). On coloured hearing, consult Lewes, *ibid.*; Galton, *Inquiries into Human Faculty*, p. 145 ff.; and Bleuler and Lehmann, *Zwangmässige Lichtempfindungen durch Schall.*

to the educative agencies of his experience. Thus, in man the range of instinct is far narrower that in the lower animals. He cannot walk just after birth, as the calf can do; still less can he adjust movements to definite modifications of visual impression, as the newly-hatched chick is able to do.[1] The human nervous system is eminently plastic, and the large bulk of its arrangements or connexions have to be formed in the course, and by the help, of individual experience and education.

At the same time the careful psychological analysis of recent years, aided by a more extended and more exact observation of the infant mind, has led to the conclusion that in man too the range of instinctive disposition is much more considerable than is commonly supposed. Thus even in the case of actions which have to be acquired and rendered perfect by a process of learning, the presence of a co-operant instinctive factor is now recognised. It is commonly held that the child's use of his limbs, and of his vocal organ, is predetermined in a measure by such an instinctive or connate factor. Examples of these instinctive predispositions blending with the action of experience will meet us when we come to trace the early development of the feelings and of conation.[2]

All such instinctive or connate tendencies must be regarded as given in organic connexion with the primitive constitution of the nervous centres. Here the psychologist has been wont to pause. To trace back a psychical phenomenon to a primordial instinct is, according to this view, to have reached the goal of psychological analysis. The modern doctrine of evolution, however, enables us to go further, and to trace out to some extent the antecedents of such a connate endowment.

§ 36. *Origin of Instincts: Heredity.* Connate endowments are either specific, that is, common to all members of the

[1] For an account of Mr. Spalding's observations on the pecking of chicken just released from their shell, and of other perfect instincts among animals, see Romanes, *Mental Evolution in Animals*, p. 161 ff.

[2] The reader must be careful to note that the terms connate and instinctive (unlike innate in its first crude meaning) do not mean that a power is fully formed and realised at birth. It may require some time and some addition of (individual) experience to bring the instinctive endowment into efficient action.

human species, or variable and individual. Our various normal sensibilities are examples of the former; native individual character is an example of the latter.[1]

All connate or congenital endowments arise in one of two ways: either as the result of those unknown influences which cause an individual to vary and differ from his ancestors, and which we call accidental variation; or as the result of the conservative force of heredity. All specific endowments are of course due to the latter agency. The normal human brain, with its correlated psychical capacities, is, like the human organism as a whole, the result of the hereditary transmission of specific or typical characters from progenitor to offspring. Individual endowments, *e.g.*, a trick of manner, though in many cases referrible in the present state of our knowledge only to the causes which produce individual variation, are in numerous instances traceable also to the action of heredity. It has long been observed that peculiar physical and mental traits are apt to reappear in the successive generations of a family.

Going back a step further, we may ask how the ancestor first came by the trait which he is thus able to transmit. If it was not always existent it must at some moment have been come by. There are two supposable ways in which it could have been attained: either it was acquired by the ancestor as the result of his experience and the use of certain native powers, or was an 'accidental' congenital variation of his organism. An example of the first would be the transmission from progenitor to offspring of a special degree of muscular agility or skill acquired by long and exceptional training; an illustration of the latter would be the reappearance of a congenital eccentricity of bodily carriage or gesture.

Without going more fully into this difficult and much-debated subject, it must suffice to say that, according to Mr. Spencer and other evolutionists, the transmission of an improvement of natural capacity, mental as well as bodily, by exercise and training is not only a reality but a chief determining factor

[1] Individual natural endowments may, of course, be common to certain varieties of the species, as the varying impulses entering into differences of racial and national temperament.

in the evolution of the race. It is by this agency that each generation transmits (on the average) a slight increment of brain-power to its successor, and that the continuous exercise of intelligence, of moral feeling, and so forth, through a succession of generations leads to a perceptible improvement of these powers.

This theory of mental heredity manifestly tends to support the conclusion that the child brings with it into the world an outfit of instinctive tendencies or dispositions constituting the natural basis of the civilised and moralised man. These tendencies, being comparatively late in their acquirement by the race, are necessarily inferior in strength to the deeper-seated and earlier-acquired impulses of the nature-man or savage.[1] At the same time, their existence (if made out) even in a feeble and nascent form is an important psychological fact. It goes to show that the gradual elevation of the individual, both intellectual and moral, is not wholly the result of experience and education, that the child is congenitally so fashioned in its neuro-psychical organisation as to be disposed and even impelled to move along the path of normal human development. In the course of our exposition we shall have occasion to illustrate the co-operation of such inherited intellectual and moral dispositions.

In this short account of hereditary transmission I have assumed, with Mr. Spencer and the older evolutionists, that acquired characters, physical and psychical, can be transmitted. This proposition has recently been vigorously attacked by Prof. Weissmann and others. According to them, it is only congenital attributes of ancestors that reappear in descendants. On this view, exercise of organ or faculty, though carried on through hundreds of generations, would produce no effect in improving the connate powers of descendants. It cannot be said, however, that this new view has, as yet, accommodated itself to known psychica phenomena, and I have accordingly felt justified in standing by the older view.[2]

[1] According to the current doctrine of evolution, what is acquired in the later stages of racial development is weaker, or less perfectly organised into an instinct, in the individual, and also appears later, according to the supposition that the order of development of the individual represents in its main phases that of the race.

[2] On the doctrine of heredity as applied to mind, see Th. Ribots, *On Heredity ;* H. Spencer, *Principles of Biology*, pt. ii. chap. viii. ; and Weissmann, *Essays upon Heredity*.

REFERENCES FOR READING.

A popular account of the several senses is given by Prof. Bernstein in his *Five Senses of Man.* A detailed exposition of sensation is contained in Prof. Bain's *Compendium of Mental Science* (book ii.). With this may be compared the *résumé* of the facts in M. Taine's work *On Intelligence*, pt. i. bk. iii. The results of more exact experimental research into the properties of sensation (psycho-physical experiment) can be studied in Prof. Ladd's *Elements of Physiological Psychology* (pt. ii.), and Prof. Wundt's *Die Grundzüge der physiologischen Psychologie*, 3rd ed. (abschnitt ii., and first part of abs. iii). Lastly, an account of the original instinctive tendencies in man is supplied by Prof. Bain (*loc. cit.*); by Prof. Preyer, *Die Seele des Kindes*; and Prof. W. James, *Principles of Psychology*, chap. xxiv.

CHAPTER VI.

MENTAL ELABORATION: ATTENTION.

§ 1. *Nature of Psychical Elaboration.* Having briefly surveyed the primitive elements of our psychical life, we proceed to study the processes by which these are elaborated into the several later products, ideas, thoughts, complex emotional states, etc.

According to our general conception of mental activity as conditioned by nervous action, we have to regard these processes of elaboration as in a manner mechanical. That is to say, as psycho-physical operations they must be supposed to involve and to depend on mechanical movements in the central nervous structures. At the same time, since the processes are conscious processes, we may be allowed to speak of them as the mind's elaboration of its material. The forms of this elaboration must be studied in the conscious processes themselves. As will appear presently, our knowledge of the nervous processes involved helps us as yet only very slightly to understand these forms.

In analysing the process of psychical elaboration into its constituent processes, we shall be chiefly concerned with intellectual development, or the elaboration of ideas, thoughts, etc., out of sensations. It is here that we can most plainly see into the nature of psychical elaboration; and it may be expected that the development of feeling and of volition will proceed by closely analogous processes.

§ 2. *Attention as a Factor in Elaboration.* The place of attention in our mental life has already been roughly defined. It is a phenomenon of the active side or phase of mind, and as such will have to be studied under the head of conation. At the same time, it is present in a measure in all fully-developed or distinct conscious states, and is the great determining factor in the raising of psychical phenomena to the dignity of clear well-defined states. Thus the development of a sensation, say of sound, into a steady distinct form of consciousness implies, over and above the process of sensory stimulation, some additional central responsive action which we call attention. This responsive action, by giving persistence and definiteness to the material of sensation, underlies the whole process known as the intellectual elaboration of sensuous material.

It follows that we must at the very outset make a preliminary study of the process of attention. Here, however, we shall be concerned with attention mainly as a determining factor. The understanding of it as itself determined, more particularly by feeling and conation, will only be possible after a study of these two domains of phenomena.

§ 3. *Definition of Attention.* It is only possible to define attention on its subjective side, as mental activity immediately resulting in a raising in point of intensity completeness and definiteness of certain sensations or other psychical phenomena, and a corresponding lowering of any other simultaneously-presented sensations, etc.[1]

In thus describing attention as activity we are not making any assumption with respect to an active spiritual principle. We mean simply that as a psychical process attention has the characteristics of our conscious active states in general, which characteristics are known by such expressions as sense of exertion, effort and strain.

It is implied in this definition that attention has its direction determined by a particular psychical content, as a sensation of colour. These "objects of attention," as they are called, must be distinguished from the external objects which are supposed to exist independently of the individual percipient mind.[2] Objects of attention are psychical phenomena forming con-

[1] On the relation of attention to the presentative and to the other constituents of mind, see above, p. 77. Attention has been likened to the fixation of the eye on a certain point in the field (Blickpunkt), which in consequence becomes distinct, while other points are relatively indistinct.

[2] This idea of objects external to, and independent of, the mind is extra-psychological and philosophical. It will be referred to when we take up the subject of sense-perception.

stituents of some individual mind. Thus, when I attend to a colour, the process really involves a psychical reaction on the sensation of colour given or presented to, or occurring in, my individual mind.

Objects of attention are either sensations, and their combinations, sensation-complexes, or what we call ideas or representations, *e.g.*, the idea or mental image of a colour. In this preliminary account of attention we shall confine ourselves as far as possible to the earlier and "outer" direction of attention, *viz.*, attention to sensations. The process of "inner" attention, or attention to ideas, will be dealt with more fully hereafter.

Attention in its simplest form is thus to be conceived on its subjective side as a kind of mental reaction upon a sensation already partially excited by the proper peripheral process of stimulation. This reaction, again, in all simple cases at least, must be viewed as arising out of the partial excitation or subexcitation of the psycho-physical process in sensation, which process thus constitutes the stimulus or excitant of attention.

§ 3*a*. *Relation of Attention to its Object.* The relation of attention to its object has given rise to much difficulty. Our common way of describing this seems to imply a psychological dualism, a ready-made sensation or presentation on one side and the mind ready to confront it on the other. It is this mode of conception, along with the ambiguity of the word activity, which has favoured the notion that attention is a direct manifestation of an active spiritual principle, the survey by the ego of its own states or phenomena. This detaching of attention from the psychical content which is its object has called forth by way of reaction the view that there is no such thing as a separate process of attention, and that, to use the words of Condillac, so-called attention is nothing but the transformation which a sensation undergoes when it predominates by its vivacity.

According to the view here adopted, both of these extreme conceptions are erroneous. There is an active process of attention which in many cases, if not in all, makes its presence known by a characteristic sensation or feeling of effort or strain. On the other hand, this process is not distinct from the fully-developed sensation, but, on the contrary, a main factor in its production. What really occurs is the partial emergence of a sensation as a sub-conscious element. This acts as a stimulus and excites the reflex process of attention. The addition of this process of attention serves, through its confluence or coincidence with the sensation, to intensify and heighten it in the manner described. The whole process may be roughly symbolised thus: $\text{s} + \text{A} = \text{A}S$, where the small s represents the sensation in its sub-conscious, the large S the sensation in its fully conscious phase. The expression AS indicates that the result of the addition of the process of attention is not merely to intensify the sensation, but to generate a new psychical product, in which we can distinguish as constituents the perfected sensation and the conscious exertion or strain in the attention itself.[1]

§ 3*b*. *Positive and Negative Aspect of Attention.* Again, our definition of attention implies that it is at once a reinforcing and a weakening of psychical contents. We cannot attend in one direction and so intensify a particular presentative element without, *ipso facto*, withdrawing attention from other directions, that is to say, inhibiting other simultaneous presentations, or the tendency of these to rise into consciousness. Attention has thus at once a positive or furthering, and a negative or hindering function: it is a narrowing or concentrating of consciousness, that is, a converging of the light of consciousness on a definite spot, and a correlative darkening of the rest of the field. This inhibitory or obstructive effect, though most distinctly manifested in the higher forms of attention, is always present. In proportion as the energy of attention is absorbed in any one direction, all other presentative elements sink into obscurity. A baby staring at a bright bauble is for the moment all visual consciousness, and loses account of its organic sensations, though these may just before have been not only distinctly present but overmastering. In many of the higher forms of attention, specially spoken of as concentration of mind, we carry out particular movements in order to aid this process of quenching irrelevant and rival sensations, as in closing the eyes when listening. It is through this selective and restrictive function that attention subserves what has been called the "unity of consciousness," that is to say, its tendency to assume the form of a single succession of psychical states.[2]

[1] The dualism here referred to may be found illustrated in the common accounts of attention, as those given by Hamilton in his *Lectures on Metaphysics*, and Carpenter in his *Mental Physiology*. Ward's way of viewing attention is avowedly based on the distinction of sub-conscious presentations as 'objects' and a concentration of consciousness upon these (article "Psychology," *Encyclop. Britann.*); and the same may be said of Stumpf's otherwise excellent discussion of attention, *op. cit.*, i. 33 and ii. 222 and 289. On the other hand, Bradley goes to the other extreme, and, like Maudsley, would eliminate the factor of attention as activity and resolve the experience of sensation-heightening attention into a complex of sensational and ideational elements. (*Mind*, xi. p. 305 ff.)

[2] *Cf.* above, p. 77 f. Ribot calls attention a tendency towards monoideism, see *Psychologie de l'Attention*, p. 9.

This distinct emergence and predominance of certain presentative elements with the submergence of others has been treated by Herbart and his followers apart from attention as a result of forces inherent in the elements themselves, *viz.*, a striving to realise itself in each presentation, and a sort of struggle for existence among simultaneous elements which act on one another according to certain laws of mutual furtherance and arrest. No doubt there is, as we shall see presently, in the psycho-physical process of sensation a force which serves to secure its predominance by determining the current of attention to set in a reflex manner in that direction; but the predominance is to be regarded as a direct result of this reinforcement by attention. This is manifestly so in many cases, and is presumably so in all.[1]

§ 3*c*. *Degrees of Attention: Inattention.* It follows further from our definition of attention that it is a process of varying degrees of strength or intensity as well as of duration. We popularly talk of attending only where we exert a specially high degree of exertion, and do so moreover by what is called a volitional effort. But the activity of attention reaches far below this exceptional effort. There may be momentary risings of attention, fugitive glances of the mental eye, of which we are only half aware immediately afterwards. Such swift and instantly-forgotten movements of attention play a large part in the developed mental life of the adult.

According to this view we shall recognise a scale of attention. At the upper extreme will be that maximum effort, maximum in respect of intensity and of duration, which we very rarely give to things that most profoundly impress and occupy us. At the lower extreme we have a barely-appreciable amount of conscious activity.

The position of this lower limit fixes the extent of non-attention or inattention, that is, the absence of mental activity.[2] How far during the maintenance of conscious life we ever realise a state of inattention as thus defined is doubtful. Thus, though attention is commonly said to be absent during sleep, a closer study of our dream-experiences shows that this

[1] For an account of Herbart's mechanism of presentation, contention and mutual arrest, see Mr. Stout's exposition of "The Herbartian Psychology" in *Mind*, vol. xiii. Mr. Bradley views the matter in a similar way in the article just referred to, "Is there any Special Activity of Attention?" (*Mind*, xi. p. 305.)

[2] Inattention as thus understood must obviously be distinguished from that *withdrawal* of attention which has just been spoken of. An "inattentive" hearer of a discourse may be inattentive in the complete sense, mentally drowsy, or merely transferring his conscious activity to other matters.

is by no means literally true.[1] However this be, it may be said that we approximate to such a point of inattention in all states of mental languor, drowsiness, mental fatigue, and so forth. The characteristics of this state of inattention are relaxation of effort, or cessation of the strain of attention, and a substitution for a restrictive predominance of certain psychical elements, of a levelling of the mental state down to a crowd of equally-confused sensations. These features of inattention are brought out by the common expression "scattering" or "dispersion" of thoughts, and the corresponding French term *distraction* (*cf.* the German *Zerstreutheit*).[2]

The demarcation of the limits of attention is a matter of peculiar difficulty. We can broadly distinguish special efforts of attention from states of comparative relaxation, but to fix the exact point where all attention disappears seems impossible. It may be said however that those psychologists who, following the new and tempting psycho-physical path, look on attention as something quite accidental and occasional misapprehend the whole structure of our mental life. Science, unlike law, has to care for minimal quantities, and the overlooking of the lower intensities of a psychical phenomena may lead to radical error.

In contradistinction to the broad definition of attention here given, other definitions confine the term to particular modes of manifestation. Thus Stumpf would deny that we attend to a box on the ear.[3] The phenomenon of "compelled attention," as it has been called, will occupy us presently. Here it is enough to say that though the oncoming of attention is peculiar in this case the fact of the activity is indisputable. One would like to know the fortunate man who could receive a box on the ear and *not* attend to it.

It may perhaps be as well to add that in the extreme case of intense and prolonged concentration on a single 'object' we get, according to the principle that extremes meet, an approach to the state of relaxation or dissipated activity. The known somnolent effects of fixating an object with the eye, and the state of stupor into which the ecstatic visionist lapses, are illustrations of the principle that too restricted an attention (persistent monoideism) issues in a result not unlike what we all call inattention.[4]

[1] See my volume, *Illusions*, p. 172 f.

[2] See James, *Principles of Psychology*, i. 404. This condition of mental dispersion is, according to Exner, capable of being brought on voluntarily when trying to fall asleep. I myself can bring on the state for very short periods, though being a very bad sleeper I have not yet succeeded in carrying it to the point of falling asleep.

[3] *Tonpsychologie*, ii. p. 283.

[4] Ward widens the denotation of the term attention to the utmost so as to make it a constant factor in psychical states (*loc. cit.*, p. 44). He does not however treat of attention as a conscious process, but merely as a factor which we have to assume hypothetically in order to account for changes in the conscious field. Ribot, in his monograph, *Psychologie de l'Attention*, tends, on the other hand, to confine the term attention to the more marked manifestations (see, among other passages, p. 7).

§ 4. *Nervous Process in Attention.* We have thus far considered attention merely on its subjective side as a mode of consciousness. Since attention is a process in time, a psychical event that follows the first sub-conscious phase of sensation, it is reasonable to expect that the study of it as a psycho-physical process will help us in understanding its nature and its effects. Accordingly, we may proceed to consider what is known of its objective side, *i.e.*, of the nervous process which underlies it.

As already pointed out, the general type of the psycho-physical process is reflex or "sensori-motor," a sensory process being followed by some motor reaction. The nature of this motor reaction will be more fully studied when we come on to the subject of conation. For the present we are concerned merely with its bearing on attention. Observation of the state of attention itself, as well as the general consideration that *all* psychical processes involve some motor factor, lead to the conclusion that attention in every case is accompanied by some amount of motor innervation, and probably also by some amount of muscular contraction.[1]

(*a*) *Muscular Element in Sensational Attention.* For the present we may confine ourselves to the earlier and simpler form of attention, *viz.*, to sensations, or sensational attention. That there is a muscular process carried out in connexion with our sensations is evident, at least in most cases. Thus, when we are looking at an object attentively, we are carrying out a number of motor adjustments, such as accommodation of the lens, alteration of convergence, turning the eyes in the direction of the object, which subserve perfect vision, or vision of maximum distinctness. Along with these eye-movements there are head-movements which serve the same purpose. Again, in actually touching we tend to bring the most sensitive part of the skin to bear on the object, just as in looking we bring the most sensitive part of the retina. In listening attentively there are corresponding adjustments, and more particularly movements of the head.[2]

[1] This last is, of course, specially insisted on by those who regard our muscular sensations as wholly the result of peripheral changes. Those, on the other hand, who view it as in part centrally excited could hold that the motor concomitant in attention may be greater than the amount of peripheral muscular contraction.

[2] Movements of the outer ear are not possible in the case of most men. The

These muscular actions are, it is evident, directly subservient to that clearness and distinctness of impression which it is the business of attention to secure. Hence it seems right to connect them with attention. But more, there is every reason to suppose that they contribute the characteristic *psychical* factor itself, *viz.*, the sensation of tension, strain or exertion. Close inspection will show, indeed, that in attending to a colour or a sound the distinctive complexion of the experience is given by that active consciousness which is the essential ingredient in all muscular sensations.

According to this view, the intensity of the strain in attention will depend mainly, if not exclusively, on the total muscular tension.[1] It has been pointed out above that very unlike amounts of muscular work may issue in the same apparent result, a particular movement, or the maintenance of a particular position, provided that the ratio of tensions in the opposing (antagonist) muscles remains unaltered. Steadfast, close seeing, as in microscopic observation, involves a good deal of such opposed or counteracted tension of the ocular muscles, as well as of the muscles which keep the head steady.

In addition to this muscular element in sensational attention connected with the due control of the particular peripheral organ engaged, there are other concomitant muscular actions. Some of these, as characteristic movements of the mouth, appear so early and so commonly that they probably depend on common congenital arrangements; others are distinctly acquired. This applies to certain useful movements, more particularly shutting the eyes, as some persons uniformly do when they want to touch exactly, or, like Goethe, want to listen as well as possible to music. These concomitant movements manifestly add a further element of active consciousness to the state of attention.

Lastly, reference may be made to that part of the muscular concomitant of attention which shows itself in the *inhibition* of movement. It is evident that a general stillness or motionless-

alterations of the tension of the tympanum, which have often been regarded as a main motor factor in the hearing of tones, are exceedingly problematic. (See Stumpf, *Tonpsychologie*, ii. 294 f.)

[1] Not exclusively if the sensation of strain can be supplied by a process of central innervation which stops short of peripheral muscular work.

ness of the body is useful to close sense-observation. The keeping of the eyes and head *steady* already illustrates this inhibition of movement. Other illustrations of it are the cessation of locomotion when we want to listen or otherwise attend to sensations. Even the slight disturbing movements due to breathing are inhibited when we attend with the higher degrees of intensity. A man looking intently will involuntarily hold his breath. This inhibition of movement must be carefully distinguished from *relaxation* of muscular activity. It is, as we shall see, brought about by tension in opposing muscles, and so adds new elements of conscious strain to all the more energetic forms of attention.[1]

It would thus appear, so far as sensational attention is concerned, that muscular sensation is not only a constant element, but varies in intensity and volume or extent with the amount of attention. It seems reasonable, therefore, to regard it as the main determinant factor in the process.

(*b*) *Muscular Element in Ideational Attention.* We may now pass to the more difficult case of attention to ideas, " internal " or ideational attention. We cannot of course as yet give a full account of this higher process. Suffice it to say, in order to deal at this stage with the question of the physiological process in attention, that we assume an idea, *e.g.*, of a colour, to be correlated with some action of the same central (cortical) elements that are engaged in the production of the corresponding sensation.

That in ideational attention, *e.g.*, trying to think of something, a muscular element is present may easily be noted. Thus when we try to visualise, that is, imagine a visible object, as a colour, we can detect a sensation of muscular strain which is referrible to the peripheral apparatus engaged in actual seeing, *viz.*, the muscles of the eye and the surrounding muscles (*e.g.*, those by which frowning is carried out), also those muscles of the neck by which movements and fixations of the head are effected.[2] Such muscular actions may be viewed as a survival or partial reproduction of the motor concomitants of the original sensation.

[1] See Münsterberg, *Beiträge*, i. p. 138. According to Féré all attention (reflex and voluntary) is accompanied by a general balancing tension of the muscles, which is a necessary support of the special *local* tension. (See *Revue philosophique*, Ann. xv. (1890), p. 393 ff.)

[2] See Münsterberg, *Beiträge*, i. p. 151 ff.

In addition to these there are, as in the case of sensational attention, concomitant muscular actions, as those in certain regions of the skin of the head, on which Fechner lays stress,[1] compressive movements of the mouth, etc. In certain cases also we get individual associated movements, as the fixing of the eye on a favourite spot in the room when we want to think intently, and the common trick of fumbling with a button observable in nervous persons when trying to think.[2] Further, we have in ideational as in sensational attention an inhibition of diffuse disturbing movement. Thus, during a prolonged effort of thought, the head is apt to be fixed, the breath held, as seen in the French expression *de longue haleine*, and so forth.[3]

These motor concomitants of ideational attention, like those of sensational attention, serve to some extent at least to ensure distinctness in the psychical result. Thus it seems reasonable to suppose that since a certain variety of muscular action is organically related to a particular mode of sensation, the renewal of that action and its psychical concomitant would tend to reinstate the idea of the sensation. This is the result of those Laws of Association which will be considered presently. For a like reason certain at least of the concomitant motor actions would be auxiliary to vivid and distinct ideation. In some cases, morever, the effect would be still more marked. Thus, as pointed out by Bain, Lange and others, when we imagine a line or a circle we tend to carry out ocular movements corresponding to those by which we should actually trace the particular form with the eyes.[4]

(*c*) *Other Physiological Correlatives of Attention.* At the same time it is doubtful whether this motor factor, large as it is, is the whole of the physiological process in attention. The intensification and clearer definition of a sensation of sound or

[1] *Elemente der Psycho-physik*, ii. p. 475 ff.

[2] Scott gives a good instance of this in his autobiography. When at school, he was beaten in class by a boy who, whenever called on to answer questions, fumbled with a certain button of his waistcoat. Scott, noticing this, maliciously cut off the useful implement, and by thus putting his rival *hors de combat* easily took his place at the top of the class.

[3] See Lewes, *Problems of Life and Mind*, third series, p. 188 f.

[4] Another occasional motor concomitant of ideational attention is a sub-excitation of the muscular process of articulation. This will be best considered, however, when we treat of the ideational processes.

colour by attention probably involves a further neural process, *viz.*, a centrally initiated excitation of the particular sensory cortical area engaged. That this is present in all the higher kinds of attention is certain. As we shall see by-and-by, a carefully directed attention to sensation is prepared by some preliminary ideational activity, which we call looking out for a thing, or expectation. This ideational activity involves on the physiological side a sub-excitation of the particular cortical area which is to be fully excited by the peripheral stimulus. And it is easy to understand how it may serve to reinforce the effects of the latter. It is possible that something analogous to this central sub-excitation is present in all cases, though we are not as yet able to give scientific definiteness to this supposition.

That the muscular action is not the whole of the neural process in attention is suggested by the fact that we can attend in the absence of muscular adjustment. Thus, as Helmholtz points out, we can attend to an object in the peripheral parts of the field of vision without moving the eye towards it.[1] The intensification of the particular colour-element that certainly takes place in this case would be readily explained by the supposition that the particular cortical process corresponding to this element was somehow centrally reinforced. The co-operation of such a central ideational process is rendered probable also in the case of attention to sensations of sound, where the process of muscular adjustment seems to be greatly restricted.[2]

The question by what special apparatus such action is carried out is not easy to answer. If we assume a certain motor tract in the frontal region of the cortex, which is known to be a special centre for movements of the head and eyes, to be specially engaged in all the higher ideational attention, we may with Wundt conjecture that there is some path by which nervous excitation may be propagated directly from this motor region to the particular sensory centres engaged in sensation and ideation. Such a process, being analogous to one of motor innervation, might (on the 'efferent' theory of the muscular sense) be supposed to contribute something to the characteristic psychical factor in attention, *viz.*, sense of strain. But the assumption remains a pure conjecture. It may be added that without assuming a special motor region as the seat of attention we may conceive of a centrally initiated nervous excitation travelling centrifugally from the sensory centre towards the periphery.[3]

[1] It is urged by some (*e.g.*, Ziehen, *op. cit.*, p. 134) that there is always a *tendency* to move the eye, and so a nascent muscular sensation in this case. That this really co-operates here is borne out by Lange's observation, that when the two eyes are confronted with differently coloured fields we cannot attend to either singly; but that if horizontal lines are drawn over the one, and vertical over the other, we can do so, *because of the different ocular movements involved*. (*Phil. Studien*, iv., p. 417 ff.)

[2] See Stumpf, *Tonpsychologie*, ii. p. 294 ff.

[3] This hypothesis is put forth by Stumpf as helpful in explaining the effects of attention on auditory sensations (*op. cit.*, ii. 305).

One other possible physiological factor of attention may just be touched upon. It is known that the fixation of attention on a particular region of the body produces remarkable modifications in the circulation and nutrition of this part, an effect which is exceptionally developed in the bringing on and the curing of diseases through imagination, and what is known as the "stigmatisation" of religious ecstatics.[1] It is not impossible that this vaso-motor concomitant of attention is a constant one. We know that cerebral, like other organic action, involves a special diversion of blood to the region, and it is reasonable to suppose that a local heightening of blood-supply always accompanies the activity of a particular cortical tract or group of elements. Since however this concomitant appears to be carried out as a reflex action by means of that part of the nervous system (the vaso-motor mechanism) which is not immediately correlated with consciousness, it does not seem to offer an explanation of attention on its psychical side as a mode of conscious activity.[2]

§ 5. *Attention as Adjustment: Expectant Attention.* It follows from the above conception of attention as a reinforcing reflex that it is essentially a process of adjustment. In many cases we can see that we fail to fix and intensify a sensation because this adjustment is not completed. Thus momentary impressions of sight or hearing, especially if following one another irregularly, do not become distinct because there is not time for the responsive reflex action. Sudden and powerful impressions, *e.g.*, loud explosive noises, are with difficulty attended to, and are apt to leave a confused after-impression. It has been ascertained by experiment that the process of adjustment is easier and more rapid in the case of sensations of a moderate intensity than in that of very intense or very faint sensations.[3]

[1] See Carpenter, *Mental Physiology*, chap. iii. p. 145, and chap. xix. p. 682 ff.

[2] Among those who hold that the nervous process in attention is wholly motor are Ferrier, *The Functions of the Brain*, p. 461 ff.; Ribot, *Psychologie de l'Attention*, p. 20 ff. and 98 ff.; N. Lange, *Beiträge zur Theorie der sinn. Aufmerksamkeit* (*Phil. Studien*, iv.); and Münsterberg, *Beiträge*, i. p. 154 ff. Wundt, while emphasising the motor process, thinks the facts require as an additional hypothesis the idea of a direct efferent discharge from the "centre of attention" (apperception) to the sensory region (*op. cit.*, ii. p. 240). W. James looks on the nervous process in attention as a double one, consisting of adjustment of sensory organ and preparation of ideational centre (*op. cit.*, i. p. 434 ff.). The vaso-motor process underlying attention has been recognised by Carpenter (*loc. cit.*), and erected into the essential physiological factor by A. Lehmann, in his recent volume, *Die Hypnose und die damit verwandten normalen Zustände.*

[3] See Wundt, *op. cit.*, ii. p. 284 ff. The effect of very powerful stimuli in lengthening the process of adjustment is probably due to the agitating and distracting effect of shock.

The fact that there is an adjustive process in attention, the duration of which varies according as the conditions are favourable or unfavourable, is illustrated in the common experience that the fixing of attention is rendered easy and rapid or the reverse by the preceding state and direction of the attention. In a condition of mental lethargy or inattentiveness a greater force of stimulus is needed to arouse the attention. This is illustrated in all somnolent states of mind.[1] Again, all preoccupation of mind is unfavourable to a new and divergent direction of the attention. When the attention is fixed in a particular quarter, say the visual field or visible scene, a greater effort is needed to direct it into a new quarter, as that of sound.[2]

On the other hand, the process of adjustment of attention to an impression or idea may be greatly aided by the preceding mode of activity of the attention. A state of mental wakefulness is favourable to attention generally. Not only so, the special direction of attention at any moment may favour the adjustment of it at the next moment. In other words, the direction of attention to an object A will under certain circumstances facilitate the direction of it to a second object B. This happens when the objects are homogeneous, as two visual impressions, and when in consequence the muscular adjustments are similar. It happens, further, as we shall see later, when the first and second object of attention are connected or associated one with another; for in this case owing to repetition and the formation of central connexions the transition of attention is rendered smoother.

The process of adjustment has, in the cases hitherto considered, been supposed to follow the effect of a sensational stimulus. But this is not always the case. The development of the ideational life enables us to anticipate, and look out for a coming sensation. The adjustment of attention is thus carried out wholly or partially before the presentation of the impression, and so may be said to be pre-adjusted. This is

[1] On the effect of hashish in lengthening reaction-time by inducing distraction and divagation, see *Rev. Phil.*, July, 1885, p. 108.

[2] This has been shown in an interesting way by experiment. Wundt found that the attention to a sound-signal was disturbed less by a homogeneous impression, as a noise, than by a heterogeneous one, as a visual impression (*Physiologische Psychologie*, vol. ii. cap. 16, § 2, p. 293.

seen in all cases of expectation or expectant attention. The consequence of such pre-adjustment is, as has been proved by experiment, a shortening of the process by which sensations become distinct and are recognised. Here, as pointed out above, there is not only a preparatory muscular adjustment but a central psycho-physical preparation corresponding to the development of the idea of that which is expected.

This expectation may be of different degrees of perfection. Thus we may know (exactly or approximately) the time at which the sensation will occur. In listening to a new poem or a new musical composition we anticipate the succeeding sounds in their regular recurrence. This anticipation of a new impression (or series of impressions) after a regular interval is a condition of the easy apprehension and the agreeable effect of an orderly rhythmic sequence of sounds or sights. In such a case the mind not only adjusts itself to each new impression but has a prolonged or recurring satisfaction of nascent expectation.[1]

Expectation, in the full sense, involves some previous knowledge of the nature or quality of an impression, and not merely of the point of time of its occurrence. This again may be of various degrees of distinctness or completeness. I may, for example, have merely a vague anticipation of the words a person will utter on a particular occasion, *e.g.*, in response to a toast. Such indefinite anticipation by effecting a preliminary peripheral and central adjustment (fixing of the head for hearing, sub-excitation of the auditory centre as a whole) may materially expedite the production of a clear impression. In other cases I may be able to distinctly forecast the particular sensation that is coming. Thus on watching a singer about to commence a familiar song I have an anticipatory idea of the opening tones. Such definite anticipation, by including a preliminary sub-excitation of the nerve-centre of the same kind as that produced by the particular sounds, will still further shorten the process of receiving a sensation. When this anticipation of the precise quality of an impression is supplemented by the prevision of the exact moment of its appearance, the preparation or pre-adjustment of attention may be said to be perfect.

[1] Not all regular successions are equally favourable to adjustments. The attention adjusts itself to a moderately rapid sequence more easily than to a very rapid or a very slow one.

§ 5*a*. *Psychometrical Experiments on Attention.* The measurement of the duration of the adjustive process in attention has been carried out by help of a series of experiments which belong to the new and promising department of experimental psychology, known as Psychometry. The method of experimentation consists in estimating by a delicate chronometric apparatus the interval between the reception of a sensory stimulus, say a sound, by the subject of the experiment, and the actual execution of a responsive movement, as of the hand or a particular finger. This interval is known as the "reaction-time". This period is supposed to be made up of a number of component periods, corresponding to the transmission of the nervous excitation from the peripheral organ to the brain, and so forth; and an attempt has been made by suitable variations of the experiment to measure the duration of each of these divisions. The results hitherto obtained cannot be said to have clearly determined these several durations. The interest of the experiments in the present connexion is that they seem pretty clearly to have demonstrated that a preparatory adjustment of the attention tends to shorten the reaction-time, whereas the presence of any distraction which obstructs the process of adjustment lengthens it. Thus, to begin with an unfavourable case, the reaction-time is appreciably lengthened when a disturbing sound (an organ playing in the same room) is at work. In the case of a person whose normal reaction-time was 100 σ (where $\sigma = \frac{1}{1000}$th of a second), it rose under these circumstances to 148 σ. If the subject is completely taken off his guard, it may even go up to 500 σ ($\frac{1}{2}$ a second). On the other hand, if the process of adjustment is carried out wholly or in part beforehand, the reaction-time is reduced. Thus, if the subject knows by some signal the instant about which the impression is to arrive, the reaction-time may fall from 253 to 76 σ. When the preadjustment is complete, an illusory predating of the impression (*i.e.*, the apparent apprehension of it before the movement of its actual occurrence), may occur, and the subject react too soon.[1]

§ 6. *Duration and Movement of Attention.* The process of attention has the immediate effect of *fixing* an impression. Attention is detention in consciousness.[2] The more serious efforts of attention always imply a prolonged fixation of a particular psychical content or group of contents. At the same time, it is evident that the duration of this process of attention

[1] These experiments have been elaborated by Prof. Wundt and his pupils. (See *Physiol. Psychol.* ii. cap. xvi. *Cf.* Ladd, *Elements of Physiol. Psychology*, pt. ii. chap. viii.) The results have been experimentally revised and severely criticised by Dr. Münsterberg, *Beiträge zur experimentellen Psychologie*, heft i. His researches succeed in showing that the several processes do not uniformly occur as *successive events* in the manner supposed by Wundt, but may under special conditions, *viz.*, when the preliminary or expectant adjustment of attention is directed to the movements to be carried out and not to the sensory signals to be received, be made to overlap. (See James, *op. cit.*, i. p. 432 ff.) At the same time, Münsterberg's arguments do not appear to affect the general truth of the proposition that attention is a process occupying an appreciable time, and varying according as the conditions are favourable or unfavourable.

[2] Ribot emphasises this effect of attention. (*Psychologie de l'Attention*, p. 6 f.)

has its limits. It has been found that, when we try to attend for a considerable time to one and the same impression, the exertion does not remain of one uniform strength, but periodically rises and falls. This is illustrated in the common experience that in listening to the ticking of a clock, or to the continuous sound of a waterfall, there is an alternate increase and decrease in the intensity of the sound. This fact of periodic rise and fall in the strength of attention has been called the oscillation of attention.

This oscillation is best seen in the case of very feeble impressions lying near the threshold of conscious sensation, as a weak and just perceptible sound. In this case it is ascertained that the impression disappears and reappears in rapid alternations according as attention momentarily fails and recovers itself. These rapid alternations are possibly due to the periodic rise and fall in the accompanying action of the muscles of the tympanum of the ear, or of the other peripheral organs concerned in the production of the sensations. This rapidly recurring and momentary decline in the strength of attention has to be distinguished from the setting in of a conscious fatigue of attention after prolonged mental effort.[1]

Common experience tells us that we never maintain at one level for a considerable time a close or energetic attention. A fixed stare, such as we may see in a baby, does not involve a prolonged effort of attention. Attention in its more severe forms is always fatiguing, and is thus in its nature intermittent.

Another fact to be noted in this connexion is the tendency to movement or change of direction observable in attention. What may be called the natural condition of attention is a flitting or rapid passing from one object to another. This is illustrated in the incessant turning of eyes and head of a lively monkey in obedience to every new visual or aural impression, and in the infant's similar transition from object to object. Even what we call prolonged concentration of mind on a single topic is in reality a succession of changes in the direction of attention.[2] As already remarked, the unswerving fixation of attention on one object defeats itself, and results in a confusion of consciousness or somnolence of mind, an effect illustrated in

[1] On the fact of oscillation, see Wundt, *op. cit.*, ii. p. 253 ff. The reference of these oscillations to a muscular source has been ably urged by Münsterberg, *Beiträge zur exper. Psychologie*, ii. p. 93 ff.

[2] See James, *op. cit.*, i. p. 420 f.

the action of monotonous sense-stimuli in inducing the hypnotic state.

These movements are determined, to some extent, by the very mechanism of attention. Thus it is evident that since all attention involves muscular action of some kind, the fatigue that arises from an undue prolongation of this action is favourable to a change in the direction of attention. As every teacher knows, a child, after attending closely to visual objects, as in drawing or other fine work involving the eye, welcomes a change in the direction of attention, as in listening to an oral lesson. A prolonged effort of attention will often tire us for the particular form of mental activity, *e.g.*, looking or listening, without tiring us for other forms.

This fact, again, favours the view that attention is in part, at least, a muscular process. At the same time, it is evident that this fatigue of particular muscles is not the only factor in what we call mental fatigue. Any great and prolonged strain of the attention appears to fatigue the brain as a whole, or at least those nervous centres which are presumably engaged in all forms of attention alike.

Again, the very fact that at any moment we are exposed to the action of a number of rival stimuli favours the movement of attention. When occupied with one particular impression or group of impressions, the intrusion of a new one acts as a diverting force. This is seen more particularly when the new impression is strong or rousing on account of its changefulness, as in the case of all moving objects, which are known by the schoolmaster to be specially distracting. Novel impressions excite by the very fact of their being new, and standing out, so to speak, in relief against the collective horde of our acquired impressions. And when the effect of surprise is added, as in the case of all unexpected objects, the diverting force is increased. Hence, perhaps, the special tendency of children's attention to wander, they being much more under the stimulus of the new, the extraordinary, and the wonderful than older people.[1]

The readiness with which these transitions of attention can be made varies with a number of circumstances. As already suggested, the existence of any connexion between one impres-

[1] The full effect of novelty and surprise can only be understood when we come to deal with the feelings.

sion or idea and another greatly favours the movement of attention from the first to the second. As we shall see by-and-by, there is a special tendency to a hurrying on from sensations or ideas relatively uninteresting to associated ideas which have a strong interest for us. This is illustrated in our scant and fugitive attention to signs, such as words, under the mastering influence of the ideas signified—a tendency which every proof-reader has to overcome. Again, what is known as liveliness of temperament shows itself mainly, perhaps, in a special mobility of attention or readiness to transfer it to any new object. The bright, impressionable, versatile mind is characterised by rapidity of mental movement. Exercise and practice, moreover, do much to develop this power, just as they serve to strengthen the ability to prolong effort on occasion in some particular direction in patient concentration.

This mobility of attention stands in close connexion with the fundamental attribute of consciousness as changeful, or as made up of a sequence of transitions. In what sense exactly this law of changefulness or "relativity" holds good will have to be discussed later. Here it may suffice to point out that the need of change is conditioned partly by the general psycho-physical fact that all prolonged nervous action tends to lose in energy and to induce fatigue, and partly by the fact that attention can only be maintained at a high level by frequent change of direction.

§ 7. *Analytical and Synthetical Action of Attention.* All attention is a process of focusing, and as such a concentration or narrowing of the psychical area. In the simplest mode of attention, as when a sound calls forth a reaction, we have the process taking on the aspect of a selective isolation of particular psychical elements. This isolating or analytic aspect of attention becomes particularly marked when we seek to break up the complexes of sensation with a view to single out particular constituents, as in analytically resolving a flavour into its constituents, and fixing attention on certain of these to the disregard of others.

While, however, attention is thus primarily separating or isolating it has, as a second function, the combining of a plurality of sensations or other psychical elements. Thus we may attend not merely to a particular detail of colour in a picture, but to the *ensemble* of colours, not merely to a constituent tone in a musical accord, but to the accord as a whole. This synthetic direction of attention is, as we shall see when we come to deal with the process of intellectual synthesis, of the highest consequence.

Each of these modes of attention has its limiting conditions, which we are able to understand by help of the above conception of the psycho-physical process. Thus minute attention to details of a sensation-complex is favoured by their local separation, as in the case of a number of fine colour-details in a miniature painting. Such local separation evidently allows of a particular muscular adjustment to this, that and the other detail. In the case of sensations of sound, on the other hand, where such local distinctness and correlated muscular adjustment are wanting, minute analytical attention is rendered difficult, and it is here that the co-operation of cerebro-ideational activity in analytic attention becomes most important.

With respect to synthetic or combining attention, on the other hand, the general limiting condition is that the various 'objects' simultaneously grasped in attention stand in a certain relation one to another as parts of one and the same whole.[1] The most obvious bond of connexion is that supplied by being constituents of the same sense-domain. I can attend to two colours together, because they constitute features of one visible scene. Where disparate or heterogeneous sensations, as visual and auditory, are attended to together, it is because they have come to be taken up into a new conjoint field through the working of the law of association to be spoken of presently. Here, too, the limiting conditions may be understood by a reference to the nature of the psycho-physical process. We attend so readily to two colours, especially if in juxtaposition, because the muscular adjustment is approximately the same for the two.[2] When association has brought about a close conjunction, it is presumable that the compound muscular adjustment required has becomes fixed and rendered easy by practice and habit. Thus, when we attend with eyes and ears to

[1] This general condition has long been recognised. Thus Thomas Aquinas writes: "Intellectus noster non potest simul actu cognoscere nisi quod per unam speciem cognoscit," quoted by Stumpf, *op. cit.*, ii. 311.

[2] This consideration holds equally whether attention in this case is strictly simultaneous or successive and alternating.

a speaker, the plexus of processes involved has become organised by years of habit. In a like manner, the doing of two or more apparently disconnected things, as in the performance of the juggler, is effected in many cases by an organic co-ordination or association of the movements into a single action.

§ 7*a*. *Area of Attention.* A special question arises in connexion with the synthetic direction of attention, *viz.*, the area or span of attention, how many things we can attend to at one and the same moment. This question has, of course, been considered with reference to a number of homogeneous and more particularly visual sensations. A new light has been thrown on the problem by recent experiments.[1] Thus it has been found that if a number of small objects, as printed letters or digits, are placed near one another so as to be all visible in direct vision, and then looked at for a fraction of a second, just long enough to generate a clear retinal impression, from four to five can be instantaneously grasped together. When the objects can be grouped together as features of a familiar form, three times the number can be instantaneously attended to. The conditions of the experiments preclude the supposition that attention passed successively from one to another.[2]

The question how many things we can attend to at once is rendered difficult in certain cases by a doubt as to whether the attention is perfectly simultaneous. In some instances there is ground for supposing that the process involves rapid movements of attention from one object to another. This applies to the doing of two disconnected things concurrently, as when a person plays a musical instrument and at the same time takes a certain part in a conversation. Here it is reasonable to suppose that there are swift alternations of attention. Similarly, when a juggler keeps a number of balls going. Yet even in such cases repetition and habit tend to solidify the two chains of movement into one, so that a single series of adjustments of attention suffices.[3]

[1] Of course the measurement of this area presupposes the higher form of volitional attention and the effect of long practice.

[2] See Wundt, *op. cit.*, p. 247. Wundt also measures what he calls the area (Umfang) of consciousness by inquiring what number of successive impressions can be grouped together as a single series. But the conditions here are less simple than in the case of simultaneous impressions, and the subject will be better discussed later on.

[3] In the case given by Paulhan and others, as reciting one thing, and at the same time writing another or working calculations on paper, it is to be noticed that

According to an ancient maxim, there is a very simple ratio between the intensity and extent of attention. This is that the wider the area covered the less the amount of attention given to the details (*Pluribus intentus minor est ad singula sensus*). This maxim may be said to roughly express the fact that when attention is broken up and distributed over a number of disconnected objects it loses in force. As an attempt at an exact formulation of a law, however, it is unsatisfactory, if only for the reason that attention to a number of *connected* objects instead of being scattered may be as much a single process as attention to a single object. When we fix attention on things as an *ensemble*, we are not attending less, we are merely attending in another way.[1]

§ 8. *Determinants of Attention.* Attention, though a fundamental factor in our mental processes, is itself determined. The determining antecedents of attention vary with its form and its degree of development. A full understanding of these different degrees of development is not possible at this stage of our exposition. Nevertheless it may be well to briefly mark them out.

In the earliest and simplest stage of attention which we have been considering, and which is marked off as Reflex or Non-voluntary Attention, the determining force resides in the sensation or its ideal representative. Here, as already pointed out, the direction of attention will be determined, on the one hand, by the strength and the persistence of the impression, and, on the other hand, by its suddenness, novelty, and generally its disturbing character in relation to the pre-existing state of mind. Each of these circumstances is important, and may suffice of itself to effect the reflex process. Thus a faint sound, as the striking of a distant clock, when repeated, gathers stimulatory force. A familiar object, as a picture on the wall, which, when in its customary place, would remain unnoticed, immediately attracts attention when moved into new surroundings.[2]

one at least of the concurrent actions is semi-organised by practice and habit, and so requires careful attention only at the outset. Yet the fact that doing the two things simultaneously only involves a saving of about one-fifth of the time required for doing them successively suggests that there must be a considerable oscillation of attention of the lesser degrees of intensity in this case (see James, *op. cit.*, i. p. 408). On the question whether our attention to a number of things is strictly simultaneous, consult further Stumpf, *op. cit.*, ii. p. 308 ff.

[1] On the question of the area of attention, and the relation of simultaneous to successive attention, see Hamilton, *Lectures on Metaphysics*, lects. xiii. and xiv.; James, *Principles of Psychology*, i. p. 405 ff.

[2] Intensity and insistence may be said to give *absolute* impressiveness or

It is evident that we have here to do with a germ of feeling. A sudden and novel impression commonly, if not in all cases, excites a certain amount of feeling, whether it be of agreeable exhilaration or of disagreeable shock; and this element of feeling seems to intensify attention in these cases. This influence of feeling on attention becomes more manifest in all cases of distinctly agreeable and disagreeable sensations. A bright colour, a sweet sound, and, on the other hand, a hard, grating noise, attract the attention by reason of the feeling that they excite. How strong this force of feeling can be is plainly seen in the early appetite-prompted actions of a child. A hungry infant enjoying its meal becomes amazingly inattentive to everything else.

A considerable extension of the range of attention is effected when the processes of association have been carried far enough for present impressions to instantly revive and connect themselves with previous ones, as when a child's attention is drawn to the process of preparing its food, or to some new object which immediately suggests a familiar one by its likeness. Here the presentative element is reinforced by the addition of representative elements, the residua of earlier impressions, and thus the process of attention involves more of the ideational or central factor spoken of above.[1] The attractive force in this case too is determined by the volume and intensity of the feeling excited, only that the feeling is here no longer a direct result of the present sensation, but bound up, and so revived, with ideas of past impressions. Thus the attraction of a picture-book for a child, or the fascination of a new animal that resembles an object of dread, depends for its force on the strength of the feeling indirectly excited by the new object.

§ 9. *Nature of Interest.* The facts just touched on are commonly spoken of as the effect of Interest. When it is

attractive force to a sensation; novelty and unexpectedness, *relative* impressiveness. The effect of insistence on attention is, as we shall see, strikingly illustrated in the region of ideation, as in the effect of all recurring teasing ideas, and of those morbidly persistent ideas known as *idées fixes*. (See Ribot, *op. cit.*, chap. iii. *Cf.* what was said in the last chapter on the "summation of stimuli".)

[1] It is owing to this development of the ideational factor that mere intensity of sensation produces less stimulative effect as experience advances. (See Lotze, *Microcosmus*, i. p. 204.)

said that we attend to what interests us it is meant that we attend when our feelings are touched, that is, to objects or ideas which directly or indirectly excite feeling. We may thus be said to be interested when we experience a sense-feeling, and our attention is determined to the object or to the action that excites this. Thus the baby is intensely interested in its feeding, and in its pretty coral rattle. In the narrower sense we are interested where a new presentation comes into relation to our previously acquired stock of ideas and their attendant feelings, that is to say, calls up and becomes complicated with an idea or cluster of ideas having some affective accompaniment. Thus a child begins to be interested in talk about itself as soon as the idea and connected feeling of self begins to grow a distinct, stable, and readily excitable factor in its consciousness. Similarly it will be interested in a new fact that can be taken up into a group of interesting facts already known, as in an account of the tiger that brings it near the valued pussy, or a description of the production of its much-loved sugar. This tendency to give attention to what comes within the circle of established feelings and interests is made use of by the modern educator as the basis of teaching method.[1]

The close dependence of attention on feeling which is implied in the idea of interest has been remarked by more than one psychologist, but has not yet received adequate recognition.[2] The fact of the affinity of attention and movement, taken with the dependence of this last on feeling, prepares us to conceive of attention as feeling-impelled. The agitation of feeling serves to give greater vivacity and persistence to a sensation, and further, through the close organic connexion between feeling and motor action to be illustrated by-and-by, to excite among other movements that special group which underlies the process of attention-adjustment.

The reinforcement which a sensation secures through the revival of kindred ideal elements is spoken of by Herbart and his school as apperception. The new presentative element is said, according to this view, to be apperceived or assimilated by a pre-existing cluster of ideas or an ideal mass. According to Herbart all attention involves this co-operation of the residua of past impressions, and only appears after such ideal aggregates have been formed. This however is to overlook the primitive reflex form of attention where a reaction is determined by the inherent force of the stimulus itself, as when a child turns to and fixates a bright light.

[1] This action of interest, as we shall see presently, involves what is known as the assimilation of the new psychical element to previously acquired elements.

[2] See Ribot, *op. cit.*, p. 13. Stumpf goes so far as to write, "attention is identical with interest, and interest is a feeling" (*op. cit.*, i. 68; *cf.* ii. 280, footnote).

More particularly it overlooks the influence of novelty and strangeness in drawing and detaining the attention.

Attention is in truth under the sway of two opposed forces, novelty and familiarity. The new, the rare, the unexperienced exerts a powerful spell on the attention, not only of the child, but of the adult. On the other hand, in proportion as fixed interests, that is, ideational complexes bound together by a common feeling, form themselves, and, one may add, as novelty of impression diminishes, these interests tend to draw off attention from the wholly new in the direction of the familiar. Thus, as feelings settle down to steady tastes and inclinations, the child attends more and more to what connects itself with and helps to gratify these. Even here however the attractive force resides in part in the *partial* novelty of the impression. What is wholly familiar, as the objects of our daily environment, do not attract our attention. "Familiarity breeds contempt" in this sense also. As pointed out above, it is the presentment of the old in a new setting that really excites the attention in such cases.[1]

§ 10. *Transition to Voluntary Attention.* As the last stage in the development of attention we have its voluntary direction and control. This is marked off by a clear idea of end or purpose. We attend voluntarily when we consciously figure and strive to realise some object of desire. In the mature and trained mind attention is largely controlled by volition. The nature of this volitional process can only be understood when we come to consider the process of conation. Here it must suffice to point out that it emerges gradually out of the feeling-prompted attention just considered as soon as experience and mental development render possible an anticipation of the results of our activity. Thus a child begins to attend voluntarily when he maintains a pleasurable sensation, *e.g.*, that of a sweet tone, under the pressure of a vague impulse to *go on* enjoying. The transition is seen still more plainly perhaps in the genesis of the impulse of curiosity, or the desire to examine and understand new or strange objects, which curiosity, as we shall see, grows out of the mingled feeling with which we survey an object that is in part strange and foreign to us, and in part, through its affinities to known objects, familiar and so suggestive of further knowledge to be gained. In like manner attention to objects associated with our bodily and other wants leads on, with the develop-

[1] On Herbart's view of the relation of assimilation ("apperception") to attention, see Mr. Stout's article on "The Herbartian Psychology," *Mind*, xiii. p. 484; *cf.* Volkmann, *Lehrbuch der Psychologie*, pp. 199, 200; and Lotze, *Metaphysic*, p. 478.

ment of our powers of movement, to a voluntary direction of attention in practical channels, and with a view to the satisfaction of our wants.

It is important to note that this transition to voluntary attention does not mean a liberation of attention from determining influences. Interest is still the stimulus or force which impels attention, only that the interest is here less direct and of a borrowed or reflected kind. Thus, when we attend to an otherwise dry and repellent subject because we see that the knowledge of it bears on some object of desire, we are, by thus connecting it with the desired object, investing it with a derived interest.[1] To this it may be added that in such cases the volitional effort at the outset is commonly soon relieved if not displaced by the inherent attractiveness of the subject that discloses itself to patient attention. The effect of this development of interest and of will-power on the attention is greatly to widen its range, and also to facilitate a more exact and more prolonged adjustment. The widening of the range is illustrated in the effect of a growth of scientific or artistic interest by which small, obscure and commonly-overlooked phenomena of the outer world become objects of close scrutiny. One important effect of this development is to render possible a much finer analysis and isolation of sensuous elements. This is illustrated in the savant's delicate observation and recognition of obscure optical and acoustical phenomena, such as flying spots, double images, partial tones. Lastly, this development of attention shows itself in increased power of steady and prolonged concentration in the face of alluring or disturbing stimuli. This increase of inhibitory power, or that of resisting distracting impressions, is indeed commonly recognised as the chief evidence and measure of the growth of will-power in the domain of attention.

In addition to the special stimuli or excitants of attention just considered, there are more general conditions of attention. These may be summed up under the general head, degree of vigour of the central organs. Attention being the greatest expenditure of psycho-physical energy, it is evident that its

[1] *Cf.* J. S. Mill's remarks in his edition of J. Mill's *Analysis of the Human Mind*, ii. pp. 373, 374.

efficient carrying out presupposes a normal vigorous condition of the brain-centres.[1]

§ 11. *Effects of Attention.* The effects of attention in adding to the intensity and persistence of a sensation have already been touched on. Since, however, we are here looking on attention as a fundamental factor in the process of mental development, it is desirable to indicate its effects more fully than we have yet done. The chief effects may be set forth under the following heads:—

(*a*) As pointed out above, attention means first of all an increase of the intensity of a sensation. When we attend we render the sensation or ideal equivalent stronger and more vivid. The relation between a narrowing of consciousness and its intensification is well illustrated in the preternatural intensity or vividness of the images that arise in the greatly restricted consciousness of the dreamer, and probably also of the hypnotised subject.

This increase of intensity is readily distinguished from that due to an objective cause, as the increase in the strength of a sound itself, since it is seen to be the result of our conscious activity. It is evident, moreover, that all such increase is limited. By attending to a sound I cannot raise its intensity above a certain height. It is this height, as realised by a full normal effort of attention, which we regard as the measure of the objective force.[2]

(*b*) Along with this increase in intensity, and of equal if not of greater importance, there goes increase in definition of character. It is when we attend to a sensation of colour, taste, and so forth, that this acquires distinctness of quality. Attention thus immediately subserves the definition or clear demarcation of the sensation. This it does by raising it to

[1] *Cf.* Stumpf, *Tonpsychologie*, pp. 69, 70.

[2] Stumpf has some good remarks on the intensification of sensation by attention. He appears (like Fechner) to dispute the proposition that attention raises the intensity of sensations, at least, in all cases, *e.g.*, in attending to an object on the side of the field of vision. See *Tonpsychologie*, i. p. 71 ff. and ii. p. 290 ff., where the effects of attention in intensifying particular elements in a clang are carefully recorded. Compare also Fechner, *Psycho-physik*, ii. p. 452; and James, *op. cit.*, i. p. 425. Ward, in his article, "Psychology," *En. Brit.*, pp. 41, 42, seems to overestimate the difficulty of distinguishing a subjectively from an objectively occasioned increase of intensity by not allowing that attention is in itself and apart from its effects a *conscious* process.

its full intensity, and rendering it predominant and, for the moment, the exclusive content of consciousness. This effect of increased definiteness covers not only the quality of the sensation, but its intensity, its extensity, and even its duration. These several phases of attention take on definiteness or sharp definition only when the process of attention is added.[1]

(*c*) Attention secures a certain persistence in the sensation or idea. To attend means to keep before the mind for an appreciable time. Even a momentary sensation, as that of a passing sound or light, when attended to endures for a short period under the form of an after-sensation, and in the case of ideas the fixing of attention tends still more to prolong their presence in consciousness. This power of detention in consciousness will be found to be of the greatest consequence for the elaboration of psychical material.

(*d*) Lastly, this attention and detention through attention lead on to retention.[2] It is, as we shall see presently, by fixing attention for an appreciable time on a presentative element that we are able to connect it with, or bring it into relation to, other elements, and so secure its subsequent reproduction.[3]

We thus see that attention underlies and helps to determine the whole process of mental elaboration. It secures in the full intensity, distinctness, and due persistence of the presentative elements the fundamental condition of those processes of differentiation, assimilation, etc., in which the work of elaboration properly consists.

The treatment of attention as a fundamental process at the very outset of our exposition may surprise those familiar with the customary arrangement of the parts of psychological doctrine. No doubt attention, in its higher and more important phase, is volitional, and forms indeed the crowning stage of mental development. But to postpone all account of it till that stage of the exposition is reached seems

[1] The importance of this effect of attention is illustrated by the fact that Wolff introduces it into his definition: "Facultas efficiendi, ut in perceptione composita partialis una majorem claritatem ceteris habeat, dicitur Attentio". (*Psychol. Empir.* § 237, quoted by Stumpf, *op. cit.*, ii. 287.)

[2] The reader will not overlook the verbal coincidence here, *at*tention, *de*tention, *re*tention.

[3] To this it may be added that attention to any psychical element favours, as we shall see, the reproduction of any other elements already connected with it.

fatal to clearness. Attention appears as a reflex at the very beginning of mental development, and as such serves to complicate and to condition psychical phenomena. And the whole movement of mental development is determined by the co-operation of this factor. It is plain that we have here to do with the root-difficulty of all psychological exposition, *viz.*, the *interaction* of psychical phenomena. We try to expound the course of intellectual development before taking up conation, on the supposition that it is only after intelligence has reached a certain stage of development that volition properly so called begins. In truth, however, the germ of conation is present from the first crude process of intellection in the shape of an active reflex.[1]

REFERENCES FOR READING.

On the nature of Attention the following may be consulted: Hamilton, *Lectures on Metaphysics*, vol i. lect. xiv.; Ward, article, "Psychology," *Encyclop. Britannica;* James, *The Principles of Psychology*, i. chap. xi.; also Ribot, *La Psychologie de l'Attention;* Waitz, *Lehrbuch der Psychologie*, § 55; Volkmann, *Lehrbuch der Psychologie*, ii. § 114; Wundt, *Grundgüge der physiol. Psychologie*, ii. cap. xv. and xvi.; G. E. Müller, *Zur Theorie der sinnlichen Aufmerksamkeit;* and Münsterberg, *Beiträge zur exper. Psychologie*, vol. i.

[1] Prof. Bain, and most German psychologists, take up the subject towards the end in connexion with volition. Prof. Wundt reaches it after the exposition of the *Vorstellung*, which suggests that the *Vorstellung* forms itself without the interposition of the selectively defining process of attention.

CHAPTER VII.

PROCESS OF ELABORATION *(CONTINUED)*: DIFFERENTIATION AND INTEGRATION.

§ 1. *Factors in Mental Elaboration.* The process of attention considered in the previous chapter prepares the way for the proper work of elaboration of the psychical elements. By this is meant the carrying out of certain processes into which the sensational elements enter as materials or constituents. Thus we may say that the visual sensations of colour, etc., are elaborated when they are distinguished one from another and combined in certain groups, as the total visual appearance of a pansy.

If now we ask what these processes are, we find that they are only another aspect of the elementary processes already spoken of as constituting what we call intellection, that is to say, Discrimination, or as it may be also called Differentiation (*i.e.*, Differencing), Assimilation, and Association, the two last forming together Integration (or "wholing"). Our mental life unfolds by help of the renewal of these elementary functional activities. Thus, just as we know a thing by distinguishing it, so the contents of mind become more numerous by successive differencings of what was before confused. In like manner, assimilation at once enters into every process of knowing, as in recognising a taste, and aids in the longer process of mental development by producing new permanent modes of grouping of psychical elements, as in the classification of like objects by help of a general name. The same thing holds good of association. Not only is the interpretation of this, that, and the other sensation-complex, *e.g.*, the succession of creaky sounds of a person walking up stairs, an illustration of association (suggestion), the process of associative combination is a main factor in development, resulting in a progressive elaboration of what is relatively simple into more and more complex products, *e.g.*, our whole highly-composite idea of a particular man, or locality, into which each new year's experience incorporates additional associated elements.

It is evident that, in speaking of discrimination, etc., at once as intellective functions and as factors in the process of developmental elaboration, we are distinguishing between a temporary and a permanent result of a process. Thus the discrimination of one taste from another and allied taste issues immediately in a cognition of this particular fruit, wine, etc., but has a further and more important lasting result, *viz.*, the possession of two distinct ideas of taste for after-use.

(A) DIFFERENTIATION (DISCRIMINATION).

§ 2. *Biological and Psychical Differentiation.* By the term differentiation the biologist means the gradual emergence or appearance of difference (heterogeneity) between one tissue and one organ and another, as the development of an organism proceeds. The process of development, we are told, begins with a relatively simple or homogeneous structure, and the organism takes on more and more distinctness and speciality of parts as the development advances.[1] Applying this idea to mind, we can speak of differentiation as the emergence in consciousness of distinctness or speciality. Thus the infant's colour-sense, though, if a normal one, potentially including all nuances of colour-quality, realises as yet but few, if any, qualitative varieties. The progress of sense-development means primarily the substitution of a more and more varied order of sensations, or of a larger and larger number of different impressions. And it will be found that the whole development of the intelligence consists in part in the advance of such differentiation.

It has already been pointed out that attention is in its general nature selectively isolating. When an infant first fixates an object, as a bright light, it virtually differentiates

[1] This may be illustrated by the process of segmentation or the self-division into segments which marks the development of the ovum.

the impression from those of surrounding objects.[1] In other words, by this process of adjustment a separate and distinctive impression is secured. The peculiar character (quality, strength) of the impression begins to make itself known: definiteness of impression begins to be experienced. In a wide sense, then, all attention, as selective, isolative and defining, is a process of differentiation.

Still it has been contended, *e.g.*, by Lotze, that a vague differentiation must precede such special isolating adjustment. If the light did not differentially stimulate a particular area of the retina, and so differentially affect consciousness, there would be no special direction of the attention with its reflex motor adjustment. And this contention is forcible, and refutes the idea that the mind puts a difference, so to speak, into a wholly undifferentiated mass of sensation. It seems reasonable to suppose that just as a sub-conscious stage of the sensation precedes and determines the reaction of attention on this sensation, so a vague impression of two different sensations precedes attention to them as different. At the same time, it is evident that such a vague awareness of different sensations is not to be confounded with the clear consciousness of them as different which follows on a direction of the attention.[2]

It follows that the physiological substratum of differentiation may be defined as consisting in unlike functional activities (either of the same or of different nervous elements) together with the isolating process of attention. Thus a distinct impression of a particular variety of colour or pitch of tone has for its nervous conditions a particular mode of optical or acoustical nerve-excitation, and the reinforcement of this by the adjustive process of attention.[3] It must be added that while we may thus define the nervous conditions of two different sensations we cannot hope to find a nervous process answering to the further psychical activity to be spoken of presently, *viz.*, the apprehension of a *relation* of difference.

Confining ourselves for the present to sensations or presentative elements, we may trace this process of differentiation or differential definition in various directions. At the beginning of life we may suppose that sensational consciousness as a

[1] It is important to note that this impression, as indeed every visual impression produced by an object, is really complex. But this fact of complexity need not yet be considered.

[2] On Lotze's view of the relation of sub-conscious differentiation to differentiation by the aid of attention, see *Med. Psychologie*, p. 267 ff. He elsewhere contends that sensational difference is present from the first, and that the idea of a primitive blur of sentience, in which no difference impresses the infant eye or ear, is an unjustified assumption. (*Microcosmus*, Eng. trans., i. p. 209 f.)

[3] Ward appears to find a further physiological condition of differentiation in that 'restriction' of the nervous current which characterises the action of the special senses, *loc. cit.*, p. 46.

whole is a confused mass in which differences are only vaguely emergent. Among the first distinctions to appear would be the broad generic ones between sensations of different classes, as a taste, a smell, etc.[1] The process of differentiation or psychical segmentation would reach a more advanced stage when distinctions within the same class of sensations began to present themselves, as different tastes, different colours, etc.

Along with these distinctions of qualitative character, those of intensity and of volume or extensity, and of local character, would gradually come to be noted. Thus, for example, different degrees of pressure, different extents of colour, and touches of different local character (at this, that, and the other point) would be separately attended to.

This process of differentiation progresses gradually. Just as tastes are first differentiated from other classes of sensations before one taste is differentiated from another, so within the limits of the same special sense the process advances from broad to finer and finer distinctions. Thus we know from the way in which the colour-vocabulary grows in the case both of the individual and of the race that a red is distinguished as such before a particular shade of red, as scarlet or crimson, is distinctively noted.[2]

The course taken by this progressive movement of differentiation is modified by the forces which act upon and determine the directions of the attention. Hence it is far from being perfectly regular, and probably varies considerably in the case of man and other animals, as well as in that of different men. Superior strength and vivacity of impression count for much here. This is illustrated in the fact that the brightest and most stimulating colours (reds and yellows) are the first to be singled out and recognised. Much depends, too, on the value of the particular sensation as bearing on the special interests of the species or individual. Thus the dog first selects and particularises among smells that of his food, his master, etc.;

[1] We are referring here only to presentative elements. As already suggested, both in the zoological series and in the human individual, the *affective* contrast, pleasure and pain, would stand out from the first.

[2] This process of differentiation only advances a little way in the case of the organic sensations. (*Cf.* above, p. 84.)

the horse singles out among colours that answering to wholesome herbage, and so forth.

The progress of differentiation is not so simple as is here represented. As already suggested, sensations or presentative elements do not occur apart, but in groups or complexes. The animal and the child mark off colour as a constituent of a complex of impressions answering to a particular coloured form, as clover, an orange. No doubt this marking off of complexes involves a certain apprehension of the peculiar character of the several constituents. But such apprehension is very vague. Clear differentiation implies the isolation by attention of the constituent sensation itself. But this follows later. The child sees the apple and the orange some time before it is capable of an abstract attention to its colour.

Mr. Ward describes the process of differentiation as the breaking up of a presentative *continuum* into discrete presentations. The term continuum seems so far appropriate here that it indicates the fact that sensation is given at first, not as a system of distinct atoms, but as a continuous whole, and that distinction is only introduced by the emergence of latent difference. It is evident, however, that the idea of a continuum as the presentation of difference in a scale of perfectly gradual change in the same direction only partially applies to sensation as a whole. Thus there is a continuous scale of intensity as well as of volume or extensity. As regards quality, it is wanting altogether in the case of disparate classes of sensation. We cannot pass from tastes to smells by any series of intermediate gradations. Nor, even within the limits of one and the same sense, does it apply universally. Thus though there is a continuum of colour and tone-sensation there is not a continuum of tastes and smells.[1]

§ 3. *Differentiation and Discrimination.* We have thus far considered differentiation merely as a process of distinctively marking off or defining particular varieties of sensation. Here, through special adjustments of attention, particular sensations of colour, taste, and so forth come to be distinguished as this, that, and the other. Such differentiation or particularisation of sensational character does not, however, amount to a full consciousness or mental grasp of a relation of difference between one sensation and another. Still less does it include a clear apprehension of the precise feature, *e.g.*, intensity, quality, in which two sensations differ, or the extent of this difference. Such a clear apprehension or grasp of difference, as distinguished from a singling out of, and attending to, different or distinct sensations is best described as an act of conscious Discrimination.[2] Differentiation, in the first sense, precedes discrimination

[1] *Cf.* above, p. 101 f. For Ward's views, see *loc. cit.*, p. 45 f.

[2] Discrimination is often used in the wider sense of differentiation, but as we require a term to indicate the complete process of 'relationing,' or apprehending relation, it seems best to select discrimination for this purpose.

in mental development. A and B must be presented and noted as two distinct impressions before we become conscious of the relation A—B.[1] An animal low down in the scale may have differentiated sensations, that is, be differentially impressed by this and that stimulus, *e.g.*, thermal or tactile, and yet never rise to a clear consciousness of a relation of difference.[2] Such an intellectual act or process of discrimination only becomes possible when sensations by repetition acquire a certain steadiness and persistence, and when attention is practised up to the point of relational or comparative attention, *i.e.*, a simultaneous grasp of two impressions as two distinct yet related impressions.[3]

True discrimination develops by gradual stages out of the process of differentiation just described. Thus we may suppose that a strong stimulating sound or light at the moment of its introduction is attended by a vague consciousness of change or transition: and this supplies the germ of discrimination. A child experiencing the change from darkness to light, from cold to heat, could hardly fail to note the change as such. This, however, is still a long way from a clear grasp of a precise relation of difference as defined above. The rapid disappearance of the receding experience under the superior interest of the new one would prevent the infant mind from attending to the two in their relation.

A more favourable situation would be the simultaneous presentation of two strong and widely-contrasting sensations, as two touches when the child happens to encounter two unlike substances with the two hands or two contrasting colours in juxtaposition. Here we may mark off two distinguishable stages in the development of a clear consciousness of difference. First of all, there is a vague sense of two different sensations, in which the apprehension of numerical distinction is uppermost, and that of a particular qualitative difference is indis-

[1] This applies to all intellection as a relational and relating process. The mental apprehension of a relation of difference, likeness, or succession in time must be carefully distinguished from the experience of having two unlike, like or successive impressions. (*Cf.* Ward, *loc. cit.*, p. 45; and Lotze, *Metaphysic*, p. 470 f.)

[2] *Cf.* Romanes, *Mental Evolution in Animals*, chap. i.

[3] *Cf.* above, p. 158 f.

tinct.[1] This is illustrated by certain experiments in which the subject can say he hears two tones but does not know which is the higher. Secondly, there comes the clearer consciousness of a particular kind and amount of difference (*e.g.*, so much pitch-interval between two tones). This last clear grasp of the relation of difference, as such, is the work of comparison, and will be explained more fully later on.[2]

§ 4. *Law of Change or Relativity.* We have already touched on the question in what sense, and to what extent, change enters into the tissue of our mental life.[3] Our examination into the mechanism of attention and the process of differentiation will enable us to discuss the point more fully.

That there is a meaning in saying that consciousness involves change of psychical state, or has change as a fundamental condition, is indisputable. A dead level of sensation without the least introduction of freshness or variation would be indistinguishable from sleep. As Hobbes has it, "Semper idem sentire ac non sentire ad idem revertunt". This fact of the dependence of mental life on change has been formulated under the head of the Law of Relativity.[4]

This law of change or variety finds its explanation in part in the very conditions of vigorous nervous action. Highly recuperated structures are capable of more vigorous function than partially fatigued and exhausted ones. Prolonged stimulation of a nervous structure is attended in certain cases at least with a falling off in the intensity of the sensations.[5]

[1] Stumpf distinguishes between 'analysis' as apprehension of numerical difference and discrimination, *op. cit.*, i. 108. It is evident, however (as Stumpf himself seems to allow), that there cannot in the case of simultaneous sensations be an apprehension of numerical distinction or plurality apart from some vaguely-apprehended qualitative difference. Even two similar colours are only seen as two when the sensations have distinction of local quality. In the case of similar successive sensations, as tones, the difference in temporal position constitutes a kind of qualitative difference.

[2] On the relation of such a clear grasp of difference to a vague sub-consciousness of difference, see James, *op. cit.*, i. p. 526 f.

[3] *Cf.* above, p. 156 f.

[4] See Bain, *Mental and Moral Science*, p. 83; Hamilton expresses the same principle under the "Law of Variety"; see Ward, *loc. cit.*, p. 49.

[5] Stumpf points out that this decline in intensity is much more noticeable in certain classes of sensations than in others. It is hardly appreciable at all in the case of sounds. (*Tonpsychologie*, i. p. 18.)

Change of stimulation, on the other hand, by calling into play a fresh organ, ensures greater intensity in the psychical effect. Not only so, as was pointed out in dealing with attention, the frequent diversion of the adjustive process from one impression or region of impressions to another is necessary to a vigorous maintenance of the attention. This is strikingly illustrated in what has been called "the acquired incapacity" to attend to constant and unvarying impressions. The miller after a time fails to hear the noise of his mill.[1] It is also illustrated in the fact that when we go on attending to an impression, *e.g.*, one of bright colour, there is a falling off in intensity, which is presumably due to the slackening of the effort of attention.

This general truth has a bearing both on the intellectual processes and on the feelings. The latter is illustrated in the well-known effects of novelty, contrast, and rapid variation of impression in heightening feeling and the enjoyment of life. This effect will have to be dealt with more fully by-and-by. We are now concerned with the bearing of change or relativity on the intellectual processes.

Here the question arises, What is the precise function of change or contrast in our sensational experience? According to one rendering of the Law of Relativity, change is not only a general condition of distinct and vivid sensation, but it is one factor in determining the particular quality of a sensation. Thus it is said that black is only seen to be black in contrast to white, that the several partial colours are for us what they are because of their relations to other colours, and that blue would not be blue, green, green, and so forth, but for these relations.

That there is some meaning in this will be seen by a reference to what was said above respecting the variability of sensation, the effect of colour-contrast, etc. That one sensation may under certain circumstances modify the quality of another is certain. At the same time, this effect appears to be narrowly circumscribed. Thus Stumpf has shown that in the region of tones there is no contrast, but rather an opposite

[1] On such acquired inattention, see Lewes, *Problems of Life and Mind*, third series, i. p. 189 f.; and James, *op. cit.*, i. p. 455 ff.

tendency in simultaneous tones to bring one another nearer.[1] These facts themselves suggest that colour-contrast is a physiological phenomenon, and does not involve a general principle of our sensational experience.

As we have seen above, the quality of a sensation is determined by its own psycho-physical process, and is only modified so far as this process is altered. The 'blueness' of a sensation of blue is thus independent of preceding sensations. Blue would still have its blueness even were the eye blind to every other colour; though, as has been pointed out, the blueness would not be so vividly and distinctly realised in this case.

All our sensational, as well as our ideational experience, is constituted by two co-operant factors or aspects. It has at once what W. James calls a "substantive" and a "transitive aspect".[2] The sweetness of the sugar I am now tasting illustrates the former, the transition to this, say from the bitter of a medicine, illustrates the latter.

These factors are by no means equally prominent in all sensational experiences alike, or at all moments of the same experience. Thus, when I am suddenly touched, or hear a familiar sound, the transitive aspect is reduced to a vague sense of an oncoming sensation. There need not, in this case, be any awareness of a particular transition from one kind of sensation to another. Again, when a sensation, say of tone, is prolonged, I can go on within certain limits of time attending to its quality with no appreciable sense of change or transition. Here the substantive aspect is uppermost. On the other hand, in the first oncoming of a sensation after another and unlike one, as in passing out of a dark room into a bright one, the sense of change may be uppermost.

The idea that every time we have a particular sensation we are apprehending more or less distinctly its difference from other sensations leads to endless difficulties. One difficulty will occur at once. In the case of all intense sensations there seems no room for an idea of a relation of contrast. When thoroughly chilled I cannot imagine heat, and consequently cannot be said to realise cold as a contrast

[1] *Tonpsychologie*, ii. p. 398. According to Œhrwall there are no contrast phenomena in sensations of taste.

[2] See his *Principles of Psychology*, i. p. 243.

to hot. In the case of sensations having a number of different relations another kind of difficulty occurs. When, for example, I have a sensation of blue, as in looking at the sky, or better still, at a blue flame surrounded by darkness, what particular relation or relations of colour-difference, it may be asked, am I realising at the moment? I cannot be bringing the colour into relation to *all* other colours at the same moment, and yet there seems no reason why I should select any one rather than another for a particular relation of difference. It seems plain that in this case there is no clear consciousness of difference at all. The blue is *differentiated*, *i.e.*, attended to as a sensation of a particular quality, but not consciously *discriminated* from anything in particular.

Even here, however, we can find a certain meaning in the doctrine of Relativity. Though to apprehend a sensational content as such is one thing, to note its difference from other contents another thing, this relational element is probably never wholly absent in the developed adult consciousness. Relations of contrast are among the most interesting; and, as such, are early remarked. From frequently noting them, we come in time to overlay, so to speak, our simple sensations with these relations. This applies most obviously to certain pairs of contrasting sensations, as hot cold, dark bright, hard soft, and so forth, the relation of which is specially interesting and easily noted, and generally to those opposed or contrasting experiences which underlie the particular variety of relative terms which logicians call "contraries" or "opposites". We cannot think of hot, tall, and so forth, without having the idea of the correlative opposite, cold, short, etc., *sub*-excited.[1] It applies also to some extent even to the series of sensations which we call the colour and tone scales. Thus a particular tone, say C^1, or a particular colour, blue, is after a certain experience of the whole series to which it belongs—the eight notes of the octave, the colour-scale—apprehended vaguely at least as differing from the remaining members of the series. In other words, to use the language of the logician, the 'positives' C^1, blue are accompanied by a dim, incomplete representation of the correlative 'negatives,' "not-C^1" (*i.e.*, tones), "not-blue" (*i.e.*, colours). Not only so, the effect of artistic culture is undoubtedly to invest each member of the series with a network of relations of difference, or, as they have in this case been called, distance. Thus a particular colour, say blue, is attached by a particular relation of distance to green, yellow, and so forth, and so ready to suggest these. In other words, in seeing the colour we refer it to its proper place in the scale of colours.[2]

(B) ASSIMILATION.

§ 5. *Nature of Assimilative Process: Relation of Likeness.* The second of the constituent processes entering into intel-

[1] On the nature of such extremes or opposites see Jevons, *El. Lessons in Logic*, p. 24. In the case of the *sensation* hot, the idea of cold would be excluded for the reason given above.

[2] The law of relativity has been specially applied to the intensity of sensations by Wundt (*op. cit.*, p. 377 ff.), who seeks to formulate a general law of relation ("Gesetz der Beziehung") into which he incorporates the appreciation of intensity as defined by Weber's Law (*cf.* above, p. 89). On the whole question of relativity consult Bain, *Senses and Intellect*, p. 8 f. and 321 f.; and Ward, *loc. cit.*, pp. 49, 50. The various forms of the doctrine of relativity are carefully distinguished and examined by Stumpf, *Tonpsychologie*, i. pp. 1-22; *cf.* James, *op. cit.*, ii. 9 ff.

lectual elaboration is known as Assimilation. This may be defined provisionally and roughly as the process by which like sensations or other psychical contents "attract" one another and tend to combine or coalesce. In its higher form it involves a "consciousness" or apprehension of a relation of similarity, and thus becomes one of the two leading intellectual functions co-ordinate with conscious discrimination or the apprehension of difference. As a bringing together and a combining of presentative elements assimilation is clearly opposed to differentiation, which in itself tends to a marking off and isolating of psychical contents. All assimilation is thus a mode of uniting or integrating. As we shall see later on, similarity is one great bond of connexion between presentations.

When we say that assimilation is the conjoining of like sensations, we mean by likeness any degree of similarity from the lowest degree of imperfect likeness which is just perceptible up to perfect likeness or psychical 'equality'.[1] Two sensations may be appreciably like one another yet far from quite or completely similar, as in the case of two adjacent members of the colour- or tone-scale or two adjacent sounds in the scale of intensity or loudness. The relation of likeness is here regarded as a perfectly simple and fundamental relation, co-ordinate with dissimilarity or difference. Perfect likeness, it may be added, whether of quality or of intensity, must be estimated for practical purposes by indistinguishableness when attention is closely directed to the sensations.

It may of course be said, as by Stumpf, that two sensations are never precisely similar or "equal" (*gleich*), and that consequently we must suppose the sensations which appear even to the severest exertion of attention as indistinguishable to be in reality dissimilar in a measure. This, however, is a subtle point not easily disposed of. We cannot, it is obvious, say that because two physical stimuli are in some degree different in form or energy the central nervous processes must be so also: for certain minimal differences in the stimuli may be inoperative on the central substance. Stumpf's idea is, moreover, beset with the difficulties that attend all theories of sensational content as something absolutely apart and independent of consciousness and attention. A difference between two sensations

[1] The term 'identity' is sometimes used to indicate such perfect likeness. But the word is open to the objection that two sensations experienced at different times are not the 'same' in the sense in which a *thing* seen to-day is the same as the thing previously seen. The nature of this identity will occupy us later.

that cannot be apprehended, and is out of all relation to consciousness, is as much a paradox as a single unconscious sensation.[1]

The distinction of perfect and imperfect likeness just spoken of has to do with *intensive* differences, or differences in degree of the likeness. In addition to these there are *extensive* differences or differences in the area of the likeness. Thus two colours may resemble one another *totally* in all points, tint, saturation, etc., or only *partially* in some one or more of these constituent features. A good deal of what we ordinarily mean by likeness, more particularly when we ascribe likeness to those complexes which we call 'things,' is of this partial character; and, as just shown, even in the case of so-called simple sensations, likeness resolves itself in many cases into partial likeness.

According to the Herbartian psychologists the fundamental relations are not difference and similarity but identity or equality and inequality (*Gleichheit* and *Ungleichheit*). According to this view, imperfect likeness as above defined is no simple relation at all, but resolves itself in all cases into partial equality. Thus all assimilation is expressed by the formula AB, AC, where A represents the common identical element in two complexes. This view, however, seems based on speculative hypothesis, and is not in strict accordance with the facts so far as they are known. That imperfect likeness may in many cases be resolved into partial has been conceded above; but this cannot always be done. 'Physiological analysis' does not enable us to say that two adjacent tones in the scale which are certainly like in pitch and more like than those separated by a wider interval have any common ingredient.[2] And, even if it could be made out that in all cases of like sensations there is a common ingredient, it might be urged that the apprehension of this likeness precedes by a considerable interval any power of abstract fixation or isolation of this ingredient. Thus children and even adults apprehend likeness between tones, as a note and its octave, and between two closely-related colours, as scarlet and crimson red, without being in the least degree able to identify a common element in them.[3]

[1] Stumpf separates in the sharpest manner sensibility to difference (Unterschiedsempfindlichkeit) from discriminative ability (Unterscheidungsfähigkeit). The only meaning I can give to the former is the influence of the organic factor which, as we have seen, co-operates with attention in determining the finest discriminative sensibility to colours, tones, etc. For Stumpf's views see his *Tonpsychologie*, i. pp. 22, 33 f. and 49 ff. On the difficulties of this theory of unapprehended sensational contents, *cf.* above, p. 143 f.

[2] It would be still less possible to determine a common element in two tones like though not perfectly like in intensity.

[3] The Herbartian view of likeness is connected with the extra-psychological assumption that presentations persist after they sink below the threshold of consciousness, so that what we call a new (similar) presentation may be conceived of as *the same* presentation re-elevated above this liminal point in the scale. The idea

A word may be added on the physiological substratum of psychical similarity. It is said that such a substratum is supplied in the fact of the identity of nervous structure involved in the case of two sensations. This, however, only applies to the case where similarity is perfect. In the case of imperfect likeness we can hardly assume that the same nervous elements and the same mode of functional activity are involved. It is to be added that, even if we could thus clearly conceive of a nervous correlative of two like psychical elements, this would be far from supplying a physiological counterpart of the consciousness or apprehension of a relation of likeness.

§ 6. *Automatic Assimilation : Recognition.* The simplest form of assimilation is to be found in that process by which a present sensation (or sensation complex) is re-apprehended or 'recognised' as something familiar.[1] This assimilation may be illustrated in the effect on the infant consciousness of recurring and interesting sensations of odour, sound, etc., as those of the mother. Such assimilation is automatic or 'unconscious' in the sense that there is no separate and distinct recalling of a past sensation, and clear awareness of the relation of the present sensation to its predecessor. It does, indeed, involve, as we shall see presently, a germ of what is called retentiveness, as also a certain nascent and imperfect form of revival or reproduction. But the revival not being full and distinct, we cannot in this case speak of a clear, explicit grasp of similarity between two psychical elements. What takes place here is the calling up by a present sensation of the trace or residuum of a past sensation (or sensations), which trace merges in or coalesces with the new sensation, being discernible only through the aspect of familiarity which it imparts to the sensation.

This mark of automatic assimilation, the aspect of familiarity or retrospectiveness in a sensation, will vary according to circumstances. Thus if the sensation has been preceded by a like one *shortly before*, the trace of this last assuming special distinctness

that all likeness is identity which appears to be shared by Ward (*loc. cit.*, especially p. 46 ff.) is ably criticised by Stumpf. He distinguishes between similarity of simples and of compounds, and argues that in the case of all sensations falling into a scale—tones, colours, temperatures—mere likeness (*i.e.*, imperfect likeness) is involved. (*Tonpsychologie*, i. p. 111 ff.)

[1] It may seem premature to introduce the word *re*cognition before we come on to deal with true cognition, *i.e.*, the apprehension of things. But the word is almost unavoidable here, and it may be as well to call attention at this stage to the fact that a simple process of re-cognition is involved in all cognition.

gives the peculiar mode of consciousness signified by 'again' or "over again". In the case of frequently recurring like sensations, *e.g.*, the taste of everyday dishes, the familiarity takes on the aspect of homeliness or commonplaceness. As already suggested, what becomes very familiar ceases on that account to be noteworthy, that is, to arouse the attention. Hence it may be said that in these cases the effect of automatic assimilation is to render the sensation unimportant or unimpressive.

This automatic assimilation by accumulation of traces plays an important part in early mental development. Recurring sensations, *i.e.*, the occurrence of like sensations or sensation-groups, is, indeed, a necessary condition of this development. A child must begin to bring together and class its sensations; and, indeed, by common consent, it begins to do this hastily and even recklessly, classing things which are only partially alike (provided the like feature is striking and interesting), and overlooking differences. All this shows that assimilation is a prerequisite of the growth of even the most rudimentary knowledge.[1]

A higher stage is reached when differences are sufficiently attended to to require a special isolating act of attention to the similar ingredient of the complex, as when a child recognises the mother's voice when she is playfully disguising it. This fixing of the attention on a similar feature or features in the midst of diverse elements involves a germ of the higher abstracting attention which will be found to play so prominent a part in the later intellectual processes.[2]

§ 7. *Transition to Comparative Assimilation.* This last process forms a transition from automatic assimilation to conscious comparative assimilation, where the relation of similarity begins to be attended to. Mere recognition with its complete coalescence of the residua of past sensations with the present does not imply such apprehension of relation. In the case of likeness, as in that of difference, this apprehension emerges gradu-

[1] The effect of successive processes of assimilation or accumulation of traces in giving vividness to sensations was well brought out in Beneke's system of psychology.

[2] The precise nature of recognition is a point that has given rise to a good deal of discussion of late. The matter of dispute will be most conveniently taken up presently when we come on to the reproductive aspect of the process.

ally, and only becomes steady and clear with the advance of development.

This conscious apprehension of a relation of likeness may take its rise in different ways. Thus one of the first forms would be the noting similarity between two simultaneous presentations, as when a child observes the image of its mother's face in a mirror. Such an unusual reduplication of a familiar object would act as a strong stimulus to the attention, and tend to arouse a vague apprehension of a relation of likeness.[1] Along with this may be instanced the simple form of comparative recognition which would arise when a second similar sensation recurs while the after-image of the preceding one still survives, as in the case of the tolling of a bell. As a last starting-point in the development of such conscious grasp of similarity we have automatic assimilation. In a case where this was checked by the presence of an obstacle, as when a child was puzzled by seeing its mother in a new dress, there would be developed the impulse to separate off the residuum of old impression from the present impression with which it tends to coalesce, and to consciously adjust this last to the first : and this would involve a germ of comparison. Such a process, however, obviously presupposes the advance of another process to be spoken of presently, *viz.*, the distinct recalling or reproduction of past presentative elements under a representative form.

§ 8. *Relation of Differentiation to Assimilation.* The two processes of differentiation and assimilation, though, as we have seen, in a manner opposed one to another, are carried out together, and in close connexion. And it may be as well to point out the nature of this connexion at once.

First of all, then, since assimilation implies attention to a new sensation, it may be said in every case to involve a measure of differentiation. A child cannot assimilate a taste, a touch, and so forth, till it mentally fixates, and so differentiates, this sensation. Our power of picking out and recognising particular elements in a sensation-complex, *e.g.*, tones in a clang, depends on our differencing these from the other concomitant elements.

[1] *Cf.* what was said above respecting the first development of conscious discrimination.

Further, the exactness of the assimilative process throughout waits on the advance of differentiation. Thus the child begins, as we have seen, by roughly classing different varieties of red as red long before it more exactly classes a particular variety, as scarlet or plum-colour, as such. Assimilation thus becomes close and exact in the measure in which distinction is introduced.[1]

This consideration helps us to understand what is meant by saying that assimilation (likeness) precedes discrimination (difference) in the development of the child. Crude assimilation progresses in advance of discrimination. Witness the daring of childish classification, as when it calls all males "dada," a rabbit "ba lamb," and so forth, a matter to be dealt with more fully by-and-by. On the other hand, assimilation as a precise process follows, or at least involves, discrimination. Tastes, odours, colours, etc., become carefully assimilated or classed in proportion as their several kinds are distinctively apprehended.

While, however, differentiation thus circumscribes the area of exact assimilation, assimilation reacts upon differentiation. It is, as already pointed out, through the interest awakened by the recurrence of partially old and familiar impressions that attention comes to be directed to these, and so the differentiating process to be carried a step further. If I did not recognise something familiar in this colour-group, this voice, and so forth, that is, partially assimilate it, I should not scrutinise it and so grow aware of its finer points of difference. As we shall see by-and-by, when we take up the subject of analysis of complexes, the singling out of a particular constituent, that is, the discriminative apprehension of it, is greatly aided by the

[1] This dependence of assimilation on differentiation is illustrated in some experimental inquiries of Lehmann on "Recognition" ("Ueber Wiedererkennen"). He found that when a subject is required to refer a gray to a well-discriminated and separately named shade as a class, *e.g.*, dark, middle, or neutral, the decision is much more certain than when he is asked to class a shade of gray under one of a series of arbitrarily selected six or nine gradations, which are not commonly distinguished and named. But oddly enough Lehmann (here following German psychologists generally in their inadequate recognition of the function of discrimination) does not connect his results with the variation of the discriminative factor in the case. (See Wundt's *Phil. Studien*, v. p. 135 ff.) The point insisted on is further illustrated in the effect of repetition in increasing precision, for this (as Lehmann himself seems to recognise) involves improved discrimination (pp. 148, 149).

circumstance that we have met with its like before, and so have our attention specially drawn to it by a process of assimilation, or, as the Herbartians would say, "apperception".

Finally, it is to be remarked that the higher forms of each, conscious apprehension of difference and of likeness, involve one another. We can only consciously compare two sensation-complexes as like when we distinguish these as two, and so in a manner at least different.[1] On the other hand, we cannot discriminate things exactly, save when we recognise a common aspect under which we can compare them. To say that two things differ is to say that they differ in respect of a common attribute, as size, colour, local complexion.

(c) ASSOCIATION.

§ 9. *General Nature of Associative Process.* In addition to the two processes, differentiation and assimilation, there is a third process involved in mental elaboration known as Association. By this is meant that process of psychical combination or integration which binds together presentative elements occurring together or in immediate succession. Thus, for example, the several sensations that a child receives together from one and the same object, as those of warmth, softness, and smoothness from the mother's breast, become conjoined, tied together, or integrated into one complex. Similarly, the succession or chain of visual and other impressions received in watching the preparation of its food, or undergoing the operations of dressing, bathing, etc., become conjoined or integrated into a series. It may be added that such integration has for its main condition, in addition to the co-presentation of two sensational elements, either together or in close succession, a mental reaction on these, either in the shape of a simultaneous grasp of them by attention, or of a movement of attention from the one to the other.[2]

This weaving together of the elements of experience (which is necessary to the very idea of experience as a system of con-

[1] That is, at least, differing in their local or temporal character, if not in their qualitative aspect.

[2] *Cf.* above, pp. 160. Wundt, following Herbart, marks off Association from Assimilation under the head "Complication" (*op. cit.*, ii. p. 369).

nected parts) begins from the earliest moment, and runs on *pari passu* with the other processes just dealt with. At the same time, the effect of this process of associative integration only becomes clearly manifest when mental development has reached the point where reproduction of sensations grows distinct. When we say that a mass of sensation-elements has been integrated we imply that when next we experience a part of the aggregate this will tend to *recall*, that is, revive under a representative form, the rest of the aggregate. Thus we know that the sight and taste of the infant's food have become integrated when the former manifestly calls up a representation (expectation) of the latter. Psychical binding together, or association, always has reference to a subsequent process of mental reproduction.

And here we reach a point of our exposition at which it becomes necessary to say something more about the psychological nature of retentiveness, and the closely-related process of reproduction.

§ 10. *Retentiveness.* By retention as a psychological phenomenon is meant in general the fact that a sensation tends to persist, or to be followed by some analogous after-effect when the process of stimulation has ceased. In its simplest form it shows itself in the temporary survival of a sensation in the shape of an 'after-sensation,' when the stimulus ceases to act, as when we retain an after-image of a bright object, say the sun's disc, some seconds after looking away from this. Here we suppose that the process of central excitation after having been started by the peripheral stimulation is capable of being prolonged, just as a tight string will go on vibrating after the withdrawal of the force which originated the movement.[1]

A much higher degree of retentiveness is shown where a sensation is not simply prolonged, but recalled after a considerable interval,[2] as when a hungry child recalls the sensations of feeding. Here it is evident retentiveness means something different from what it meant in the case of the temporarily prolonged or surviving sensation. The sensation recalled is

[1] *Cf.* above, p. 97.

[2] There is an intermediate case between the after-sensation and the revival after a considerable interval; but we need not consider this yet.

not supposed to have persisted, at least as a conscious sensation, during the interval. How then are we to conceive of the retention of it during this period? Two answers at once present themselves. (1) It has persisted as a true psychical phenomenon, but, having fallen below the threshold of consciousness, it has failed to make its existence known. (2) It has not existed at all as a psychical phenomenon, but the 'retention' is referrible exclusively to the persistence of certain changes, changes variously spoken of as physiological 'traces' or 'dispositions' in the nervous centres. In other words, it has been retained 'potentially' in the sense that its nervous conditions or substratum have been rendered permanent.

The determination of this point is, as already hinted, one of the 'cruces' of psychology. That sensations persist as psychical phenomena seems a necessity of thought to those who, like Leibniz and the Herbartians, conceive of the mind as a distinct spiritual substance. It follows from this view that all spiritual activity is indestructible, like the energy of the physical world. According to this way of envisaging the matter, it is not retention but loss or forgetfulness that requires to be accounted for.[1] On the other hand, it has been urged that psychological retentiveness is only a special case of a general biological function; and that all organs preserve either as an ingrained change of structure, or, at least, as a permanently acquired physiological disposition, the traces or residua of their previous activity. On this view, psychological retention is merely the subjective correlative of a physiological process, *viz.*, the cerebral organisation of the traces of past functional activity.[2]

How far this second view will help us to understand all that is meant by the conscious processes of memory and recollection cannot be discussed as yet. It may be as well to point out, however, even at this stage, that there is no greater difficulty in understanding how a persistent cerebral action or disposition should secure the revival of a sensation than how the original peripherally-induced cerebral excitation occasioned the sensation itself. The transition from physiological conditions to psychological results is just as difficult in the one case as in the other.

§ 11. *Process of Reproduction: Immediate and Mediate Revival.* The process of reproduction is something added to mere retention, since it implies the reappearance "in consciousness" of

[1] See Hamilton, *Lectures on Metaphysics*, ii. lect. xxx.; and Ward, article "Psychology," p. 47.

[2] It seems to be a question whether such a physiological disposition involves a prolongation of the functional activity in a weakened or nascent form. (See Wundt, *op. cit.*, ii. 381; *cf.* article "Memory," by Dr. Burnham, in *American Journal of Psychology*, vol. ii. p. 571, etc.)

the impression, no longer indeed as a sensation, but under a new representative form.[1]

This reproduction, as already hinted, appears in a crude or nascent form in automatic assimilation. When a new sensation or sensation-complex is recognised as something familiar it is because of the revival and coalescence with the presentation of representative residua of past sensations. Here, however, as pointed out above, the revival is in most cases nascent and incomplete. The new sensation has its character altered by the consciousness of familiarity, that is, of having had a like sensation before, but there is no distinct representation of this past sensation. It is only in exceptional cases, as when one particular experience of an odour, of a musical impression, and so forth, is retained with special distinctness, standing out clearly from among other retentions of the like, that a new similar experience at once recalls this particular member of the series of experiences. This partial reproduction, being due directly to the stimulus of the new like sensation and independent of any other stimulus, has been called Immediate Reproduction.

The other and more perfect form of revival of a presentation involves the absence of a like presentation at the moment. We cannot recall a colour and see a perfectly similar colour at the same moment, just because a presentation and its corresponding representation, being qualitatively indistinguishable, irresistibly coalesce. Perfect revival can only take place in a free form, through the rousing action of some other, that is, unlike stimulus. Such a stimulus is supplied by some connected or associated presentation. Hence this fuller form of revival is known as Associative Revival or Suggestion. Since, in this case, the revival is brought about indirectly by some disparate associated element, the process is spoken of as Mediate Reproduction.

This distinction of immediate and mediate reproduction is common among the Herbartians. It is possible to give the distinction a psycho-physical meaning by supposing, as is commonly done, that immediate revival involves a nervous process restricted to certain cortical elements answering to sensation and idea alike,

[1] The exact relation of this to the original presentation-form can be more profitably discussed later on.

whereas mediate revival involves the excitation of these elements indirectly by other adjacent elements. At the same time, as already hinted, it does not seem possible to assign a definite neural counterpart for the *assimilative* phase of immediate reproduction.

The recent tendency among "physiological psychologists" to simplify mental phenomena to the utmost, and to acknowledge no psychical process that does not readily lend itself to a mechanical, *i.e.*, a psycho-physical interpretation, has shown itself (among other ways) in a disposition to strike out assimilative revival from the group of elementary psychical processes. This has been urged on different grounds, as, for example, that (as we have admitted) the process does not involve (explicit) revival at all, that it is only conceivable by supposing past sensations to be persistent magnitudes which can come up again *as past sensations*, and that it is incapable of being interpreted in psycho-physical language.[1]

These objections, forcible as they no doubt are against certain ways of conceiving of assimilation, do not affect the position taken up above that in recognising any sensation as familiar we are assimilating it to a past experience, in the sense of importing into it a meaning as representing something that has been already experienced. It follows from this position that the image of this past experience, though not appearing as a detached phenomenon, must be said to be implicated. This conclusion, reached by an analysis of what we call recognition, is confirmed by the fact that in many cases, as where a second sensation (*e.g.*, of a tolling bell) comes while the after-image of a preceding like one still survives, and further, in all expectation of coming presentations, the idea precedes the sensation, and on its occurrence combines with, and is absorbed into, the same. As pointed out above, the process of reinforcing a sensation by attention probably involves this coalescence of an ideational with a (like) sensational element.

It is possible that, in addition to this immediate and mediate revival, there is a third form which might be marked off as 'automatic,' *viz.*, that due to some direct centrally-originating stimulation of the cortical elements. Such automatic revivals appear not only to be a consequence of a recognition of the automatic functions of the central substance, but also to be borne out by observation ; as the sudden emergence of ideas which to all appearance are wholly unconnected with the circumstances of the moment and preceding train of ideas. This possibility will be considered by-and-by.

Such associative revival begins as soon as sensations by repetition and cumulation of residua have acquired the requisite degree of after-persistence, and association has knit together with sufficient firmness different parts of a sensation-complex. Thus the infant's first observable revivals, *e.g.*, direct sugges-

[1] This line of argument is well urged by A. Lehmann in his article "Ueber Wiedererkennen," in Wundt's *Phil. Studien*, v. p. 96 ff.; *cf.* Münsterberg, *Beiträge*, i. p. 125 ff. The psycho-physical objection is almost naïvely set forth by Riehl when he says we are wholly unable to think of a mechanism of association through inner affinity, *i.e.*, likeness. (*Der Phil. Kriticismus*, ii. bd. 2, p. 214, quoted by Lehmann, *loc. cit.*, p. 155.) Must we strike out memory, that is the representation of an experience *as past*, from the list of psychical phenomena because nobody has ventured as yet to suggest the underlying physiological process?

tions of eating, bathing, etc., illustrate at once the persistence and the weaving together.

§ 12. *Stages of Associative Revival.* This associative revival, like the processes of differentiation and assimilation, appears under an earlier implicit or sub-conscious, and a later and more explicit and clearly-conscious form. In the connexions which enter into our everyday perceptions we have a number of disparate presentative elements (tactile, visual, etc.) solidified in an inseparable mass. Here, though, as we shall see, we can show the presence of representative elements revived by the presentative, it is impossible to analytically separate them so as to render each factor perfectly distinct: the constituents tend to merge in one indistinguishable mass. Such close associative integration defying analytical separation is one principal form of psychical fusion or coalescence, and is sometimes spoken of as Inseparable Association.

One important feature of this close interweaving of psychical elements into inseparable compounds is transformation. It must be never forgotten that psychical development is not like a mechanical process in which particular material elements persist as such, even in new modes of combination. The integrated experience that constitutes my knowledge of a person, or my feeling for a locality, though it can be seen by careful inspection to presuppose and to involve a number of elementary experiences, is not merely the sum of the ideas of these. The whole idea or feeling is a *new* type of psychosis. Hence some writers, as J. S. Mill, seek to establish an analogy between psychical integration and chemical combination, and speak of a process of "mental chemistry".[1]

In this close organic interweaving of elements into a new psychical product or growth there is one effect which appears so frequently that it may almost be erected into a general law: *Where asssociative cohesion of two or more psychical elements is strong,*

[1] See Jas. Mill's *Analysis of the Human Mind* (J. S. Mill's edition), i. p. 93; J. S. Mill's *Examination of Sir W. Hamilton's Philosophy*, p. 191. Stumpf appears to argue against the possibility of any complete *psychical* fusion of elements or process of psychical chemistry. Inseparable association seems to be to him an effect of a coalescing or running together into one of the underlying nervous processes. His whole discussion of the subject is painstaking and learned, yet leaves the idea of psychical fusion far from clear. (*Tonpsychologie*, ii. esp. §§ 19 and 20 (p. 127 ff.).)

the characters of dominant elements tend to be distributed over the whole compound. The whole of the lower sense-domain of our mental experience illustrates this. As we shall see by-and-by, our perceptions, though really compounded of sensations and ideational elements, take on, *as a whole*, the superior sensuous vividness of the former. We can, as Goethe has it, see "with the feeling eye," and feel "with the seeing hand".[1] It has recently been pointed out by Stumpf that in unanalysed tone-complexes the characters of particular constituents are, to some extent, transferred to the whole. Thus a clang takes on the pitch and the intensity of its main ingredients.[2] In the region of feeling we shall see this effect of transference or distribution of character from one constituent to other and associated constituents playing an important part.

If now we turn from the lower sphere of sensation and perception to that of ideation, *i.e.*, imagination and thought, we shall find association taking on a more explicit and easily-recognisable form. In thinking, say of a series of events, we have what is called a train of ideas or mental representations, which ideas are distinguishable as discrete psychical states. It is in this higher domain, accordingly, that we shall expect to see the workings of associative integration illustrated most plainly. The very use of the term association in psychology with special reference to ideas ("association of ideas") points to the superior manifestation of the process in the ideational sphere.[3]

Without attempting as yet a complete account of the law of associative revival or suggestion, we may just note its two main conditions.

(1) In the first place, then, retention is determined by the

[1] *Elegien* (Römische), v.

[2] *Op. cit.*, ii. p. 540. Stumpf regards this as a kind of reasonable illusion.

[3] This marking off of ideational association from sensational integration by absence of fusion is based on the circumstance that while our sense-experiences are organised into more or less completely-fused unities or "percepts," these percepts become the units of our ideational processes, and remain distinct unities. This must not be taken to mean, however, that a train of ideas is nothing but the sum of the separate ideas. Every particular succession of ideas has a total distinctive character, which is given partly by the characters of the constituent ideas, partly by the relational factor. Of this more by-and-by.

intensity and distinctness of the presentative element. Now we have seen that attention tends directly to the increase of each aspect. Retention may thus be said to depend on the closeness of the act of attention and the consequent degree of differentiation. Hence one reason why the organic sensations and those of the lower special senses are not readily revivable. We cannot isolate and differentiate elements of taste as we can analyse a sound, or distinguish simultaneously a number of tactile or visual sensations.[1] It follows that feeling, which, in the form of interest, is the great sustainer of the process of attention, is the main promoter of retention. Those presentations are, in general, readily revived which interest or excite the mind by their novelty, their beauty, their moving associations, and so forth.

(2) The other main condition of associative reproduction is the repeated and uniform recurrence of the associated elements as parts of one co-presentation. This second condition, usually dealt with under the head of repetition, will be found to be all-important in the work of associative integration. The child tends, no doubt, to integrate elements that are only occasionally and accidentally co-presented, as when it looks into empty tea-cups for sugar after finding that dainty in one. But experience is ever correcting this tendency, so as to bring the process of integration into agreement with the recurring juxtapositions, and what we call the fixed order of events, of the external world.

§ 13. *Physiological Basis of Reproduction.* It remains to say a word on the probable physiological conditions of this revival. According to the common view this revival involves and depends upon the re-excitation of the central structures originally excited by a peripheral stimulation. In other words, the cortical seat of the sensation and of the idea are the same.[2] Such re-excitation is further supposed to be similar in its character to the original excitation, though of a less wide extent than

[1] Dr. Bain makes retention depend directly on discrimination. (*Mental and Moral Science*, i. p. 96.) The exact relation of discrimination to retention is carefully discussed by Stumpf. (*Tonpsychologie*, pp. 287-9.)

[2] This hypothesis is not, however, universally adopted. The point will be dealt with again later on.

this, since it does not involve the peripheral region of the nervous system.[1]

In the case of that partial or nascent revival which takes place in assimilation we have to conceive of the nervous process somewhat after this manner. A given central element or cluster of elements is re-excited to a functional activity similar to that of a previous excitation. The residuum of this previous activity or surviving 'physiological disposition' somehow combines with and modifies the new activity; which blending of nervous processes has for its psychical correlative the peculiar mode of consciousness known as recognition, sense of familiarity, or identification.

Here our physiological psychology seems to be more than usually conjectural. It is not easy to represent any process of overlapping or summation of actions in the same nervous elements which would form a physical basis of the peculiar psychical phenomenon involved in all assimilation. It is to be added, however, that a mere process of identifying a sensation is an abstract conception never realised. In all assimilation, as we shall see, some points of difference make themselves known as well. And in all assimilative revival there is at least a tendency to reinstate some of the differentiating concomitants of the past sensation. According to this view, then, the nervous process in assimilation is more complex than that just supposed. There are two nervous actions, the new excitation and the re-excitation, these involving different elements or functional activities and only overlapping and coalescing at particular points.

In the case of complete or Associative Revival the physiological process will be somewhat different. Here we suppose that the excitation of a central element (or group of elements), P, answering to the reviving stimulus, occasions by means of special lines of nervous connexion a re-excitation of a second element, Q, more or less remote from P, which answers to the revived psychical content. Thus, following the common view, we conceive that, when the sight of the milk calls up in the child's mind the idea or representation of the taste and of the appropriate movements, the excitation of the child's visual centre transmits itself along certain nervous paths to the centres of taste and movement, producing a re-excitation of these centres.

[1] If we suppose retention to involve a persistent state of suppressed or nascent excitation in the central elements involved, we may say that revival depends on a sufficient intensification of this nascent excitation.

This view obviously assumes that the nervous centres of sensation and of ideation (representation) are the same; and physiological opinion appears to be tending towards this conclusion. The paths of connexion by which excitation is thus transmitted along definite lines are supposed to be partly laid down in the original structure of the brain, though largely evolved in connexion with the life-experience of the individual. As to the exact manner in which they arise, we are as yet very much in the dark. Although association is of all the psychical processes that which seems to lend itself best to translation into physiological terms, it cannot be said that the nature of the nervous changes involved has been fully elucidated. The fact that a concurrent stimulation of two points, P and Q, leads to a subsequently increased propagation of excitation from one point to another can only be fully explained when we understand the whole subject of irradiation of nervous excitation, together with its restriction or inhibition, much better than we do as yet.[1]

§ 14. *Unity of Elaborative Process.* We have appeared by the order of our exposition to suggest that these three constituent processes follow one another. But this does not correspond with the facts. All three processes are closely inter-connected. We have already seen this in the case of the two processes, differentiation and assimilation. It now remains to show the same thing with respect to each of these and the third process.

Beginning with differentiation, we can easily see that it goes on hand in hand with integration. Looked at in one way, differentiation is the initial process in association. In order to mentally connect two psychical elements, A and B, we must, it is commonly said, first discriminate them. Hence discrimination has been viewed by Bain and others as the fundamental intellectual process.

That a sub-conscious differentiation is involved in all integration may be admitted. This does not, however, mean that we clearly apprehend differences, that is, consciously discriminate before we begin to integrate. As already remarked, sensations are given as complexes, and begin to be attended to as such, and so integrated before any careful analytic separation or discrimination of constituent parts is carried out. Thus the complex, warm—smooth—soft, corresponding to the

[1] For an ingenious hypothetical account of the formation of such nervous channels or lines of least resistance, see H. Spencer, *Principles of Psychology*, vol. i. p. 515 ff., and p. 577 ff.; *cf.* Wundt, *Physiol. Psychologie*, ii. p. 381 ff.; Münsterberg, *Beiträge*, heft i. p. 129 ff.; and James, *op. cit.*, i. p. 562 ff.

mother's breast, begins to be known and marked off from other complexes before the comparatively abstract or analytical apprehension of warm as a separate sensation (or quality of object) is reached. This is sufficiently attested by the fact that even after the child can use words it names concrete objects, *i.e.*, complexes of sense-experience, some time before it begins to qualify things, that is, mark off single qualities. It is only when experience has advanced a stage, bringing up constituent elements in comparative isolation and in different (partially like) complexes, that the child perfectly differentiates, that is, renders perfectly definite the constituent sensations themselves. Thus the sensation warm becomes definite only when it appears in the different complexes answering to the mother's breast, the bath, etc.

This view that the child apprehends the complex before it apprehends the constituents may seem paradoxical at first, and to contradict what was said above about the tendency to assimilate things on the ground of partial likeness and by overlooking differences. There is, however, no real contradiction here. What really happens is this. There is first a vague differentiation of a group in which some constituents as of greatest interest in all cases stand out prominently, *e.g.*, the brightness (lustre) of the eyes in the mother's face-complex. This vague apprehension becomes clearer by repetition of the complex (automatic assimilation) and, still more, by minuter analytic attention to details. Here it is that variation in the arrangement of the constituents and the process of partial or analytic assimilation become so important. Thus the child gets a definite sensation, warm, by experiencing it not merely along with the other interesting sensations, soft and smooth, but also in comparative isolation, as when held near the fire, or as an element in another complex, *e.g.*, the bath. All this goes to show how very abstract a supposition is the common one of psychologists that mental elaboration begins by weaving together a number of ready-made elementary sensations.[1]

It may be added that not only does associative integration thus run on concurrently with, and even in advance of, differentiation, it is one means by which the latter is rendered more exact. That is to say, any two things which are only imperfectly distinguished will become better distinguished by taking on unlike associative adjuncts, and the greater and more impressive the associated differences, the greater the amount of their improving effect on the discrimination. Thus if we let *a* and *a* stand for two imperfectly-differentiated sensations,

[1] *Cf.* Ward, *loc. cit.*, p. 45.

KM and XY for two contracting associative adjuncts, it is easy to see that *a*KM and *a*XY will be more readily distinguished than *a* and *a* apart. Instances of this will occur as we advance. One striking example of this reaction of association on discrimination is seen in the development of the differential local characters of our sensations, *e.g.*, those corresponding to different points of the skin, through the associative addition of greater and more striking differences of motor experience.[1]

If now we inquire into the relation of assimilation to association, we find that the two proceed concurrently as organically-connected processes or parts of one process.

It follows, to begin with, from what has just been said that automatic assimilation (immediate reproduction) begins with a complex coherent mass rather than with its constituent parts. Thus the child assimilates the sensation warm as an ingredient of a complex before it assimilates it separately.

If now we look at the higher process of association (mediate reproduction) which involves distinct representation or reproduction of sensations, we find that automatic assimilation forms the initial phase of the whole operation. Thus, before the child can, upon seeing the milk, recall the taste, etc., it must assimilate or recognise the visual or presentative element, *viz.*, the white colour, etc. Assimilation is here the initial step of the whole process.

This may be symbolised thus—

$$\begin{array}{l} \mathrm{V} \\ | \\ (v)\text{—}s,\ t,\ \text{etc.,} \end{array}$$

where the large letter V stands for the presentative parts (visual impressions), the small letter *v* in brackets the residuum of past similar impressions which is excited by and at once coalesces with V, giving this its aspect of familiarity or representativeness, and the other letters the distinct representative elements, taste, etc. The reader must here bear in mind the warning already given, that when we speak of a presentation (V) exciting contiguously an idea (*s*) through assimilative reproduction of a past like sensation (*v*) we do not mean that the identical original experience (V) reappears. As Lehmann well points out in the article already quoted, sensations are not like persistent material things which may come and go. All that is meant by the above scheme is that the new sensation calls up the associated idea through and by means of an initial process of recognition. No doubt this stage of

[1] W. James has well illustrated the improving effect of such associated differences on discrimination (*op. cit.*, i. p. 510 f.).

recognition is in many cases fugitive, and in some of those illustrated by Lehmann's experiments becomes evanescent.

According to some, assimilation is not a distinct process, but only a part of the process of integration or association. This question, already touched upon, will have to be discussed again later on in connexion with the processes of ideation and the Laws of Association. Here, however, it may be observed, in addition to what was said just now, that, while always found together, assimilation and association serve to mark off two distinct directions of the elaborative process. Assimilation, even in its lower automatic form, answers to the depth of the combining process, integration to the breadth or extent of it. And these two do not necessarily proceed *pari passu*. A particular taste or smell may answer to a whole series of past sensations, and in a manner represent these by its familiar aspect: yet it may not call up the contiguous concomitants of any one of these experiences. In like manner, as we shall see by-and-by, where a number of partially-like things are assimilated on the ground of a common constituent, the assimilative or classing process tends to exclude the revival of the several integrated concomitants. A familiar face, a familiar name, is associated with a rich variety of impressions answering to the various circumstances in which I have seen or met with it, etc. But, just because these are not uniform but variable concomitants, they neutralise one another's tendency to reappear in consciousness.

It may be added that retentiveness, which we have seen to be the fundamental condition of associative reproduction, must be assumed to be co-operating throughout the process of elaboration. Thus it is evident that the simplest type of differentiation, the conscious transition from one sensation to another and unlike one, as from cold to warm, involves the rudimentary form of retentiveness, *viz.*, the temporary survival of the antecedent sensation. I must keep the sensation of cold in mind after the oncoming of the warm if I am to realise, however vaguely, the change as such. Similarly, when a person notes a difference or change in something recurring or constant, as in the flavour of a familiar dish, or the dress of a member of his family. Here the vague sense of a difference plainly presupposes the persistence of the idea of that which has changed. Again assimilation, as has been shown, not only involves retention, but is the first and simplest manifestation of its effect, *viz.*, a revival of sensation. Not only so, as we shall see by-and-by, all the higher comparative discrimination and assimilation depend on the retention and reproduction of presentations.

The importance of retentiveness as a condition of this composite psychical process may be seen in another way. Each of the processes advances gradually, the new and higher stage presupposing and depending upon the lower stages. Thus every succesive act of differentiation renders possible a higher degree of the process through the subsequent persistence of its products. For example, by distinguishing the colour blue from other colours and retaining this presentation as a distinct element, a child is prepared to take a new start, *viz.*, in the direction of marking off from one another this, that and the other variety of blue; or, taking instead of single sensations the complexes which our experience gives us, we may say that the persistence of the first vaguely differentiated presentation of a flower as a whole, prepares the way for a more complete differentiation of it with this and that detail distinctly apprehended.[1]

COURSE OF DEVELOPMENT.

§ 15. *Stages of Intellectual Development.* Our analysis of the process of mental elaboration has now been carried sufficiently far to enable us to trace out in its main features the general course of intellectual development.

This intellectual development may be described agreeably to the general idea of development as a progressive double process of separation and combination, with the result of an emergence of more and more complex or highly elaborated products. This result is secured by the three processes just described. Differentiation obviously answers to the process of organic segmentation, assimilation and integration to the pro-

[1] See Ward, *loc. cit.*, p. 46, col. *a*, and 47, col. *b*. W. James regards the effect of retentiveness in improving discrimination as due to a process of assimilation. Thus, having noted a difference of local character in two skin-sensations at a sensitive part, we are able to note a smaller and otherwise imperceptible difference elsewhere, because this "reminds us" of the larger one, or because we assimilate it to the "image of doubleness" already gained (*op. cit.*, i. p. 510 and 514 and f.). This idea of assimilating an unperceived difference (not, be it noted, two different sensations) is not quite clear to me. A difference must surely be apprehended vaguely, at least, before we can assimilate it to other differences. Hence the meaning of saying that discrimination is the fundamental process in cognition. At the same time, James touches an important truth here. The effect of practice in improving discrimination is rightly attributed by psychologists to improved attention. Now, as we saw, attention is commonly aided by some amount of ideational preadjustment, some expectation of what there is to see. Hence, it is explainable that after observing broader differences of any kind our minds are focused for this class of differences, and so more likely to note a small one.

cess of organic co-ordination or the formation of structural arrangement.

Beginning then with an initial state of vague undifferentiated sensation or sentience, we find that the progressive action of the elaborative process gives rise to three successive products, which constitute advancing phases of elaboration. These are percepts or sense-intuitions, images or representations of concrete objects, and thoughts or representations of general classes or abstract qualities.

(1) The first stage in true cognition is reached when a mass of sensations has been differentiated, assimilated and integrated into a percept. By a percept is here understood the outcome of an act of sense-perception. Thus, when the child has reached the stage at which it sees the cat, the doll, and so forth, as a thing existing apart from itself in the external world, it has a percept. Perception is the beginning of true cognition. It is the first and lowest stage in the organisation or unification of experience. As the content of a percept is to some considerable extent presentative, perception is spoken of as presentative cognition. But, as we have seen, it always involves a representative factor as well, and is therefore best described as a presentative-representative process.

(2) By an image is meant the ideal copy or representation of the percept. We imagine an object which we have seen when it is no longer present to sense. Images are thus marked off from percepts as wholly or purely representative, and hence the operation by which we form images is spoken of as Representation or Representative Imagination. Such imagination is only possible after percepts have become sufficiently fixed or set. Its appearance is the full indication of the mind's retentive and reproductive power. So far as the images are representative of past percepts, imagination does not add to, but simply preserves, cognition under a new or representative form. The child, by being able to imagine the dog barking, knows the fact not only when it happens to hear the sound, but afterwards.

What is commonly called *imagination*, however, includes more than a mere revival of past percepts. In addition to this purely-reproductive imagination there is a productive imagination which involves a certain process of elaboration, as when the child imagines what is beyond the ken of its senses by help of impressions gained through these. This productive imagination will be found to play an important part in the early extension of knowledge.

(3) As the last stage we have thought-products, general notions or concepts, and so forth. This is the highest stage of elaboration, since it involves the perfect organisation and unification of experience in a general or universal form, and so in the form of a systematic and reasoned knowledge. This stage is only reached after a certain accumulation of images and a careful comparison of these. It thus presupposes not merely a considerable amount of previous differentiation, etc., but also the growth of the power of attention. A child cannot classify a number of unlike objects on the ground of a clearly-apprehended common attribute as round objects, transparent substances, and so forth, because it cannot hold different percepts and images steadily before its mind so as to compare.

The direction of this whole process of thought-development may be described as follows. It is a transition from presentation to representation, from immediate cognition through the senses to mediate cognition by way of ideas. Such a movement is plainly away from sense. It is the substitution for an outer sense-conditioned type of psychical activity, of an inner sense-detached type of activity. This detachment from sense appears already in imagination, which, though picturing the concrete and sensible world, does so apart from actual perception, and, as we may see in dreaming and childish reverie (day dreaming), may give rise to another and disconnected ideal life. It shows itself, however, still more plainly in thought proper, seeing that here the mind no longer pictures concrete objects as they are known to sense, but represents them in an abstract way, that is, under certain selected aspects, *e.g.*, form, and by help of word-symbols.

§ 15*a*. *Meaning of Developmental Stages.* It is to be observed that while we thus mark off distinct stadia in the intellectual movement, there are no sharply divided stages. Thus, as we shall see by-and-by, the image first appears in a nascent incomplete form as incorporated into the percept, and only detaches itself from its perceptual stem and attains to distinctness and independence by degrees. In like manner the general notion is evolved gradually out of the image.

Not only so, the actual course of intellectual development is not a simple succession of unlike phases, but a much more complex process. It involves a concurrent advance of the earlier phases after the later ones have been added. Thus, a child goes on forming new percepts, and percepts of a more complex order, after it has begun to imagine and to think.

Once more, the development of the higher phases of intellection reacts on the lower. Thus, as we shall see, percepts come to be overlaid not only with images but with general notions. In looking at an object the man accustomed to think immediately considers it as a member or representative of a general class. In observing a natural phenomenon, he recognises in it an illustration or fulfilment of a universal process or law.

§ 16. *Development and Habit.* Finally, what we call mental development implies not merely an advance from lower to higher psychical forms, but a growing rapidity and facility in all recurring or repeated processes. This result, already touched on in connexion with organic development, and again under the head of attention, is due to retentiveness. We carry out accustomed acts of perception *e.g.*, recognising a person, trains of ideas, as well as habitual actions, with greater and greater rapidity, and less and less strain of attention, just because of the psycho-physical property of retentiveness. All that is meant by habit, that is, the effect of repetition and custom in rendering psycho-physical processes more and more automatic or sub-conscious, illustrates this side of development.

It follows that as our conscious life advances and takes on new and higher phases of consciousness it is continually dropping, so to speak, the old forms, in the sense of allowing them to grow sub-conscious. And it is only by this economising of attention or consciousness in the case of habitual processes that the higher psychical processes become possible.

Habit, as we shall see, has a narrower and a wider meaning. When it refers to the rigid fixing of ideas or actions in one definite order it is a force that opposes development. Habitual action or grouping of ideas means action or grouping which is with difficulty altered. But taken in a larger sense, as including all the effect of repetition of psychical processes, habit is, as we saw just now, an integral factor in the process of development itself. It is only by retaining the traces of our past activity that we can render this activity more perfect.

§ 17. *Development of Feeling and Willing.* The development of the other two phases of mind, feeling and conation, follows the same general course, and exhibits the same underlying process. This results in a measure from the fact that the higher developments of feeling and conation are bound up with and depend upon intellectual development. This will appear more plainly when we come to consider the precise character of these developmental processes. Here we may content ourselves by barely indicating the general agreement of the three directions of mental development.

It is easy to see that the growth of feeling, like that of cognition, begins with an external sense-element, *viz.*, what we call a sense-feeling, and proceeds in the direction of internal states, *viz.*, emotions, such as sympathy, or the agreeable sense of self-approval, which involve representation or ideation. This development of feeling, moreover, is, as we shall see, brought about by a double process analogous to that of intellectual differentiation and integration. In like manner, action begins with external bodily movement of an impulsive sense-prompted character, and passes on to a higher type of reflective or deliberative action marked by internal processes of reflection and rational choice. And here, again, we see the double process of differentiation and integration at work. The development of volition is throughout conditioned by the separating off or discriminating particular movements and combinations of movements. On the other hand, it proceeds by a progressive integration of motor elements, as in combining a number of simultaneous movements, or following out a succession of movements.

§ 18. *Psychical and Physiological Development.* That the psychical processes just traced are correlated with the development of the nervous system has already been pointed out.[1] It is presumable that to each of the constituent processes here dealt with there answers some mode of change in the substance of the nerve-centres. But, as has been remarked, we are as yet unable to define the correlations with any degree of precision.

In allowing this general correlation between the psychical and the concomitant physical process, we must not be taken

[1] *Cf.* above, p. 56 f.

as assimilating the one to the other. Thus discrimination and assimilation in their complete form as conscious apprehension of relations are peculiarly psychical. Although we may reasonably look for a physiological concomitant of two unlike sensations, and so a certain nervous substratum for the act of discrimination, it is vain to attempt to find any physiological analogue of the act of discriminating these, that is, apprehending their unlikeness.

§ 19. *Development as Biological Process.* It was pointed out in our account of psychological method that we may view psychical phenomena from a biological point of view. This idea we can now apply to the conception of mental development just reached.

Mental development is clearly a particular phase or concomitant of organic development. This last process may be viewed as a progressive adjustment of organism to environment due to the repeated exercise of that sum of functional activities which we call life. Such progressive adjustment has, it is obvious, a teleological significance. It is only as such adjustment is effected that the conditions of stable life, that is, of permanent self-preservation, are realised. The general course of psychical development is susceptible of being brought under this conception. Thus it is evident that the superinducement of the internal ideational upon the earlier sensational consciousness involves a greater capacity of self-adjustive action. By imaging the remote results of action, by co-ordinating our particular experiences in the form of general rules, we are able to carry out far-reaching and comparatively permanent forms of adjustment. The child, with its mind steeped in the impression of the moment, is exposed to all the hazards of the future. The growth of intelligence or wisdom is an enlarging of the mental view, a progress towards a complete coping with our environment in its whole extent and complexity.

One important bearing of this biological idea on mental development is seen in the phenomena of habit. As pointed out above, consciousness, in the sense of close attention, is only involved in new, and consequently difficult adjustments, as in beginning to learn a language, a trade, and so forth.[1]

[1] See above, p. 78.

When, on the other hand, the action is called forth again and again by recurring circumstances, and so grows habitual and automatic, we have the completion of the adjustment to environment indicated by detachment of consciousness. According to this view, our psycho-physical life consists of two processes: acquiring new adjustments, and utilising old or previously-acquired ones. The first domain of our activity is that of intense consciousness or concentration, the second, that of weakened consciousness, which approaches in cases of perfectly-organised action to an unconscious or purely physiological process.[1]

The application of the teleological point of view to mental development, and more particularly to the lapse of consciousness which accompanies the organisation of particular actions into what we call habits, suggests the possibility of a further application of it to the first genesis of consciousness as a feature of organic life. Thus, it may be argued that, if in the course of organic evolution, consciousness can be supposed to appear on the scene at all in connexion with particular (nervous) structures, it would tend to be preserved on account of its utility to the organism. It has been urged that, owing to the addition of consciousness, action has become more widely modifiable, that is, differentially adjustive to particular circumstances, than it could ever have been without. It is evident, however, that we here reach the boundary between scientific or positive psychology and metaphysic. The biological question of the preservation of consciousness for the sake of its utility forces on us the closely-allied question, How did this unique, non-physical concomitant appear at all? And this question of the "origin of consciousness" is acknowledged to be extra-psychological. This way of regarding consciousness, moreover, as a co-operant factor in biological evolution, raises the other and closely-kindred question, Does consciousness stand in a causal relation to organic processes? a question that evidently is only another form of the metaphysical problem, What is Mind in itself, and how is it related to Body? These questions will be taken up at the close of our exposition.

§ 20. *Social Environment and Development.* While we can thus bring the process of psychical development into connexion with the collective functions of the organism, and so with the action of the physical environment on this, we must not omit to point out how in its higher and more complete form it involves and is conditioned by the action of that other environment which is marked off as the Social or Human.[2] The

[1] For a fuller account of the process of mental development under the aspect of a growing adaptation to surroundings, see Mr. H. Spencer's *Principles of Psychology*, vol. i. pt. iii. (General Synthesis); *cf.* pt. v. (Physical Synthesis).

[2] *Cf.* chap. i. p. 34. This action, like that between the organism and its physical

influence of this environment is partly undesigned, as when a child is stimulated to imitate the words, actions, etc., of others, and partly designed or educative in the proper sense. The effect of it is seen throughout the whole process of individual development, and more and more clearly as we approach the higher stages of it. Thus, even a child's perceptions are increased in number and improved in quality by the educative influence of others, as in pointing to objects and naming them. In like manner, the reproduction of past presentations is greatly aided by the fact of common observation and experience, and the conjoint revival of this through the medium of language. Lastly, the influence of the social environment is seen still more plainly in the work of thought, which, as we shall see, is carried out by means of that great instrument of social life, *viz.*, language. All this higher plane of mental life is, indeed, only attained under the educating influence of a civilised community.

In like manner, the higher feelings, *e.g.*, sympathy, and reverence for the moral law, depend on social relations, and in this way the development of feeling presupposes the social environment. Lastly, the development of conation into its higher form of calm, rational action is brought about by help of the system of influences through which the community works on the individual.

REFERENCES FOR READING.

The constituent processes in mental elaboration are dealt with by Ward, article "Psychology" (*Encyclop. Britann.*). A systematic treatment of the processes of mental in connexion with organic development is given by H. Spencer, *Principles of Psychology*, especially vol. i. parts iii. and iv. A somewhat peculiar though suggestive view of mental development is presented by Ladd, *Elements of Physiol. Psychology*, pt. iii. ch. ii. This may be compared with the views of Lotze, *Microcosmus*, i. bk. ii. ch. i. and following, and *Metaphysic*, bk. iii. ch. iii.

environment, is really an interaction, the individual mind not only being acted upon but in its turn acting upon the collective mind. But here we are concerned only with one side of this interaction.

PART III.

INTELLECTION.

CHAPTER VIII.

PERCEPTION.

§ 1. *Perception: how Distinguished from Sensation.* Sensations, as we have seen, are not in themselves knowledge, but only the material for it. In order that knowledge may arise out of, or by means of sensation, those processes of elaboration are necessary which were described in the last chapter.

The first stage of this complex process of elaboration is seen in those seemingly simple mental acts by which we refer a sensation (or a sensation-complex) to what is commonly spoken of as the external world, in other words, localise it in some region of space. In its complete form this external reference implies that we regard the sensation as the mark of a quality, *e.g.*, colour, weight, which quality we assign to a particular object situated somewhere in space; this object being viewed as external to, or distinct from, the mind which perceives it.[1] Thus we refer a sensation of sound of a certain kind to a particular direction in space, say to the right of us, and to a particular object, say to a bell, and in doing so we attribute the sonorous quality (state of vibration) to this object. The first

[1] The reader should note the ambiguity of the word external. An object is external which lies outside our body in space. In the philosophical sense, however, any part of our body as a physical object is external to the mind, *i.e.*, a part of the external (physical) world which is opposed to, and independent of, the internal world of mind.

process may be called the localisation, the second the objectification of sensation. As we shall see presently, these two processes are closely connected.

The two processes here spoken of, the localising and the objectifying of sensation, make up together what we commonly understand by Perception. Whenever we perceive a thing through or by means of the senses, we are thus assigning a sensation to a particular locality and a particular object. To perceive an orange, for example, is to refer a group of sensations of light and shade and colour to an object called an orange situated at a particular point in space. The result of this process, that is to say, the completed psychical product, is called a Percept.

It will at once be seen from this that perception is more of a mental process or an act of mind than sensation. In sensation (so far as we can imagine this apart from perception) we are comparatively passive and recipient; in perception we not only attend to the sensation (or sensations) discriminating and identifying it, but pass from the impression to the object which it indicates or makes known.

The meaning of the word perception, like that of the closely-related term sensation, has varied with different writers. In common life we use the expression for almost any kind of cognition, as when one says, "I perceive a similarity between two ideas," or "a connexion between premises and conclusion". And earlier thinkers employed the term in much the same way.[1] Recent psychologists, however, agree in the main in restricting the word to that mental process by which we discern an external object by way of the senses. This cognition of outer things is sometimes called external or sense perception, to distinguish it from the mind's cognition of its own states, which is named internal perception.

Sensation and Perception are sometimes distinguished, *e.g.*, by Hamilton, by saying that the former is the subjective fact of feeling, the latter the intellectual part of the process.[2] We have seen, however, that sensation is not mere feeling, but contains a presentative element. And this presentative element is the distinctive constituent of the percept. Moreover, Hamilton's view suggests that we know

[1] See Sir W. Hamilton, *Lectures on Metaphysics*, ii. xxiv. p. 93. *Cf.* his edition of Reid's Works, Appendix B*.

[2] Conceiving the distinction in this way, Hamilton seeks to establish the proposition that perception and sensation (like knowledge and feeling in general) are always in the inverse ratio of each other. (See *Lectures on Metaphysics*, vol. ii. xxiv.; *cf.* edition of Reid's Works, p. 863.) Consult further, Ward, article "Psychology" (*En. Brit.*), p. 52. For a careful examination of Hamilton's doctrine, and of the relation of sensation to perception, see H. Spencer's *Principles of Psychology*, vol. ii. pt. vi. ch. xviii. §§ 353, 354.

sensations as states of ourselves before we begin to connect them with external objects; and this is a palpable error. The child attains to self-consciousness only in connexion with the process of external perception.

This perceptual process, properly so-called, has been variously described as projecting the sensation outwards into the external region; interpreting it as a mark or sign of an objective existence, etc. A common way of describing it is by saying that in perception we are assigning an effect (a sensation) to its cause (an outer object). But this is hardly a correct account of the process in all cases. When, for example, I have an impression of colour and refer it to an object, say an orange, I do not think of the quality of colour with which I endow the object as the cause of the sensation. The real cause of the sensation is of course the agent known as light which is reflected from the body; but in perceiving an object we do not think of this, and may, indeed, be wholly ignorant of its existence.

§ 1*a*. *Intra-organic and Extra-organic Localisation of Sensations.* While a process of localisation takes place in the case of all sensations, it has not always the same form. Thus, the lowest class, the organic sensations, are referred to a part of the organism itself, as when we localise a sensation of burning or tickling in a certain part of the skin.[1] This may be called intra-organic localisation of a sensation. In the case of the special senses there is a further extra-organic localisation, in close connexion with what we have called objectification, that is, reference to a thing or object. Thus we refer a sensation of colour to the surface of an object lying in a particular direction. In this case we do not separately attend to the sensation as such and apprehend its organic seat, but our mind passes at once from the sensation to what it signifies, *viz.*, the presence of an object in a particular region of (extra-organic) space, which object the sensation serves to qualify. What is commonly called perception is this reference of impressions of light, sound, touch, etc., under the form of qualities, as luminosity, hardness, to things external to the organism.

§ 2. *Process of Perception.* It may be confidently asserted that in adult life we never experience a sensation which, provided it is sufficiently attended to and differentiated, we do not *at once* refer to an object in space. The reference may be more or less definite and complete. Thus a sound may be

[1] Some writers, as Bain, appear to confine the term localise to this reference of sensation to a particular locality in the body. There is an advantage, however, in generalising the meaning so as to include reference to extra-organic locality as well.

referred to a particular object, as a belfry, or only to some unknown object vaguely localised in space. But in a perfect or imperfect form such a reference always takes place. And it takes place so automatically and instantaneously that it is difficult for the student at first to distinguish the act of perception from the mere sensation. The reason of this habitual interweaving of a perceptual process with sensation will appear presently.

This applies to discriminated sensations or sensation-complexes only so far as attended to and differentiated. The difference between simply having a sensation and perceiving is best illustrated in the case of indistinct sensations. We often have sensations, as those arising from contact of our body with its clothes, to which we do not attend, and which in consequence are accompanied by very little, if any, of the perceptual or localising element. In waking from sleep we may not infrequently distinguish a first stage of vague sensation followed by another of differentiation and integration resulting in perception.

There is every reason to suppose that this act of referring impressions to things or objects in space, though appearing to us so simple, immediate, and irresistible, is the result of a long process of acquisition or learning from experience. An infant in the first weeks of life betrays no sign of recognising the bodily seat of his sensations of heat and cold, pressure, and so forth. Nor does he show by an appropriate turning of the head that he perceives the direction of a sound, the sensation of which he evidently experiences. Perception is probably aided from the first by definite inherited tendencies; but it is only fully developed through the processes of individual experience.

Let us now analyse the process a little further. When on hearing a particular sound we say, 'A bell is sounding in such a direction,' the beginning of the psychical process is manifestly the differentiation and assimilation of a particular sensation. If we had never had an impression before similar to this in some respect we could not now refer it to a particular portion of space or to a definite kind of object.

The second stage, that of perception proper, involves a process of integrative association. When we say (on the ground of an auditory sensation alone) 'I hear a sound over there,' it is because in our past experience this sensation of hearing has become co-ordinated or associated with other sensations, muscular and tactual, by which we gain the idea of direction or position. And, further, in referring this sound to a *bell*, I am recalling a complex of sensations of active touch and sight corresponding to the bell. If I had never heard sounds in the same quarter before, and if I had never handled or seen a bell before, the present sensation would not be referred to this locality and this object. The percept is thus the result of a process of associative fusion, or organisation of a number of elements into one mass.

As we have seen, all associative grouping of sense-elements involves a germ of representation or ideation. In the case of the perceptual process it is manifest that the tactual and visual sensations answering to the touch and look of the bell are not actually present when we hear it and recognise it by the sound. They are revived or reproduced. In referring the impression of sound to the bell we are more or less distinctly representing or imagining the look and the touch of the bell. A part at least of our meaning in saying that we hear a bell in such a direction or at such a distance is that we know we might move in a particular way, say to the right, and come in view of, and into contact with, the bell, thus renewing these visual and tactual experiences. Hence perception has been described as "a presentative-representative process".[1]

While, however, perception is, when viewed historically, a process made up of a sensational and an ideational factor, it is, as already suggested, of the essence of the percept as a phenomenon of our developed consciousness, that it appears as a perfectly-welded whole. In cases of ordinary perception we do not consciously go through first a sensational then an ideational or interpretative stage: the two stages overlap and merge into a single momentary consciousness which we call a percept or an intuition.

The reasons of this merging or fusing of the two factors into the peculiar form of a percept have already been suggested. It is evident that we have here to do with associative cohesion of the highest degree of strength. The conjunctions of our sense-experience, *e.g.*, the visual marks of smoothness (lustre, etc.) with the corresponding tactual consciousness, are among the most constant and most frequently renewed. Hence the reviving

[1] By H. Spencer, *Principles of Psychology*, vol. ii. part viii. chap. ii. p. 513.

force is here at its maximum. But again, the relation of the two associated factors in perception is a peculiar one. On the one hand, as pointed out by Helmholtz and others, the actual sensations are often of very little interest to us on their own account, and are attended to merely as signs of that which is of real moment.[1] Hence a tendency to slur over the sensation and hurry on to the ideational significate. In appreciating with the eye the smoothness of a billiard ball our consciousness is at least half as much tactual as visual: that is to say, our interest is centred in the suggested manual experience. This is an illustration of the general principle that attention moves from the less to the more interesting.[2] While, however, the ideational element is thus reinstated and made prominent, the sensational element persists just because it is sensational, and maintains itself by its superior sensuous vividness. Hence the ideational element is apprehended through the medium, so to say, of a sensation. I "ideate" the tangible smoothness of the marble slab in or beneath the lustre and the uniform distribution of luminosity which I directly "sensate"; or, as we expressed it above, the distinctive characters of the sensation, vividness, immediacy, diffuse themselves by associative transference over the whole presentative-representative complex.

Some writers do not seem to regard the presence of a representative element as essential to perception. Thus Prof. Wundt regards a complete presentation (Vorstellung) as differing from a mere sensation simply by its complexity. Hence a series of sound-sensations apprehended in their time-order constitutes a *Vorstellung*.[3] It may, however, be said, that even here the *perception* of the sounds as external, that is to say, travelling from a certain direction of space, implies a reference to experiences of touch and sight, and so a process of representation; and that in any case the apprehension of a series of sounds involves after-images, *i.e.*, temporary representations of the constituent members.

Since in perception the mind thus passes from an actual sense-impression to

[1] See Helmholtz, *Physiol. Optik*, pp. 431, 432; quoted by W. James, *op. cit.*, ii. 241, 242.

[2] *Cf.* above, p. 158. W. James expresses the underlying principle thus: "The substantive strength of a state of consciousness bears an inverse proportion to its suggestiveness" (*op. cit.*, ii. p. 124, *cf.* p. 240 ff.). This, however, simplifies the phenomenon too much. It is not a mere result of a psycho-physical process of associative attachment, but also of a preponderant interest in that which is suggested. In proportion as a sensation becomes interesting in itself, as a colour to an artist, it loses this "suggestiveness".

[3] *Physiol. Psychologie*, ii. cap. xi. § 1; cap. xii. § 1.

the representation of other sense-experiences (*viz.*, movements with their attendant sensations), it bears a certain analogy to a process of inference. Thus, by a little forcing of language, we may be said in hearing the bell to infer the possibility of certain touch and sight experiences. Accordingly some writers have not hesitated to describe the process as one of "unconscious inference".

That there is a certain appropriateness in this approximation of perception to a process of conscious reasoning is certain. Our intellectual life is one continuous movement, and the rigid demarcation of the spheres of sense and thought which has been handed down from the philosophic masters of antiquity must not mislead us into supposing that they are absolutely and in their ultimate elements disparate and heterogeneous. A closer analytical examination of the whole process of sense-perception, with its immediate apprehension of a real object, shows us that it presupposes, as its historical antecedents, a number of more or less elaborate operations which are strangely like the higher processes of constructive thought. None the less it is, as suggested above, a psychological error to assimilate perception to reasoning. As there pointed out, we have no evidence that in our customary perceptions we carry out, however rapidly, a transitive movement from sensational premise to ideational conclusion. Perception is wanting in the illative consciousness; the sense of deriving one portion of truth from another which is always present in a complete process of reasoning. Moreover, the presence and predominance of sensation as the central factor, which radiates its vividness and warmth over the whole, gives to perception its distinctive colouring, marking it off as an immediate "intuitive" grasp of reality from the discursive movements of thought.[1]

§ 3. *Definition of Perception.* By aid of the foregoing brief analysis we may define perception as follows. Perception is a process of psychical elaboration, involving both presentative and representative elements. More particularly, perception is that process by which the mind, after discriminating and classing a sensation or sensation-complex, supplements it by an accompaniment or escort of revived sensations, the whole aggregate of actual and revived sensations being integrated or solidified into the form of a percept, that is, an apparently immediate and sensuous apprehension of an object now present in a particular locality. This definition may be accepted provisionally. We shall be better able to judge of its appropriateness after we have carried our analysis of the perceptual process a stage further.

§ 3*a*. *Physiological Conditions of Perception.* Since perception is more complex than sensation, we may suppose that its nervous concomitants are also more com-

[1] The fundamental identity of perception and reasoning is emphasised, among others, by H. Spencer, *Principles of Psychology*, part vi. chap. ix. and following; Helmholtz, *Physiol. Optik*, pp. 430 ff: and Binet, *La Psychologie du Raisonnement*,

plex. Thus, inasmuch as perception involves a certain persistence and intensification of the sensation, it will always call into play the motor apparatus which, as we have seen, is the special mechanism of attention, and more particularly include those muscular adjustments by which distinct sensations are obtained. Further, as we shall see presently, perception of locality always involves a certain motor process, as when we hear a sound and experience an impulse to move the head in the direction of the sound. In addition to such motor elements, perception involves, as its nervous substrate, an extended area of sensory excitation. Thus the perception of the sounding bell by the ear manifestly implies that the centre of audition is co-ordinated with other centres, and more particularly the optical and tactual central tracts. Lastly, it is to be noted that the close implication and partial coalescence of the representative with the presentative element in perception is presumably correlated with the fact of a perfect co-ordination of the cortical tracts engaged, as a result of which the whole process of excitation takes on the form of a single and approximately instantaneous nervous action.[1]

§ 4. *Special Channels of Perception.* It has been observed that every sensation is interpreted by an act of perception, or, in other words, is worked up as an element into that complex mental phenomenon which we call a percept. Thus we refer sensations of smell to objects as when we say, 'I smell violets,' just as we refer sensations of light and colour to objects as when we say, 'I see a candle'. Nevertheless, when we talk of perceiving we generally refer to knowledge gained at the time through one of the higher senses, and more particularly sight. To perceive a thing means in every-day parlance to see it. Where sight is wanting touch assumes the function of the leading perceptual sense. Sight and touch are thus in a special manner channels of perception. Hearing, though it has an important *rôle* as a perceptual sense, will be found to be distinctly inferior to these.

The reason why the senses of touch and sight are thus distinguished has been hinted at in the previous chapter. We there saw that they were marked off from the other senses by

p. 77 ff. The theory that perception is unconscious reasoning, disavowed by Helmholtz in his later writings (*Die Thatsachen in der Wahrnehung*, p. 27), is criticised by Stumpf, *Tonpsychologie*, i. p. 80 f.; and W. James, *op. cit.*, i. p. 111 ff.

[1] On the nervous concomitants of perception, see Maudsley, *Physiology of Mind*, chap. iv. The difficult task of assigning the nervous concomitants of perception has recently been attempted by Prof. G. Sergi (*Teoria Fisiologica della Percezione*), who lays emphasis on the co-operation of an outgoing nervous process. The central structures engaged will of course be conceived of differently by those who assign to the idea image or representation another cortical base than that of the corresponding sensation.

the possession first of all of a system of clearly-defined local differences, and secondly of an exceptional variety of muscular experience. Owing to these circumstances these two senses supply us with a wider and more varied knowledge of objects than the other senses. In smelling a flower I can only apprehend one aspect or quality of a thing, its odour: in looking at it I instantly take in a number of aspects, as its colour, shape, and size.

The additional knowledge, moreover, gained by means of the fine local discrimination of the skin and the retina, together with the accompanying movements, is of a most important kind. To begin with, what we mean by perception in its simplest form is, as pointed out, localising or referring a sensation to a point in space. Now it is only touch and sight which give us any considerable direct knowledge of space, of the situation of objects with reference to one another and to ourselves. In the case of hearing, as we shall see by-and-by, the appreciation of the position of sounding bodies is very imperfect, and probably always involves a reference to tactual and visual perceptions.

By means of these same endowments touch and sight can make known to us the space-qualities or 'geometric' properties of bodies, *viz.*, figure and size. With these space properties of bodies must be coupled the 'mechanical' or force properties, that is to say, resistance under its several forms of impenetrability, weight, etc., as made known by active touch.

It is to be noted that these qualities are of much greater importance than those made known by the other senses, such as the taste of a substance and the sonorousness of a body. We may be said to know more about an object when we have ascertained its shape or size than when we have heard its sound.

The superior importance of such qualities as size, figure, and weight turns on a number of considerations. To begin with, all objects exhibit these attributes. What we mean by a *thing* or a material body is constituted by figure, size, hardness and weight, etc. On the other hand, there are many things which have little or no smell or taste. Again, the former qualities are comparatively speaking constant or unchanging in the case of the same object. A stone is always the same as to its size, hardness and weight. On the other hand, a body is only sonorous when put into a particular condition of vibration, and a fragrant body varies considerably in the degree of its fragrance according to circumstances.

Finally, different persons agree very much more respecting the size or weight of an object than respecting its taste or smell: the former impressions vary less with the state of the individual organ than the latter. Hence the former aspects of objects have been erected into a higher class under the name of 'Primary Qualities,' while the latter have been marked off as 'Secondary Qualities'.[1]

(A) TACTUAL PERCEPTION.

§ 5. *Characteristics of Tactual Perception.* Although, as has been observed, what we commonly mean by perception is seeing an object, touch (by which we mean active touch) must be regarded as an important channel of perception, especially in early life. We obtain by means of this sense a larger amount of important knowledge respecting objects than by any other sense. The bulk, figure, hardness, weight of a thing are directly known to touch. Hardness and weight are known only to this sense, and these qualities are obviously an important part of what we call *material* objects, or bodies. Hence we find that those who are born blind, and so thrown upon touch for nearly all their knowledge of material objects, acquire a wealth of information which astonishes the seeing man. Hence, too, the fact that even in the case of normal persons the sense of touch seems of all our senses to bring us into the closest relation to external things. It is for all of us the sense to which we make appeal when we want to be *certain* of a thing being present. We call a thing of whose reality we are sure something 'tangible'. Further, observation of children tells us that touching things is the way by which all of us have, in the first instance, come to know them. Hence we shall do well to study the process of perception first of all in this fundamental form. In order to understand this process we must, it is evident, suppose sight to be absent, as in the case of the blind.

§ 6. *Tactual Perception of Space.* As already remarked, we may come to know about the various localities of our body, as also the positions, distances, etc., of extra-organic objects

[1] The distinction here touched on has played a prominent part in philosophical discussions respecting the real nature of external objects. (See Sir W. Hamilton's Edition of Reid's works, note D.) For a fuller account of the psychological distinction, see H. Spencer's *Principles of Psychology*, ii. pt. vi. chap. xi. and following.

by help of active touch alone. We have now to inquire how these tactual space-intuitions arise.

We here set out with the supposition that when the baby first touches a surface, say that of its mother's body, it has not a space-consciousness as a grown person would have in like circumstances. What this primitive consciousness amounts to we can only form a very vague conjectural idea. As pointed out above, there would be something in the experience answering to extensity or spread, though this would probably not at first be differentiated from intensity. Whether this primordial extensity when it began to be apprehended would carry with it *any* spatial consciousness in the form of a sense of amplitude or volume is a disputed point, and one which, it may be safely predicted, will never be definitely resolved.[1] However this be, psychologists are agreed, up to a considerable point at least, that other elements must be added to, and integratively interwoven with, this primal "bigness," before our distinct space-consciousness becomes possible. This new element is supplied by motor experience, that is to say, the sum of those muscular sensations, and groupings of muscular sensations, which attend movements of our limbs.

This being so, we may best begin our genetic account of the tactual space-consciousness by inquiring what modes of consciousness having a spatial or *quasi*-spatial character our motor experience yields us. Having considered these apart, we may go on to trace out the effect of their combination with those aspects of passive touch which we have marked off as extensity and the correlated local differences of sensation.

(*a*) *Limb-movement as Source of Space-consciousness.* In order to understand the help given by movement we will make the fanciful supposition that the child has, instead of an extended hand, only one finger-tip, so that he is able to have only one tactual sensation at a time. This sensitive point he would

[1] The view that a mode of space-consciousness is given from the first along with sensation and as a distinct qualitative aspect of this is held by those who, like Stumpf and W. James, regard the attempt to develop the space-consciousness out of simpler antecedent psychical phenomena as futile. An examination of the grounds of the hypothesis must accordingly be postponed until we have completed our genetic account of how the space-consciousness is developed.

carry from one point of space to another just as the insect can carry one of its antennæ.

Every movement which he would thus perform is, as we saw above, accompanied by a definite and distinct series of those sensation-complexes which have been called 'sensations of movement' or 'positional' groups of sensation. This series, as soon as it becomes attended to as a whole, constitutes his consciousness of that movement.[1] The character of this series of sensations will, as pointed out, vary according to the direction of the movement. Thus in carrying his finger from his breast to a point a little in front of him, say the edge of a table, he has one distinctively-coloured series of sensations. Moreover, a movement having a range of two feet will plainly give rise to a different (that is, longer) series from that of another movement of the same direction having only half this range.

Owing to the action of the primary form of retentiveness the preceding members of the series would persist along with, or overlap, the succeeding. Accordingly, when the movement was completed, and the limb brought to a stand-still, the final positional sensation would be supplemented by the representative residua of the preceding members of the series. This overlapping of the after-images of the earlier sensations and the final sensation would constitute an analogue of that presentative-representative complex of which the perceptual process consists. Hence we may say that it would supply the materials for a rudimentary *perception* of a movement of a given direction and range.

In this way, then, a sensation of contact would be (extra-organically) localised by being conjoined with an experience of movement as its immediate consequent. In other words, the child would begin to say, 'I touch something *there*,' because he would begin to realise that the sensation of contact follows and depends on a movement of a particular direction and range away from his own body as starting-point.[2]

[1] Such a first incomplete consciousness of movement must be carefully distinguished from that complete perception of movement, as change of place, which comes later *after the perception of space has been developed*.

[2] The starting-point seems to be but vaguely thought of as some part of the chest, and to vary from time to time. (*Cf.* James, *op. cit.*, ii. p. 196.)

The series of sensations here referred to is, as already pointed out, probably a complex one made up of a succession of 'sensations of innervation' and of certain 'reflex' afferent sensations arising from changes in the periphery, brought about by the carrying out of the muscular contractions. These last again probably include, as we have seen, sensations arising directly from changing conditions (degrees of contraction) of the muscles, and from accompanying changes in the tension of the skin, etc. The sensations of innervation, which we assume to vary merely in intensity and volume according to the strength and range of the efferent current, may be supposed to undergo comparatively slight changes only during the successive stages of one uniform movement. On the other hand, the sensations due to the muscular contraction vary in a more marked way from point to point. This applies to the sensations immediately connected with the changing condition of the muscles themselves, or, to speak more precisely, the altered relation of condition of the contracting muscles and their antagonists; and also to the sensations due to the pressure of the joints, foldings of the skin, etc.[1]

This series of sensations would become solidified, and the resulting perception more complete, by repetitions of the movement. Each time the child executes this particular movement he would experience the same sequence of sensations; and in this way they would become more firmly coherent, and grow solidified into one indivisible whole. This series would, moreover, become differentiated from other series answering to other movements having a different direction, a different range, or both.

Such mere successions of sensation would not however give our imaginary child any perception of *space* as made up of co-existing points or positions. A step would be taken towards a vague apprehension of such spatial co-existences by further variations of the motor experience. Thus the effects of changes in velocity would prove instructive. By varying the pace of the movement the child finds that the duration of the several distinguishable sensations, and of the series as a whole, becomes shorter or longer. The interval between the initial and final sensations, answering to the initial and final positions of the limb, varies indirectly with the amount of energy thrown into the muscles.[2] In this way the series would come to be recognised as a fixed order in time, *the duration of which can be varied*

[1] See above, p. 127. Wundt points out that localised tactual sensation also enters into a clear perception (Vorstellung) of movement, *op. cit.*, ii. p. 21.

[2] It follows from our general conception of the *rôle* of the efferent factor that our consciousness of velocity, though largely made up of peripheral elements, contains a central element as well.

indefinitely. And this would serve to differentiate the motor succession from an ordinary time-sequence, such as that of sounds.

A new and much more important element would be added by the experience of reversing the movement. In carrying his finger from a point B, say on the edge of a table immediately in front of him, to his starting point A, his own body, the child has a different experience. New antagonist muscles are here called upon to contract, while those previously contracted are relaxed. At the same time the sensations answering to the successive positions of the hand (so far as they depend on changes of pressure on skin and joint, and also on the ratio of the activities of the opposed muscles) would be the same as before, only the order would be reversed. This fact of reversibility would serve in a much more effectual way to differentiate the complex motor experience from a mere succession in time, if not to suggest the idea of spatial co-existence or co-extension.[1]

By innumerable repetitions of this complementary pair of movements, together with other complementary pairs corresponding to other points of space, the child would gradually learn to map out the several regions immediately environing him, to place or localise objects relatively to the position of his own body at any moment. In a similar way, by comparing the movements he executes in reaching out in this and in that direction, as also in carrying his hand from one (remote) point to another (without bringing it back to the body), he would learn to place an object in relation to other surrounding objects.

By the additional aid of the movements of a second arm, and still more of leg-movement or locomotion, the range of this tactual exploration would be greatly enlarged. Our imaginary blind child walking about the room and feeling out towards this and that object would gradually piece together, so to

[1] How far reversibility alone (to which much importance is attached by English psychologists, *e.g.*, H. Spencer) would suggest spatial co-existence or extension is a disputed point. It has been observed by a German critic that we have a reversible series of motor sensations with their respective passive concomitants in the case of singing upwards and downwards the notes of the musical scale, and yet that we do not localise the sounds in space. It may, however, be contended on the other side that there is a distinct *approach* to a spatial ordering in this case, as is seen in our speaking of the "upper" and "lower" regions of the tone-scale.

speak, a number of regions of space answering to different positions of his own body.

The ascertaining of a fixed spatial order among things supposes that certain objects are at rest or occupy the same position. So long as the child does not move, the position of his own body would be the point of reference. In moving about, however, this position varies, and then the situation of any object must be estimated relatively to that of some other object supposed to be fixed. The changes in the position of movable objects, such as the chairs, etc., would be ascertained in the same way.

In very much the same way as he finds out the relative situations of different objects, such as the several pieces of furniture in a room, the child might discover the shape and size of an object. Thus he could pass his finger over a book-cover in different directions. In so doing he would have not only two tactual sensations at the beginning and end of his excursion, as he had before, but an unbroken series of tactual sensations accompanying the series of motor sensations. And this new experience would bring into view the distinction between empty space as mere room for movement (*cf.* German Raum) and *occupied* space, or space as bounded and hemmed in by an extended and resisting surface.[1]

In this case, too, by varying the velocity of the movement, by reversing it, as also by executing a number of movements in different directions, he might possibly reach a rudimentary perception of a fixed order of tangible points or an extended surface. The range of this touch-accompanied movement in different directions would determine his idea of the figure and size of this surface. This perception would be rendered still more distinct by passing the finger along the outline or contour of the surface.

In this way a dim apprehension of what we mean by space might be obtained by movement alone. What this would amount to, however, it is impossible for us to conceive. Everybody's tactual acquaintance with space is gained by help of the extended surface of his skin including that of the hands, with the correlated local differences of sensation at this and that point. Thus, when an object comes into contact with any

[1] We see from this that the development of the perception of space is closely connected with that of the apprehension of materiality or resisting impenetrable substance. This connexion will be brought out later.

part of the body, we instantly know of its whereabouts through our apprehension of the particular locality of the skin acted on. So, in spreading the hand on an object, we instantly recognise the relative positions of its several parts through a localisation of the several tactual sensations at the corresponding skin-points. This definite localisation of skin-sensations is here assumed to be acquired, and acquired by means of experiences of movement. It remains to show how this grafting on to the original (local) differences of definite local significations by the agency of motor experiences takes place.

(*b*) *Localisation of Skin-sensations.* And here we must bring into view what we have hitherto left out of sight, *viz.*, the fact that the child explores his own body, or rather the accessible regions of it, just as he explores bodies external to it. Thus he can (and does) carry his finger-point now to his mouth, now to his other hand, now to his foot, and so forth, and by touching the particular part he excites in it a sensation having a peculiar local character. These movements are for the same parts of the body (so long as *they* do not move) the same in respect of direction and of range. In this way experience serves to connect with each of the original (local) differences among the skin-sensations a definite experience of movement, and such an association would, it is evident, serve to give not only greater definiteness of character but also a new significance to the primitive difference. The original vague distinctions, whatever they were, will now be complicated and overgrown with acquired definite distinctions answering to appreciable differences of muscular experience.

Other motor experiences would co-operate in this rendering definite and spatially significant the primitive differences of the skin-sensations excited at different points. Thus, movements over the skin from point to point in different directions, varied in velocity and reversed as already explained, would serve to render much more definite the spatial relation of one skin-point to another. In this way the left eye would be recognised as left in relation to the right by movement from the latter in what we know as the left direction.

Lastly, the local signification of the original differences would be acquired to some, though a subordinate, extent by moving a limb over a fixed object-point, say the palm of the hand over the stationary extremity of a pencil. Here it is evident there would arise a succession of tactual sensations of different local character, and the transition from one to another would be experienced in close connexion with movements of the organ touched. Here, again, therefore the original difference would be found to answer to movement, and to be measurable by the direction and length of the movement.

In these various ways the obscure differences among the sensations answering to the several distinguishable skin-points would become spatially defined by being complicated with clearly-distinguished motor experiences. That is to say, all sensations arising from a particular point P on the skin would now be transformed into complexes, in which the presentative tactual element (with its original local character) is fused with a group of representative elements. Of these the chief and most prominent would be that answering to the movement of the arm by which we customarily reach and touch the point; while this would presumably be accompanied by fainter representations of other movements, *viz.*, from this particular point to other points, as P^1, P^2, etc.

It is here assumed that the whole effect of movement on the primitive differences of dermal sensation is to complicate them by corresponding differences of muscular experience. It must not be overlooked, however, that movement would have another effect, *viz.*, the rendering of the original local colourings themselves more distinct and impressive, by introducing the element of change or transition. Thus supposing a series of dermal points p^1, p^2, etc., endowed with certain original local differences, it is easy to understand that these would be brought out and attended to much better by passing a moving point successively from p^1 to p^2, and so forth, than by simultaneously stimulating the whole series. This effect of movement in vivifying local sensations is seen in the familiar fact that a moving object on the skin, or a moving point in the side region of the field of vision, attracts the attention much more powerfully that a stationary one.[1] While, however, recognising this effect one cannot follow W. James in supposing that this is the whole of, or even a considerable factor in, the effect of movement on the primitive local differences. For one thing, movement, say of a finger-tip over the skin, would, presumably, by introducing a series of changing pressures with corresponding dislocations of the skin, etc., supply new qualitative differentiæ to the several sensations. And, however this be, according to the view here adopted, the active experience of the moving limb would itself come to be integratively fused with these passive dermal sensations, and to fundamentally alter their original differences of character.

[1] On this effect of movement in giving freshness to sensation, see James, *op. cit.*, ii. p. 173 ff.; *cf.* Stumpf, *Tonpsychologie*, vol. ii. p. 337 f.

(*c*) *Simultaneous Perceptions of Points: Tactual Intuition of Surface.* As soon as this localisation of skin-sensations at different regions of the body is learned, the tactual perception of surrounding space, and more particularly of the extended surface of objects, will take on a more definite and perfect form. When the child now spreads out his hand over a surface, say the book-cover, he will no longer get merely a vague sense of bigness or 'extensive magnitude' as at the outset. He will now receive a number of touch-impressions, each of which has a separate and distinct local significance. By such a simultaneous group of definitely-localised touch-sensations the knowledge of space as made up of parts co-existing side by side would be rendered far more distinct.[1] Indeed, it may be safely asserted that our little explorer would, by aid of this experience of a multitude of sensations of contact with their respective motor suggestions at one and the same moment, reach a new *kind* of space-perception. For the first time the space-order would now be clearly differenced from a mere time-order, or a renewable and variable *succession*. In other words, the tactual perception of space is a product of two factors, *viz.*, muscular sensation proper and certain discrete contact-sensations which acquire spatial significance through association with movement.

Such perfectly simultaneous tactual perception would of course only be possible in the case of small objects. In that of larger surfaces, as a table or a wall, we can only obtain a *succession* of such simultaneous apprehensions, as in moving along the wall and measuring different small areas with one or both of the hands. Here we come to a characteristic limitation of tactual perception. As we shall see presently, sight gives us a much wider scope for the simultaneous perception of points.

The supposition here unfolded that the tactual perception of extra-organic bodies depends on the localisation of bodily sensation is borne out by the fact tha this localisation is finest *in the most mobile parts of the body* as the finger and tip of the tongue. This seems to show that the finer localisation of dermal sensation is developed in close connexion with those movements by means of which the child apprehends the position and extended surface of objects. It follows that the localisation of sensations on the surface of the body and the apprehension of the

[1] It is not implied here that there is a perfectly simultaneous *attention* to these several impressions at any one moment. It is enough that the impressions are simultaneously presented, and that the attention can rapidly pass from one to the other, while those not directly attended to are still obscurely detected. This is well brought out in the similar case of retinal perception by Mr. H. Spencer, *Principles of Psychology*, vol. ii. pt. vi. chap. xiv. p. 184, etc.

extended surface of bodies in contact with the skin are closely-conjoined processes developing *pari passu*. It may be added that practice, involving special concentration of mind, tends greatly to improve the localisation of skin-sensations. The famous Laura Bridgman, who was born deaf and dumb, and lost sight at the age of two years, had twice or three times the usual acuteness in localising skin-sensations.[1]

(*d*) *Other Modes of Space-perception: Solidity, etc.* It has already been pointed out that the tactual perception of space includes a complete apprehension of it in its three dimensions, that is to say, of depth of space or distance from the observer, as well as the two surface dimensions. In moving the hands away from and towards a fixed point in his own body, the child discovers the direction and distance of objects relatively to this starting-point. Similarly, by passing his hand along a receding object, say the horizontal surface of a table, he would acquire a perception of its several parts as nearer and further, advancing and receding.

The appreciation of the third dimension enters into the perception of the solidity or bulk of objects. Thus a blind child would estimate the receding direction of a table by movements of the hand over its surface away from his body. A more definite and complete perception of solidity would be gained by help of simultaneous tactual sensations. Thus, in the case of a very small object, as a ruler, a child can grasp it with one hand; if larger, as a ball, he can clasp it between his two hands; if still larger, as a cushion, he can fold it within his arms.[2] In so doing he experiences a multitude of touch-sensations which are instantly localised with reference one to another. Along with these he has a number of muscular sensations which immediately make known to him the bent position of his hands and arms. And thus he reaches at once a clear perception of the object as a solid or cubical body, having bulk.

[1] Vierordt seeks to establish the generalisation that the fineness of the discrimination of locality by the skin is proportional to the distance of the skin-region from the axis of rotation about which the particular part moves. On the influence of movement and practice in developing and perfecting localisation, see Wundt, *op. cit.*, i. p. 16 f.

[2] If the object were a very large one, as a table, this simultaneous apprehension of its several parts, as those of a solid body, would of course be impossible. Its solidity in that case could only be perceived by the aid of locomotion, and a succession of touch-perceptions.

It is evident from this that the formation of the human hand and arm, with the possibility of grasping and enfolding movements, is all important for the development of the perception of solid objects. It is probable that only a few of the lower animals acquire this idea, and even these very imperfectly, for example, the kitten by rolling itself about an object.

Closely connected with the perception of space is the discrimination of unity and plurality of objects. In general we may say that a single object allows of, and can be known by, continuity of surface, and by a complete contour. Thus, a child knows his ball or his book as one object by passing his hand about it and finding out the continuity and enclosing character of its surface. In the case of a plurality of objects, on the other hand, there is no such continuity, or single limiting contour. In passing the hand from one toy-brick to another the child has its sensation of contact interrupted.

Experience would help to perfect discrimination by supplying a knowledge of the relative positions of points of the bodily surface, and of the alterations of these by movements of the organs, as in bending the fingers, or bringing the hands together. In this way the child would learn to interpret the double sensation of contact of two opposite skin-surfaces, *e.g.*, the anterior surface of thumb and the fingers, or the two palms, as answering to one solid object. On the other hand, he would in general ascribe two simultaneous impressions of contact by way of non-opposed surfaces, as the palm and the back of the hand, to two objects.[1] This tendency again would be checked in certain cases by a fuller knowledge of the figure of bodies. Thus he would discover that a concave surface, as the inner surface of a basin, could simultaneously come into contact with the outer surfaces of the thumb and fourth finger. Lastly, the distinction between one and a plurality of objects would be enlarged by noting the effects of movement. Thus two objects, which when contiguous offer a single complete contour, and so appear as one, would be distinguished when separated, as by thrusting the hand between them.

[1] This tendency is illustrated in the familiar experiment of crossing the third and the fourth finger and placing a marble between them. Under these circumstances we seem to be touching *two* objects. (For an explanation of this error, see my work on *Illusions*, p. 72. *Cf.* W. James, *op. cit.*, ii. p. 86 f.)

Along with these perceptions of space, and of one and many objects in space, the child would gain the perception of things as moving, or as changing their position. This would take place by following the moving object with the hand. The perception of 'objective,' as distinguished from 'subjective movement' (that is to say, of the movement of the object, and not simply of the hand), would be based on the persistence of one uniform touch-sensation (as distinguished from the changing sensations of contact, involving rudimentary sensations of resistance or obstruction of movement, experienced in moving the hand over a surface); and also on the recognition of the fact that the direction and velocity of the movement were determined for him and not by him. The full recognition of the movement as such, *i.e.*, as a change of position, would only arise as the tactual space-perception developed.

§ 7. *Theories of Tactual Space-Consciousness.* The idea that our space-perception is the product of two factors, *viz.* (1) an original distinctness of sensations having different local conditions, and (2) experience of movement, may be said to mediate between two extreme views. On the one hand, it is said by those, *e.g.*, Prof. W. James and Prof. Stumpf in Germany, who deny altogether the possibility of *acquiring* the intuition of space, that the dermal sensation of contact involves from the first the sensation or perception of spatial quality (extension, local situation). On the other hand, extreme empiricists, like Mr. Spencer and Dr. Bain, have attempted to derive the idea of spatial co-existence or co-extension from the successive experiences of movement alone.[1] Neither of these theories is satisfactory. Observation of children shows that there is no definite localisation of touch-sensation till movement is developed; on the other hand, it seems impossible to derive the idea of space as made up of co-existent parts out of mere experiences of succession, which are all that movement gives us; and, as has been shown above, there is good reason to suppose that our tactual sensations are somehow or other marked off one from another from the first by differentiæ connected with the distinctness and different anatomical connexions of the nerve-fibres.

There remains the question, what the original 'local colouring' and what the subsequent movements respectively contribute to our space-consciousness. On this point very different views have been held. Thus, according to Lotze (or at least one statement of his views), the original differences (due to dissimilar anatomical attachments of the several tactual nerve-fibres) amount to Local Signs, though the meaning of these signs has to be interpreted by experience (movement).[2] More recently, Dr. Ward and Prof. W. James have argued that sensations of touch

[1] See Spencer's *Principles of Psychology*, ii. pt. vi. ch. xiii.; and Bain's *Senses and Intellect* ('Sense of Touch'), p. 181, etc.

[2] See *Metaphysic* (Eng. trans.), p. 486 ff. Lotze's several statements of his Local Sign Theory are carefully compared by Stumpf, *Ursprung der Raumvorstellung*, p. 86 ff.

(as of sight) carry with them from the beginning a rudimentary consciousness of space in what the former calls 'extensive magnitude,' and the latter voluminousness or bigness, though this only becomes what we now understand by a space-perception after movement has helped us to measure this out and to mark off definite positions, directions and distances. This view obviously lays itself open to the objection that it assumes a psychological impossibility, *viz.*, a consciousness of abstract space or room without any rudimentary discrimination of particular parts or regions, directions and distances.[1]

As already hinted, there seems to be no conceivable way of determining what the original aspect of sensation which we have marked off as extensity (together with the correlative multiplicity of discrete sensations) is like. One thing is fairly certain: an adult trammelled with the mental habits of the whole habit-forming period of life never experiences it. The supposition, for example, that we have it in the case of a buzzing sound in the ear (James), or in the massive internal sensations of the body (Ward), is highly improbable; our auditory and organic sensations are overlaid with a plexus of acquired adjuncts, analogues and contiguous associates. Possibly the best representative of it that we can now obtain is that *quasi*-spatial massiveness or volume which, as Stumpf has pointed out, characterises low as distinguished from high tones.

Whatever the precise nature of this primitive "massiveness," it seems reasonable to conclude that it requires the incorporation of motor ideas before it becomes spatial as we understand the term. This conclusion may be reached both deductively and inductively: (*a*) It is certain that by the play of the forces of association motor elements become integratively interwoven with the primitive experience; (*b*) Our analysis of the space-consciousness confirms this deduction, by showing that motor elements are present and can, by a careful analytical effort, be detected. Room, it is said, and unanswerably said, would not be room but for its motor significance, the rich and multiform suggestions of movement.

In having an extensive dermal sensation (or in looking out into space) these motor suggestions are, of course, vague; the very number of possible movements of different directions and ranges prevent, in this case, the distinct emergence of the idea of any one.[2] On the other hand, where the space-consciousness is definite, as when two points of the arm are touched, the motor suggestion becomes more distinct. Even when only a single point is touched there seems to be a special preferential tendency to represent one out of the many possible movements. Thus, if a point on the side of the trunk of the body or one of the legs is touched there is in most cases specially suggested a movement of the arm of the same side which would bring the fingers to bear on the part. If a point on the mobile ex-

[1] See Ward, article "Psychology" (*Ency. Brit.*), p. 46 and 53 f; and James *op. cit.*, ii. p. 134 ff. It may be added that James appears to hold that movement does not further the development of space-consciousness directly by contributing new psychical elements, but only indirectly by rendering more distinct the primitive "local" differences in the dermal (or retinal) sensations (see especially p. 173 f). Wundt regards the space-consciousness as a synthetic product of passive sensations (dermal, etc.) and of "feelings" of motor innervation. (*Op. cit.*, i. p. 528; *cf.* Ladd, *op. cit.*, pt. ii. chap. vi.)

[2] This is analogous to the fact, to be spoken of later, that a general name, which is associated with a number of particular memory-images, does not call up any one of these with perfect distinctness.

ploring arm itself be touched, there may emerge, instead of the idea of an approaching movement of the other arm, a tendency to move the same arm in such a way as to bring the finger-tips to bear on the object.[1] That is to say, in either case there is a special tendency to carry out a movement by which the most sensitive part of the exploring member shall be brought into contact either with the particular region of the organism affected or the object affecting it.[2]

It may be added that the organic interpretation of the experience of space and of movement is corroborated by the fact that poetic description customarily intensifies the impression of linear form by explicitly bringing out the idea of movement. Thus we talk of the sweep, or of the roll of the moorland, of the climbing of the mountain-peak, and so forth.

§ 8. *Perception of Material Quality: Impenetrability.* Closely connected with the perception of space, and developing concurrently with this, is the perception of material quality, impenetrability or corporeality. It has already been pointed out that the perception of material quality, in its various modes, hardness, etc., is derived from muscular sensation (sensation of resistance or impeded movement).[3] It is a dermal sensation of contact, coupled with a muscular sensation (or sensation-complex) arising from the action of the muscles when this is not allowed to issue in movement, that gives us the rudimentary idea of something material, apart from us and opposed to our effort, in other words of the 'non-ego' as real material object. The fundamental experience underlying the perception of material reality is the impulse to move opposed and counteracted. This thwarting of muscular activity always takes place upon contact, and so becomes indissolubly associated with the dermal sensation. Further, it makes itself known not only by the cessation (or retardation) of movement, but by an increasing sensation of pressure as the effort is prolonged and increased. The material object thus reveals

[1] This is the analogue in the region of tactual experience of the ocular movements by which a retinal impression is shifted from a less sensitive region in the periphery to the more sensitive central area.

[2] James thinks that when touched on the fore-arm we specially realise the cutaneous line between the point and the finger-tip, but not apparently any motor idea or tendency (*op. cit.*, ii. p. 161). In my own case, I certainly recognise the tendency here spoken of, though it is less distinct and constant than the tendency to move the other limb to the spot. The reason seems to be that we have come to localise our dermal sensations much more by movements of other parts over the surface than by movements of the part affected along the object.

[3] See above, p. 130.

itself as that which, when touched, arrests movement, and which further exerts pressure.

Now, a like experience of contact, arrested movement, and pressure varying with the effort, occurs when two of our own moving organs, say the two hands, oppose one another. And in this case it is evident that we have a sense of muscular exertion or strain in each of the two members. When a second person opposes our movement we attribute to him an analogue of that active consciousness of which we are the subject when we obstruct our own movements. And it seems highly probable that even in the case of inanimate objects, when the child refers the obstruction of his movements to something real and external to himself, he is carrying out a similar mode of inference. In other words, he finds the explanation of his arrested action in the opposing action of a "force" analogous to that which his own active consciousness suggests to him when he himself arrests the action of one limb by that of another.[1]

This perception of material body or reality becomes specialised in a number of modes, according to certain variations of the experience. Thus the difference between hard and soft, and the difference, so far as made known to active touch, between a rigid solid and a fluid, turn on the fact that increase of muscular effort is now futile, giving rise only to increased sensation of pressure, and is now productive of movement accompanied by sense of obstacle or friction. Similarly, the difference between a non-elastic and an elastic substance, as clay and india-rubber, turns on the difference in the reaction. An elastic body is that which will yield to effort, but at the same time maintain its resistance under the form of a tendency to recover its former position or shape.[2]

§ 9. *Connexion between Ideas of Body and Space.* Although, for purposes of clear exposition, we have traced out the development of the perception of space as if it preceded that of material body, we have to remember that the two are mutually implicated and develop *pari passu.* The child does not

[1] That the idea of force arises out of the muscular or active consciousness will be shown more fully later on.

[2] On the development of the perception of body through the sense of resistance, see H. Spencer, vol. ii. pt. vi. chap. xvii.; Bain, *The Senses and the Intellect*, p. 177 ff.; and Stout, *Mind*, xv. p. 33 f.

first find its way to an intuition of empty space and then begin to mentally place objects therein. The rudimentary idea of body gained by touch and muscular effort is quite as early as the first idea of space gained by movement and touch. Each perception grows distinct, partly by opposition to, partly by the assistance of, the other.

It has been already pointed out that contact following upon movement serves to define the boundary of the latter. And this it does by a sharply-contrasting experience, *viz.*, that of free movement and the arrest of movement or of resistance. By finding its arm-movement suddenly brought to an end by contact with something hard or resisting, the child gains a first crude knowledge of the distinction between empty and occupied space (vacuum and plenum), or between space as room, and resisting body in space.

Our knowledge of spatial position can be resolved into the experience of a uniform connexion between certain movements and resulting passive sensations of contact: not so our apprehension of body as something objectively real. This is based upon experiences of arrested and thwarted movement. So far from our envisaging material reality as that which depends on particular voluntary movements, as seems to be implied in certain English theories of perception, we regard it as that which is independent of, and opposed to, our subjective experiences, including volition and movement themselves. It has been well pointed out that if the experience underlying apprehension of reality were uniformly obtainable by voluntary movement, and obtainable in no other way, we should never attain to our present cognition of object.[1]

But not only do the two perceptions define one another by way of opposition, they aid one another's development. Thus it is the experience of resistance, giving, as explained above, a rudimentary knowledge of materiality or body that serves to invest space with its outness or externality, that is, its independent reality. This is manifestly so in the case of touching objects and gaining a knowledge of their figure and size. The perception of a surface as made up of a system of co-existing parts involves the idea of a certain extent of resistance corresponding to a certain range of movement in various directions. In other words, extension as an attribute of real bodies derives its external reality from its close and inseparable association with the experience of resistance. And since, as we have seen,

[1] See Stout, *loc. cit.*, p. 33.

the perception of (empty) space is definitely related to, and conjoined with, that of resisting objects, it can easily be understood how much the whole perception of space or extension owes to that of material reality or body.[1]

§ 10. *Other Modes of Tactual Perception.* Closely connected with the perception of material quality or impenetrability is that of weight. This, too, involves a sensation of contact, and (when the supporting hand or other member is not itself supported, *cf.* above, p. 105) the muscular sense. In estimating the weight of a small body, as is our custom, by lifting it in the hand, we find that the heavier the body, the greater is the exertion required to support it (as measured by the muscular sensations), as also the attendant sensation of pressure. Great weight means much muscular strain, *i.e.*, intense muscular sensations and correspondingly intense sensations of pressure. The cooperation of this last factor with muscular sensation is seen conspicuously in lifting a body by means of a string, when the difference of pressure makes itself felt by a distinctly painful sensation.

In lifting a weight the active consciousness seems to be peculiarly vivid and distinct. It is this experience which most plainly suggests "the putting forth of energy". This is probably due to the circumstance that, whereas in the experience of dead strain, or perfect arrest of movement by obstacle, the sense of opposing force is apt to overpower that of our own exertion, in the case of raising a weight the resisting obstacle not being wholly frustrative of movement serves, by intensifying the muscular sensations, to render this factor in the whole experience peculiarly clear. According to the view of the muscular sense here adopted, we have to suppose that the sense of weight is in part determined by the intensity of the efferent sensational element.

Since in estimating the weight of a thing by lifting it we have to counteract the effect of gravity, it is evident that the innervational impulse must be adjusted to the particular amount of the weight. This adjustment need not be exact since, as is well known, we appreciate weight, say that of a letter, more exactly when we alternately let the arm sink a little and then raise it. Now, the same amount of excess of innervational discharge over weight to be counteracted leads to greater range, and also greater velocity of movement, in the case of a light than in that of a heavy weight. Hence we can understand that in certain cases velocity of upward movement becomes a factor in the judgment of weight. Thus it has been found by some experimental researches of G. E. Müller and F. Schumann that if, when a succession of weights is put into the hands of a subject, a light weight is unexpectedly introduced after a series of heavy ones, and in consequence (owing to the

[1] This has been well brought out by Mr. Spencer, *Principles of Psychology*, vol. ii. pt. vi. chap. xvii. Compare Prof. Croom Robertson, *Mind*, xiii. p. 418, etc.

fact of the unprepared motor centres discharging too vigorously) the arm flies up rapidly, the person falls into the illusion that the weight is lighter than it really is. (Pflüger's *Archiv*, bd. xlv. p. 37 ff.)

Another important tactual perception of quality is that of roughness and smoothness of surface in their several degrees. The roughness of a surface, as that of a piece of undressed stone, may be recognised to some extent by merely laying the outspread hand on the surface. In this case the perception of roughness arises by means of the different intensities of the sensations of pressure received by way of different points of the hand, and definitely localised in these points. This experience at once suggests inequalities of surface, projecting and receding points. But the perception is much more distinct when the hand moves over the surface. In this case the unevennesses make themselves known as impediments to movement. A rough surface is thus that which offers resistance to movement, whereas a smooth surface, as that of marble, is one over which the hand glides easily.

With these perceptions of the impenetrability (hardness) and weight of bodies are closely connected those of resisting force, whether of a body at rest or in motion. Thus in trying to move a heavy body, as a table, a boy estimates its inertia or resisting force by the degree of muscular exertion made, together with its effects, whether there be no movement accompanied by certain intense sensations of pressure, or a movement of a certain rapidity, accompanied by less intense sensations of pressure. Similarly in the case of estimating momentum, as when a boy tries to stop another boy running, or a football.

A bare reference may be made to one or two other tactual perceptions. It has already been pointed out that our sensations of temperature are highly relative, varying with the changing temperature of our bodily organs. It follows that the perception of the real temperature of bodies must be faulty. In order to know this we have to verify the report of our sensations, by comparing the sensations received at different points of the organism, and our own sensations with those of others. Even when thus improved our subjective sensations are but a poor guide, and all accurate measurement of temperature proceeds by help of an unvarying physical test.

A curious variety of tactual perception, apt to be passed over by psychologists, is that of moisture or wetness. This is now known to be not a simple but a complex perception, being compounded of a tactual and a thermal one, *viz.*, that of smooth surface and of cold. Since the complex of sensations here involved is commonly supplied by a wet surface, we habitually interpret it as a sign of wetness, and thus are apt to fall into illusory perceptions, as in touching a smooth cold metallic surface.[1]

[1] See my volume, *Illusions*, pp. 53, 54.

§ 11. *Integration of Tactual Perceptions: Intuition of Thing.* By means of the several experiences of Active Touch here described, a child receiving no help from sight might, as we know from the observation of those born blind or who very early lost their sight, acquire a clear apprehension of what we mean by a thing or object. A word or two must suffice by way of showing what this involves.

First and foremost, then, in such a child's tactual intuition of object would be the conjoined perception of spatial quality, *viz.*, position, figure, and size, and of materiality. The first crude idea of object would be the experience of a continuous system of resistances definitely localised. Thus the child's ball as object makes itself known primarily as an integrated cluster of experiences of movement (towards the object and over its surface), contact, and resistance. And these several elements are recognised as related to one another in a definite way. Thus the movements towards the object are followed by the sensations of contact, which, again, are accompanied by the experience of thwarted movement on the continuance of the muscular action.

This part of the group furnishes the foundation of the whole intuition. The perception of other qualities, as roughness of surface, temperature, becomes combined with this and so taken up into the intuition of thing. This involves the reference of the corresponding sense-experiences to the same locality as the resistances. Thus the child projects the sensation of cold and of smoothness into the thing, the marble, because they occur, along with the sensations of touch and resistance, in close connexion with, and dependence upon, certain definite movements. The object as unity is thus primarily determined by a common reference of quality to one definite region of space and the connected fundamental experience of material substance or reality.

The apprehension of thing grows more distinct by the development of the knowledge of persistence or continuity in time. This implies repeated experiences, and a discovery of certain constant elements and relations among these. Thus, as long as the object remains where it is relatively to the child, the group of experiences underlying the apprehension of its qualities will recur as often as certain movements, stretching out the hand, lifting, etc., are carried out. Persistence is thus known through a *uniform* or *unchanging relation* (or sum of relations), *viz.*, the occurrence of a certain group of experiences of contact and resistance on carrying out a particular group of movements.

Of great importance in connexion with the development of this apprehension of persistent object is the experience the child obtains in connexion with his own body. The persistence of the several parts of this object when no longer touched discloses itself through the persistence of the sensations connected with, and localised in, these parts. It is probable, as we have seen, that a child fashions other objects on the model of his own body, endowing them with sensations analogous to his own; and if this is so, we can understand the more readily how he comes to attribute persistence or continuous existence to these objects.[1]

The full knowledge of unity and persistence of object presupposes the experience of the movement of ourselves and of objects, and the attendant changes of position. The cluster of qualities composing an object only becomes clearly discriminated from other clusters by movement. Thus the spoon becomes isolated as a single object when it is found that it yields the same group of experiences whatever its local relations to the cup and other objects. The same experience of movement and change of position would extend the idea of persistence by showing that objects continue to exist *somewhere* after changing their position. It is highly probable that, to the infant mind, the disappearance of an object is tantamount to its destruction. It is only a wider experience, familiarising it with changes of locality, which enables it to reach the idea of persistence, or identity of object as we understand it.

Such a tactual intuition as that described would supply a sufficient means of distinguishing and recognising objects apart from sight. Thus a blind child, by the complex of experiences gained on touching an orange, is able to recognise the object *as an orange*, thus reinstating by means of active touch other sense-experiences, as those of smell and taste.

[1] It is pointed out by Uphues (*Wahrnehmung und Empfindung*, p. 282 ff.) that the cognition of object as persistent is rather representative than presentative. Our immediate presentative apprehension of things is, strictly speaking, momentary.

This tactual intuition involving a complex group of sensations would be a highly *presentative* mode of perception. We have now to pass to a mode of perception where the representative element is much more preponderant over the presentative than in the case of tactual perception.

§ 11*a*. *Tactual Apprehension of Real Object.* The perception of object is thus seen to be not merely the result of a (passive) process of integration or association, but to involve a certain element of constructive activity and of inference. A child acquires the idea of real objects persisting when no longer acting on his senses very gradually, and by a certain exercise of imagination and of reason. That is to say, using the analogies supplied by his experience, and more particularly what he knows of his own body, he frames a supposition by help of which he can render consistent and explain what his senses tell him.[1]

The complete apprehension of object involves, in addition to the cognition of material reality, unity, and persistence dealt with above, that of the relation of substance and attribute and of externality or the relation of the not-self to the self. The clear apprehension of these relations comes later. Thus the distinction between substance and attribute only arises after a measure of abstraction. To a child a thing is one indivisible whole, and remains such till analysis (abstraction) begins to resolve it into a number of qualities. This is seen in the fact that children name objects as wholes some time before they begin to qualify them, by calling them hard, and so forth. The fundamental fact in the distinction of substance and quality has already been touched on. It is the resisting aspect of a thing, its material quality as obstructing movement, which constitutes the essential element in its substantiality. The impressiveness and practical importance of this aspect, supplemented by the teaching of experience that it is the ever-present or constant factor, lead all of us to separate it out as *par excellence* the thing or substance, whereas the other and secondary qualities are recognised as of subordinate importance and as dependent on this.

With respect to the relation of the material object to the self, it is to be observed that this idea becomes distinct only when the consciousness of self has reached a certain development, which, as we shall see, first takes place after the inner representative life of imagination and thought has been developed, and the difference between sensation and idea, presentation and representation, clearly apprehended. At the same time, as we have seen, the ground of a vague apprehension of the relation is supplied in the simplest perception of real object. For the resisting object is known to the child through its opposition to his own movement, and on that very account is endowed with force analogous to that of which he begins to be aware in himself. And here it is evident the germ of the distinction between self and not-self emerges.[2]

[1] This is well brought out by Lipps, *Grundthatsachen des Seelenlebens*, kap. xvii.; *cf.* G. F. Stout, *Mind*, xv. p. 26 ff.

[2] On the whole question of the perception of object, see Bain, *The Senses and the Intellect*, p. 375 ff.; J. S. Mill, *Examination of Sir W. Hamilton's Philosophy*, chap. xiii.; Taine, *On Intelligence*, pt. ii. bk. ii. chap. i.; Ward, article, "Psychology," p. 55 f.; and Julius Pikler, *The Psychology of Belief in Objective Existence* (part i.).

(B) VISUAL PERCEPTION.

§ 12. *Tactual and Visual Perception.* While, as we have just seen, tactual perception is the most direct mode of apprehending things, it is limited in its range at any one moment. Our imaginary blind child would be able to perceive directly at any one time only a small portion of the external world, namely those objects which were within his reach and capable of being simultaneously touched.

Visual perception stands in marked contrast to this direct but limited mode of apprehension. In normal circumstances seeing is, as has been remarked, the customary mode of perception. It greatly transcends touching in the range of its grasp of external things. Thus in vision we apprehend objects not only near us, but at vast distances from us, such as the heavenly bodies. Again, by sight we are capable of apprehending in a single moment a wide field of objects in different directions and at different distances from us, that is to say, a whole region of the external world.

The predominance ot visual perception is illustrated by a number of facts. In smelling, tasting, or touching an object which we do not see, the corresponding visual presentation (visual form with colour more or less distinct) is instantly recalled. Similarly a word always suggests to our mind first of all, and most irresistibly, the visual appearance of a thing. And this holds good with respect to objects which are of most interest to us in relation to other senses. Thus the word 'bell' calls up the bell-form before the bell-sound, the word 'orange,' the particular form and colour of the fruit before its taste.

The resources of sight, more particulurly the capability of the retina of receiving a multitude of finely differentiated local sensations, and the delicate movements of the eyes, enable this sense to develop a highly-complex mode of perception of its own. A clear understanding of the true function of sight as a means of perception will, however, compel us to adopt the idea first clearly set forth by Berkeley, that in seeing objects in space the sense of sight is greatly aided by that of touch. We apprehend so much through sight because it gathers up and preserves for us under a representative or symbolic form experiences of active touch.

We will first trace out the development of an independent Visual Perception. After this we may study that more complex mode of perception which arises through the associative integration of experiences of Touch and Sight.

§ 13. *Visual Perception of Space.* Here, as in the case of touch, we set out with the appreciation of extensive magnitude and plurality of sensations. Our visual idea of space, position of objects, and so forth, is obtained by help of this retinal discrimination. At the same time, this primordial distinctness of sensation answering to different retinal points only takes on a definitely spatial or local significance by the addition of movement.

In order, then, to understand the development of the visual perception of space, we may proceed, as in the case of tactual perception, to enquire into the nature and results of the experiences immediately connected with movements of the eyes. And for the sake of simplifying the problem we will suppose that a child has but one eye, and that this eye has but one sensitive retinal point, the yellow spot or area of perfect vision.

(*a*) *Ocular Movement as Factor in Space-consciousness.* The eye is capable of rotating in various directions, as to the right, upwards, and so forth, all such movements being resolvable into rotations about three axes, *viz.*, a vertical axis, the horizontal 'optic axis,' and a third horizontal axis drawn through the centres of the two eye-balls. These movements which are executed by means of a system of six muscles,[1] serve to bring the yellow spot opposite to different points of the field. This is commonly described as turning or directing the axis of vision (optic axis) from one point to another. In performing any particular movement our imaginary child would experience a series of sensations analogous to those experienced in carrying the finger-tips from point to point of space. Thus in moving the axis from a point A in the field of vision to a point B to the right of it he would experience a series of sensations of movement of a definite character. Here, too, the final sensation, answering to the position of the eye at the close of the movement, supplemented by the representation of the preceding members of the series, would supply materials for a rudimentary perception of movement of a particular direction and range.

[1] On the nature and laws of ocular movement, see Wundt, *op. cit.*, ii. p. 94 ff.; *cf.* Ladd, *op. cit.*, p. 428 ff.

By repeating the series, by varying its rapidity, by reversing it, and finally by carrying out a variety of such pairs of movements in different directions, the perception of movement in a definite region of space would acquire a measure of distinctness, as in the case of manual movement.

In this way the child might explore the field of vision or map out the several positions of points on a surface, or in space of two dimensions. In a similar manner he could pass the optic axis over the surface of a body in different directions, and so obtain, by means of numerous series of muscular sensations with the concomitant trains of retinal sensations, a perception of its extension and the form and magnitude of the surface. Thus he might pass his eye from the centre of a circular body, as a wheel, to various points of the circumference. These movements might be supplemented by others along the contour (the circumference).

(*b*) *Simultaneous Retinal Perception.* Let us now suppose the child's eye to be supplied with its extended retinal surface, and its innumerable nerve-elements, together with the correlated extensity and plurality of sensations. The movements just described would now serve, as in the case of touch, to develop this primordial discrimination into a true appreciation of locality or position in space.

It is evident that, being thus endowed with a retina, our little explorer in carrying the axis of its eye from one part of the field to another would not instantly lose sight of a point as soon as his eye passed on to another, but would continue to see it in what is called indirect vision. Thus, in moving from the centre to a point on the circumference of the wheel, the retinal image of the former point would slide over a succession of retinal points. That is to say, the child would continue to receive the impression of this point (with decreasing degrees of distinctness), varied, however, by a succession of distinct accompaniments in the shape of the original differences of sensation corresponding to distinct retinal points. In like manner, the point of the circumference towards which he was moving would be seen 'indirectly' (with increasing degrees of distinctness) before the eye was fixed on it in 'direct' vision.

This conjoined experience of ocular movement and of varying (retinal) impression would lead to the ordering of visual sensations in space much in the same way as in the case of manual movement. Let us imagine any point P lying on the retina to the right of the centre C and having an original difference of local colouring π. Whenever P was stimulated the child would find by trial that a movement of a certain kind (direction and range) was necessary before this impression could be received with perfect distinctness by way of C. In other words, the point of the field seen indirectly by way of P can only be seen directly by way of C by means of a movement of a certain kind (to the left, and of a certain range).

After innumerable experiences of this kind the child learns automatically to localise any visual sensation received by way of the retinal point P with reference to C. On receiving such an impression there is now developed a tendency to move the eye in the required direction. Thus on seeing a light enter the room to the left of the field he tends to move his eyes (or his head) a certain distance to the left. And this shows that all sensations corresponding to this particular nerve-element are now accompanied by a *representation* of the movement necessary to a fuller realisation of them in direct vision. In other words, all sensations having the original peculiarity symbolised by π are now localised in the field in relation to the centre of the field.[1]

Through numberless variations of these movements in different directions, the visual impressions corresponding to the other retinal points would be similarly localised with reference to the central point of the field, and also with reference to one another. As a result of these co-ordinations or integrative associations our child would now be able with his eye at rest to apprehend or take in simultaneously an extended field of objects, the various points of which are instantly localised, one above or below another, to the right or to the left of it, and at a certain distance from it.

When this stage has been reached, the child will be able

[1] This capability of moving the eye so as to fixate an object first seen indirectly appears early in life. Preyer observed his child on the 11th day turn his eyes from his face to the light at the side of it. (*Die Seele des Kindes*, p. 30.) This suggests that these movements may be aided by congenital reflex arrangements. Münsterberg has shown that such reflex arrrangements would be useful, and so likely to be preserved by natural selection. (*Beiträge*, ii. p. 147.)

further to recognise the form of any object 'at a glance' by fixing the eye on it. Thus the wheel would at once be seen to be a round object by the eye at rest. And this instantaneous perception of roundness would be due to the circumstance that the retinal impressions answering to the several points of the circular outline of the object are now automatically localised, or referred to the proper points in the field. Similarly the magnitude of an object could be instantly apprehended. The size or 'extensive magnitude' of the retinal image would now serve to suggest instantly the amount of movement required for carrying the eye along the contour or outline.[1]

§ 14. *Perception of Visual Magnitude and Form.* In the case of sight we have a much more minute and exact perception of magnitude and of figure than is attained, under normal circumstances at least, in the case of touch. The eye shows a remarkable delicacy in the appreciation of linear magnitude, and can also distinguish with great fineness a difference in the length of two lines. And by help of this appreciation of linear magnitude that of superficial magnitude is rendered exact.

The visual appreciation of (superficial) form is plainly based on the same modes of sensibility, retinal and muscular, as that of magnitude. Accordingly we may expect to find it no less delicate than this last. A form is constituted by the relative positions of its several parts, and more particularly by the character or arrangement of the boundary lines making up its outline or contour. Here the first element entering into the perception is the discrimination of the direction of lines, which shares in the delicacy of that of linear magnitude. The appreciation of contour in the case of a rectilinear figure, as that of an oblong or triangle, proceeds by noting the exact direction of each of the lines, as well as the amount of change of direction at the corners (magnitude of the angles). Or, if the figure be a curvilinear one, the appreciation of contour is based on the perception of continual change of direction, and of the rapidity of these changes (degree of curvature).

The other principal element involved in the appreciation of

[1] As we have seen (p. 121), local discrimination loses in fineness as we go from the centre to the periphery of the retina; and it has been proved (by Kries, Auerbach, and Charpentier) that the reaction-time in indirect is longer that in direct vision, and increases with the distance from the centre of the region acted upon.

form is relative magnitude or proportion among dimensions. In ordinary vision we do not note with any close attention the absolute magnitude of an object.[1] But we note very carefully the relative magnitudes, *e.g.*, that of the two sides of a rectangular figure, or of the two arms of a cross. This is seen in the fact that a very slight deviation from the true proportions in the drawing of a human figure or face at once strikes an observant eye.

The comparative inattention to the absolute magnitude of visible objects is explained by the superior importance of the form-element in ordinary cases of recognition ; also by the circumstance that the absolute size of the visible object continually varies with its distance from the eye, while the relative size of its parts remains constant, and so is the main clue to the nature of the object. It may be added that this perception of relative magnitude or proportion does not, in common cases, include the detection of numerical relations. We do not see the length of one side of a rectangle standing in the ratio of 3 : 2, or of 2 : 1 to that of the other. In the perception of geometrical form there is, of course, in addition to the estimate of proportion, that of equality and inequality.

The question whether, and if so to what extent, both the retina and the ocular muscles take part in the visual perception of space, has given rise to much discussion. According to the view of those who, like Prof. James and Mr. Ward, consider extensity to be given along with retinal sensation,[2] movement is not necessary to the perception of space, but only to the division of it into parts, and to the measurement of these. On the other hand, Münsterberg has recently gone to the other extreme and asserted that retinal sensations have no original difference of local colouring, and that they only become differentiated one from another by means of different adjuncts, *viz.*, the unlike muscular sensations which occur as concomitants of the several movements excited reflexly on the stimulation of different parts of the retinal areas.

We have here assumed that in the case of retinal as in that of dermal sensations there are original differences which lie at the base of our subsequent spatial discriminations. Such an assumption appears to us justified as a necessary hypothesis in the genetic explanation of our space-consciousness. It must be confessed, however, that our anatomical knowledge does not enable us to suggest any physiological conditions of the local differences of retinal sensation such as we find in the case of dermal sensation.[3] Hence it seems reasonable to suppose that they are in this

[1] This is illustrated in the absence of any feeling of incongruity in looking at a colossal statue, or at a fine miniature drawing.

[2] *Cf.* above, p. 96 f.

[3] It has been supposed that the alterations of colour-quality which accompany a movement of the stimulus from the centre of the retina towards the periphery might constitute such original local differences (see Bain, *Senses and Intellect*, p. 397 note); but, since colour also varies with change in the nature of the stimulus, it seems impossible that such alterations should become specially significant of local change. (See Ladd, *op. cit.*, p. 397.) On the whole question of the retinal

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case but vaguely marked, and that the added *motor* differences constitute the main factor.

Coming now to the question of the precise part played by retinal and muscular sensation respectively in the measurement of the visual field, we find the accessible facts far from conclusive. That the moving eye appreciates a linear magnitude more exactly than a fixated eye has been proved by a number of experiments, among which those of Münsterberg deserve special mention. But it does not necessarily follow from this that it is the delicacy of the muscular sense which is the determining factor. Certain errors in measurement suggest, indeed, that the muscular sense of the eye alone is far from exact. And it may be argued that movement aids in visual measurement by intensifying the retinal data. Thus, as suggested by James. movement of the eye in tracing out a line might serve to bring into greater distinctness the several local qualitative shades of the series of retinal elements engaged. The fact that we can compare the lengths of two lines more exactly when they are parallel may be interpreted as due to the circumstance either that the same group of muscles is employed, or that the same series of retinal points is engaged. It thus appears that we cannot as yet determine the relative contributions of the retinal and the muscular factor in the measurement of visual magnitude.[1]

§ 15. *Binocular Perception of Space.* Under normal circumstances we see with two eyes. These must be regarded as a single organ. Numerous facts show that the perception of space has been developed by the habitual exercise of them in co-operation.

The co-operation of the eyes in vision differs from that of the two hands in touching. These last double the area perceived at any one moment. When, however, we look at an object with the two eyes a large part of the field of view is common to both. They are both fixed on the same central point (point of fixation, German *Blickpunkt*), and all the central portion of the field is seen by each. The sweep of the field is only increased to some extent at the two sides, to the right by means of the right eye, and to the left by means of the left. The portions of the field common to both eyes as well as those peculiar to each are, in general, not seen as double but as single. That is to say, we see one single field or one continuous scene.

perception of extension, and of the respective functions of the retinal and motor factors in the development of the space-perception, see Wundt, *op. cit.*, ii. cap. 13, §§ 3 and 8; Stumpf, *Ueber den psychol. Ursprung der Raumvorstellung*, kap. 1.

[1] On this question, see Wundt, *op. cit.*, cap. xiii. (esp. 3); Ladd, *op. cit.*, p. 450 ff.; Münsterberg, *Beiträge*, ii. p. 125 ff.; and W. James, *op. cit.*, ii. p. 231 ff., and 234 ff.

This general statement is subject to some limitations. Objects in certain portions of the field having a particular situation relatively to the common point of fixation are seen double. Thus, when we are looking at a distant object, a second one, as a pencil, held just in front of the nose is seen as double. This doubleness of images, due to what is known as "binocular parallax," is, however, to a large extent overlooked by us.

A good deal of speculation has been expended on the question: Why do we see objects as single when we receive double impressions from them? This is known as the problem of single vision. It has been supposed by some that there are certain 'corresponding points' on the two retinas, the impressions received by which uniformly coalesce in a single impression.[1] And it has been argued that this perfect coalescence of two visual impressions is only possible by means of a fusion of the nerve processes. Hence an attempt was made to show by means of anatomical facts that this conjunction of nervous processes did take place. More recent research has gone to modify this theory. Though impressions of the corresponding points do usually combine, they are not the only ones which do so. Nor do even these coalesce in all cases. Exceptional circumstances may frustrate the coalescence. Many facts, such as those of the stereoscopic combination of pictures and the perception of relief and solidity, also the non-fusion of totally dissimilar impressions (as when the two eyes look at two different colours) support the conclusion that the mind can, in certain circumstances, distinguish the impressions received by way of the so-called corresponding points. The customary coalescence of the impressions of the two eyes, and the limits of this, are only to be explained by conceiving of visual perception as developed along, and in close co-ordination, with tactual perception.[2]

§ 16. *Co-ordination of Tactual and Visual Perception.* Thus far we have traced the development of the eye's perception of space as an isolated process. That is to say, we have supposed that by means of the experience supplied by the retinal sensations, together with those of the ocular muscles, a child would learn to map out spatial arrangements in two dimensions without any assistance from another sense.

This supposition seems on the whole justified. There is good reason to think that each sense develops, to some extent at least, its own spatial consciousness, apart from other senses. At the same time, another process is going on from the beginning. The child is not only noting the visual changes

[1] These corresponding points include the two centres of the retinas and all pairs of points situated symmetrically with respect to these, *i.e.*, in the same direction to the right of them, above them, and so on, and at the same distance from them.

[2] For a fuller account of the theory of corresponding points and of the phenomena of single and double vision here touched on, see Ladd, *op. cit.*, p. 434 ff.; Wundt, *op. cit.*, ii. p. 149 ff.; James, *op. cit.*, ii. p. 222 ff.; and my two articles on "The Question of Visual Perception in Germany," *Mind*, vol. iii.

which result on moving his eyes, he couples with these the lessons of his tactual experience. Thus, even with respect to the relative situations of a system of visual points in two dimensions, movement and touch are from the outset coming in to modify the visual experience. This is clearly illustrated in the different significance which we have learnt to attach to the *look* of a vertical and a horizontal line, and of a movement to the right and to the left. There is good reason to suppose that though there are slight differences in the corresponding ocular experiences these would not of themselves explain the whole difference. It is because there is a much more strongly-marked difference in the movements of the limb in a horizontal and a vertical direction, and because of the prominence of the distinction right and left in the case of limb-movements, that these directions acquire so different a look to the eye. We may say, then, that the space-perception of the eye is even in its most elementary form complicated by references to active touch.

This complication is the result of a somewhat intricate process of associative integration. The child, especially in the first use of his hands, watches them as they move to the right and to the left, upwards and downwards. In this way particular experiences of ocular movement are associatively co-ordinated with the corresponding experiences of arm-movement so that they will afterwards tend to suggest these last. This co-ordination is aided by others, as when the moving limb, though not fixated by the eye, is seen in indirect vision to pass into some side region of the field.

How far this embodiment of tactuo-motor experience enters into our common visual intuition of space is a disputed point. Arguing on biological grounds, from the fact of the superior practical importance of touch and movement as that by which we are immediately harmed or benefited, and to which sight serves as a sort of premonitory scout, we may infer that to ordinary men the visual scene is always suggestive of tactuo-motor experiences. It is only where special lines of study, as geometry, optics, and such pursuits as painting, induce an artificial separation of touch and sight that the latter presents its spatial relations in something like their purity.[1]

[1] This consideration should be borne in mind in judging of the space-theories of those who devote themselves to optical research. Their visual experience cannot be taken as accurately representative of that of the plain man.

That the co-ordination of the several sense-spaces is never perfect is shown by experiment. Thus it has been ascertained that in requiring a person to translate a visual magnitude, *e.g.*, a line of a particular length, into the corresponding tactual magnitude there is a constant error.[1] The explanation of the error is not quite clear, but it may be safely said that it is too unimportant a quantity to count as an objection to the above argument.

It is time, however, to abandon our supposition that the eye is engaged merely in arranging a system of points in two dimensions. When we look out into space we see the situation of points not only in relation to one another but in relation to our own position. One point lies away to the left of us, while another lies to the right. One part of the scene is further off from us than another. That is to say, we see things in a space of three dimensions, having depth or distance. This apprehension of the third dimension necessarily reacts on the perception of the visual field. For it is obvious that the real distance one from another which we ascribe to any two points depends on the distance from ourselves which we attribute to this field. There is every reason to think that this fuller and concrete perception of space by the eye, the perception we all know, is developed by aid of the tactual perceptions already described. We have now to trace this more complex process of tactuo-visual perception.

The above supposition of a development of a purely ocular perception of a flat picture-world is of course a fiction. No one can say what sort of a view of things we should have by means of these visual experiences alone, for nobody has undergone them. It would, no doubt, have something in common with our own perception of a number of projections of objects on a big screen, which however could not have any distance assigned it.[2] Perhaps we should regard these flat things as touching us (after the analogy of touch-experience), just as those born blind and afterwards recovering sight are said to have at first regarded visible objects. It is to be added that this picture-world would be a different one for every variation in the distance of the objects. An object receding from us would appear to become a smaller one, but we should not know what this meant. And we should know nothing of 'real' as distinguished from 'apparent' magnitude.

When tracing the growth of the tactual perception of space we saw that a child could obtain a direct apprehension of the

[1] Jastrow, in *Mind*, xi. p. 44; *cf. American Journal of Psychology*, iii. p. 49; Fechner had already experimented in the same direction, *Psycho-physik*, ii. p. 318.

[2] Such a screen would, for objects in front of the head, answer to a vertical plane surface, or if we include all objects above and behind us, etc., the inside of a spherical surface.

situation of an object with reference to himself by arm-movement (stretching out to reach the object), supplemented or not by leg-movement (walking towards it). But the movements of the eyes are incapable of giving us this direct apprehension of depth. As Berkeley pointed out, we cannot send these out into space, but only roll them about in their sockets. We do, indeed, move them differently when we merely transfer them from one point to another on a surface, and when we move them from a further to a nearer point. In the latter case the two eyes are made to converge.[1] But this difference would not of itself make known the fact that one object was nearer than another. There is every reason to suppose that in recognising the situation of objects with respect to himself the child is deriving aid from his experiences of active touch. In other words, the visual perception of depth is developed in conjunction with, and by the aid of tactual perception.

§ 17. *Perception of Direction.* By means of ocular movement supplementing retinal discrimination a child perceives the *relative* direction of points lying in the field, that is, their situations relatively to one another (above, to the right, etc.). But he does not recognise the *absolute* direction of an object, that is to say, its situation with reference to his own position. This mode of perception has reference to something outside visual experience, *viz.*, arm-movement away from the body. It is only by reaching out the hand that the child discovers the absolute direction of an object in the field.[2]

This absolute direction is suggested to the child by means of certain visual signs. The chief of these is the position of the eyes at the moment, as made known by the muscular sensations connected with the condition of the ocular muscles engaged. In 'fixating' or looking at a point to the right of us the state of contraction of the muscles concerned and the accompanying sensations are different from those which arise

[1] The exact difference between these binocular movements over the common field and the movements of the single eye is well brought out by Wundt, *Physiologische Psychologie*, ii. cap. 13, § 5.

[2] If the object is further off, leg-movement is involved as well. But arm-movement is the more important element. Even in the case of distant objects direction is commonly apprehended by the movement of the arm in pointing, a movement which causes the hand to cover the object.

when a point to the left is looked at. For every change in the direction of vision there is an accompanying change in the muscular sensations. Along with these sensations of the ocular muscles must be taken those of the muscles of the neck concerned in moving the head to the right and to the left, upwards and downwards.[1]

The co-ordinating or associating of these ocular sensations or signs with the arm-movements signified is the work of experience. At first the child, on seeing and fixating an object, makes no attempt to reach out the hand and touch it. Later on, somewhere about the third month, we may observe the hand to be stretched out to touch the object seen. It is only after some months that the association is perfected so that the child aims correctly and touches the object instead of passing by it. This means that by frequent repetitions of particular arm-movements in connexion with particular visual sensations the latter have become firmly united with the former; so that when the child now looks at an object there is instantly suggested the kind of arm-movement necessary for reaching the object.

The reason why in later life we are not distinctly conscious of the muscular sensations of the eye referred to above is that, long before we begin to reflect psychologically on our psychical states, they have become inseparably fused with the representative elements which accompany them. These sensations have no interest and importance in themselves but only as signs; and according to the law of attention, that we pass from what is relatively unimportant or uninteresting to what is important, we have acquired a strong and practically invincible habit of instantly passing from them to the representations which they call up.

According to the older theory we have an intuitive knowledge of direction. We tend, it was said, instinctively to project retinal sensations in the direction of the rays of light entering the eye-ball. In this way the alleged difficulty of seeing objects erect and not inverted, as they are represented in the retinal image or picture, was supposed to be overcome. But the difficulty and the solution are alike imaginary. They imply the erroneous supposition that in seeing things the mind has a direct knowledge of the structure of the eye, the arrangement of the parts of the retina and the mechanism of the organ as an optical instrument. The difficulty disappears as soon as we recognise the truth that seeing an object in a certain direction always has a reference to arm-movement.

[1] The different positions of the eyes are further attended with different dermal and other sensations due to varying pressures on the soft tissues of the orbit. Thus it has been suggested that an upward movement of the eye is differentiated by the pressure on the eyelid. See Münsterberg, *op. cit.*, ii. p. 176.

§ 18. *Perception of Distance.* It is this aspect of visual perception which has received most attention from English psychologists. Berkeley's aim in his Theory of Vision was to show that in seeing the distance of an object we are interpreting certain visual signs, which are in themselves as destitute of meaning as word-sounds, and like these acquire all their meaning by the teaching of experience, that is to say, by association. A child learns to see an object at a particular distance only when it has firmly co-ordinated certain visual elements with the corresponding elements of active touch (sensations of movement and of contact).

What is meant by the distance of an object, its remoteness from our own body, is, just like its absolute direction, ascertained by means of arm-movement, or, in the case of greater distances, by this supplemented by leg-movement. When we look at an object, say a shop across the street, and 'intuit' its distance, we represent the amount of muscular action (as made known by the attendant muscular and other sensations) needed to bring us up to, or in contact with, the object.

Sight, though it does not give us the experience underlying the idea of distance, supplies us with certain variable signs of this. In the case of monocular vision these signs are the sensations attending the varying degrees of accommodation of the eye, that is to say, the greater or less degree of convexity of the eye-ball (or lense) for different distances. In looking at an object a few inches from the eye the muscles concerned in this process are contracted much more than in looking at an object two or three feet away. The degree of contraction determines the character of the accompanying sensation of contraction. Hence this last serves as a sign of the distance.

This monocular appreciation of distance is, however, greatly inferior to the binocular.[1] By the use of the two eyes we have an additional system of distance-signs. Since in moving these (symmetrically) the two axes are always directed to the same point of the field, it follows that a movement to a nearer or to a further point involves a change in the relative position of

[1] The limits of the monocular discrimination of distance by means of sensations of accommodation are given by Wundt, *Physiol. Psychologie*, ii. p. 93; *cf.* Ladd, *op. cit.*, p. 433.

the eyes. In the former case the two axes turn towards one another or become more convergent; in the latter they become less convergent. These changes in the degree of convergence are accompanied by different muscular sensations; and it is these sensations which serve as the signs of different distances.[1]

The sensations of convergence, though giving us a much wider range of distance-discrimination than those of accommodation, cease to avail when objects are very remote. In these cases the perception of distance is determined by other elements, and takes on more of the character of a conscious *judgment*. These signs include such as the following: (1) Recession of an object from the eye diminishes its "apparent magnitude"; it is further attended with the effects of "aerial perspective," such as diminution of the brightness of the object, and also of the differences between the bright and dark parts (which last, together with reduction of size, produces the *indistinctness* of distance), and lastly, those modifications of colour due to the action of the intervening medium.

The most important of the factors in this perception of distance is the 'apparent magnitude' of an object. This is determined by the 'extensive magnitude' of the retinal image or picture, or by the magnitude of the 'visual angle' subtended by this. As objects recede their retinal pictures decrease in area, whereas when they approach they increase. Whenever the object is a familiar one, a tree, a house, or a sheep, these variations of apparent magnitude are auxiliary signs of the distance of the object. Thus in looking across a Swiss valley we judge of the distance of the opposite mountain-side by the apparent magnitude of the chalets, the goats, and so on. Painters when they want to emphasise distance make use of this circumstance by introducing in the background a familiar form.

The development of the perception of distance in the infant has been observed in close connexion with that of direction. We see the child at first unable to adjust the movements of its eyes to objects at different distances, and for a still longer time unable to co-ordinate its arm-movements with its visual

[1] On the discriminative aspect of these muscular sensations see above, p. 128; *cf.* Wundt, *Physiol. Psychologie*, ii. p. 118.

impressions. Children appear to attain to the distinction between what they can reach with their hand and what they cannot only after some months have passed. In the case of one otherwise intelligent child it was not perfect till about the end of the sixth month. And it was observed that another child tried to reach the lamp of a railway compartment when over a year old. As all observers of children know, it is some years before they become ready in distinguishing and recognising the signs of more remote distance.[1]

§ 19. *Perception of Real Magnitude.* The real magnitude of an object is directly known by means of active touch, arm-movement accompanied by contact, or, if the object is a large one, as a wall, by the aid of locomotion as well. All that the eye gives us directly is an apparent magnitude determined by the area of the retinal image. Since this varies inversely as the distance, it seems to follow that the eye's recognition of the real magnitude takes place in close connexion with that of distance. If the object is a familiar one we instantly recognise its real magnitude, whether or no we have a distinct perception of its distance. In this case the apparent magnitude may, as was shown above, become one factor in our estimation of distance. On the other hand, in the case of unfamiliar or unknown objects we only recognise (real) magnitude by aid of a rough perception, at least, of distance. Thus we only estimate the height of a cliff in a landscape by first judging of its distance from us. Children are wont to make absurd blunders about the size of more distant objects. The moon appears to everybody a small object, just because a direct appreciation of its enormous distance fails us.

While the perception of real magnitude thus implies, ultimately, a reference to active touch, it probably contains also, in many cases at least, a more immediate reference to a visual standard. In looking at an object, as a house, at a considerable distance, we seem first of all to recall the visual magnitude which it presents when near. We appear to transfer it imaginatively to a nearer point, namely at that distance from us which is most favourable to the seeing of it at once distinctly (in its parts) and comprehensively (as a whole).

The perception of magnitude is further affected by a knowledge of the position of the object relatively to the spectator. Thus in estimating the height of a church-

[1] On the slow development of the child's perception of distance in its contrast with the instinctive perceptions of the lower animals, see Preyer, *Die Seele des Kindes*, pp. 35-47; *cf.* Perez, *The First Three Years of Childhood*, p. 226 ff.

spire, we allow for the difference of level between the object and the eye, and the consequent (apparent) diminution of the vertical dimension. So, again, in estimating the length of an object fore-shortened, as an arm stretched out towards us, we allow for the inequality of the distance of the several parts from the eye.[1]

§ 20. *Perception of Relief and Solidity of Form.* The visual perception of a solid body or one having relief is in part a special case of recognising distance. A solid or cubical body is one the parts of which lie at unequal distances from us, some advancing, others receding. There is no original intuitive knowledge of solidity by means of the eye. This is abundantly shown by the fact that the infant requires some experience before it distinguishes solid objects from pictures and shadows. The idea of solidity or bulk is gained by means of active touch in the way indicated above.

The recognition of this solidity in the case of near objects takes place by discriminating the impressions received by way of the two eyes. A flat picture projects one and the same image on corresponding parts of the two retinas. On the other hand, a solid body, if not too far off, projects two partially dissimilar pictures. Thus in looking at the end of a box situated some little distance in front of the face the left eye takes in more of the left side, the right eye more of the right.[2] This dissimilarity of the pictures makes a difference in the total resulting sensation-complex.

This dissimilarity of the two retinal pictures and corresponding mental impressions, though an important differentia, is not the only sign of solidity. Even in the case of those portions of the object which are seen by both eyes there is a different arrangement of the images in the case of each of the two retinas, due to the unequal distances of the several parts of the object from the observer. Thus in looking at the nearer end of a narrow cylinder held before and between the two eyes horizontally and in the line of vision, the image of the remote extremity will be further off from the yellow spot in the case of one retina than in that of the other, so that they fall on two non-corresponding points (lying on the nasal side of the centres). This produces an effect of double images, and this again is taken as a sign of greater distance, so that the point is projected further away.

Our knowledge of these signs of relief and solidity has been greatly furthered by Sir Ch. Wheatstone's discovery of the Stereoscope. This instrument imitates

[1] W. James has well brought out the fact that in interpreting our visual impressions as realities we choose that mode of visual experience which is of greatest æsthetic interest or practical consequence, *op. cit.*, ii. p. 237 ff.

[2] This can be readily ascertained by alternately closing each of the eyes and comparing the impressions received by means of the open eyes.

the effect of solid bodies by presenting to the eyes two distinct projections of an object, as a building, taken from two slightly different points of view, and so differing one from another much as the two retinal pictures obtained from a solid object differ.

The perception of solidity or relief may also be gained by means of the sensations of convergence which attend movements of the eyes from point to point of the object. But the fact that the stereoscopic recognition of solidity arises instantaneously when the two pictures are illumined by an electric flash shows that such movements are not necessary to the perception of bulk.

When an object is too far off for the dissimilar retinal effects to come into operation, relief or solidity has to be recognised by other signs. These include the distribution of light and shade on the surface, or what is known by artists as 'modelling'. Thus the prominence of a distant mountain is perceived by the gradations of light and shade. Of still greater importance than this is what is known as the cast-shadow. Objects in a landscape stand out much better in morning and evening light when strong and distinct cast-shadows are thrown, than in noonday light. The painter has, it is obvious, to produce all impressions of relief by means of such auxiliary signs. Lastly, reference may be made to the effects of 'linear perspective' or the apparent alteration in the direction of the lines of an object due to distance. Outline drawings of certain familiar forms, such as a flight of steps, seen from a point a little above, may succeed in vividly suggesting relief.

It is to be further noted that in perceiving the whole figure of a solid body there is commonly a reference to other *visual* perceptions. A complete visual intuition of solidity is obtained by turning an object about, and successively looking at different sides or aspects. Hence when we have any aspect of an object presented to us we tend to supplement this by a mental representation of the other aspects. This tendency shows itself most powerfully when the less favourable, less instructive, or less interesting aspect of an object happens to present itself to the eye. Thus when a book is placed directly opposite the eye with the surface of the cover at right angles to the line of vision we tend to supplement this imperfect view by filling in imaginatively the appearance of the edge as seen, say from a point to the right and above the book. Similarly on seeing a face in profile we tend to represent the full face.[1]

§ 21. *Other Modes of Visual Perception: Number, etc.* Closely connected with the development of the perception of things in

[1] On the whole subject of stereoscopic vision, or the perception of relief, see, further, my volume, *Illusions*, p. 77 ff.; Wundt, *op. cit.*, vol. i. p. 172 ff.; Ladd, *op. cit.*, p. 443 ff.; and W. James, *op. cit.*, ii. p. 222 ff.

space having figure and magnitude is the growth of the visual intuition of a multitude or multiplicity of things. A plurality of objects is recognised in the case of the eye, as in that of the hand, by the local separateness or discreteness of the impressions.

At the same time, this grasp of a number of things by the eye appears to involve a reference to active touch. This is borne out by what we know respecting the phenomena of binocular combination and single vision. The impressions of the two eyes are in general combined in circumstances which are found by experience to correspond to the tactual perception of a single object.[1] So, again, when one object partly covers another further off, so that their contours become continuous, we discern plurality by recognising the difference of distance.

Our visual perception of a plurality of things must be distinguished from our recognition of them as a particular number, say three, or six. A child perceives all differences of number at first as mere differences of magnitude, of greater and less. That is to say, discrete quantity is not yet differenced from continuous. The knowledge of number as such is gained later by means of a series of perceptions and an exercise of the powers of comparison and abstraction. It presupposes a process of counting by breaking up a group of objects into its constituent parts or units (analysis), and of re-forming it out of these (synthesis). Along with such experiences, it involves the variation of a group of things in respect of its figure or mode of arrangement, by which we distinguish number from form, and the comparison of groups of things similar only in their number. After such experiences a child learns to look on a group of things as a number, and on a single object (in its relation to an actual or possible collection) as a unit. And in the case of very small numbers, as three and four, he can by a momentary glance intuit the number.[2] And even in the case of larger numbers, as twelve, the rapidity with which the eye can run over them and seize their numerical aspect is a fact of great consequence. It gives to sight a special function in the acquisition of the knowledge of number.

§ 22. *Perception of Objective Movement.* As we have seen, ocular movement is the original experience which suggests to the eye the existence of definite localities or points in space. From this consciousness or perception of 'subjective' movement, that is to say, a movement of our own organism (eye

[1] This fact is really illustrated by the apparent exceptions, *viz.*, the phenomena of double images. When I have two images of an object (*e.g.*, of one much nearer than the object fixated) I instantly recognise this doubleness as belonging to the visual impression and not to the object.

[2] *Vide supra*, p. 160.

or head), must be distinguished the perception of 'objective' movement, or a movement of objects.

The visual perception of movement, like the tactual one, arises in one of two ways. First of all we may follow a moving object with the eye and perceive its movement in direct vision. In this case the objective movement is recognised by means of the muscular and other sensations accompanying it, coupled with a persistent impression received by way of the area of perfect vision. In the second place, we may perceive the movement of an object across the field in indirect vision, the eye being at rest. In this case we recognise it by means of a succession of locally differenced retinal sensations coupled with the absence of those muscular sensations which tell us that we are moving.

In its developed form the perception of movement implies the intuition of space. It includes the recognition of a transition from one point of space to another, or of a continual change of position. It thus stands in a particularly close relation to the perception of direction, and like this has been developed in connexion with active touch. This inference is borne out by the observation of those curious phenomena known as apparent movements (Scheinbewegungen). Thus when with one eye closed we press the outer region of the other eye-ball there is an apparent movement of objects; yet we instantly recognise the impression to be illusory. That is to say, though in this case owing to the firm association of touch and sight, displacement of visual image without that escort of muscular sensations which tells us that our organ is moving powerfully suggests objective movement, we are able, in a measure, by reflexion to counteract this tendency, and to distinguish what sight tells us from what movement and touch would tell us.[1]

§ 23. *Growth of Visual Perception.* It follows from this short account of the nature of visual perception that, though an instantaneous automatic operation in mature life, it is the result of a slow process of acquisition involving innumerable

[1] The whole group of phenomena known as apparent movements (*Scheinbewegungen*) are important as illustrating the close connexion between visual perception and experience of active touch. For a fuller account of these, see my volume, *Illusions*, pp. 50, 57, 73.

experiences in early life. It is probable that in connexion with the inherited nervous organism every child has an innate disposition to co-ordinate retinal sensations with those of ocular movement, and visual sensations as a whole with experiences of active touch.[1] But individual experience is necessary for the development of these instinctive tendencies.

A very little reflexion will show that the experiences of early life must tend to bring about the closest possible associations between sight and touch, and to favour that automatic interpretation of "visual language" which we find in later life. The child passes a great part of his waking life in handling objects, in walking towards and away from them, and concurrently looking at them and noting the changes of visual impression which accompany these movements. Thus in countless instances he notices the increase of the 'apparent magnitude' of a body when he moves towards it; the dissimilarity of the two visual impressions received from a solid body while he is handling it, and so forth. In this way an inseparable coalescence of signs and significates takes place at a period of life too far back for any of us to recall it.

When this stage of automatic visual perception is reached reference to touch in all cases is no longer necessary. Sight, having completely taken up and absorbed the touch-elements, is now independent. In the large majority of cases we recognise distance, real magnitude, and solidity, without any appeal to limb-movement and touch. Seeing has now become the habitual mode of perception. It is only in doubtful cases that we still go back to touch in order to test our visual perceptions.

While, however, visual perception has thus in a manner grown out of tactual perception, it far surpasses this last in respect of discriminative fineness as well as in comprehensive range. Seeing is more than a translation of touch-knowledge into a new language, and more than a short-hand abbreviation

[1] This conclusion, reached deductively from the general laws of evolution, may also be verified, to some extent, by the observation of the progress of space-perception in early life. See Preyer, *op. cit.*, cap. i., and below, Appendix B.

of it. It adds much to this knowledge by reason of its more perfect separation and combination of its sense-elements.[1]

§ 24. *Theories of Visual Space-consciousness.* The above theory of visual perception follows the lines of the common English view of the subject since the classical work of Berkeley. It allows, indeed, the possibility of a purely visual development of the space-intuition ; but at the same time contends that this would not be *our* common space-perception. This, as Berkeley argued, and as subsequent experimental research on the whole seems to confirm, involves co-ordinations of experiences of active sight with those of active touch. These co-ordinations must be supposed to have become perfectly organised in the early years of life. It may be added that, according to that theory of evolution which admits of the hereditary transmission of acquired character, it is highly probable that this process of organisation is accelerated by inherited nervous arrangements representing the habitual conjunctions of experiences of the child's ancestors.[2]

At the same time it must be pointed out that this Berkeleyan theory of vision, even when thus modified by recent speculation, is only a hypothesis. It is still maintained by some that the eye is capable, without any assistance from touch, of supplying a complete perception of space in three dimensions. According to some, as Stumpf, and more recently W. James, space is given originally along with, or as a property of, the retinal sensation, ocular movement serving merely to subdivide and measure this bigness. Others, as Lotze and Wundt, seem to contend that a properly visual intuition is *developed* by means of ocular movement and the attendant sensations. The tendency to resolve the space-consciousness into motor elements only is carried to an extreme by Münsterberg, who denies that retinal sensations have any original local differences, and supposes that the perception of locality arises through the reflex movements called forth from the first by stimulation of different retinal elements, which movements serve to transpose impressions from these points of the retina to the yellow spot. This view is so far empirical or genetic that it supposes the space-perception to be acquired through experience of ocular movement.[3] At the same time, it is some way removed from the empiricism of Berkeley, which sees in visual perception the interpretation of symbols ('visual language') that have acquired all their meaning through the complex experience of sight and touch in alliance. This view of seeing as having reference to touch has, in the main, been developed by English psychologists, though it has received

[1] A rough analogy is suggested by the phrase 'visual symbols'. Just as the use of symbols in mathematics and logic helps us to reach ideal results which only remotely represent actual facts, so the addition of the visual symbols to tactual perception allows of a kind of idealising of our experience of active touch.

[2] On the facts bearing on this view, see Appendix B giving the results of experiments on those who through congenital blindness have only come into possession of sight after a considerable development of touch.

[3] German theorists on the subject of space-perception are commonly divided into two classes: nativists, *i.e.*, those who affirm the space-consciousness to be native or unacquired; and empiricists, those who derive it from experience. Wundt describes the view of the latter as the genetic or derivative theory.

important support from German psychologists and physiologists, among whom the name of Helmholtz deserves particular mention.[1]

§ 25. *Perception of Colour, etc.* The perception of colour as a quality in objects takes place in close connexion with that of extension. The relation is similar to that obtaining between tactual sensation and the movements by which we explore and acquire a knowledge of space. That is to say, we learn to project and localise colour in this and the other locality because the retinal sensation of colour is found to accompany and depend on certain eye-movements. The reference of the colour to a material object involves, in addition to this, the interpretation of these ocular movements as signs of arm-movements ending in contact and resistance.

In this objective projection or localisation of colour-sensations we include not only the partial sensations answering to a particular kind of light stimulus, but the total sensation of white light itself, in its several distinguishable intensities. We see a mass of snow coloured white and a cloud as gray, because the sensation of light in this case, just like that of colour in the narrow or partial sense, is indissolubly associated with, or taken up into, the complex of visual and tactual experiences underlying the visual perception of object. For a like reason the minimum of light stimulation coming from a surface is not experienced merely as a negation of light, but is perceived as a positive quality, *viz.*, black.[2]

It may be added that the distribution of light and colour over a surface is a considerable aid to the visual interpretation

[1] On the different views of the nature of visual perception, see my article on "Visual Perception in Germany," in *Mind*, iii. p. 167 ff.; *cf.* Abbot, *Sight and Touch* (an able statement of the anti-Berkeleyan view); Stumpf, *Urspung der Raumvorstellung;* James, *op. cit.*, ii. chap. xx., the fullest and ablest discussion of the subject in the English language; *cf.* also Wundt, *op. cit.*, ii. p. 196 ff.; Th. Lipps, *Grundtatsachen des Seelenlebens*, cap. xxiii., and *Psychol. Studien*, i.; and Münsterberg, *Beiträge zur exper. Psychol.* ii. p. 137 ff. A further account of the theories and of the facts bearing on the point of dispute is given below, Appendix B.

[2] The impression given by a dead black surface depends on the presence of a certain feeble light stimulus. (See Helmholtz, *Physiol. Optik*, p. 280 f.) Even darkness itself has something of a positive character, as may be seen by contrasting the visual consciousness when the eyes are shut with the auditory consciousness in perfect stillness. To speak of 'seeing' darkness is less paradoxical than to talk of 'hearing' silence.

of object. Thus the contrast of the bright projections and the dark-shaded recesses of a common object as a tree, the graduated shading of a ball, the minute areas of light and shade corresponding to the pitting of a surface like that of an orange, are all valuable as indicating differences in the configuration or modelling of the object.

As is well known, (partial) colour-sensation is highly variable. As we have seen, the peripheral portions of the retina have little, if any, colour-discrimination. Hence it is demonstrable that in looking at a wide extent of colour, as the blue of the sky or the sea, the impression varies at different regions of the field. Yet we see the surface as of a uniform colour. Similarly, in the case of the 'local colouring' of a part of an object due to reflected coloured light, and the yet more important modifications of colour due to distance and atmospheric causes. We habitually overlook these modifications, and only become aware of them, if at all, as the result of a special training, such as the artist receives, involving a severe attention to the visual impression itself *apart from its signification.* These facts are psychologically important because they show that in our everyday perception the representative element plays a large *rôle*, and tends when strongly excited to overpower the presentative. We see the distant mountain side green (though an artist would tell us there is no green in it) because we recognise it as a grass-covered surface, and so overlook the actual quality of the sensation.[1]

Another mode of visual perception requiring a bare reference is that of lustre. It was first noted by Dove that this effect can be obtained by combining stereoscopically a retinal impression, white, with another, black. The perception of lustre in natural objects appears also to involve a combination of two dissimilar retinal impressions. Thus the perception of the glitter of a sheet of still water or other mirroring surface probably depends on the attempt to combine the impressions received from the mirror surface and the mirrored object.[2]

[1] The most remarkable illustration in the sphere of visual perception of this effect of vivid representation is the filling out of the area of the field of vision corresponding to the 'blind spot' of the retina. It can be shown by means of a simple experiment that in every field there is a small blank where, to speak truly, we *see* nothing. Yet, under ordinary circumstances, we are not aware of this *lacuna.* On the whole subject of the overpowering of sensation by imagination in visual perception, see my work, *Illusions*, especially p. 87 ff.

[2] On the whole subject of combining dissimilar retinal impressions in stereoscopic vision, see Wundt, *op. cit.*, ii. p. 178 f., and p. 183 ff.

§ 26. *Visual Intuition of Things.* In looking at an object, as in touching it, we apprehend simultaneously (or approximately so) a whole group of qualities. These include its degree of brightness as a whole, the distribution of light and shade of its parts, its colour (and local disposition of colours), the form and magnitude of its surface, and its solid shape. These seemingly immediate intuitions involve, as we have found, tactual as well as visual elements. This complex of visual and tactual elements may be called the fundamental part of our intuition of an object. In looking at a new object, as a gem in a cabinet, we instantly intuit or take in this group of qualities, and they constitute a considerable amount of knowledge concerning the nature of the object as a whole. In proportion to the distinctness with which these qualities are discriminated both severally and collectively as a group will be the clearness and accuracy of our perception of the thing.

The recognition of any individual object, as a particular horse, or of one of a class of things, as oranges, presupposes a *repetition* of this assemblage of qualities. In this case the group is not only discriminated but assimilated or classed. Thus, on seeing an orange, a child at once 'classes' the aggregate of qualities (yellow colour, roundness of form, etc.) with like groups previously seen.

Moreover, in thus classing a particular group of tactual and visual qualities a child will take up and recognise the presence of a number of other conjoined qualities. Thus in recognising an object as an orange he invests it more or less distinctly with a particular weight, temperature, taste, and smell. In this way visual perception (embodying important tactual elements) suffices for the full apprehension of an object clothed with its complete outfit of qualities.

It is not meant that the whole aggregate of qualities will be called up with equal distinctness. In looking at an orange, for example, we appear to represent its taste better than its smell, and its touch (degree of roughness, hardness) better than either. The reason of this inequality has already been suggested. The sensations of the more refined or more discriminative senses are (in general) more 'revivable' (*i.e.*, capable of being more distinctly reproduced) than those of the less refined senses; and the facility of revival varies in all cases with the frequency of the past experience. We represent the roughness of an orange's surface better than its taste partly because tactual sensations as a whole are more revivable than gustatory, and partly because the experiences of touching the rough surface of oranges and other objects (in connexion with seeing them) vastly outnumber the experiences of tasting the fruit.

§ 26*a*. *Visual and Tactual Apprehension of Reality.* The intuition of thing as material object and as a unity has already been dealt with in a measure under the head of Tactual Perception. A word or two here by way of supplementing this account of the subject must suffice.

Since, as we have seen, material quality or substance is given by active touch only, it follows that seeing *an object* is the reinstatement along with the visual complex of the corresponding tactual complex. The exact carrying out of this process implies the perfect co-ordination of the visual and the tactual space-scheme. That is to say, the visual impression must be localised in the region of visual space corresponding to that of tactual space where it could at this instant be touched and known to be resistant. Such co-ordination of the two space-schemes or maps goes on according to the above theory by help of innumerable simultaneous experiences of concurrent and symmetrical movements of the eyes and arms when we are looking and touching objects. In this way the visual impression comes to be embedded, so to speak, in the represented sensation-complex which gives the knowledge of resisting thing or object. We see a coloured body because the visual impression supplies marks by which we know that arm-movement (with or without locomotion) in a definite direction and of a particular range would, at this instant, be attended by the experience of contact and resistance.[1]

A word may be added on that intuition of the whole object as concrete thing, orange, bell, or what not, which, though obtainable through tactual perception, is normally reached through sight. This implies a firm association of the several experiences gained from the object by the different senses, and a clear recognition of the time and space-relations among these. Thus a child sees it is the watch ticking because, as will be shown, he is able to localise the sound, roughly at least, in the direction in which he sees the object. And this is greatly aided by such experiences as moving the watch to the ear and noting the increase of the sound resulting. In like manner, when he looks at a bit of sugar and recognises it is a sweet substance, it is because his experience has taught him that certain movements of the hand (accompanied by the resistant contact which gives the tactual apprehension of thing) would end in a taste of its sweetness. Since, moreover, these several experiences are interchangeable; since the child can, for example, go indifferently from seeing to tasting, or from tasting to seeing, there arises gradually the knowledge of the corresponding qualities as co-existent, that is, existing together in what we call an object.

§ 27. *Identifying Objects.* The visual recognition of a thing as identical with something previously perceived takes place by help of the idea of persistence already dealt with. Since things vary greatly at different times in their appearance to the eye, it follows that visual recognition involves the germ of a higher intellectual process, namely, the comparison of successive impressions and the detection of similarity amid diversity

[1] On the co-ordination of the several sense-spaces, see James, *op. cit.*, ii. p. 181 ff.

or change. Thus a child learns to recognise his hat, or his dog, at different distances and under different lights (in bright sunlight, evening dusk, etc.), by discounting a certain amount of dissimilarity. Of these changes of aspect one of the most important is that due to the position of the object in relation to the spectator. The difference of impression in looking at a hat 'end on' or foreshortened and from the side, or in having a front and side view of a face, is considerable. Children require a certain amount of experience and practice before they recognise an object amid such varying aspects. Other changes are those which take place in the objects themselves, such as alterations of form due to accident as in compression, or to alterations in the position of parts due to movements, as in the changing positions of animals, and lastly the important changes of magnitude and form due to growth. It is not surprising, then, that the clear recognition of the identity of individual objects belongs to a comparatively late period of child life.[1]

Finally, it is to be observed that the identification of objects is greatly aided by the social environment and by language. A child learns to perceive and recognise objects in association with others. From the first the mother or nurse is pointing out objects to him; describing their characteristics, and naming them. By these interchanges of impressions and this social guidance he learns that others see things as he sees them, that external things are *common* objects of perception. And by hearing them again and again called by the same name he learns more quickly to regard them as the same.[2]

The process of constructing percepts of things just described is very imperfect at the beginning of life, and only attains to exactness with experience and education. As already pointed out, children first learn to interpret the visual signs of distance, solidity, and real magnitude after a certain de-

[1] The recognition by the eye of a particular substance, as wood, iron, or glass, illustrates the same process. The similarities of colour, texture, and lustre are detected amid differences of form. The assimilation of very unlike things, as oranges, grapes, etc., under the head of a wide class of objects, fruits, involves a higher exercise of the assimilative function to be illustrated by-and-by.

[2] On the effect of a common language in bringing about a uniformity of individual perception, see some excellent observations by Dr. Venn, *Empirical Logic*, p. 13 f.

velopment of experience. Similarly with respect to the signs of smoothness and roughness. The integration of sense-experiences into intuitions of concrete objects presupposes a full examination of these by the several senses. To this it may be added that the development of these into clear and distinct intuitions of individual things is effected by the improvement of discriminative attention to the less obtrusive distinguishing features.

§ 28. *Knowledge of Bodily Organism.* It was pointed out above that the tactual perception of external objects goes on in close connexion with that of the bodily organism. It is only as the child learns to localise its dermal sensations in this and that part of the trunk, or of the limb, that a complete tactual apprehension of extended surface becomes possible. We have now to look at this process of localisation as an element, and a principal element in the knowledge of the body.

There is no reason to suppose that the child's first bodily sensations are definitely localised. Whatever the vague 'local' differences that mark off the sensations arising in different regions of the body and connected with the distinctness of the nerve-fibres, these would convey no knowledge of locality at first. A baby pricked in a particular area of the trunk makes no attempt to reach this with its hand. Localisation comes gradually by help of the exploring movements already discussed. The fact that the child's own body is always present to its moving tactile organ would in itself favour the acquisition of knowledge of its surface. But there is a more important reason. When the child touches and holds his foot he *produces*, or to speak more correctly, *alters sensation in that part.* Thus, by taking a cold foot in his hand he warms it. By rubbing a part of the skin that itches he soothes the part. With these beneficial results must be taken baneful ones, as when by accident he knocks his head with his fist. Such experiences would necessarily lead to the reference of all sensations of a particular original local colouring to a definite region of the bodily surface. In other words, bodily sensations would be projected to the points corresponding to the peripheral extremities of the corresponding nerve-fibres. The child would learn to say the sensation is in my finger, in my head, and so forth, just because experience has taught it that sensations having the particular original colouring can be excited and modified by action of the tactual organ on that part of the skin.

This purely tactual localisation would be supplemented by a visual localisation. A child can see a good portion of the surface of its body, and the direct visual perception is later on eked out by the help of mirrors. In this way the body comes as an object within the changing field of vision, and a visual map of its surface is developed in addition to, and close connexion with, the tactual map. Thus, when the hand is moved to the toe the movement is followed by the eye, and in this way the toe is localised in corresponding regions of the tactual and the visual space-scheme. Sight would further assist in the development of this localisation of bodily sensation by showing the locality of a foreign body that was acting agreeably or disagreeably on the skin.

The imperfect localisation of internal bodily sensations, as those of the viscera, depends on the same principle. These parts are of course excluded from sight, and are not directly accessible to touch. But by pressures on the surface of the body we are able indirectly to act upon and modify the sensations. In this way children come in time to refer pains to more or less definitely apprehended regions of the organism. This knowledge is later on supplemented in the case of educated persons by a scientific study of the bodily organs and their local arrangements.

The truth expounded above that our ability to localise a sensation on the surface of the body depends on the tactual and visual exploring of this surface is shown in a striking manner in the illusions of those who have had a limb amputated. When the truncated nerve is excited, and a corresponding sensation occurs, the patient instantly refers it to the extremity of the limb as before. Thus the man who has lost a leg still localises certain sensations in his "toe". This tendency to project sensations to the periphery, whatever the region of the nerve acted upon by the stimulus, has been spoken of as the Law of Eccentricity, and has been regarded by many as instinctive. But the tendency is fully explained as the product of experience and association. It is evident that under normal circumstances we only have a skin-sensation when the peripheral extremity of the nerve (end-organ) is stimulated; that is to say, when some portion of the bodily surface *accessible to touch* (or to touch and sight conjointly) is acted upon. Hence we learn to localise a sensation at the peripheral point of its origin. This dependence is further illustrated by the indistinctness of the localisation of internal "organic sensations".[1]

§ 28*a*. *Bodily Organism as Self.* To a child his own body, though tactually and visually explored like other objects, is marked off from these by the fact that it is connected in a peculiar way with his conscious life, and more particularly his feelings of pleasure and pain. The experience of touching his foot with his hand differs from that of touching a foreign body by the all-important adjunct to the sensation in the touching hand, of a sensation in the touched foot. The contact of a soft or agreeable, or of a hard and painful substance with the skin soon comes to be recognised as the direct cause of a pleasurable or painful sensation. Our earliest pleasures and pains are largely made up of bodily feelings. And these, whether due to external agencies (as a blow or caress), or to internal changes (*e.g.*, in the circulation or temperature), are always found to be connected with some part of the organism. Hence we all come to regard the body as a portion of ourself, and in early life probably it makes up the chief part of the meaning of the word 'self'.

The child has little power of abstraction and cannot therefore turn his attention inward or *reflect* on his own thoughts and feelings. Hence the antithesis of self and not-self, the internal mind and external things, as the philosopher conceives of it, is imperfectly developed in the first years of life. The recognition of things as detached from self, so far as a child attains to this knowledge at all, seems to imply merely externality to the ever-present, relatively-unchanging, and feeling-endowed bodily organism.[2] A knowledge of objects as independent of percipient mind only grows clear later, in connexion with the growth of the idea of their permanence, as also

[1] For a fuller account of false localisations, see my work, *Illusions*, p. 59, *et seq.* An interesting summary of the process of localising sensations is given by M. Taine in his volume *On Intelligence*, part ii. book ii. chap. ii. section i. and following.

[2] In the case of all of us this reference to the bodily organism is always present. The very word 'externality,' implying relation *in space*, points to this. The most abstract of philosophers never succeeds altogether in projecting his own body into the external world and regarding it as a part of the not-self.

that of the higher reflective consciousness of self to be spoken of by-and-by.[1]

(c) AUDITORY PERCEPTION.

§ 29. *Space-perception: (a) Genesis of Aural Space-consciousness.* As has been observed above, the ear falls far below the hand and the eye as an organ of space-perception. Its want of a mosaic-like sensitive surface and of a muscular apparatus, such as exist in the case of the two other organs, prevents the development of a space-consciousness comparable to theirs in directness, completeness, and fineness of discrimination. Nevertheless, the ear is not wholly without an apparatus capable of developing space-distinctions, and recent research has tended to emphasise the independent power of this sense in acquiring a space-perception.

We distinguish sounds as to their direction, relatively to one another and to ourselves, and also as to their distance from us. With respect to direction, common experience tells us that we distinguish a sound to the left from one to the right better than a sound immediately in front of us from one behind us. According to the current supposition, it is mainly, if not exclusively, the difference in the intensity of the impressions received by the two ears which determines the sense or judgment of direction. Recent research has, however, shown that this is not the only factor in our judgment. It is, indeed, ascertained that the two ears normally co-operate, that hearing is binaural just as seeing is binocular, and that when one ear is stopped not only does a sound in front appear to shift towards the direction of the other ear, but that the discrimination of direction for sounds opposite the open ear falls off materially. At the same time it seems to be established that a sub-

[1] This truth is rightly apprehended by the Poet Laureate in the lines :—

> "The baby new to earth and sky,
> What time his tender palm is prest
> Against the circle of the breast,
> Has never thought that 'this is I';
> But as he grows he gathers much,
> And learns the use of 'I' and 'me,'
> And finds 'I am not what I see,
> And other than the things I touch'."
>
> —(*In Memoriam, XLIV.*)

conscious comparison of the impressions of the two ears is not, in many cases at least, the main factor in the auditory judgment of direction.

That the two ears co-operate and their impressions coalesce is shown in the fact that if two sounds of equal intensity are simultaneously excited in the two ears the impressions give rise to a perception of a single sound which is localised in the 'median plane,' *i.e.*, the vertical plane dividing the head into two symmetrical halves. The recent carefully-planned investigations of Münsterberg into the ear's discrimination of direction go to show that this is very unequal for different points. Thus, in a horizontal plane running through both ears, it is greatest (that is, the smallest change of direction is detected) immediately in front, and falls off as we move away from this point, being at its minimum at a point immediately behind the head. Since, moreover, this discrimination is particularly high for points in the median plane, that is to say, the plane in which the intensities of the two aural impressions remain the same, it seems certain that the perception of direction does not depend exclusively at least on the dissimilarity of the two aural impressions.[1]

It remains to inquire by what means this discrimination of sound-direction is possible. According to Preyer and Münsterberg this takes place by help of the semi-circular canals of the ear. These, as pointed out above, being situated in three different planes at right angles one to another, it would follow that a difference in the direction of the entering series of air-vibrations would involve as its effect a change in the *relative* intensity of stimulation of the three sets of nerve-fibre located in the three canals. And such a change in the proportionate excitation of the nerve-filaments would probably modify the resulting sensation, agreeably to the general assumption that the like stimulation of different nerve-elements is attended with a psychical difference.

It may be added that though, in the case of man, the ears are immobile organs, this want of movement is to a certain extent made good by the rotatory movements of the head. In these we possess the necessary material for a rudimentary space-consciousness. The most important movements here are those which bring the front of the head opposite the direction of the sound, as when we turn the head to the

[1] For an account of Münsterberg's experiments, see his *Beiträge zur exp. Psych.* ii. p. 215 ff. Von Kries has more recently tested the discrimination of direction-changes in the median plane when the two aural sensations remain equal in intensity, and finds it very imperfect save under particular conditions. (*Ueber das Erkennen der Schallrichtung, Zeitschrift für Psychologie,* band i. p. 235 ff.)

right on hearing a sound coming from that direction. The importance of seeing the object that emits the sound would serve to develop an impulse to carry out the required head-movement, an impulse which, as we see, begins to show itself in the first weeks of life.[1] These movements plainly resemble the system of ocular movements by which we transfer all impressions received by a side-region of the retina to the central yellow spot. If, then, we suppose that the muscular sensations attending the movements of the head come to be firmly associated with the corresponding differences in the auditory sensations already referred to, and analogous to the differences of 'local colouring' in the several retinal sensations, we may understand how, through the sense of hearing alone, we come to acquire a certain rudimentary apprehension of space under the form of (absolute) direction and difference of direction.

The above hypothetical explanation of the facts of the ear's discrimination of direction follows that of Münsterberg so far as to make the impressions received by the nerve-filaments of the semi-circular canals a main element in the judgment. That the semi-circular canals play a part in our space-consciousness so far as to subserve those sub-conscious muscular adjustments which we call equilibration or balancing of the body is highly probable. This seems to be inferrible from the fact that a person lying flat and at rest on a horizontal table with eyes shut knows when the table is turned. At the same time, our knowledge of the functions of these canals is far from being perfectly understood.[2] It is to be added that Münsterberg supposes the stimulation of the canal nerve-filaments to call forth head-movements reflexly, and without giving rise to sensations at all, apparently through the sub-cortical path of connexion provided by the cerebellum.

It may be added that the outer ear or shell is known to assist in the judgment of direction. This is proved by the interesting experiment of Weber, that if the natural shell be bound down on the head, and an artificial one placed in front of the meatus, sounds will appear to come from behind. It has been supposed that the service rendered by the shell is due to the stimulation by the air-waves of nerves of touch on the surface of the ear. Recent experiment, however, suggests that the function of this part may be confined to modifying in

[1] The reflex, however, is far from perfect at birth. Preyer first noticed a movement of his child's head in the direction of a sound in the eleventh week. (See *Die Seele des Kindes*, p. 54.)

[2] See above, p. 114. *Cf.* Foster, *Text-Book of Physiology*, pt. iii. p. 1012.

some way the direction of the entering air-waves, and so the properly aural sensations.[1]

There is some reason, moreover, to suppose that the ear furnishes modifications of sensation by which differences of distance in the sounding body are apprehended. In the varying intensity of sound with varying distance, we have, it is evident, an analogue of the differences of apparent magnitude and brightness of visible objects under like circumstances. It is inferrible also that, owing to the dropping out of the weaker partial tones as distance increases, sounds alter in timbre as they recede from the ear. Recent researches appear to suggest that there are other data (the nature of which is not yet understood) by help of which variation of distance is apprehended by the ear.[2]

(*b*) *Co-ordination of Aural and Extra-aural Factors.* While the sense of hearing thus probably develops a certain space-perception of its own, this is at best inchoate and fragmentary. The ear's sense of direction in relation to the hearer involves, like that of the eye, a reference to arm-movement and touch. We are all aware, indeed, in carrying out such imperfect localisations of sound as we are able, that we project them into a space which we have come to know by touch and sight.[3]

This is further shown in the fact that the ear by itself would develop no *direct* perception of distance. Whatever the data supplied by aural sensations for estimating distance, it seems certain that in the resulting judgment there is always a process of inference from past experience. Thus, we learn that sounds diminish in intensity as their source recedes, and hence we come to associate low intensity with distance. This is seen

[1] On the whole question of the psycho-physical process in the ear's perception of direction, see Wundt, *op. cit.*, ii. p. 80 ff.; and Münsterberg, *op. cit.*, ii. pp. 182-216. On the special part played by the shell, *cf.* Wundt, p. 81; and Münsterberg, p. 233.

[2] This is the conclusion reached by Von Kries as the result of certain experiments. "The perception of distance (he writes) is far more perfect than one would expect by setting out with the presupposition that it rests on inferences from the intensity and timbre of the sound, and that consequently an accurate judgment of distance is only possible in the case of a previously known sound-stimulus." (*Zeitschrift für Psychol.* bd. i. p. 246 f.)

[3] This seems implied in Münsterberg's theory that the stimulation of the filaments of the canals excites movements tending to bring the direction of the sound into the median plane of the head opposite to the line of vision.

in the fact that by closing the ears with the fingers we seem to send sounds further away. In the case of familiar sounds, as the ticking of a clock, we can, after a certain amount of experience, very roughly estimate its distance by this means. That this presupposes experience is seen in the ease with which we can in play deceive children as to the distance of our voice from them;[1] and that it remains very rough is illustrated in the illusions of the ventriloquist, in our tendency to regard a faint sound close to the ear as a loud sound coming from a distance, and so forth.

We may say, then, that the projection of aural sensations to certain points of extra-organic space is an indirect mode of perception. In the case of seeing the muscular sensations of convergence, etc., when their tactual significance is thoroughly incorporated, supply us with an apparently direct perception. But in that of hearing the paucity and crudity of the aural data, and the absence of a finely graduated system of movements such as we have in the case of sight, render the perception palpably vague and indirect or inferential.

§ 30. *Perception of Time: (a) Apprehension of Sound-series.* While hearing thus gives us comparatively little knowledge of space, it yields a very exact perception of time-relations. By this is meant the approximately direct apprehension of the order of succession, and of the rapidity of succession or duration of sounds. Thus we perceive the sequence of, and estimate the interval between, two clicks of a clock, and the duration of a musical tone.

Since the impressions whose time-relations are thus apprehended actually succeed one another in time, it is obvious that our perception of succession, etc., implies a certain persistence of the succeeding impressions in a weaker form, so that they may co-exist and be related to one another in one unifying act of perception. Our so-called *perception* of time, as we shall see by-and-by, always involves at least a rudimentary process of retrospection and representation of impressions which are already past.

The newer experimental psychology has occupied itself much with measuring our sense or perception of time (Zeitsinn), and

[1] See Perez, *First Three Years of Childhood*, p. 230.

these experiments have been chiefly carried out in relation to auditory impressions. This line of inquiry has already yielded some curious and interesting results. A reference to some of the principal ones may well complete this brief account of the auditory time-perception.

First of all, then, these experiments have shown that the grasp of successive sounds in a time-perception, that is as a succession, has its limits. Thus the two sounds must be separated one from another by a certain interval. According to Exner, two successive clicks of a Savart's wheel are apprehended as successive when the interval is reduced to one five-hundredth of a second.[1] At the other extreme we find that if the interval is increased to four seconds it becomes impossible to connect them as members of a series.[2]

Again, a number of inquiries have been carried out into the range of this perception of succession, or serial integration of sounds, that is, the number of impressions of sound that can be integrated into one series. It is found that this depends in part on the interval between two successive sounds, the most favourable one being from ·3 to ·18 seconds. Under these circumstances a series of eight or more sounds can be grouped as one series. If, however, as almost certainly happens, there takes place an involuntary rhythmical arrangement of the sounds, the whole series being compounded out of periodic sub-divisions, a much larger number can be thus integrated. According to one experimenter as many as forty sounds will be perceived as constituents of a single serial whole, provided they are thus rhythmically grouped in periodically recurring groups of eight or five.[3]

(*b*) *Measurement of Time-interval between Sounds.* Lastly, reference may be made to the experimental inquiry how far we can measure the precise interval between two sounds, and how

[1] Visual discrimination of succession is less delicate, two successive sparks being no longer distinguished when the interval is reduced to 0·044 seconds.

[2] See Wundt, *op. cit.*, ii. p. 331; also W. James, *Principles of Psychology*, i. p. 613 f. It is curious to note the analogy between these lower and upper limits in the serial integration of sound, and the lower and upper limits of rapidity of vibrations in the scale of sound-sensations. (*Cf.* above, p. 111.)

[3] See Wundt, *op. cit.*, ii. 249; Dietze, *Philosophische Studien*, ii. p. 362. Such a series would occupy about twelve seconds.

this power varies as the interval is lengthened or shortened. It seems to be ascertained that the measurement is most exact when the interval is a small one, this favoured interval varying, according to different observers, from about ·4 to 1·25 seconds.

The aim of these last experiments is to get the subject to construct a second time-interval equal to a given standard one, and to compare the errors made as the interval is increased. In this way the point of nicest appreciation, or 'the interval of least error,' is ascertained. Below this point the interval is made too large, above it, too small. Later research tends to show, however, that beyond this interval of least error the exactness of perception periodically declines and rises again. The explanation of the facts is not quite clear. The researches of Münsterberg, however, make it probable that in estimating time-interval we use as psychical material the muscular sensations that accompany the attitude of attendant expectancy. These sensations involve the varying tension of the muscles generally, and more particularly the alternating phases of tension and relaxation of the respiratory muscles. The influence of these last is interestingly illustrated in the fact that the comparison of interval was much more exact where the beginning and end in each case synchronised with the same respiratory phase.[1]

The nice appreciation of time-relations in the case of the ear is of great practical consequence. Thus it is evident that the rapid and easy apprehension of spoken language depends on an accurate perception of the order of succession of the sounds, and a ready combination of the members of a time-series in a single perception.

It is, however, in the perception of the rhythmic successions of verse and music that the ear's appreciation of time-relations shows itself at its best. The essential element in this experience is regular recurrence after a definite interval, or periodicity. Here an accurate measurement of time-interval becomes essential. What we mean by the appreciation of time in music includes the comparison of successive simple time-lengths, whether filled with sound, or empty intervals or pauses, as well as multiples of these. Thus in 'common time' the ear recognises the equality of duration or time-interval of the units (the crotchets), and of the quadruple groups of these making up the bars. The full appreciation of rhythm in music, and measure in verse, implies, in addition to measurement of time-length or interval,

[1] On the results of this time-measurement, see Wundt, *op. cit.*, ii. p. 348 ff.; Ladd, *op. cit.*, p. 488 ff.; Münsterberg, *op. cit.*, ii. p. 1 ff.; and W. James, *op. cit.* i. p. 611 ff.

a recognition of numerical relations. The ear notes the periodic recurrence of a particular number of sounds in the case of each musical bar, as of the three in triple time, and this recognition underlies the appreciation of the particular form of the movement. This perception of time is aided by the distribution of accent, the place of the accent serving to mark the division or boundary of the successive time-intervals.[1] Similarly the appreciation of (modern) metre appears to rest on the recognition of a regular, periodic recurrence of sounds, and a particular numerical grouping of these, the characteristic time-relations being marked by the distribution of the accent.[2]

§ 31. *Musical Perception.* Besides the perception of time-relations under the form of rhythm, music involves the discernment of other and specifically musical relations. These include the distances of tones one from another in the scale, or pitch-interval. To the musical ear each note in the scale has its definite position, and presents itself as standing at a certain distance from other notes, more particularly the ground- or key-note. In other words, tones are projected on a represented background answering to the total scale of sounds, or, more exactly, to the series of tones constituting the particular key. The fact that the two directions of the scale are universally known as up and down serves to give to positions in the scale a close analogy to a series of positions in space.[3]

In addition to these relations of pitch, the musical ear perceives relations of tonal affinity, such as that between a note and the octave above it. These tonal relationships enter into what we call melody or melodious succession of tones. According to Helmholtz, such melodic relationship depends, like the harmonious combination of simultaneous tones, on the

[1] The German word Takt, as distinguished from Tempo, marks off this aspect of musical time.

[2] For a fuller analysis of the perception of time and rhythm by the ear, the reader is referred to my volume, *Sensation and Intuition*, chap. viii.; and Wundt, *op. cit.*, ii. p. 72 ff. The differences between the perception of space-form by the eye and of time-form by the ear are well illustrated by Mr. E. Gurney, *Power of Sound*, chaps. iv. and v.

[3] The question how we come to think of tones as high and low is one of some difficulty. It is probable that associations of muscular action, *viz.*, the varying movements of the vocal organ involved in producing sounds of different pitch, have an influence here. See, however, Stumpf, *Tonpsychologie*, i. § 11, p. 189 ff.

presence of upper partial tones. Two tones are tonally or melodically related when they have a common upper-tone. Hence the perception of such a tonal relation appears to involve a sub-conscious identification of a common element in the tones.[1]

It is evident that in this recognition of the *relations* of tones one to another, both those of time and those of pitch and tonal affinity, there is something more than in what is commonly understood by perception. Instead of a seemingly direct apprehension of a mass of presentative and representative material under the form of a single whole, there is a conscious separation of presentations, and a comparison of these one with another under a particular aspect. Inasmuch, however, as the discernment of the relation, in the case of the practised ear at least, is rapid and *quasi*-immediate, it approximates in character to a simple act of perception, and hence is treated by psychologists, *e.g.*, Wundt, under the general head of presentative cognitions.

(D) PERCEPTIONS OF LOWER SENSES.

§ 32. *Rudiments of Perception by Taste and Smell.* As already hinted, the two lower senses are not the source of perceptions answering in completeness to those of the higher senses. We do indeed perceive objects when we have a sensation of taste or of smell; but the slightest reflexion shows us that in this case we are supplementing the sensations received by a representation answering to a visuo-tactual perception. Thus, in recognising a rose on the ground of a sensation of odour alone, I am imaginatively reconstituting the rose as known to touch and sight.

Each of these senses does, however, give us a rudiment of perception. In the case of taste, the close proximity of the nerve-filaments of taste and touch proper, as also the mobility of the tongue and palate, secure a tactual perception along with the gustatory sensations. In the common experience of mastication we gain a considerable knowledge of the sapid substance, as hard, granular, viscid, and so forth, answering to that which we gain by the hand. Hence, in the case of an unfamiliar substance entering the mouth, when, moreover, we receive no aid from sight, we gain a *quasi*-tactual perception, and thus

[1] On the nature of this tonal relationship, see Helmholtz, *Sensations of Tone*, pt. iii.; or, for a shorter statement of Helmholtz's theory, my volume, *Sensation and Intuition*, p. 177 f.; *cf.* Wundt, *op. cit.*, ii. cap. xii. §§ 1-3.

refer the sensation of taste to a variety of body or substance which we know presentatively at the same moment and in the closest local connexion with the taste-stimulus.

In the case of smell, too, we gain a rudimentary sort of percept by means of movements and resulting changes of intensity in the olfactory sensations. Thus, by movements of the head or whole body in different directions, aided by the action of sniffing, we learn in a measure to localise olfactory sensations. Such projections into space of our sensations of smell may be rendered definite by the addition of contact with the nose itself. Thus, by bringing this organ into close proximity to the petals of a rose, the child is able to connect immediately the olfactory sensation corresponding to its odour with a tactually-perceived object. The fact that the dog habitually investigates objects with its nose suggests that it acquires percepts which resemble our own in being compounded out of movements and touches, but differ from them by the addition to the tactual element of the important adjunct, the maximum intensification of olfactory sensation.

The fact that our sensations of taste and smell are highly relative or subjective, that is, conditioned by varying organic circumstances, makes perception through these avenues a far less trustworthy process than that by means of touch and sight. Olfactory and gustatory perceptions are alike specially apt to be illusory, as when owing to an unhealthy condition of the tongue, or the persistence of the effect of a previous sensation, we mistake the quality of that which we are eating. The easy way in which children can be imposed on in the matter of tastes, as when they are told that the disliked mutton they are eating is pork, shows how readily we misapprehend through these senses.[1]

§ 33. *Perception and Observation.* All perception involves a measure of that reactive process which we call attention. But we are often able to discriminate and recognise an object or an action by a momentary glance which suffices to take in a few prominent marks. Such incomplete fugitive perception is ample for rough everyday purposes. On the other hand, we

[1] For a like reason we are all liable to illusions of taste and smell, that is, the projection into the external world of purely subjective sensations arising out of disturbances of the organ itself.

sometimes need to throw a special degree of energy into the psycho-physical process of perception so as to note completely and accurately what is present. This is particularly the case with new and unfamiliar objects. Such a careful direction of the mind to objects is known as Observation. This observation may be carried out by way of any one of the senses, as when a lady tactually examines the texture of a fabric. The term commonly refers, however, to a careful visual scrutiny of objects.

Observation in its highest form is a methodical process. It implies a deliberate selection of an object for special consideration, a preparatory adjustment of the attention, and an orderly going to work with a view to see what exactly takes place in the world about us. This methodical procedure is specially conspicuous in scientific observation, as that of the astronomer, or the chemist. Such observation commonly involves, further, a prolonged and patient attention to changes in an object, or to a process. Observation may thus be said to be regulated perception.

Good observation consists in careful and minute attention to what is before us. Thus, in order to observe nicely a particular flower or mineral, we must note all the individual characteristics, the less conspicuous as well as the more prominent. Similarly, if we wish to observe a process such as evaporation, or the movements of expression in a person's face, we must carefully seize all the stages of the operation. By such a close effort of attention we give distinctness to our observations and accurately mark off what we are observing from other and similar objects with which they are liable to be confused.[1]

It may be added that good observation includes a certain self-restraint, a resolute limitation of attention to what is actually presented, and an exclusion of all irrelevant imaginative activity. Thus it includes in the carefully-trained mind the inhibition of the impulse to go beyond the observed facts in what is called inference, a common fault of bad observers, as the witness-box in our law courts illustrates. Also it involves the restraining of the impulse to look out for a

[1] We might call a percept distinct when we see an object apart from other and surrounding objects, and clear when we mentally grasp all its parts or details.

particular thing when this grows into prepossession. The undisciplined mind is apt to see what it expects, wishes, or it may be fears to see. Even scientific observation has been vitiated by a strong prepossession or expectation of a particular appearance. In like manner the undisciplined mind tends, like the Professor in the *Water Babies*, to overlook that which it is disinclined to believe in. Methodical observation must, no doubt, as the history of physical science tells us, be stimulated and guided by anticipation or imaginative conjecture. We should, in many cases, not see things at all if we were not on the look-out for them. At the same time, good observation never allows itself to be overshadowed or interfered with by such imaginative activity.[1]

It is less easy to draw up definite rules for the regulation of the perceptual process in observation than for that of the reasoning process. Good observation comes from a trained habit, and is the resultant of a combination of forces such as a strong interest in objects, zealous regard for fact or reality, and so forth. Education can, under favourable natural conditions, do much to develop observation and perfect the child in the use of the senses; but it attains this object not so much by laying down any definite rules, as by exercising the child in observing, and so producing a habit of accuracy.[2]

REFERENCES FOR READING.

For a fuller account of the way in which we learn to localise impressions and perceive objects the reader is referred to Prof. Bain's treatise, *Senses and Intellect*, under 'Sense of Touch,' § 13, etc.; under 'Sense of Sight,' § 12, etc.; and later, under 'Intellect,' § 33, etc.; also to the excellent analysis of perception in Mr. H. Spencer's *Principles of Psychology*, vol. ii. pt. vi. chaps. ix. to xviii. With these may be compared M. Taine's interesting chapter on 'External Perception and the Education of the Senses,' *On Intelligence*, pt. ii. bk. ii. chap. ii. Among more recent works in English are to be noticed Ward's article, "Psychology" (*Encyclop. Britann.*), p. 51 ff.; and W. James's *Principles of Psychology*, vol. ii. chaps. xix. and xx. For a knowledge of the current German theories of space-perception the reader should consult Lotze, *Metaphysic*, bk. iii. chap. iv.; Wundt, *Physiolog. Psychologie*, vol. ii. caps. xi.-xiii.; Stumpf, *Ueber den psychologischen Ursprung der Raumvorstellung;* and my articles on "The Question of the Visual Perception in Germany," *Mind*, vol. iii. The relation of the psychological to the philosophical aspect of perception is touched on below, Appendix C.

The bearing of the psychology of perception on the corresponding philosophical problem, *viz.*, the nature of the external reality perceived, is discussed below, Appendix C.

[1] On some of the effects of prepossession in vitiating observation, see the account of illusory perception in the author's volume, *Illusions*, chaps. iii., vi.

[2] On the logical control of observation, see J. S. Mill, bk. iv. chap. i.

CHAPTER IX.

REPRODUCTIVE IMAGINATION: MEMORY.

§ 1. *Regions of Presentation and Representation: Sequence of Percept and Image.* The percept is the immediate outcome of the organisation of certain portions of our sense-experience. It is, moreover, as we have seen, though taking up into itself a representative element, coloured throughout by its sensuous base. Hence we mark it off from the higher region of ideation as a presentation or direct sense-presentment.

Presentations or percepts, though the foundation of all our thought respecting things, are in themselves fugitive psychical phenomena. A percept, depending as it does (in normal circumstances) on a peripheral stimulus, ceases when that stimulus is withdrawn. In order, then, to that permanent psychical product which we call cognition something more than perception is necessary. This additional factor is supplied by that consequent or after-effect of the percept which we popularly call an idea, but which is more accurately described as a mental image, or representative image.[1] Thus the percept called forth by a colour-stimulus is followed (under favourable conditions) by an image of that colour.

Here, as pointed out when dealing with the processes of psychical elaboration, we have the fullest manifestation of that psycho-physical property which we call retentiveness. In the persistence of the image after the percept we find a purely representative phenomenon, which stands out clearly from

[1] The term image in psychology points to a double distinction. On the one hand it is representative, whereas a percept is presentative (or largely so); on the other hand it is a representation of a concrete object, or a mental picture, and is thus distinguished from a concept or general notion which typifies a class of things. The terms 'idea' and "ideation" are commonly used to include both images and concepts, or imagination and thought, thus marking off the whole region of the internal and representative from the external and presentative.

presentative phenomena. In normal circumstances we all mark off the image from the percept by referring the former to the internal, the latter to the external or sensuous region of our experience. The precise nature and extent of the difference between the percept and image will be dealt with presently.

THE IMAGE.

§ 2. *Transition from Percept to Image: (a) The After-image.* It was pointed out above that sensations have a temporary persistence under the form of the after-sensation. Since all sensations in mature consciousness instantly develop into percepts, we may express this fact of temporary retention as follows: All percepts, whether visual, auditory, or other, tend under certain circumstances to persist beyond the moment of the cessation of the sensory stimulus. Thus the perception of a bright object, as the setting sun, is often followed for some seconds by that which is known as an 'after-image,' but which may be just as appropriately described as an 'after-percept,' of the object. Similar after-percepts sometimes occur in the case of hearing, touching, and so forth. All such after-images are due to the continuance of the process of excitation in the nerve-centres engaged in the formation of the percept.

These after-images just referred to are known as 'positive'. They commonly occur immediately after the percept, and may be regarded as a prolongation of the same; but, in other cases, they recur for some little time, as, for example, after severe and protracted fixation of the eye on a microscopic preparation.[1] They are distinguished from 'negative' after-images, which arise from a temporary fatigue and disablement of the retina, either of all its supposed constituent elements (answering to different colours) or of some of these. The first effect is illustrated by the transformation of a positive after-image of a bright object, say the window, into a black image. The second effect is illustrated by the familiar coloured images known as complementary spectra.

The (positive) after-images, or after-percepts, are phenomena of great psychological interest in relation to mental reproduction. They form the connecting link between percepts and images properly so-called (revived images). They approximate closely to complete percepts in respect of their psychical marks, namely, vividness or intensity (*i.e.*, degree of luminosity and strength or 'saturation' of colour), distinctness of parts, and definiteness of localisation (either in the field of objects if the eyes are open, or in the dark field if they are shut). The chief difference consists in this, that they appear to shift their position in the field of view with every movement of the eyes. Thus the after-image of the sun's disc seems to

[1] See Ward, *loc. cit.*, who calls these recurrent sensations.

move to the right of the dark field when we turn our eye in that direction. This is owing to the fact that they depend on a (relatively) permanent excitation of a certain portion of the retina, and not on the immediate action of an external stimulus.[1]

(*b*) *Primary Memory-image*. In addition to these after-images, which are only occasional and fugitive, a vivid and distinct impression, involving a special effort of attention, is apt to beget a mental image properly so called, which may persist for some time after the percept. Thus after intent visual inspection, as in microscopic investigation, the image of the object hovers about, so to speak, for some time, recurring again and again, as soon as other objects of attention are removed. This temporary image is important as forming the first stage of the true image. Hence it has been called the primary memory-image.[2] Such temporary images may be observed to become little by little blurred and indistinct. There is thus a gradual subsidence or dying away of percepts.

Though shading off into the other when it occurs, the after-image or after-percept may commonly be distinguished from the primary memory-image by certain marks. The latter is, like all ideal or imaginative products of sensation, wanting in the full intensity or vividness of presentations (in respect of luminosity, force of colouring, and so forth). Moreover, even when it is definitely localised (as it is in the early stages) it is *fixed* in some region of external space corresponding to the place where the actual object presented itself, and so does not, like the after-percept, appear to shift its position with movement of the eyes.[3]

This temporary persistence of percepts as images is a matter of great importance in the apprehension of all successions or series of impressions. Thus, in the perception of the time-relations of sounds already referred to, it is evident that the grasp of the whole of a series, *a*, *b*, *c*, *d*, *e*, etc., as such, implies that the earlier members of the series, *e.g.*, *a* and *b*, persist when the later ones occur. Hence

[1] Another distinguishing mark of after-images is that unlike percepts (externally excited impressions) they are not doubled by pressing laterally on the eye-ball. (See the careful consideration of the facts by Dr. Hack Tuke, *Brain*, xliv. p. 445.) Mr. Ward calls all such phenomena after-*sensations*, regarding them as wanting in some of the characteristics of the percept and the image proper. (Art., "Psychology," p. 59.) Inasmuch, however, as they are distinctly projected (into the dark space) and localised in a particular direction therein they are on a level of psychological complexity with rudimentary percepts.

[2] By Exner and others. (See Ward, *loc. cit.*, p. 59; and James, *op cit.*, i. 643 ff.) Dr. Richet speaks of this temporary persistence of the image as "elementary memory," *Revue Philosophique*, xxi. p. 568.

[3] See the account of the points of difference between the after-image and the true image given by Fechner, *Elemente der Psycho-physik*, chap. xliv. *Cf.* W. James, *op. cit.*, ii. 50 ff.

we may assume that the range of our grasp of successive impressions is limited by the persistence of such impressions. Recent experimental inquiry into what has been called the "span of prehension," or the number of sounds (*e.g.*, of letters or numerals) that can be repeated after a single hearing, shows that this power varies considerably, and, what is of great consequence, appears to vary with mental capacity generally.[1] Experiment has also shown that the subsidence of the temporary image is a gradual one, and, after a time, reaches a stationary condition.[2]

It may be added that this temporary persistence of a percept as an image underlies many of the lesser acts of what is popularly called remembering. Thus in carrying a message to a person a child has the sound of the words persisting in his mind for a few minutes. And this persistence makes the work of retaining and repeating easy.

§ 3. *The Revival of Percepts.* This temporary 'echo' of impressions or percepts,[3] though it enables us to prolong, in a manner, the inspection of our percepts, has only a limited value in relation to the permanent acquisition of knowledge. When we talk of picturing, imagining, or mentally representing an object, we imply the appearance of the image *after an interval.* This resurgence of the image after the complete subsidence of the percept is popularly described as a revival or reproduction of the percept.

In speaking, however, of a "revival," "recalling," and so forth, of a percept, we must bear in mind that all such language is highly figurative. A percept is not a material object that persists, and can come and go. When I image a horse I have, as we shall see more fully presently, a different psychosis from what I have when I actually see the object. So far, indeed, is the image from being a reinstatement, that is, a renewed experience of the percept, that it carries with it in its representa-

[1] See *Mind*, xii. p. 75 ff. These variations suggest that such a temporary retention of a series involves a special effort of combining attention, and that temporary, like permanent, retention—with which, as we shall presently see, it is correlated—is conditioned by intensity of concentration.

[2] According to the experiments of Weber (with weights and tones) there is a considerable sinking of the primary memory-image during the first ten seconds (quoted by Ward, *loc. cit.*). It has been more recently shown by H. K. Wolfe that the same thing occurs in the case of the temporary images of tones. (*Philosophische Studien*, iii. 4. *Cf.* Stumpf, *Tonpsychologie*, p. 230.) Lehrmann says (*loc. cit.*), that the recognition of a shade of gray seen shortly before was only certain as long as the interval did not exceed 60″.

[3] The student should note that psychologists use commonly the term 'impression' as the original of the image. When so used, the term must be taken to be synonymous with percept.

tive function a more or less distinct reference to the sensation as something different. This reference in all cases of "recalling" proper involves a consciousness of the sensation as a *past* experience. The use of the expression representative image serves to bring out this distinctive peculiarity.[1]

It is to be further noted that this revival under the form of an image holds good of all classes of percepts or "sense-impressions". Thus, in psychology, we speak of an image of a sound and of a taste, just as we speak of an image of a colour. Images derived from visual percepts are, no doubt, as we shall see, the larger and more important portion of our image-store, but we must keep steadily in view that other sense-experiences as well give rise to images. That is to say, the word image in psychology stands for every variety of percept (visual, auditory, etc.).

This revival of percepts after the lapse of time shows us in a striking form the effect of peripheral stimulation in modifying the nerve-centres by the formation of "physiological dispositions".[2] When Milton went on picturing objects with wonderful vividness and distinctness after the loss of sight, and Beethoven continued to imagine tones after he had lost his hearing, they gave signal proof of the power of the nerve-centres of storing up and afterwards using the effects of their past functional activity.

While we thus distinguish between the temporary after-effects of perception and the subsequent revival of percepts, we must not regard these as absolutely distinct. Not only is the primary memory-image the precursor and the guarantee of the later (secondary) image, but, in what is commonly spoken of as revival, recency of original impression is an important auxiliary factor. We may say generally that the revival of an impression is most perfect soon after the time of its actual occurrence, and becomes less and less perfect as

[1] The various ways among plain men and philosophers of describing the relation here touched on are admirably adapted to confuse the subject. Witness the common way among thinkers, *e.g.*, Hume, of talking of the idea (*i.e.*, image) as a weakened impression, as a copy of the impression, and so forth. The popular expression recalling *an object* is less misleading; for this brings out the real differentia of the image, *viz.*, that it is representative of that which is directly presented in sense-perception.

[2] See above, p. 192 f.

the interval increases. We can commonly recall with ease, and a considerable degree of distinctness, a face or a *bon mot* that impressed us a few days before, though after the lapse of a month or six months the mind loses its hold on the impression.[1]

§ 4. *Process of Revival.* It has already been pointed out that, speaking psychologically, we only know retention through the fact of revival. If, as is supposed by Herbart, Hamilton, and others, a percept has any conceivable existence during the interval preceding revival out of consciousness or below the threshold of consciousness, we can have no direct knowledge of the fact; and it seems much more scientific, as already suggested, to confine ourselves to known psychical facts, and to speak of the percept being subsequently re-excited, or reproduced, under the new form of an image.

The immediate conditions of the appearance of the image are, as pointed out, the recurrence in restricted form of that mode of central excitation which conditioned the original impression. That is to say, I picture or have an idea of a rose when the group of nerve-centres engaged in the perception of this object are re-excited to similar functional activity.[2] The process of revival doubtless includes a stage, or rather a series of stages, of imperfect, that is, sub-conscious ideation. Thus, in imagining a rose, I can trace a process of gradual growth or formation of the image. This succession of a distinct on an indistinct stage does not, however, any

[1] The close dependence of the revived on the temporary image is illustrated in the fact, noted by Lehmann (*loc. cit.*), that individual differences of reproductive power show themselves also in the duration of the after-image; and that impairment of memory involves that of the power of carrying out temporary retentions.

[2] As pointed out above, the common assumption of physiologists and psychologists is that the cortical seat of a sensation and of its ideational correlative are one and the same. It follows from this that an image involves a re-excitation of that group of central structures (*e.g.*, visual and tactual) which is engaged in the process of perception. This hypothesis of one and the same central seat for sensation and idea is, as Ziehen has recently pointed out, not free from difficulties; at the same time his own attempt to mark off separate though connected cortical regions for the two phenomena seems to complicate the matter unnecessarily. (On the whole subject, see Bain, *The Senses and the Intellect*, p. 338 ff., Appendix B.; Maudsley, *The Physiology of Mind*, chap. v.; Ferrier, *The Functions of the Brain*, chap. xii.; Ladd, *Elements of Physiol. Psychol.* p. 548 ff.; Ziehen, *Leitfaden der physiol. Psychol.* p. 98 ff.)

more than the reverse process, the sinking or fading of the original, prove that the image existed previously.

§ 5. *Differentiæ of Images and Percepts.* The fact that we have no difficulty in general in distinguishing between the percept and the image, *e.g.*, the sight of a horse and the mental representation of it, suggests that there must be certain differences between them. The most obvious point of difference is the greater intensity of the sensational or presentative element in the percept, which gives to the whole structure its peculiar vividness (or strength).[1] Along with this superior intensity, and perhaps more important than this, is the greater distinctness of percepts, in general, as compared with images.

According to Hume, this exhausted the difference. But it is evident that this is not the whole of it; otherwise we should confuse weak and indistinct impressions, *e.g.*, those of faint sounds, or of indistinctly-seen objects, with images. Other differences assist in normal circumstances. One important distinguishing character of images is their unstable, changeable nature, as compared with the steadiness of percepts. Another point of difference is the presence in the percept and the absence in the image of the muscular and other sensations by which we know that we are using our eye or other sense-organ. Although when we visualise or visually imagine an object intently we undoubtedly have the eye engaged, the sensations are not the same. As pointed out above, the muscular sensations excited in ideational attention are, to some extent, different from those accompanying sensational attention.[2] It is to be added that though in distinct mental picturing we roughly localise the image, referring it to the space *in front of us*, the localisation is apt to be very vague and unsteady. This is probably owing to the circumstance that there is no definite fixation of the eye during an imaginative process. Other marks of difference present themselves when a closer examination is needed. Thus there is the obvious distinction that images are not affected by movement, as percepts are, which appear

[1] The characteristic of "vividness" is brought out by James Mill, *Analysis*, i. p. 84 f. Mill makes feeling as well as sensation a source of vividness. It is probable that all sensations which have an effective tone are more vivid than the corresponding images in respect of this feeling-concomitant.

[2] See above, p. 149 f.

and disappear as the eye moves towards or away from a particular point.

With respect to the nervous processes involved, it is to be observed that while the central structures engaged in the case of a percept and an image, *e.g.*, seeing and imagining a colour, are supposed to be the same, there is the important point of difference that in the one case the excitation comes from the periphery, while in the other it is confined to the centre. It seems reasonable to assume that this would affect the psychical result in some way. And such an effect we appear to see in the several points of inferiority of the image just enumerated, more particularly the indistinctness, the fluctuating character, and the absence of those definite and palpable muscular and other sensations which constitute the basis of our reference of a percept to a particular peripheral organ, as the eye or the ear.

It may be added that such a distinction as we find drawn by normal persons when in health between the percept and the image obviously has a biological significance. If we were given to taking our images for percepts, so as to re-act upon them as such, we should plainly fail in biological adjustment. This failure shows itself in those distinctly abnormal states where the image reaches the stage of a hallucination, and the subject directs his actions to imaginary as distinguished from real objects in his surroundings.[1]

The question what are the precise psychical differentiæ of percepts, or sensational phenomena, and images is beset with considerable difficulty. On the one side we have the fact that, under normal conditions, we never take an image for a percept, or *vice versâ;* on the other hand, there are the curious and perplexing phenomena of hallucination, that is to say, of images which, under special abnormal conditions, assume the appearance of percepts, and are (unless the tendency is corrected by reflexion) taken to be perceptions of real objects. It is commonly supposed that in the case of hallucinations the periphery is engaged. Thus in a visual hallucination the retina is supposed to be active just as it is when external light stimulates it. We see, moreover, in the fixation of the eye in hallucinatory states, and the definite localisation of the imaginary object, that the peripheral organ is much more deeply engaged than in the case of normal imagination. This favours the view put forward above that the (normal) image answers to restricted central activity, which has a somewhat different psychical accompaniment from the more extended activity (involving the periphery) which occurs in the case of the percept and presumably of the hallucination. It is to be added that even in

[1] *Cf.* Münsterberg, *Die Willensbundlung*, p. 139.

perfectly normal states we do occasionally feel a moment's doubt as to the reality of sense-impressions, as, for example, in the case of feeble sounds; in which cases we determine the point by reflexion and reasoning. Lastly, it may be said that the abnormal development of images into percepts in the case of the insane, hypnotised subjects, and all of us during sleep, seems to show, as M. Taine has pointed out, that where there is no superior opposing force at work, due to stimulation of the peripheral sense-organs, the psycho-physical process of the image tends to develop into one indistinguishable from that of the percept.[1]

§ 6. *Coalescence of Image and Percept: Recognition of Objects.* Just as in mature life we never have a sensation without some of that complicative process by which percepts are formed, so all our percepts, as already hinted, embody a merged form of the image. It is evident, indeed, that, in recognising an object seen before, the assimilation of the present percept to a former one involves the coalescence with this percept of the revived image of its predecessor. And since we never see wholly new objects, but assimilate so-called new ones in respect of their position in space, size, and so forth, to objects previously known, it follows that there are image-rudiments in all our percepts.

Such a nascent rudiment of an image must, however, be distinguished from an image proper. The process of assimilating a percept, and of calling up the image of an object now absent, are markedly different, and represent two stages of the reproductive process. We are often able to identify an object, as a face, when we actually see it, without having any corresponding power of imaging it when it is absent. The lower animals, which have at best only a rudimentary power of imaging, often display a marvellous power of recognising.

[1] On the whole question of the relation of the percept to the image, see Taine, *On Intelligence*, pt. i. bk. ii. chap. i., and pt. ii. bk. i. chaps. i. and ii.; Ward, *loc. cit.*, p. 58; Horwicz, *Psychologische Analysen*, thiel i. § 50; Volkmann, *Lehrbuch*, i. 449 ff., who emphasises the greater liveliness of the sensation, which he appears to identify with its 'tone' or affective aspect. On the (peripheral) muscular sensations occurring in the case of imagination, see Ribot, *Psychologie de l'Attention*, p. 104. On the difference in the range of the nervous process involved in the case of sensation and of imagination, see, in addition to the authorities quoted above, W. James, *op. cit.*, ii. p. 68 ff.; and Münsterberg, *Willenshandlung*, p. 136 ff. An ingenious attempt has recently been made by M. Binet to show that in ordinary visualisation we localise images in a 'mental field of vision' corresponding to the external field of actual vision. (See his article "La Vision Mentale" in the *Revue Philosophique*, April, 1889.)

The memory of the dog, as illustrated in the famous story of the recognition of Ulysses after years of travel, is proverbial.[1]

The process of recognition here touched upon has been made the subject of experimental investigation, with the object of determining the variations in the rapidity of the recognition as the conditions are altered. As might be expected, the rapidity of the process increases first of all with the simplicity of the presentation, and consequently the facility of the act of attention; and, secondly, with the degree of familiarity, or frequency of past recurrence, of the same. The second condition appears to be the more important. Thus Cattell found that the recognition of a common and familiar object is somewhat more rapid than that of a letter of the alphabet, and that the recognition of a short word is almost as quick as that of a letter. (See Wundt, *op. cit.*, ii. p. 307.) As the result of the experiments already referred to, Lehmann concludes that there is no such thing as a purely assimilative recognition, but that what we call recognition always involves associative complication, as when we recognise a colour by apprehending its name. But, as already hinted, we may have recognition in the indistinct form of a sense of familiarity without any definite emergence of associative concomitant.

§ 7. *Reaction of Image on Percept.* In recognition the percept and the image are fused, the presence of the latter being indicated merely in the peculiar appearance of familiarity which the percept assumes. In many cases, however, the coalescence is preceded by a partial or complete severance of the two factors. In these instances the percept is modified by an image which distinctly appears as such. This effect is known as the reaction of the image on the percept.[2]

The most common illustration of this action is that in which there is an ideational or imaginative preparation for the percept, or a stage of "pre-perception".[3] This imaginative preparation appears in a less distinct form, where, previously to the occurrence of the sensation, there is a central excitation leading to a sub-conscious ideation. Thus, if I visit a particular town, the idea of an acquaintance who happens to live there will be partially excited, so that, should he actually present himself, the recognition will be expedited. Another and closely-related variety of this effect is seen in the case where a partial excitation of an impression is followed by a complete excitation.

[1] On the facts, such as dreams, that go to evidence a certain imaginative power in dogs and other animals, see Romanes, *Mental Evolution in Animals*, chap. x.

[2] Since the image is derived from, or a product of, the percept, we may say that there is a reciprocal action, or an interaction between percepts and images.

[3] *Cf.* my volume, *Illusions*, p. 27 ff.; and W. James, *op cit.*, i. p. 439.

Here is an example. A few mornings ago, on taking my usual after-breakfast walk, I saw a friend who is accustomed to be my companion at these times. When I got sufficiently near I called him by his name. He was deep in thought, and made no sign of having heard me. In about twenty seconds after I came up from behind, close to him; whereupon he quickly turned and greeted me, just as if he had expected me that particular moment. The call had set his brain-centres working, so that he afterwards recognised the quick step as mine.

In the process of (distinct) expectation or "expectant attention" considered above,[1] we see this action of the image on the percept illustrated in a particularly clear manner. As we there saw when referring to recent experiments on attention, a preadjustment of mind, involving ideational activity, tends to bring about an instantaneous perception or recognition of a sensation. Such preliminary central preadjustment, with its ideational correlative, more or less distinct, plays a large part in our everyday experience. Thus it has been found that it takes about twice as long to read aloud a series of words having no connexion as it does to read a series having such a connexion;[2] and this is explained by the fact that, where words are bound together in significant sentences, there is a continual forward movement of the mind in anticipation of what is coming, so that each successive impression or group of impressions is instantaneously recognised. A practised reader of a musical score, or of novels in MS., shows a marvellous power in thus reading the end before it comes.[3]

It may be added that the action of imagination on our sense-experience is beneficial only so long as a certain balance between the two is maintained. Normal mental activity is that which adjusts itself to real circumstances, and so must start from, and be based upon, sense-presentations. Hence the healthy influence of the image on the percept is restricted to the effect of furthering or expediting the percept which would otherwise arise. If, however, the imaginative factor grows so masterful as to modify the distinctive characters of the sensa-

[1] See above, p. 152 ff.

[2] This fact was established by Prof. Cattell, see *Mind*, xi. p. 64.

[3] Dr. G. O. Berger found by experiment that the effect of practice in accelerating the process of (audible) reading is much more marked where the matter is understood. (*Phil. Studien*, v. p. 170 ff.)

tion-complex, we have a tendency to illusion. This is the state of things in all conditions of emotional excitement, as when a frightened child takes a harmless object for a hobgoblin, a state involving a certain disturbance of healthy mental action, and in those more permanent psycho-physical disturbances which we commonly recognise as pathological.

§ 8. *Distinctness of Images.* The chief merit or excellence of a representative image consists in its distinctness or clearness. By this is commonly meant that the image be definite and not vague, that the several parts or features of the object be distinctly pictured in their relations one to another. Thus we have a distinct image of a person's face when we call up its several features, as the outline or contour of the whole, the shape of the mouth, and the colour of the eyes. On the other hand the image is spoken of as indistinct, obscure, or vague, when, instead of all the details of the object, only a part is pictured.

Closely connected with the distinctness of images as just defined is their distinctness in relation to other images. The expression "a distinct mental picture" seems, indeed, to have as one of its meanings perfect differentiation, or detachment from other images. Thus we are said to represent a face "distinctly" when we do not confuse it with another face.

The terms clearness and distinctness seem to be employed almost interchangeably for each of the above aspects of images. If it were possible to break through a habit of speech, it might be advantageous, modifying the phraseology of Leibniz, to use the antithesis clear—obscure with reference to the first kind of distinctness (distinctness of parts or details), and the antithesis distinct—confused with reference to the second kind (distinctness of the whole). The close connexion between the terms distinct and clear will be illustrated again by-and-by, in connexion with general ideas or concepts.

It is customary to distinguish between the liveliness or vividness of an image and its distinctness. For purposes of knowledge the latter is more important than the former. Images are in general wanting in the intensity of the corresponding percepts. I do not visualise all the brightness of the sun, or all the depth of colouring of a sunset when I imagine it. A high degree of vividness in an image may, indeed, easily lead on to hallucination. There may be a fair degree of distinctness with a comparatively low degree of vividness; and this seems to be the condition most favourable to clear thinking.

Our mental imagery shows all degrees of distinctness. Many of our representations are vague, blurred, and indistinct, and as a consequence tend to be confused one with another.

The statistical investigations of Mr. F. Galton into the nature of visual representation, or what he calls 'visualisation,' go to show that this power varies greatly among individuals (of the same race), that many persons have very little ability to call up distinct mental pictures of objects as figured, coloured, etc.[1]

From this distinctness of an image it is important to distinguish its accuracy. By this is meant its fidelity as a copy, or its perfect correspondence with the original, the percept. Want of distinctness commonly leads to inaccuracy, if in no other respect, in that of deficiency. But what we ordinarily mean by an inaccurate image is something more than a merely defective one. It implies the importation of some foreign element into the structure of the image. Thus we have an inaccurate image of a face when we ascribe a wrong colour to the eyes, or a wrong height to the brow. It is probable that all images tend to become inaccurate, by way not only of loss, but of confusion, of elements, with the lapse of time.

§ 9. *General Conditions of the Retention and Reproduction of Percepts.* The capability of representing an object or event some time after it has been perceived is not absolute, but is limited by certain conditions. These may be roughly summed up under the two following heads. In the first place, the original impression must, in order to be subsequently revived, attain a certain degree of perfection in respect of vividness, and clearness. We will call this condition the depth of the impression. In the second place, there is needed in ordinary cases the presence of something to remind us of the object or to suggest it to our minds. This second circumstance is known as the force of suggestion.

(*a*) *Depth of Impression :* (1) *Intensity, etc., of Sensation.* In the first place, then, we may say that a distinct image presupposes a certain force and distinctness of the original impression. A moderately loud sound will in general be recalled better than a faint one, just because, as a sensation of greater intensity, it is stronger and more impressive, and makes a more powerful

[1] Among the curious results reached by Mr. Galton are the following. Men given to abstract thinking are, as a rule, weak in visualising power. The capability does not vary, apparently, with keenness of sight (perceptual power), or with a tendency to dreaming. (See his *Inquiries into Human Faculty*, 'Mental Imagery,' p. 83, etc.)

appeal to the attention. For a similar reason, clearness and distinctness of impression are favourable to retention. A face distinctly seen with all its details is much more likely to be recalled than one indistinctly seen. For these reasons actual impressions are in general much better recalled than products of imagination; for, as a rule, they surpass the latter in vividness and distinctness. We recall the appearance of a place we have seen better than one that has been described to us. The habit of repeating words audibly when we want to remember them is based on this principle. As a last determining factor of a forcible impression may be named duration. Every fully-developed sensation requires an appreciable time. A momentary sound remains indistinct as to its quality, its direction, and so forth. Accordingly prolonged sensations are as such of greater impressive force than momentary ones.

(2) *Attention as Condition of Retention.* So far as to the nature of an impression as conditioned by external circumstances. But, as we have seen, the intensity, distinctness, and the duration of a sensation are partly determined by an internal condition, *viz.*, the amount of reaction in the way of attention called forth. Hence we have to add that the depth, and consequently the revivability, of an impression depend on the degree of interest excited by the object and the corresponding vigour of the act of attention. Where, for example, a boy is deeply interested in a spectacle, as a cricket match, he retains a distinct image of what has been seen. Such interest and direction of attention ensure a clear discrimination of the object, both in its several parts or details, and as a whole. And, as we have seen, the fineness of the discriminative process in perception is one main factor in the determination of the subsequent retention.[1]

The nature and sources of interest have been sufficiently discussed above. The essential element in interest is feeling, and any marked accompaniment of feeling, whether pleasurable or painful, is, as we all know, a great aid to retention. Thus the events of our early childhood which we permanently retain commonly show an accompaniment of strong feeling, more particularly, perhaps, that of childish wonder at something new and marvellous, whether delightful or terrible. The effect

[1] See above, p. 192.

of disagreeable feeling in fixing impressions is illustrated in the retention of the image of an ugly or malevolent-looking face, of words in a foreign language which have disagreeable associations, as *bougie, douanier,* to the English traveller. Where such a powerful intrinsic interest is wanting, a vigorous exercise of *voluntary* attention may bring about a permanent retention. But, as pointed out above, such voluntary attention is only effective because it involves a feeling of interest. When we try to retain for social reasons a person's name we are feeling at the moment a social interest in that name.

It is to be observed, finally, that even when the conditions just specified are equally favourable to retention the result may vary, owing to temporary variations of our psycho-physical state. We have not always the same degree of susceptibility to impressions. Thus we are much more ready to note and to retain what presents itself to our senses when our sense-organs and brain are refreshed by rest and vigorous. It is commonly agreed that children take on new acquisitions better in the earlier part of the day when their psycho-physical organism is recuperated by sleep. Differences in emotional condition, again, closely connected with variations in the energy and rapidity of brain-action, render us much more impressionable at some moments than at others. As more than one novelist have illustrated, moments of intense feeling appear to raise the plastic or acquisitive powers of the brain to a preternatural height.[1]

(3) *Repetition as Condition of Retention.* We have thus far supposed that the object or event represented has been perceived but once only. But a single impression rarely suffices for a lasting representation. As we have seen, images tend to grow faint and indistinct; hence they need to be re-invigorated by new impressions. Most of the experiences of life, including some of great and absorbing interest at the time of their occurrence, are forgotten just because they never recur in a sufficiently like form. The bulk of our mental imagery answers to objects which we see again and again, and events which repeatedly occur. Here then we have a second circumstance which helps to determine the depth of an impression. Every

[1] This effect of emotional excitement in vivifying the presentations and representations of the moment will be dealt with by-and-by.

repetition of an impression, provided the interval between them is not long enough to produce effacement, tends to render the image more distinct and more stable. Where the repetition of the actual impression is impossible, the reproduction of it will serve, to some extent, to bring about a like result. We may fix names, verses, and so forth in the memory by going over them inaudibly. In like manner, we keep the images of remote experiences from disappearance by periodically reviving them, as when children talk with their parents about common experiences of the past. The points of similarity and dissimilarity between the physiological process in the case of the percept and of the image help us to understand how this renewal of the image serves as an inferior substitute for the repetition of the original presentation.

The distinction here drawn between unrepeated and repeated impressions or percepts is not an absolute one. On the one hand, there is no such thing as a single unique impression. Objects that are seen but once are assimilated in respect of their several features to other objects. As we shall see by-and-by, a child forms a rough outline-image corresponding to each of a number of objects before he shapes a complete image of an individual. Hence, in all retention there is some effect of repetition. On the other hand, we must remember, in speaking of the *repetition* of an impression, that the perfect and exact reduplication of a presentation is an impossibility. Familiar visible objects, as the figures of our friends, are continually undergoing changes of aspect.[1] Even what we call one and the same impression, as the sound of a particular word, presents itself with varying degrees of intensity and differences of quality (roughness and timbre, to some extent) with change of speaker, or of the speaker's psycho-physical condition. Thus, in all cases of retention alike, there is some measure of repetition, that is, recurrence of similar presentative elements, though the amount of repetition is much greater in certain cases than in others. It follows that our seemingly simple images are in a measure composite. This fact will be referred to again by-and-by.

These two conditions, a certain amount of attention, and a certain frequency of repetition, may take the place of one another to some extent. Thus the more interesting an impression the smaller the number of repetitions necessary, as is illustrated in the words of the already-enamoured Juliet :—

My ears have not yet drunk a hundred words
Of that tongue's utterance, yet I know the sound.

On the other hand, repeated impressions, even when not very interesting, as, for example, those of ubiquitous advertisements, manage by their importunity to stamp themselves in the memory.

[1] See above, p. 261.

At the same time, it may be said that, in all cases alike, the two conditions co-operate, though in very unequal quantities. As we have just seen, repetition, if only in the form of recurrence of image, is needed to supplement the effect of attention. And, on the other hand, mere repetition, without some amount of interested attention, is ineffectual. Even the tiresome advertisement possesses the momentary attractiveness of a sudden and forcible visual sensation. Many persons cannot distinctly represent even so familiar an object as their friend's face, just because they have never carefully attended to its several features, for their own sake, as a stranger would observe them.

The reason why, as Mr. Galton's inquiries show, so many persons are unable to visualise distinctly such familiar oft-seen objects as the faces of their friends, and the aspect of their breakfast-table, seems to be that attention is carried off to what is of greater interest. Thus, in observing our friend's face we have no interest in noting the colour of his eyes, but attend to the variable signs of health, temper, and so forth. So a man, in glancing at his breakfast-table, does not attend to the whole object, but only to points of special interest, as the unexpected dish. It must be remembered, too, that repetition, while within certain limits a great aid to revival, is opposed to it in so far as it makes us inattentive to what is habitually with us. This is an illustration of the principle of Habit, according to which what is customary tends to grow indifferent and sub-conscious.[1]

(*b*) *Laws of Suggestion: Association.* When an impression has, under the influence of the above favourable conditions, been fixed on the mind there remains a predisposition or tendency to reproduce it under the form of an image. The degree of facility with which we recall any object always depends in part on the strength of this predisposition. Nevertheless, this tendency will not in ordinary cases suffice in itself to effect a reinstatement after a certain time has elapsed. There is needed as a further condition the presence at the moment of some second presentation (or representation) which serves to *suggest* or call up the image, or remind us of the event or object. Thus the sight of a building, as our old school, reminds us of events which happened there, the sound of a friend's name, of

[1] It may be urged with some force that these two conditions are ultimately reducible to one. Whether an impression, it may be said, has occurred once or more than once, the degree of perfection of the retention and reproduction will be determined by the amount of attention bestowed on it. This point will be dealt with presently.

that friend, and so on. Such a reminder may be spoken of as the 'exciting' cause in contradistinction to the first or 'predisposing' cause. The reason why the large majority of our life-experiences, including our deeply-impressive dreams, are so readily forgotten is that they are not brought into relation to other facts which would serve to remind us of them.

Now we are reminded of a presentation by some other presentation (or image) which is somehow related to, connected with, or, as we commonly express it, 'associated' with it. Thus it is plain that the events of our school-life are associated with the particular building which recalls them, and similarly the person with his name. Hence we speak of association as the second great condition of reproduction.

ASSOCIATION OF IDEAS: CONTIGUITY.

§ 10. *Reproduction as Effect of Suggestion.* The general nature of association has already been discussed.[1] So far, however, we have only been engaged with it in its more rudimentary form, that is to say, as the process by which presentative and representative elements are perfectly integrated and unified into percepts. Here, as pointed out, the several elements are called up together, and firmly cohere as parts of one indivisible whole. We have now to trace the workings of association in the higher domain of ideation, that is to say, in the succession of distinct psychical products, *viz.*, images or ideas. Association is the term commonly used to cover the processes or laws involved in the succession flow or train of our thoughts.[2]

It has been held by psychologists generally that the revival of images or ideas depends in all cases on the working of the Laws of Association, or, as they have been called by some, Laws of Suggestion.[3] Thus Hume regards them as filling in the world of mind a place similar to the universal Law of Gravitation in the physical world. It was shown by Hobbes

[1] See above, p. 185 ff.

[2] See Hamilton, *Lectures on Met.* ii. p. 229; and Prof. Croom Robertson's article, "Association," in the *Encyclopædia Britannica* (9th ed.).

[3] Dr. T. Brown uses the term suggestion in preference to association, *Lectures on the Phil. of the Human Mind*, xxxiii. and xl. The question of the appropriateness of the classical expression "Association of Ideas" to all cases of suggestion will be discussed later on.

that in cases where we pass from one idea to another in a seemingly disconnected manner there are hidden bonds of association to be detected by careful examination.[1] Among the suggestive elements which thus serve to reinstate images we have to include all presentations received by way of the special senses, together with the corresponding representations, also all organic sensations which, as we shall see, play an important part in directing the successions of our ideas.

The question whether there is any spontaneous revival independently of suggestion is not easy to answer. It is conceivable that in the automatic functions of the brain we have a means of stimulating particular nervous elements to activity apart from the activity of other and connected elements ; and certain psychological facts, as the occasional sudden and inexplicable revivals of apparently disconnected images in normal waking life, the seemingly unsuggested revivals of imagery on going to sleep, as also the reappearance in dreams of images supposed to be effaced, the recovery in states of somnambulism or hypnotism and in certain forms of mental disease of whole aggregates of imagery lost to the normal consciousness, suggest that revival may be effected by the direct action of stimuli (such as could be supplied by an exceptional condition of the blood-supply) upon certain local groups of central elements. At the same time the progress of psychological analysis goes to show that the range of such spontaneous revival must, in normal conditions at least, be a small one. The more we look into the process of reproduction the more plainly do we discern that the revival of images is conditioned by the antecedence of other psychical contents which stand in a certain relation to the same.[2]

Presentations may suggest one another in consequence of different relations between them. Thus, if we let A stand for the antecedent or reminder, B for the consequent or the representation called up, we see that A and B may correspond to two objects locally connected, as two adjacent buildings ; or to two events following one another in time, as sunset and the coming on of darkness ; or, again, to two like objects, as a portrait and the original. These various kinds of relation, or bonds of connexion between presentations, have been reduced by the psychologist to certain comprehensive principles or Laws of Association.

[1] See Hamilton, *loc cit.*

[2] On the apparently spontaneous revival of images in dreams, *cf.* my volume, *Illusions*, p. 151 ff. The facts that tell for a spontaneous or non-suggestive revival of images are emphasised, among others, by Volkmann, who regards such spontaneous reinstatement as the simplest form of immediate reproduction. (*Op. cit.*, i. p. 399 ff.) On the reappearance of seemingly forgotten acquisitions in mental disease, see Carpenter, *Mental Physiology*, § 344 (p. 436), and following.

§ 11. *Association of Ideas by Contiguity: Statement of Law.* Of the several distinguishable modes or varieties of association the most important is that known as Contiguity. By this is meant the association of two or more presentations through, or on the ground of, their proximity in time, whether under the form of simultaneity or of succession. This is illustrated in such familiar experiences as the suggestion of the sensations of a cool plunge by the sight of a sheet of water; or that of a person's form, voice, and so forth, by the sound of his name. It may be roughly stated as follows: Presentations which occur together, whether simultaneously or in close succession, tend afterwards to revive or suggest one another.

This variety of association, which is recognised by most psychologists as the principal if not the only one, evidently corresponds to that process of integrative association considered above. Thus, just as the several presentative constituents entering into a percept revive one another because they (originally) occur together, being, as we saw either simultaneous, or successive in varying order, so two distinct presentations or percepts will suggest one another provided they have proximity in time. Since, moreover, any two presentations which thus come together may be said to constitute parts of one experience or complex of experiences, we may speak of the process of association by the link of contiguity as one of integration or totalisation; or, if we refer more particularly to the last stage of the process, that of reproduction or suggestion, we may call it, as Hamilton and others have proposted, a process of redintegration, that is to say, a re-constitution of what was originally given as a whole by means of a recurrence of some of its parts only.[1]

This Law of Contiguous Association may readily be seen to cover the larger part of our ideational connexions. Thus, it includes (1) all merely temporal connexions, as those between simultaneous events, *e.g.*, sunlight and increase of warmth, or successive ones, as the flash of lightning and the peal of thunder.

[1] The bond of suggestion here called contiguity is also spoken of as "vicinity," "connexion in time and place," and so forth. Since connexion in time is a relation given along with external presentations, it may, as by Wundt, be spoken of as "external association". (*Op cit.*, ii. p. 300.) Ward suggests the substitution of the expression 'continuity' for contiguity. (Article "Psychology," *Encycl. Brit.* p. 60, col. 2.)

Since causal connexion, whatever else it is, clearly involves sequence of events, it is evident that the connecting of things with their causes or their effects illustrates this bond of temporal attachment. (2) Again, the Law of Contiguity embraces all object associations, or association of quality (not directly involved in the percept), use, and so forth, with things, as the voice of a person with that person, the use of iron with that substance. (3) Once more, it covers all local associations, or those connexions in which locality is a binding element; as the association of wild-flowers with the field or hedge-row, the meal with the table, the agitating thoughts of the examination with the sight of the examination-room. Locality, as has been recognised in ancient and modern times, is a powerful aid to revival.[1] (4) As a last group we may take verbal associations, or those numerous connexions into which words enter, as names with objects, one word with a related word, and so forth.

This process of Contiguous Association, as suggested in the general account of associative integration, though commonly expressed in purely psychological terms, has a physiological side also, and this side must be kept in view so far as possible in seeking to elucidate its true nature. Just as the psychical integration involved in the percept involves the formation of nervous connexions between separate central elements, so the association of one percept with another occurring along with it presumably involves the building up of further nervous connexions between these complexes.

Confining ourselves, as the limits of our knowledge compel us to do, mainly to the psychical or subjective side, let us see what the Law of Contiguity exactly asserts. It evidently sets forth the fact that images are recalled suggestively on the ground of a certain relation between the original percepts. We have now to look into the nature of this ground with a view to see precisely on what condition the associative cohesion depends. In this way we shall be in a position to define the Law of Contiguity with greater scientific precision.

§ 12. *Conditions of Contiguous Integration: (a) Proximity in Time.* To begin with, then, the Law of Contiguity plainly asserts that proximity in time, pure and simple, constitutes a

[1] This was expressed in the Greek phrase *ἡ χώρα αὐτὴ τὸ μὴ ὂν ποθήσει.*

sufficient ground of association. In other words, no real objective bond, as that of causal connexion between the facts presented, is needed for the generation of a contiguous cohesion. This is evident from the common observation that the most disconnected elements of experience, if they only happen to present themselves at the same time, are liable to become associated one with another. In this way we associate persons with places with which they hold no relation beyond the momentary one of having been there at a particular moment; odours with experiences of joy or sorrow which happened to synchronise with them, and so forth. This formation of accidental associations is specially conspicuous in the case of children and the uneducated, whose minds have not come under the controlling influence of logical thought.

It is, no doubt, true that a relation is always involved in contiguous association. This may be either a pure time-relation, or a time-relation involving a space-relation also. The former is illustrated in the association of a visual percept, say that of a particular scene with the sensations of muscular fatigue experienced at the moment, and due to a tiring walk. The latter is illustrated in all local associations, as those between adjacent objects, a place and certain events happening there, and so forth. A complete reinstatement of the original complex of experiences involves the representation of these relations. Thus we recall the peal of thunder as following the flash of lightning, Charing Cross as lying at the west extremity of the Strand, and so forth. But such reinstatement of the relation is not a necessary element in suggestion by contiguity. We often have a place, a scene, a person suggested by an odour or other percept without being able to say in the least what relation subsisted between the corresponding experiences.

If, now, we examine this time-relation, we see that the degree of its efficacy as a forger of the associative link turns on the degree of proximity of the presentations. Of all contiguous associations those between simultaneous presentations are strongest. Witness the revival of the sound of the clock's ticking by the sight of the swinging pendulum, or of one feature in a visible scene, as the river Thames, by other features, say the Houses of Parliament. Where, indeed, as in this last case, the presentations are hardly distinguishable from parts of one whole complex presentation, we find that the adhesive or suggestive force is at its maximum.[1] On the other hand, this force falls off with the time-proximity. Thus successive presentations are, *cæteris paribus*, less firmly associated than contemporaneous ones, and presentations separated by an interval of time less firmly than those which are strictly contiguous in time.

(*b*) *Combining Movement of Attention.* Mere proximity in time gives us only the broad limiting condition of contiguous suggestion. Many impressions, however, occur together without afterwards reviving one another. Thus a particular sight or sound may synchronize with a multitude of sensations, including the large group of organic sensations, and yet only enter into associative connexion with one or two of these. A more special condition of contiguous association must be looked for in the process of attention. Just as attention gives vividness to the percept considered as an isolated psychical content, and thus favours its revivability, so it serves to bind together two or more of such contents.

The effect of attention on the process of contiguous integration may be brought under two heads: (1) that of the particular direction of the process of attention, (2) that of the quantity of attention bestowed.

(1) That the order of the movements of attention serves to determine the special order of revival is seen in the general fact that in the case of successive presentations suggestive revival takes place much more readily in the forward direction than in the reverse, or in any other order, as from first to fifth, from this to third, and so forth. The difficulty of reversing or otherwise varying the original order is greatest where the associated elements are actions, as movements of the limbs in drill-exercise, and the actions of speech and song. Anybody can test the truth of this by trying for the first time to vary the order in separating the sounds of the Greek alphabet or the notes of a tune. The probable explanation is to be found in

[1] This is clearly illustrated in the interesting experimental inquiries into the relative frequency of different directions of suggestion published in *Mind*, xiv. p. 230 ff. These show that a favourite line of suggestion was a whole reviving its part, as "house," reviving "room," or "window". Here it is evident we are on the limits of the "association of ideas," since 'window' may be said to be an integral constituent in the percept, 'house'.

the fact that all attention involves, as we have seen, muscular action; and a series of muscular actions, including the corresponding processes of central innervation, is presumably much more readily repeated in the original than in any other order.

Mr. Ward finds in the movements of attention, considered purely as a psychical activity, a sufficient reason for the fact that a series can be recalled more readily in the original that in the reverse order.[1] The special difficulty of reviving a series of muscular actions suggests, however, that the effect has a physiological condition. It is to be added that we have a considerable, even if inferior, power of retracing a succession of experiences in the reverse order. This is evidenced in the fact that we are able to go back over the events of the day in the reverse order to that of the actual occurrences. In his interesting experiments on the effect of repetition on the revival of a series of syllables, Ebbinghaus showed that the repetition of a series effects a certain saving of labour in recalling the same in the reverse order, and that there is a somewhat smaller saving in recalling any other permutation involving transitions to remote members of the series or " skippings ". Thus he found that a series formed out of one already repeated with skippings of even seven syllables could be learnt in less time than a perfectly new series. He concludes that, while a bond of association holds together all members of a series, this is weaker for remote than for adjacent members, and for a definite distance backward than for the same distance forward.[2]

Leaving, however, this general effect of attention on the order of contiguous suggestion, let us turn to a more important particular effect. By this is meant the selective action of attention in bringing together, in the region of distinct consciousness, from among a multitude of presentations certain interesting ones. This effect is illustrated in the common experience of running the eye over a large and complex scene; the action of interest determines attention to transfer itself in certain directions or along certain lines rather than others. Thus it passes from a strip of shining river to the castle looking down on it from the adjacent cliff, from this last to the flushing western sky beyond, or what not. And in this way certain elements from among a multitude of simultaneously given ones are successively differentiated and so integrated.

The formation of the associative bond will be more perfect the more immediate this transition of attention. Thus we associate the appearance and the name of a person when we bring them together as closely as possible and grasp them in

[1] *Loc cit.*, p. 61.

[2] See his volume, *Ueber das Gedächtniss*, § 39 and following.

one comprehensive act, or in rapidly successive acts, of attention.[1]

It is probable that the importance of proximity in time, and of coadjacency in space, depends on the facility rendered by these to such a continuous process of connective attention. Where two presentations are contiguous we have the most favourable conditions for welding them together by one act or process of attention. Similarly, two immediately connected members of a series, as the letters of the alphabet *a* and *b* or *x* and *y*, will be more firmly associated that two remote ones, as *a* and *f*, by the very fact of an immediately transitive movement of attention.

(2) We may now pass to the other point in the action of attention, *viz.*, the effect of the quantity of attention bestowed. It is true of a conjunction of presentations, as of a single presentation, that the degree of retention varies with the intensity or vigour of the process of attention. The firm associations that are apt to form themselves in moments of excitement are explained by this circumstance. In watching a fire or other stirring and awful spectacle the several features of the scene are wont to cohere because of the preternatural vigour or energy of the observant process.[2] Where, on the other hand, attention is feeble, the links of connexion are liable to remain half-formed and useless.

It follows from this action of attention in singling out and pinning together certain specially interesting parts of the presentation-complex, that the order of mental combination is not a mere reflexion of the external order. In the process of association the leadings of interest prompt us to build up out of the presentative materials given a new and particular order. And to this extent all memory, like art-construction, may be said to idealise the actual by a process of selective arrangement.

The process of attentive integration is really more complex than is here supposed. In many cases there is one main centre of interest, which irradiates a

[1] On the question whether such attention is strictly simultaneous, see above, p. 160.

[2] Darwin tells us that he could many years after remember the exact appearance of old trees, banks, and so forth, where as an undergraduate he made a good capture of beetles. (*Life*, i. p. 51.)

secondary or 'associated' interest on its surroundings. Thus we link together names and persons, not because there is an independent interest in the name, but because the interest in the person embraces the name as one of the person's belongings. Still more clearly is this transference of interest seen in the contiguous integration of experiences with particular localities. The fact touched on just now, and frequently referred to by the novelist, that great emotional excitement stamps on the mind with unusual vividness the most insignificant details of the scene which happens to be presented at the moment, is explained by the large irradiation of interest due to the intensity of the feeling. The educator makes use of this circumstance by presenting comparatively uninteresting facts along with interesting, and so securing conjoint attention and retention, as when he connects the fact of the warm climate of Spain with the interesting fact of that country's sending the boy its oranges.

(*c*) *Repetition and Association.* As a last factor serving to determine the special directions and the strength of contiguous association we have repetition. Just as the renewal of a single percept strengthens the corresponding image, so the recurrence of two or more percepts in the same temporal conjunction strengthens the cohesive bond between them. Most of our common retentions illustrate this effect. Thus the association of names with objects, of periodically recurring conjunctions and sequences of natural phenomena, as light and heat, a blow and a painful sensation, and so forth, is an effect of repeated co-presentation.

This effect of repetition may be conceived of in physiological language. If the excitation of two central elements simultaneously or in immediate succession tends (in some way not perfectly explicable as yet) to develop a nervous connexion or channel of communication between them, it would follow that the repetition of this process would serve to strengthen the nervous bond.

Recent investigation enables us to measure the effect of repetition with some exactness. Thus Ebbinghaus, in the experiments already referred to, in trying what the effect of learning a series of (nonsense) syllables would be in shortening the process of re-learning twenty-four hours later, found that the economising of time was roughly expressible as follows: Every three repetitions to-day effects a saving of one repetition to-morrow. The saving does not, however, continue in the same ratio when the number of repetitions is greatly increased (above sixty-four), for in this case fatigue interferes with any further effect of repetition.[1] This agrees with our common school-experience that after a certain amount of repetition any further rehearsal becomes comparatively useless.

A word may be added on the connexion between repetition and attention as joint factors in the formation of contiguous bonds. On the one hand, repetition may, as was hinted above, be said to be an increase of attention, under a different form. Thus in repeating a verse six times in succession there is a renewal of attention this number of times ; and we might plausibly conjecture that the effective force at work is represented by the product of the number of repetitions into the average quantity of attention (as estimated by intensity and duration) called forth by the several co-presentations.

Such a formula would, however, be of little practical value. For one thing, repetition, as already suggested, is apt to modify the quantity of attention forthcoming. Thus in the case of a series of syllables repeated in immediate or rapid succession the effect of a prolonged repetition is to induce fatigue, and so to deaden the attention. And if the repetition occur after a longer interval a new factor comes into play. Familiarity is apt to breed intellectual as well as moral contempt. Thus juxtapositions of impressions that arrest attention on their first occurrence, especially those involving a striking contrast, as between two very unlike members of a family, or an amusing incongruity, as between a big-sounding name and an insignificant-looking person, lose this attractiveness by their very repetition. On the other hand, repetition is in a certain class of cases a main condition in the awakening of attention to a conjunction. This applies to all cases where we are interested in discovering a general connexion. Thus a schoolmaster is struck by the *recurrence* of the juxtaposition of disorder and the presence of a certain boy or boys ; the scientific observer, by the recurrence of the conjunction between the growth of certain plants and particular circumstances of soil, and so forth.

§ 13. *Derivative Laws of Associational Revival.* If now we combine what has just been said respecting the conditions of contiguous association with what was said above concerning the circumstances which favour the revival of presentations con-

[1] See *Ueber das Gedächtuiss*, § 23, esp. p. 78 f.

sidered as separate units, we reach the following results, which may be regarded as a fairly complete account of the process of suggestion so far as we have yet considered it:—

(1) If we let A stand for the reviving presentation or suggestion, *b* the representation (corresponding to the presentation B) suggested, we may say, that the revival of *b* by A depends, first of all, on the independent values of the two combining factors A and B. Thus it is favoured by the strength (intensity and persistence) of A, as we see in the greater suggestive force which presentations have in general, as compared with representations. Again, it depends on the depth of the impression B as determined by its interest and its total repetition in varying connexions. To this it must be added that the recent occurrence of B is an important aid to its revival in all cases. Persons, places, and so forth are the more readily suggested by contiguous links when they have recently been presented.

(2) The revival of *b* by A will be the more certain and the more rapid the greater the strength of the cohesive bond between them. The degree of cohesiveness varies with three principal circumstances. (*a*) It is greatest when the presentations A and B are simultaneously co-presented, and falls off with the degree of their proximity. The occurrence of B before A, it may be added, is equivalent to an increase in remoteness. (*b*) It increases (within certain limits) with the frequency of the conjunction or co-presentation. (*c*) It increases with the intensity of the interest, and the consequent amount of the attention, called forth by the two in their juxtaposition.

(3) It follows that if A is presented at different times with other concomitants besides B, as for example D and K, it will tend to revive not only *a*, but *d* and *k*. In this case there will be an opposition or inhibition of suggestive tendencies. Here then we must say that A's power of reviving *b* will depend on the preponderance of the interest and the frequency of the conjunction A—B over those of the conjunctions A—D and A—K. A proper name instantly calls up the image of the place or person because the suggestive force works all in one direction. This is the most favourable situation. Next to this we have the situation of predominant interest and frequency.

It follows from this brief statement of the complex conditions of associational reproduction that it is a highly variable result. The same antecedent presentation is by no means always followed by one and the same ideational consequent. The result will vary, first of all, with varying conditions in the excitant, *e.g.*, greater and less interest and attention from moment to moment; in the second place, with varying degrees of *absolute* strength in the psycho-physical disposition underlying the reappearance of a particular image, *e.g.*, as arising from a recent presentation or particularly impressive occurrence of the same; and, lastly, with varying degrees of its *relative* strength, that is, as measured with that of other connected and competing suggestions. We shall see presently, after considering other modes of suggestion besides contiguous reproduction, that the complexity and variability of the process of suggestion are even greater than we have here described it to be.

§ 14. *Experimental Investigations into Association: Associational Time.* Some interesting experimental inquiries into the workings of association have recently been carried out in England and in Germany. The special object of these experiments has been to determine what is called association-time, that is, the time required for a presentation, as a spoken or written word, to call up a connected idea. The results of these inquiries, though here and there curious, do not throw any considerable additional light on the nature of the process. Thus the researches of Mr. F. Galton, carried out on his own mental processes, illustrate the fact that those associations with words which reach back to early life recur most readily. He estimates the time of associative reproduction to be about fifty ideas a minute. On the other hand, Trautscholdt and Cattell have experimented on a second subject, by naming a word, and estimating the time occupied in the suggestive process. According to Trautscholdt, the reproductive or associational time is about 0·727, or three-fourths of a second. The researches of Cattell bring out some interesting points, as that the sound answering to a printed letter is revived by means of this last more rapidly than the name of a colour by the sight of the colour; that in the case of young children the suggestion of concrete images predominates over that of abstract ideas, and so forth. More recent experiments of Von Tschisch and others go to show that the association-time varies in the case of normal and abnormal conditions of mind. It appears to increase in paralytic dementia, and to diminish in mania, in which a rapid rush of ideas is a well-known characteristic.[1]

§ 15. *Ultimate Form of Contiguous Association.* From the above discussion of the process of contiguous association we can see that it assumes a somewhat different form in different classes of cases, different, that is to say, in respect of the nature of the impressions, or the way in which they are presented together. Thus, though presentations connected in the time-order and those connected in the space-order both illustrate the action of contiguity, they illustrate it in a different manner. In the case of two fugitive impressions, as the sound of a horse's hoofs and the sight of the animal, the attention is momentary only. And if, as commonly happens, one succeeds the other, the subsequent process of suggestion will be from antecedent to consequent, and not conversely. On the other hand, when two objects are collocated in space, as Richmond Hill and the Thames, the attention can not only be prolonged, but, what is of equal importance, pass indifferently from the first to the second or in the reverse order, and finally comprehend them in a single (or approximately single) act. Hence in this case the images call up one another with equal force, and will appear, as we have seen, rather as parts of one representation.

Again, the mode of connexion formed between representations may be said to differ, in appearance at least, according as the presentations are homogeneous or heterogeneous. It follows from the theory of attention expounded above that, apart from repetition and habit, attention passes more readily from one impression to another of the same class than to a disparate one. Thus we can in general more readily connect two succeeding sounds than a sound and a sight accompanying or following it. Heterogeneous association may thus be distinguished from homogeneous.

Another modification of the associative process depending on the peculiar action of attention is seen in the connexion between signs and significates. A sign, as a word, is some impression which, for the most part, has no interest for us except as a mark to denote and recall to our minds an interesting presentation. The result of this paramount interest in one member of the couple is that the sign tends to reinstate the representation of the thing signified with much greater force than that with which this last tends to suggest the first. Thus, upon seeing a person, the image of his name may hardly be excited at all, but when we hear his name the image of the owner starts up instantly and uniformly.

Attempts have been made to reduce the process of contiguous association to the one form of simultaneous co-presentation. Thus Münsterberg endeavours to show that where we have a series of successive impressions, as sounds, they are really associated together through a common association with one persistent element, *viz.*, the muscular sensation involved in the process of attention. This, however, plainly does not accord with the facts as ascertained by Ebbinghaus. Were Münsterberg's theory correct we ought to be able to reproduce a series of sounds in any permutation with equal ease.

Münsterberg's attempt is avowedly based on the supposition that we can only

[1] See Galton, *Inquiries into Human Faculty*, p. 185 ff. On the experiments of Trautscholdt, see *Philosophische Studien*, i. p. 213 *seq.* The investigations of Cattell are described in *Mind*, xi. p. 524 ff. and xiv. p. 230 ff. *Cf.* Wundt, *op. cit.*, ii. p. 312 ff., and W. James, *op. cit.*, i. p. 557 ff.

conceive of the physiological process in association as a simultaneous occurrence of two central excitations. But, as already pointed out, nobody has as yet succeeded in making the physiological process in association perfectly clear. And Münsterberg himself can only say that it is "consistent with our other physiological and anatomical knowledge" to suppose that when two central regions A and B are excited simultaneously the nervous process passes over to the path that connects the two points.[1]

§ 16. *Trains of Representations.* As already implied, contiguous association binds together not only presentative couples but whole groups or aggregates. These aggregates may be combined on the ground of simultaneity, or, what is virtually equivalent to this, spatial co-existence, as when we group together a number of historical events as happening in the same year or reign without reference to the order of succession among them, or when we link on a number of various experiences with one and the same place. Here, it is evident, no one order of succession is favoured over others. Thus the sight of a locality A will call up now the order *b*, *d*, *f*, now *f*, *b*, *d*, and so on according to the variable circumstances of the moment.

In other cases, and these form an important class, the aggregates arrange themselves in a linear or serial form, so that we uniformly pass through the succession, A, *b*, *c*, *d*, etc. Such successions are called trains of images. A large part of our ideal acquisitions assume the form of such a train. Thus our representation of the regularly recurring series of natural phenomena, as the periodic succession of day and night, the seasons, and so forth, takes on this form. In like manner, a prolonged visible action, as that of a play, and a succession of sounds, as that of a tune, give rise to a representative train.

As suggested above, the fact that the series is revivable in the original order much better than any other, *e.g.*, the reverse, implies that, though all members of the series within a certain distance of one another are associated, the strongest bond of association is between proximate or immediately successive members; and that it is of such a nature as to favour suggestive revival in the original forward direction.

The effects of repetition in the case of such chains are very

[1] See Münsterberg, *Beiträge*, i. p. 128 ff. *Cf. Zeitschrift für Psychologie*, band i. p. 99 ff.

marked. The frequency of the succession tends, by the help of an organisation of the nervous processes involved, to an easy and semi-mechanical form of reproduction, in which attention is at its minimum. This may be illustrated in mentally running over the familiar series of the alphabet.

It is presumable that in all such effects of the repetition of psycho-physical series the nervous process is not only greatly shortened in duration, but tends towards the form of a simultaneous co-excitation of connected cerebral structures. That is to say, instead of a chain of successive nervous actions at cerebral points, A, B, C, and so forth, we may have something of the form $A, \genfrac{}{}{0pt}{}{B}{C}$, etc., or $\begin{matrix} A \\ B \\ C \end{matrix}, D$, etc. This would help us to understand the submergence of particular conscious elements, relatively unimpressive constituents being overpowered by impressive simultaneous ones. Yet the necessity of this hypothesis of overlapping nerve-processes can hardly be said to be demonstrated as yet. According to the general view of the psycho-physical correlation given above, an increase of rapidity of the nervous processes would of itself tend to bring about a submergence of the concomitant conscious element.[1]

§ 17. *Composite Trains: Motor Successions.* In nearly all instances of representative trains we have to do not with a single series of elements, but with a number of concurrent series. For instance, our representation of a play is made up of a visual series, answering to the several scenes and movements of the actors, and an auditory series, answering to the flow of the dialogue. The effect of repetition here, supposing the two series to be both interesting, is to bind together the several elements of each successive complex experience into one whole, and each of these wholes to succeeding ones. Thus each visible situation will become associated with the corresponding words, and this composite whole associated with what precedes and follows it. Frequent repetition tends to consolidate each successive group into one complex representation, so that the whole series approximates to a single series. Such complete reinstatement of a composite series is, however, difficult, as

[1] *Cf.* above, pp. 57 and 78. It was argued by Dugald Stewart that in all such cases the conscious factor is not wholly submerged. There is a momentary consciousness of, and even a momentary direction of the attention to, each successive member of the train, only this is too rapid to leave a trace in the memory. Hamilton regards such dropping out of links of a repeated chain as a case of unconscious mental modification. (See his *Lectures on Metaphysics*, i. xviii.; and Mill's *Examination of Sir W. Hamilton's Philosophy*, chap. xv.)

may be seen in the familiar experience that it is far easier to learn a series of words alone, or a melody apart, than to learn the words and tune together for singing purposes. Hence, perhaps, the tendency in recalling a composite series like that of a dramatic performance to revive with special vividness, now the visual, now the auditory train.

Among these recurring composite trains of images are those answering to our repeated or habitual actions. Every voluntary movement presupposes, as we shall see, an antecedent representation of that movement; and consequently where there is a succession of movements we must view each step as preceded by the appropriate motor image. Further, since the carrying out of a movement transforms the anticipatory motor image into the corresponding sensation-complex, it follows that in performing a series of familiar movements, as in dressing, or playing a tune from memory, we have each representative element immediately preceded and excited by an associated presentation; the whole series assuming the form m^1 M^1—m^2 M^2—m^3 M^3, etc., where the horizontal line indicates suggestion by contiguity.[1]

Not only so, along with this motor chain there goes one or more series of sensory elements, also representative and presentative.[2] Thus in walking there is not only the series of motor images and corresponding muscular sensations, but another consisting of the tactual images and sensations connected with the bringing of the feet alternately to the ground, and in most cases, too, a visual series arising from the changing appearances of the moving organ, and of the ground. So in singing or speaking the succession of vocal (motor) representations is bound up with one of auditory images.

In general the motor elements are weak as compared with the sensory. Hence the train of motor representations may be said to depend on the presence of the sensory elements.

[1] This applies only to actual performances of movements. In merely imagining a familiar series of movements the series will assume the simpler form M^1—m^2—m^3, etc.

[2] In marking off the two chains as motor and sensory we must bear in mind that the motor sensations and corresponding images are, as we have seen, themselves constituted, in part at least, by sensory (*i.e.*, peripherally induced) elements. (See p. 123.)

Thus, in writing, the succession of manual movements is directed or controlled by the visual impressions. How much this is the case may be known by the simple experiment of trying to write in the dark.

The effect of frequent repetition or practice in such cases is to dispense with that close attention to the detailed elements of the composite train which was necessary at first. This is seen in the fact that the sensory elements which had first to be distinctly attended to become indistinct. Thus a young pianist learning her notes has at first to look at her fingers. Later on she can strike the notes with only an indistinct indirect glance at them. In this way practice tends, to a considerable extent, to render a chain of movements independent of sensory elements.[1] The series of actions approximates to an apparently single series, in which the muscular sensations immediately accompanying the execution of one step call up a representation of the following, which is too fugitive to be distinguished from the subsequent presentation. The final outcome of this repetition is a habitual or *quasi*-automatic action in which all the psychical elements, presentations and representations alike, become indistinct.

§ 18. *Verbal Integrations*. Among the most important of our associations are those of words. Language is the medium by which we commonly recall presentations. This arises from the circumstance that we are social beings, dependent on communication with others. If, further, it is remembered that language is the medium by which all the higher products of intellectual activity are retained and recalled, its importance will be still more apparent.[2]

The value of our selected system of signs, articulate sounds, in relation to this function of recalling, depends on certain characteristics of the sensations concerned. As we saw above, sounds are finely distinguishable in their quality. Articulate sounds constitute a wide range of finely differentiated sensational material. Again, these elements are susceptible of being discriminated one from another even when occurring in rapid succession, and further of being readily grouped together and

[1] That the sensory elements are still present as indistinctly recognised factors is seen in the fact that a man who has lost skin-sensibility has to look at his feet n order to walk.

[2] The full use of language in (general) thinking can only be explained later on. Here it is enough to dwell on its service as a medium of *reproducing* knowledge.

grasped as a whole series. To this refinement of the auditory sense there answers a considerable degree of delicacy in the muscular sensibility of the vocal organ, as well as a high degree of flexibility or capability of rapidly varying its actions.

It may be added here, as a fact in favour of an ear language rather than an eye (or gesture) language, that the former sense can distinguish two successive sensations separated by a much smaller interval of time than the minimum time-interval of distinguishable visual impressions. This will be referred to again presently.

(*a*) *The Articulated Word-complex.* A little attention will show that our common verbal acquisitions are highly complex results of contiguous association. To begin with, each element of a word is an aggregate of disparate sense-elements, *viz.*, the sound, look, and movements of articulation. Of these the sound and the articulation are the fundamental portion. A child in learning to utter the sound *o* or *t* must combine a particular sensation of sound with the corresponding articulatory process as made known by its characteristic muscular and other sensations (*e.g.*, the sensations accompanying the closing of the lips, the moving the tongue against the teeth). This association as a psycho-physical process clearly involves the formation of a nervous connexion between the two distinct central regions of audition and articulatory movements. The clearest proof of this is to be found in different forms of aphasia or disturbances of speech, and the known differences in the cortical seat of the disease. Thus, where the articulation-centre only is affected, as in "motor aphasia," we have hearing and understanding of words but no speech, whereas in "auditory aphasia" the hearing of words is itself affected.[1]

The process of acquisition is that of motor association in general. The sensation of sound serves (along with the other sensations involved) to effect a reinstatement of the movement. Thus a child that has learned to articulate *p* does so by first representing the sound along with the sensations attending the particular articulatory movement involved. The importance of the sensation of sound as a controlling element in this process of articulatory reinstatement is seen in the fact that, in the case of those born deaf, articulation can only be learnt by substituting some other guiding sensation as the visual

[1] See Ferrier, *The Functions of the Brain*, p. 444 ff.; W. James, *op. cit.*, i. p. 37 ff. and 53 ff.

impression received from observing the movements of the lips and other parts of the articulatory apparatus.

What we call a word is a serial combination of a number of such associated couples. Observation of children learning to speak, and of persons losing the faculty from disease or old age, shows that the firm retention of the members of such a series in their proper order is a matter of some difficulty, presupposing practice, and the integrity and proper working of certain nervous arrangements.

(*b*) *Ideo-verbal Integration.* A word, however, is more than a series of auditory and motor complexes. It involves the association of this series with a particular image or idea. This association again depends on a further process of central nervous formation, the connected elements of the auditory and articulatory centre being conjoined with certain elements in the particular centre of ideation involved. That this is so is proved by the observation of that variety of aphasia known as word-deafness where there may be a certain crude sensation of sound, but no grasp of it as an intelligible word.

The relation of the word-complex to the idea illustrates the strongest form of contiguous attachment. As we all know, the word, especially when actually spoken or heard, and not merely imaged, is apt to call up the associated idea with exceptional vividness. In early life, when names are signs of concrete or pictorial ideas, this verbal suggestion of imagery is particularly powerful. This is due in part to the childish tendency to 'reify' the name, that is, to regard it as a part of the real thing itself, instead of something extraneous and arbitrarily attached to it. It is also connected with the circumstance, that a name being a presentative complex (motor and sensory) always realisable by our own volition, is specially adapted to call up images with force or vividness. Hence with imaginative children, as is well known, names of animals, and so forth, come to take on the likeableness and dislikeableness of the things themselves.[1]

[1] Ruskin said that, when a child, he was apt to be frightened by the sight of the word 'crocodile,' quoted by Ward, *loc. cit.*, p. 76. Such verbal preferences and antipathies in the child are, however, in part due to the intrinsic character of the sound-masses. A sensitive child would dislike the sequence of hard gutturals in he sound crocodile, and possibly see in the awkward length of the word something unpleasantly like the animal itself.

It is only necessary to add that, in this associative integration of the idea and the word, the suggestion is not equally strong in both directions. A word calls up the idea much more certainly than the idea the name. This is explained by the symbolic function of the word. We often have occasion to see things without naming them. On the other hand, we never speak of a thing without needing the corresponding idea. To this it may be added, that since words have in general but little intrinsic value, and are of interest merely as signs of interesting ideas, the attention is not detained by the name, but passes instantly to the suggested idea.[1]

(*c*) *Words as Visual Symbols.* Thus far we have dealt with words as spoken and as heard only. In the case of the educated other factors enter into the association, *viz.*, the visual percepts corresponding to the printed and written forms, and, further, the movements of the arm, hand, and fingers, constituting the actions of writing. In forming such associations a child builds on new psycho-physical elements to the complexes already established. Thus in learning to read he has to associate the appearance of the letters with the corresponding auditory and motor complexes, and the group of letters composing the whole word with a definite series of such complexes. The reading habits of modern life serve to give this visual factor a prominent place in verbal associations.

It is somewhat uncertain how far these several elements enter into our customary verbal revivals. That the auditory and motor (articulatory) factor are the fundamental part of the reproduction seems to be generally allowed, and recent investigation goes to show that they are constant ones. Thus when we think and speak we represent fugitively the sound of the word; similarly when we read. On the other hand, even in listening to another speaking or reading out, there is probably a faint reinstatement of the articulatory element. This motor element, however, seems to be more prominent in some cases than in others. Thus it is more distinctly recognisable when we closely watch a speaker's articulatory movements

[1] The strength of this ideo-verbal association is illustrated in a manner in certain recent experiments of Trautscholdt and others on what has been called association-time, that is, the time occupied for a verbal sound to call up an idea. (See Wundt's *Phil. Studien*, i. p. 213, and his *Physiol. Psychologie*, i. p. 314 ff.)

than when we simply hear his words. Children, as is well known, continue for some time to articulate when they read to themselves, and only learn to inhibit the articulatory movements by practice. All of us, moreover, tend to "think aloud" when we are excited, preoccupied, and relax the inhibitory effort. According to Stricker, a nascent revival of such movements is a constant, and the main constituent in verbal reproduction. But it is probable that this is not universally true. Much will depend on differences in relative power of articulate and of other representation. Thus in recalling words read in a book many persons have the visual symbols uppermost. And in ordinary thought-processes individuals appear to differ in respect of the relative prominence of the auditory and the motor factor.

The subject of verbal representation has been specially investigated by Stricker in his work *Studien ueber die Sprachvorstellungen*, 1880. According to him, the articulatory element is the only constant and the essential one. It has been suggested however, that Stricker has the individual peculiarity of having a particularly strong motor representation, whereas others may just as decidedly tend to an auditory and even a visual mode of word-representation. Indeed, it has been proposed to classify persons into 'motors,' 'audiles,' and 'visuals,' according to their predominant mode of representation. It may be added that pathological observation tends to show that the auditory centre plays a constant part in these processes, being engaged when we think and express our thoughts in words.[1]

(*d*) *Ideo-verbal Series*. The verbal complexes just spoken of, together with their associated ideas, are capable of being further integrated into series answering to the intelligible structures of language. To learn language necessarily involves these serial formations. Not only so, but as will appear by-and-by, our power of following out trains of ideas or of thinking is limited by the stock of such verbal acquisitions. In all our more difficult thinking operations words play a prominent part.

The formation of such verbal series has for its conditions those of composite trains in general. First of all, the integration of the several word-complexes is presupposed. A child cannot arrange words in an intelligible order till he has firmly

[1] On this subject, in addition to the work of Stricker, see Egger, *La Parole intérieure*, p. 75 ff.; and Binet, *La Psychologie du Raisonnement*, p. 18 ff. *Cf.* Hoppe, *Das Auswendiglernen*, p. 113 ff. On the special central arrangements involved in verbal acquisition, see Bastian, *The Brain as Organ of Mind*, chap. xxviii.; Ferrier, *The Functions of the Brain*, chap. xii.; and James, *op. cit.*, i. p. 53 ff.

associated the parts of the word-complex one with another and the whole complex with the idea. When this rudimentary part of the process is mastered, the linking on of words and ideas in series turns on a careful attention to words in their order of succession, as also to the relations of time, place, and so forth, among the ideas expressed by this order.

It is here assumed that the verbal trains are compounded of words and their associated ideas. Learning, in the complete sense, involves this double chain. At the same time, the two series are by no means equally prominent in all cases. As every teacher knows, words may be strung together and reproduced with only a very faint accompaniment of ideas. This result turns on the facility with which the verbal complexes are serially integrated, especially in the early years of life. This is best illustrated in that mode of acquisition much decried by Locke and other educationists, *viz.*, learning by rote. At the same time it must be remembered that verbal cohesion constitutes a valuable support of the reproductive process even where the ideas are also retained. Indeed, it may be said that owing to the organic connexion between an idea and its verbal framework or embodiment, as also to the cohesive properties of words, the perfect acquisition of ideas is greatly aided in all cases by verbal retention. Learning by heart, that is to say, the acquisition of a complex thought in a definite verbal setting, is thus a most important factor in intellectual education. Men of surpassing intellect have commonly been distinguished, among other ways, by the fulness and exactness of their verbal reproduction.

The phrase 'learning by heart' is here used to mark off the complete ideo-verbal process of acquisition as distinguished from "learning by rote," that is, a merely verbal or parrot-like memorising. It should be added, however, that what is commonly called learning by rote in the case of children is not a purely verbal process. A child would find it hard to learn even a metrical series of words without any aid from the associations of the correlative ideas. The experiments of Ebbinghaus referred to above go to show that where, instead of a series of nonsense syllables verses of poetry are taken, there is a saving of about one-tenth in the number of required repetitions.[1] At the same time the power of a purely verbal acquisition is attested by the cases of those who in abnormal states have repro-

[1] *Ueber das Gedächtniss*, p. 68 f. By taking modern verse (lines from Byron), Ebbinghaus added also the important aid of rhythm and rhyme.

duced whole passages from a foreign language which they happened to overhear some time before, and of the meaning of which they were wholly ignorant.[1]

§ 19. *Memory and Expectation.* Our images and trains of images are commonly accompanied by some more or less distinct reference to the corresponding presentations, and to the time-order of their occurrence. This complete representation of presentations or sense-experiences in their time relations involves a further intellectual element, to be dealt with by-and-by, *viz.*, a *belief* in the corresponding events as real occurrences. In some cases, no doubt, this accompaniment is of the vaguest kind. In a state of listless reverie we may have a series of images without any distinct reference to the corresponding experiences. We simply picture the objects, without reflecting where or when we have seen them or shall or might see them. In other cases, however, we distinctly refer the images to some place in the time-order of our experience. This reference assumes one of two well-marked forms: (*a*) a reference to the past or memory, or, to describe the process more fully, memory of events, and (*b*) a reference to the future or expectation.[2]

Both memory and expectation involve a series of images succeeding one another in time, and both illustrate the suggestive force of contiguous association. Thus in remembering the events of a particular day we retrace the succession of experiences, the images of these following in the order of the events, and being temporally 'localised' in this order. Simi-

[1] The best known instance is that given by Coleridge of a servant who, when insane, raved in Hebrew, Greek and Latin; the passages being afterwards found to be from books which his former master used to read aloud to himself. Quoted by Carpenter, *Mental Physiology*, pp. 437, 438. On the nature of the process of learning by heart, see Hoppe, *Das Auswendiglernen*.

[2] It were to be wished that there were some word to mark off this fuller process of memory from the mere revival of images. Some German psychologists, as Drobisch and Volkmann, would distinguish the former as Recollection (Erinnerung), contending that this distinction is supported by long usage. (See Drobisch, *Empirische Psychologie*, § 35; Volkmann, *Lehrbuch der Psychologie*, vol. i. p. 464.) But this distinction seems hardly borne out by popular speech. Besides, the word recollection seems best confined to the active side of the reproductive process. There is something to be said for Brown's use of the word remembrance to indicate the process of suggestion supplemented by the time-reference. (*Philosophy of the Human Mind*, lect. xli.) Rabier employs the expression, 'Recognition of Memories' (Reconnaissance des souvenirs), *Leçons de Philosophie*, p. 524.

larly, in anticipating the succession of the events of a journey resembling one already performed, we pass over a succession of images having the same time-order as the events of which they are the representations, and held together by the bond of contiguity.

While thus both modes of associative suggestion, they are different modes. In the case of memory the images are projected backwards in time, and the corresponding presentations are recognised as preceding the actual presentation of the moment; in the case of expectation, on the other hand, they are projected forwards, and the presentations viewed as following the present actual one. The nature of this difference will be discussed more fully presently.

Again, memory and expectation, though both modes of belief, are perfectly distinct modes. Since in memory we have to do with a reality which is over, the mind is in a comparatively passive attitude with respect to it. The train of memory images may indeed excite faint feelings of regret or longing, but these are momentary only, and we resign ourselves to the fact that the events are past. In expectation, on the other hand, the mental attitude is one of strenuous activity. There is a preparatory fixation of the attention which makes itself known by a sense of tension or strain. Along with this there goes a readiness to act in conformity with the occurrence, that is to say, a preliminary rehearsal of certain muscular actions. Thus, while memory is a comparatively passive state of mind, expectation is one of active tension.

The mental state known as expectation varies according to the number and character of the images called up. Where the anticipation is definite, that is, where the actual presentation of the moment calls up only one series of images, the active tension is greater. In waiting for a person to begin to recite a familiar poem we eagerly look on and desire to realise the coming sounds. If, on the contrary, the expectation is indefinite, as when we are watching a person who is about to recite some poem, though we know not what, different series of images are called up, more or less distinctly. And in this case mental activity takes another and more complex form, and includes, among other elements, an impatient curiosity to know which of the anticipated series it is to be.[1]

[1] A state of uncertainty often adds to the eagerness of expectation through a desire to exchange a painful state of doubt for one of rest. We are less impatient when sure of the fruition of some hope than when there is an element of uncertainty.

Not only so, the whole concrete state of expectation will vary greatly according as the representations are pleasurable or painful. In each case the attention is fixed, only in a different way. In the former case the direction of the attention is more of a voluntary act, and is accompanied by an active desire to realise the anticipated good. In the latter case the attention is bound and fettered, while at the same time there is a shrinking away from, or an impulse to put the evil further off. In extreme cases, as in that of a paralysing terror, this overpowering of the attention may reach to such a pitch that all effort to avoid the evil is precluded.[1]

In addition to expectation and memory there are successions of images which are not commonly included under either. These may correspond to a *recurring* order in our experience, as the series morning, noon, afternoon, etc., or may have been artificially formed, as by the reading of fiction. The nature of these and their relation to belief will be best discussed later on.

REPRESENTATION OF TIME.

§ 20. *Perception and Idea of Time.* We have already considered the process of time-apprehension in its simplest form as a mode of perception.[2] It remains to inquire into the higher form of time-consciousness as a representation or idea of relations of succession and of duration. This time-consciousness, in its most developed form, is one of the most elaborate of intellectual products, involving processes not yet dealt with. Nevertheless, inasmuch as the process of time-construction, which is evidently involved in all the more elaborate forms of memory and expectation, is based on the contiguous association of successive presentations, it may be convenient to deal with it at this stage.

It is difficult for us at first to conceive that a child could ever have had a succession of unlike experiences and not instantly referred these to their positions in the time-order as before and after. Yet there is every reason to think that the knowledge of time is a somewhat late acquisition. In its developed form the representation of events in their temporal order is attained much later than that of objects in their spatial or local order. The genesis of the former is intimately connected with the process of reproductive imagination, whereas, as we have seen, the development of the latter is bound up with the processes of sense-perception. Children attain very clear ideas about the position of objects in space, the relations

[1] The difference of mental state in looking forward to a good and to an evil will be illustrated more fully by-and-by when we examine into the nature of willing.

[2] See above, p. 269 ff.

of near and far, inside and outside, and the like, before they have any definite ideas about the succession and duration of events. Thus a child of three and a half years, who had a very precise knowledge of the relative situations of the several localities visited in his walks, showed that he had no definite representations answering to such time-divisions as 'this week,' 'last week,' and still tended to think of 'yesterday' as an undefined past.

§ 21. *Consciousness of Succession.* The representation of time begins with the recognition of two successive experiences as such. This, as already remarked, implies, in addition to the mere fact of succession, a subsequent mental process, *viz.*, an ideal retracing of the presentations, or a representation of them together, *as successive.* And this, again, as we saw also, presupposes the persistence of presentations for an appreciable period, or an overlapping of successive presentations together with the correlative nervous processes.

When we say that the apprehension of time is instantaneous we mean comparatively only. Strictly speaking, all representation of time, whether as succession or as duration, is itself a process occupying a certain duration. I cannot represent a succession of two rapidly consecutive impressions, *a* and *b*, without mentally retracing the order. And, as we shall see, in our more complex representation of time, as the events of a day, of a week, and so forth, the representative process is appreciably lengthened, and may occupy a considerable duration.

The first apprehension of a time-order in our experience involves the contrast of presentation and representation, of percept and idea, already spoken of. All arrangement of psychical elements in time is an ordering of representations in relation to an actual present. The simplest form of such arrangement is the relating of a represented experience as immediately antecedent or consequent to the actual present one; and the most elaborate time-construction is but an expansion of this process.

Strictly speaking the actual present is an unreal abstraction. It is a sort of mathematical point which is continually changing, and has ceased to be present before the process of attentive reflexion on it is developed.[1] What we are in the habit of calling the present is the sensation-complex of the moment together with

[1] Hence it has been suggested that we ought to distinguish the real unseizable present from the 'specious present,' that is, the immediately preceding experience, which is all that we reach by reflexion. (See W. James, *op. cit.*, i. p. 608 f.)

its escort of representative elements answering to immediately preceding and immediately succeeding presentations. Thus, as has been pointed out, the minimum of consciousness involves memory (representation).[1]

§ 22. *Differences and Similarities of Time and Space Consciousness.* It will be seen from the above that the consciousness of time and of space are psychologically or genetically related one to another. To begin with, space, as being in its several parts capable of apprehension at a single moment by means of a number of locally discriminated sensations, appears in contrast to time as a sense-presentation. All time-apprehension, even that rudimentary form of it which we have called the "perception" of time, is indirect and representative. We do not grasp time merely by going through a number of successive sense-experiences, but must first run over and connect these by a subsequent representative (reflective) process. Hence, though, as we saw in our analysis of the space-presentation, a certain rudimentary apprehension of time (succession, duration) is involved in the integration of sensations into the form of a space-perception, a clear and complete apprehension of time follows that of space.

Yet, while the space and the time consciousness are thus broadly distinguished, they have more than one important point of similarity. To begin with, in spite of the seemingly sensuous immediateness of the space-intuition, our analysis has led us to recognise that it is in reality mediate and highly symbolic. If space is resolvable into a summation of motor experiences, it is obvious that it can never be realised at any one moment. The 100 yards or the mile that our eye perceives is a symbolic epitome of a number of experiences which together would require a considerable time. To this extent, then, space is on a psychological level with time. Both are 'intuited' mediately or representatively, by help of symbols. That this is so in the case of time will become more evident when we examine into the representation of duration. It is obvious that when we think of a section of time, even so short a period as five minutes, we do not actually go through an experience of another five minutes, or even recall all the successive experiences that would commonly enter into such a period. Our representation of time is thus always a process of compression or abbreviation by help of a system of shorthand symbols.

The representations of time and space have other points of analogy. Thus, to the actual present moment in time there corresponds, in a measure, our own position in space, with the two directions 'in front' and 'behind'. But it is evident that the analogy here is a very partial one. Space differs from time in the fact of having three dimensions, and an indefinite number of directions from a given point. Not only so, there is a striking point of contrast between the *presentation* of the space in front of us and the *representation* of that behind us.[2] In the case of time no such difference exists, both the future and the past being alike representations.

§ 23. *Representation of Past and Future.* The simplest form of time-representation would seem to arise in the following way. A child is watching some interesting object, say the play

[1] See Shadworth Hodgson, *The Philosophy of Reflexion*, i. p. 248 ff.

[2] It is worth noting that, when we imagine the space behind us, we suppose ourselves moving and fronting it, so that, strictly speaking, we never represent it as behind us.

of the sunbeam on the wall of his nursery. Suddenly the sun is obscured by a cloud and the marvel of the dancing light vanishes. In place of the golden brilliance there now stands the dull commonplace wall-paper. This cessation, however, as we saw above, does not imply an instantaneous sinking of the presentation below the level of consciousness. The image persists, and attracts the attention by reason of its interestingness. At the same time there is the actual present, the sight of the sunless wall. Here, then, both presentation and representation, the actual experience of the present, and the represented experience which is not now, occur simultaneously, and so supply the most favourable conditions for the development of a consciousness of their difference or contrast. The strong interest of the child in this transition would ensure the requisite amount of attention.

Such a discrimination of presentation and representation may be supposed to include a vague consciousness of the difference between the now and the not-now, or the present and the not-present. But this is not all. There would be something in the whole experience to suggest a particular time-relation between the two events.

The representation *a*, and the presentation B, would, in the case supposed, tend to group themselves in a certain order. Every time the attention was recalled to *a* (by reason of its persistence and interestingness), it would tend (following the direction of its movement in successively fixing the presentations A, B) to be carried on to B. That is to say, *a* would take up its place as an antecedent to B, and the relation of the corresponding presentations A, B, would thus be represented as a transition from A to B, and not conversely. And this apprehension would be aided by the fact that *a* declines in intensity and distinctness, while B, as the actual presentation, persists intact, and so gains in force relatively to *a*. These characteristic features of the presentative-representative combination would serve as "temporal marks," by the help of which a particular time-order would be given to the corresponding experiences. That is to say, the child would fully seize the fact that A had been followed and displaced by B. The vague representation of a 'not-now' would be developed into the more definite representation of a 'no-longer'.

Let us now take the case of anticipation. The representation of a future may be supposed to arise, like that of a past, in connexion with an actual present. Here, it is obvious, the previous occurrence of the succession is presupposed. A presentation A calls up a representation *b* as its consequent, because the sequence A—B has occurred before, and the two presentations in consequence become associated. Now, if the presentation B were to follow A at once, or as soon as the corresponding image is called up, there would be no room for anticipation, or for the representation of a future. But if there is an interval between the calling up of the image and the realisation of the corresponding percept, there are the conditions for the genesis of a representation of a future.

In order to retrace the process, we will imagine the situation of a hungry child who sees all the preparations of his food. Under these circumstances the representation of the pleasurable experience of eating is suggested by strong contiguous links. Since, further, in this case the image is immediately associated with, and directly called up by, an actual impression, it will attain an exceptional degree of intensity and persistence. And the pleasurable character of the representation will still further ensure its persistence. Here again, then, there are all the conditions for noting the contrast of presentation and representation, the realised 'now' and the unrealised 'not-now'.

In this case, however, the relation of representation and presentation would be apprehended as different from that in the first case. During the prolonged existence of the two in mental juxtaposition, the child would discover that every time the actual presentation A rose into distinct consciousness it would be followed by the representation *b*. The presentation and representation would thus assume a different order in this case from that taken up in the first. Through repeated mental transitions from A to *b*, moreover, *b* would gain in force, and not lose, as in the former case. That is to say, the relation between presentation and representation would here disclose itself in a tendency in the latter to supplant the former, and not *vice versâ*, as in the first case. And on the ground of this relation between A and *b*, the child would ascribe a different order to the actual occurrences. A would be viewed as leading on, and about to give place, to B. In other words *b* would be projected in advance of A as its consequent. Here, then, the vague representation of a 'not-now' will be differentiated into the representation of a 'not-yet'.[1]

The representation of a number of successions, or of a time-series, would take place, in much the same way, in connexion with an actual presentation. Suppose a series of presentations A, B, C, D . . . . H. Then when the presentation H occurs, the representations *a*, *b*, *c*, *d*, etc., may, as we have seen, still persist in consciousness. These last will, as just explained, be placed or localised in the past, or as antecedents of H. But they will not be referred to the same points in this past. In considering in rapid succession the group of images, the attention is (as was pointed out above) determined to a certain order. Thus, it moves easily and smoothly in the order *abc*, but only with difficulty along another order, say *cba*, or *cab*. In this case, too, the differences in the intensity of the images, due to unequal degrees of subsidence, would make themselves felt, and serve as additional temporal signs, or clues to the temporal order of the events.

The above theory of the origin of the differentiation of past and present, which follows in some particulars the common explanation by German writers, is not an attempt to account for our time-sense or time-consciousness. Psychologists do not seek to derive the consciousness of time from other elements, as they endeavour, for example, to derive the space-consciousness from muscular and other sensations. Time is immediately known by a concomitant mode of reflective consciousness induced by an actual succession of experiences. All that is attempted here is to point out the special psychical conditions which lead to a particular form of time-ordering in a particular case, that is, to a particular dating of the event represented in the past or future.[2]

[1] If, indeed, as is fairly certain, each presentation and resulting representation occupies a certain duration, and goes through a rapid series of changes of rise and decline, it would seem that a consciousness of the decline of the representation and the rise of the presentation in the first case, and of the reverse process in the second, would further serve to suggest the distinction between the 'no-longer' and the 'not-yet'.

[2] On the function of such temporal signs in ordering our experiences in time, see Volkmann, *Lehrbuch der Psychologie*, ii. § 5 A; Lipps, *Grundtatsachen des Seelenlebens*, p. 588; Ward, article, "Psychology," p. 65; and James, *loc. cit.*, p. 632 ff. W. James emphasises as the neural condition of a sense of temporal succession the overlapping of different brain-processes. Such overlapping is no doubt, as we have recognised, a physiological condition of all integrating or combining modes of consciousness. Mere overlapping of cortical excitations has, however, in itself nothing that could stimulate a time-consciousness. It is only as

§ 24. *Representation of Duration.* A second aspect of time, over and above mere succession, is duration. This aspect is given from the first, along with succession. As pointed out above, all sensations are apprehended as lasting or occupying so much time. And so a given experience is thought of not merely as preceding or succeeding another, but as separated from it by a certain time-interval or distance. In other words, time, like space, is made up of relations of relative position and of distance.

It is, however, only after a certain range of experience, and a certain development of reflective power, that a child begins to be distinctly aware of time as duration. As long as sensations and thoughts are all-absorbing, and attention is not called off to the fact of duration, he remains unconscious of it. In order to the development of this consciousness of time, there must be something in the experience, which not only allows, but prompts attention to direct itself to this particular aspect of it.

These conditions appear to be fulfilled in the case of a prolonged expectation. A child, for example, might probably obtain his first distinct idea of a time-length when told to wait for the satisfaction of an expressed wish. In such a situation of tedium or *ennui* his attention fixes itself on the representation of the promised gratification. Owing to this state of pre-occupation, the succession of events filling the interval, including the other images which might intrude themselves, are not distinctly attended to. The mind is in the active state of tension described above, in which a sense of muscular strain is a prominent factor. In this way the very attitude of expectation induces a flow of attention to the fact of duration, and this tendency would be greatly increased by the sharp realisation during such prolonged expectation of the contrast between the state of unsatisfied desire and the desired gratification itself. Reflexion on this prolonged process, this continued anticipation of a pleasure accompanied by a recurring recognition of its non-realisation, leads to an apprehension of the fact of duration.

the several excitations vary in intensity from moment to moment and their psychical concomitants vary concurrently that we have the stimuli to a time-consciousness, that is, the secondary reflective apprehension of time following on succession of experiences.

Since, moreover, the sense of strain and the feeling of disappointment would increase with the prolongation of the state, they would supply 'temporal marks' by help of which one might appreciate the length of time. At any given moment the increasing sense of fatigue and of ennui would have reached a particular phase, and this phase would serve as an index to the length of time traversed.

That the appreciation of duration begins in this way may be seen by observation of children, who first speak about 'long time' and 'short time' with reference to strongly desired futures.[1] It is further illustrated in the familiar fact that we all realise duration most vividly when called on to wait for something in circumstances that offer no distractions, as for a train at a railway station. The German word "Langweile" suggests that we realise time as duration most vividly when suffering from this experience of tedium or *ennui*. With this vivid and exaggerated sense of duration there contrasts the underestimation of it during other and more especially deeply interesting and absorbing experiences. When our thoughts are completely engaged in some pursuit, as a delightful pastime, we have no sense of duration, and the discovery that an hour or more has passed produces the effect of shock.

It is sometimes said that duration is known as empty interval between two experiences. But this view is incorrect. Mere unconsciousness does not yield the sense of time. As Rosalind puts it, time stays still with the lawyer during vacation: that is to say, in his sleepy indolence he has no perception of time.[2] In all our estimates of time some psychical content supplies the material. What we call an empty interval, as between arriving at and leaving a railway station, is, in truth, filled with the peculiar experience described above. The same thing is true of shorter intervals, as those between succeeding sounds. It has been recently pointed out by Münsterberg that, in the estimation of these shorter intervals, the muscular sensations involved in the attitude of expectant attention play an important part.[3]

It may be added that where expectation is of something painful, and so includes the feeling of fear, the effect is somewhat different. In the brief philosophy of time-estimation given by Rosalind we find that time gallops with the thief to

[1] The animal estimate of time-interval, which is otherwise remarkable, and not wholly explicable, is seen to conform to this condition. Dogs show the most accurate calculation of time in relation to expected enjoyments, *e.g.*, a customary play with a child at a particular hour.

[2] In *As You Like It*, act iii. scene ii.

[3] *Beiträge*, ii. p. 20 ff. *Cf.* W. James, *op. cit.*, i. p. 619 ff.

the gallows. That is to say, dread, as an instinctive aversion, or trying to get away from a future evil, tends by contrast to heighten the impression of its swift approach.

So far we have spoken of the consciousness and estimation of time during the period concerned. From this contemporary estimate we must distinguish the retrospective and the prospective apprehension and measurement of duration. As is well known, this is not identical with the first. The waiting at the railway station, which seemed so long while it lasted, looks short enough afterwards ; and a day's holiday, which is boundless to the sanguine anticipation of a boy, shrinks painfully as it is taken possession of.

Here the other aspect of time-succession comes in as a factor in the time-estimation. As we have seen, we can estimate time apart from change and succession, though a change is necessary for defining a duration, just as a sensation of contact is needed for limiting the extent of (empty) space. In all our more complex representations of time succession and duration are both involved. Thus it is well known that in the retrospective and prospective estimate of time the number of represented elements forming the content of the period directly affects the result. Days or weeks, filled with many new, striking, and interesting experiences, appear, on that account, both in prospect and in retrospect, long.[1]

As already hinted, the appreciation of duration is always indirect or mediate. Even in the case of our appreciations of short intervals of time, as those dealt with in the experimental investigation of the time-sense, we apprehend the interval by help of certain sensations and other psychical factors which are present at the termination of the interval, and so assist in a retrospective, that is, mediate apprehension of the same. Similarly, in what has here been called a contemporaneous estimate of duration, the actual process is obviously a representative one, made up mainly of a retrospective estimate by means of the sensations and feelings referred to, supplemented by a prospective grasp of the interval yet remaining. What marks off this contemporaneous estimate from one that is purely retrospective or prospective is that we have here, at each successive formation of the estimate, to do with a (specious) present, and to measure closely adjacent time-lengths by the help of temporal signs in the shape of certain actual (muscular) sensations.

§ 25. *The Temporal Scheme.* Our complete representation of the time-order whether past or future is that of a succession

[1] For a fuller account of the variations in our subjective estimate of time or duration, see my volume, *Illusions*, chap. x. p. 239 ff., and chap. xi. p. 302 ff. *Cf.* Prof. W. James, *loc. cit.;* Wundt, *op. cit.*, ii. p. 354 f.

of experiences or events having a certain duration, and lying at certain distances or intervals one from another. In this way we represent the events of a particular week, the successive incidents of a tour, and so forth. This complex representation is only acquired after a considerable development of the power of reproduction and of reflexion. It involves, in addition to reproductions of individual experiences, a comparison of their order with that of others' experiences. A word or two must suffice to indicate the course of this development.

With respect to the temporal order of our experiences we are all aided greatly by certain conventional arrangements, more particularly the divisions of time into periods, as years, seasons of the year, months, weeks, days, and sub-divisions of these. This arrangement enables us to date any experience we are able to fix in our minds by attaching it to a particular division. Our common experiences are in this way ordered similarly in a common time-scheme. Thus, all members of a family come to think of an event of common interest, such as the migration into a new home, as having happened at a certain date. Such reproduction of past events in association with others greatly enlarges the individual's power of conserving the images of them, and of localising them in the past. The conjoint going back on past occurrences supplies new bonds of contiguous association. Thus, by recalling in common with others the circumstance that the migration occurred the year before another event, say a birth or a marriage in the family, we are able to fix the time-order of these events yet further by associating each with a corresponding symbol answering to its respective date.

Not only so, the formation of this common time-scheme enables the individual to retrace portions of his past which are only very imperfectly revivable. Thus he assigns a group of experiences which he can only dimly recall to a particular year or series of years. The serial order of our past, though based on contiguous association and the reproductive process, involves in addition a higher form of mental operation, *viz.*, constructive inference. Still higher processes enter into that complete representation of time which includes a recognition of duration and time-interval. As pointed out above, we do not clearly apprehend the duration of a series of events which completely absorbs attention at the time. But time has the peculiarity of admitting of parallel or contemporaneous experiences and series of experiences; and it is by noting this fact and by comparing different series and measuring one against another that the child learns to attribute a certain duration to every experience and chain of experiences alike. This comparison of his own experiences one with another is greatly aided by comparing them with those of other people. Thus a child apprehends that he has been at play an hour when he hears that another boy has been doing so much book-work while he has been playing.

This corrective process is completed in the case of all of us by a common reference to an "objective" standard of time, which answers to a constant (or approximately constant) time-experience of ourselves on different occasions and to a similar time-experience for ourselves and for others. Such a standard of reference seems to be found in movement and, more particularly, visible movement. A movement of perfectly uniform velocity from point to point of space serves to define time-length, inasmuch as the positions successively taken up by the moving body correspond to, and at once suggest a series of equi-distant points of time. And it is by help of a regular series of such uniform movements, *viz.*, those of the sun and of the mechanical appliances used to measure time, that our common 'objective' estimates of duration are carried out. In this way our space intuitions, though presupposing, as we have seen, a vague knowledge of time, serve in their turn to perfect the representation of the latter.[1]

The representation of the future is, of course, still less complete than that of the past. Here we have not even that fragment of a definite series of events which we have in the case of recalling a portion of our past life. Our future is only susceptible of a dim forecast. Yet, even here, the formation of the common time-scheme just referred to enables us to move forward in imagination through a succession of periods in which imperfectly representated changes of age, surroundings, occupation, and so forth, with the correlative changes of feeling, form the serial content.

[1] *Cf.* Herbert Spencer, *Principles of Psychology*, vol. ii. pt. vi. ch. xv. p. 267, etc.

The development of the time-representation here briefly described is closely connected with that of self-consciousness. It is only when the reproductive process is thus completed and systematised by the aid of the time-scheme that a child gains a clear idea of its experience as a continuous movement. And this idea is necessarily involved in the clear consciousness of itself as one and the same at successive times. Self-consciousness, in its higher and clearer form, as has commonly been recognised by psychologists, grows out of the memory of the past. It will be better, however, to postpone a fuller explanation of this process till we come to deal with the higher forms of intellectual operation.

The psychology of time has only received special attention at a comparatively recent date. In our own country, Locke, Reid, Brown and James Mill are the writers who have made the most important contributions to it. The tendency of English thought on the subject has been to regard the cognition of time as an immediate apprehension of a certain aspect or certain relations of our experience, which apprehension involves not merely sensation but reflexion, and so memory.

In contradistinction to this simple view of the time-consciousness there has been developed in Germany a psychological theory of time-construction. According to this view we do not find time immediately presented in our experience, but have to construct the idea of it. This construction follows the actual time-process, is itself an instantaneous act, not a process in time, and is carried out by means of a persisting group of psychical elements. This way of envisaging the subject seems to have had its origin in the Kantian doctrine that time is a subjective form contributed by the mind to the matter of its experience. It has been especially developed by Herbart and his followers.

The above account seeks to combine and reconcile these two ways of approaching the subject of time-consciousness. It has been allowed, in the first place (with the Germans), that the idea of time is a secondary consciousness, something over and above the mere time-process of experience, and involving a special reflexion upon this. On the other hand, it has been urged that the secondary consciousness is not, strictly speaking, an instantaneous act, but is itself *a process in time*. In other words, the cognition of time is only possible through and by means of a time-experience.[1]

[1] Since writing the above account I find that a young American psychologist, Mr. Herbert Nichols, has urged that all time-perception is a time-process, that is, an immediate experience and not a subsequent construction. His study on the subject contains a full historical *résumé* of previous views, and also an account of some interesting new experiments bearing out his own theory. (See *The American Journal of Psychology*, vols. iii. 4, and iv. 1.) On some of the chief theories of time-perception, see below, Appendix E.

OTHER FORMS OF SUGGESTION.

We have now completed our account of the reproductive process so far as the Law of Contiguous Association is concerned. As pointed out in our general account of association, this refers mainly, if not exclusively, to the integration of presentative elements which fall together in the time-order of our experience.

§ 26. *Suggestion of Similars.* At the same time, all suggestion does not take the form of revival by links of contiguity. When, for example, a photograph calls up an image of the original person or locality, or when a word in French or Italian calls up the parent word in Latin, the succession is commonly said to follow, not the (external) order of time, but the (internal) order of likeness or similarity. And from the age of Aristotle downward the Laws of Association have, by the majority of writers, included a special Law of Similarity. We have now to examine into the nature of this process of suggestion, and to define its relation to the process of contiguous suggestion already dealt with.

In the first place, then, we must distinguish this process of suggestion from that of automatic assimilation already considered. In order that there be the suggestion of one representation by another, they must, it is evident, be in a measure distinct. That is to say, the similarity in this case is incomplete. The portrait and the original, though similar in certain features or aspects, are dissimilar in others. Hence we have in this case a succession of partly dissimilar representations, or a distinct process of revival of one representation by an antecedent one. It may be marked off from Automatic (*i.e.*, coalescent) Assimilation as a process of Suggestive Assimilation.

This suggestion of a representation by its similar is immediate, and does not depend on a consciousness of the similarity. In many cases we are reminded by one face, one locality, one work of art, of another without being able at once to trace any similarity. Where the consciousness of similarity grows distinct it is as a subsequent process. It is evident, indeed, that the two like representations must be both present before the relation of similarity between them is clearly detected.[1]

§ 27. *Suggestion by Similarity not Association.* It is evident that we have here to do with a process apparently different from that of contiguous association. We have not, as in the last case, two psychical elements attached or bound together on the ground of their having been originally presented together, or having formed adjacent elements in the tissue of our experience. The present sight or sound that recalls the past similar sight or sound has never before been brought into any relation to this last. The whole ground of the suggestive process is here the fact of similarity. The relation between reviver and revived would, accordingly, in this case, have to be symbolised thus: $\begin{matrix}\mathrm{A}\\ \vert \\ a\end{matrix}$; or thus: $\begin{matrix}\mathrm{BAC}\\ \vert \\ kal\end{matrix}$, rather than thus: $\begin{matrix}\mathrm{A}\\ \vert \\ (a)-b\end{matrix}$, which form we found to be fitting in the case of contiguous cohesion.

It follows that the sole assignable ground of such assimilative revival is the functional activity of assimilation itself. We have to assume that presentations tend to reinstate previous ones which resemble them, whether as wholes or in certain of their constituents. The current physiological hypothesis respecting the supposed nervous concomitants of this assimilative revival has already been dealt with.[2]

It would seem as if these characteristics of assimilative revival, including the absence of any preceding connective process as found in the case of contiguous association, make the use of the word association inappropriate here. We may speak of the reciprocal suggestion of similars, or of the "attraction of similars," but not of association by similarity.[3]

[1] Brown would call this thought of the likeness Relative Suggestion, as distinguished from Simple Suggestion. (*Phil. of the Human Mind*, lect. xxxiii.) Mr. Bradley objects to the Law of Association of Similarity by supposing it to mean that there must be *a consciousness* of similarity before this can act as a suggestive force. (*Logic*, p. 294 f.) But this is a misapprehension of what is meant by Assimilation or revival of like by like. The reinstatement is one thing: the consciousness of likeness between that which reinstates and that which is reinstated, another.

[2] See above, p. 193.

[3] The objection to the use of the word association in this case has been dwelt on by Brown and others. See note on "Association" in Hamilton's Edition of Reid's Works. *Cf. Mind*, xii. p. 162.

A true process of association does, no doubt, take place in connexion with this assimilative suggestion, but only as its consequent, not as its antecedent. That is to say, when A recalls α, the two will henceforth be associated on the ground of their having now been present together. The effects of such assimilative integration will be traced out more fully by-and-by.

§ 28. *Nature of Assimilative Suggestion.* Let us now inquire a little more closely into the mode of working of this "Attraction of Similars" as it has been called. To begin with, then, since the attractive force resides in the fact of similarity, we may expect that it will vary with the amount of the similarity, and this is what we find. Where two presentations are closely similar, as in the case of two voices very like in timbre, there the tendency to revival will be strong. A number of common features in two objects is a known aid to assimilative revival. We identify a person after an interval of absence by a complex of similarities, as form, expressional movement, voice, and so forth. Speaking generally we may say that, according to the principle now dealt with, presentations tend to revive one another in the proportion in which likeness preponderates over difference.[1]

To complete the statement of the principle we must, as in the case of Contiguous Association, add the effect of certain characters of the separate presentations. Vivid past presentations, especially if recent ones, are more readily revived by similarity, just as they are more readily revived by contiguous association, than faint and partially effaced presentations. And lastly, the greater the impressiveness of a presentation, the greater will be its reviving force with respect to its similars. Thus the impression of a face or of a voice, when feeble and momentary, may fail to revive its like among past impressions, whereas when intensified or prolonged it may effect this result.[2]

The attraction of similars exerts a marked influence on the flow of our ideas. The sights and sounds that meet us tend now to revive contiguous adjuncts, now to suggest similar sights and sounds in our past experience. Where we fail to detect the presence of a link of contiguity connecting two successive

[1] The conditions which favour the detection of similarity and of difference respectively will be dealt with more fully hereafter.

[2] Prof. Bain regards the force of assimilative revival as having two main obstructions, *viz.*, concomitant diversity, and feebleness of present impression.

representations, a thread of connexion may often be found in some point of likeness. This action of similarity, moreover, being unlimited by time and circumstances, has a wide scope. It serves to connect not only sensations of the same class, but even disparate sensations. In what has been called the "analogy of feeling" we have an example of this far-reaching influence of similarity. This is illustrated in our current mode of describing the effects of colour in tone-language, and *vice versâ*, as when we speak of a "note" of colour, or the "tone" of a picture, or of the "rich colouring" of an orchestral accompaniment. We have classical authority for likening a trumpet note to a brilliant scarlet colour. The curious phenomenon known as 'coloured hearing' already referred to may be due in part to such an analogy of feeling.[1]

§ 29. *Assimilative Integration.* Although assimilative revival is not in itself a true process of association it gives rise to such. When a presentation KAM recalls another PAQ the immediate succession of the two in consciousness secures a certain amount of contiguous cohesion between them. We all know that after mentally bringing together, for example, two faces, and recognising their likeness, we tend to connect the two habitually. This effect of connecting similars brought together in consciousness may be marked off as assimilative integration.

Such assimilative integration plays a certain part in the acquisition of our concrete knowledge, and is a still more important factor in the building up of our thought-complexes, *viz.*, general notions and judgments. The latter of these effects will have to be considered later on. A word or two may here be added on the former.

When we say that learning is assimilation we mean that it takes place largely by help of assimilative suggestion. Thus, in learning the German word Vogel we are apt to recall fowl, and by thus attaching the new to the old acquisition by a link of likeness we greatly expedite the process of retention. The new and strange fact becomes incorporated with familiar facts, and acquires something of the interest of these. Thus the hard repellent-looking foreign word takes on a friendly mien when assimilated to some homely vocable; the dry his-

[1] *Cf.* above, p. 136.

torical fact becomes vivid and striking when brought into analogy with some interesting fact of the present day, and so forth. Hence a firm integration of the two; and, as a result of this, a strong retention of the new fact.

While the binding force of similarity thus aids memory-work in certain directions, it is apt to interfere with a distinct picturing of past events in their concrete fulness and complexity. Every approximation of two images, not connected by contiguity, serves to loosen them from their proper connexions of time. Hence a mind strongly impressed by resemblances is liable to become confused in its recollections. Thus, by connecting two words or two places because of their resemblance, we are apt to transfer some of the (unlike) features or accompaniments of the one to the other. In this way, as we shall see more fully presently, the process of assimilative suggestion tends of itself to bring about a certain transformation of our ideal formations. In addition to this, it must be remembered that by going on connecting two objects, as two faces, by a link of likeness we are beginning to form a typical image which is equally representative of each of them. And this is a germ of the process of generalising which belongs to the operations of the understanding to be considered by-and-by.

It follows that the 'attraction of similars' may oppose the revival of distinct mental pictures, and to this extent be unfavourable to the development of a good pictorial memory. *En revanche*, it subserves the growth of another kind of memory, that which is known as the 'philosophical' or which might perhaps be better called the scientific. The binding force of similarity leads to that grouping or arranging of particular facts which prepares the way for the processes of thought; and, after these have been performed, to the connecting of facts with the principles of which they are the illustrations.

§ 30. *Relation of Suggestion by Similarity to Contiguous Suggestion.* We have thus far marked off, as sharply as possible, suggestion by similarity from suggestion by contiguity; and this on the ground already pointed out, that they answer to two perfectly distinct directions of the reproductive process. The latter, as we have seen, tends to a reinstatement of experiential wholes, or time-connected aggregates, in other words, to a reproduction along with each presentative element of its experiential context. The former, on the other hand, brings together elements of experience not necessarily connected in time at all, but lying, it may be, very remote in the time-order. Or, to express the contrast in another way, we may say that associative (contiguous) reproduction is *externally* conditioned, *viz.*, by the time-proximity of the original presentations, whereas assimilative reproduction is *internally* conditioned by the psychological (or psycho-physical) relations of the presentations.

At the same time, it follows from what was said in a previous chapter on the unity of the elaborative process as a whole, that the two modes of reproduction are mutually implicated. All contiguous suggestion, as we there saw, begins with a process of automatic assimilation. When the sight of a flower recalls an odour, a particular locality, or a romantic experience, it is because this visual presentation is assimilated to one or more like previous ones. On the other hand, as already pointed out, similarity is never the only reviving circumstance. When, for example, one face recalls another similar one, the revival is assimilative only so far as certain like or common features of the two objects are concerned. All that is revived beyond this, the unlike concomitants of expression, figure, dress, habitation, and so forth, is the work of contiguity.

The symbolic representation of the assimilative element in contiguous reproduction was given above (p. 196). The co-operation of contiguous suggestion in what is commonly called the revival of similars may be symbolised thus:—

$$\begin{array}{ccccc} A, & X, & B, & K, & \text{etc.} \\ & | & & & \\ p— & x,—m,—r,—e, & & & \text{etc.,} \end{array}$$

where the group of capitals stands for the reviving presentation-complex, and that of the small letters for the revived images. Here the assimilative part of the process is expressed by the letters $\begin{matrix} X \\ | \\ x \end{matrix}$;[1] while the other and contiguous part of the reproduction, or associative revival proper, is indicated by the smaller letters and their connecting lines.

Yet while both compounded of the same elements, *viz.*, assimilation and associative revival proper, the two operations commonly described as suggestion by contiguity and by similarity are, in general, readily distinguishable. In what is called contiguous suggestion the assimilative step in the process, being automatic and instantaneous, is slurred over and lost sight of, the associative revival of concomitant elements being the main part of the process. These concomitants, moreover, are kept distinct from the reviving presentation. On the other hand, in assimilative suggestion the process of assimilation is the conspicuous part of the whole operation. Here we have one whole followed by and suggesting another whole, the sequence having (in most cases, at least) as its clearly differentiating circumstance the peculiar consciousness of likeness. In some cases, indeed, the assimilative step constitutes the main part, as in that common type of experience in which a presentation reminds us of another like one, though we are unable to reinstate the circumstances (time, locality, etc.) of this last. The difference in the two operations may be symbolised thus:—

[1] To meet the case of the imperfect similarity of X and x, it would be necessary to use letters not regarded as identical, say B and the Greek β. (*Cf.* above, p. 179.)

Contiguous Suggestion,	$\begin{array}{c} \text{A} \\ \mid \\ (a)\text{—}\pi\text{, etc.} \end{array}$	Assimilative Suggestion,	$\begin{array}{c} \overparen{\text{C A D}}\text{, etc.} \\ \mid \\ \overparen{m\text{-}a\text{-}k}\text{, etc.} \end{array}$[1]

§ 31. *Suggestion by Contrast.* In addition to that of similarity another principle of suggestion known as Contrast is commonly laid down. By this is meant that one impression or presentation tends to call up the image of its opposite or contrast. Thus it is said that black suggests white, poverty makes us think of wealth, a flat country reminds us of a mountainous, and so forth.

It is, however, extremely doubtful whether contrast as such constitutes a bond of attraction among representations. On the contrary, it would rather appear that contrast between two representations, merely as such, leads to an opposition and a mutual hindrance. In the play of conflicting suggestive tendencies, to be spoken of presently, it will be found that presentations tend to exclude the simultaneous rise of all unlike, and therefore all contrasting presentations.

Suggestion by contrast, so far as it is a fact, seems to owe its force mainly to the circumstance that all knowledge of things begins with that crude form of discrimination which consists in marking off broad differences or contrasts, such as bitter and sweet, and more particularly those involved in such correlative pairs as rich and poor, heavy and light, tall and short.[2] Not only does the mother or teacher begin to instruct the child by pointing out these contrasts to him, he spontaneously brings one thing into contrast with another, or views it in that relation, as when he says, 'This is a hot plate, this is not a cold plate'. This initial bringing together of contrasting presentations for purposes of cognition is aided by the common forms of language which serve for a like reason to connect opposite qualities. In this way, contrasting ideas do, undoubtedly, become associated, but only as the result of conjoint presentation,

[1] On the relation of the two so-called 'Laws of Association' Contiguity and Similarity, see Bain, *The Senses and the Intellect*, chap. ii. § 2; J. Ward, *loc. cit.*, p. 60; and. W. James, *op. cit.*, p. 578 ff., and p. 590. *Cf.* Rabier, *Leçons de Philosophie*, chap. xvi., and A. Lehmann, *Phil. Studien*, v. p. 96 ff. See below, Appendix D, ii.

[2] See above, p. 178.

i.e., contiguous association. Hence the facility of transition from the sight of a calm sea to that of a rough, and so forth.

This intellectual association of contrasting presentations and ideas is further aided by a special feeling of interest in the relation. To see a bright and a dark colour, or a large and a small object, in juxtaposition is, as we have seen, impressive, and serves to excite attention to the two, and so to connect them by a contiguous bond. This interest of contrast is still more conspicuous in the case of all those presentations and representations which are strongly coloured by a concomitant of feeling. As we shall see, contrast is a great intensifier of feeling in general. We gain a more vivid impression of poverty when we contrast it with wealth, and of virtue when we contrast it with vice. Hence the popular disposition to note contrasts in life, the transitions from grief to joy, from sickness to health, and so forth. Hence, further, the large use of contrast in poetry and in art generally. The heightened interest thus awakened tends still more strongly to cement contrasting ideas (according to the Law of Contiguity) and so to add to their mutually suggestive force.

That contrast is not an independent principle of suggestion is commonly allowed. Its action is explicable as a special mode of contiguous association. It is added by some psychologists, *e.g.*, Drobisch and Prof. Bain, that suggestion by contrast illustrates the force of similarity, since two contrasting representations, *e.g.*, hot—cold, tall—short, imply a difference in respect of one and the same quality or aspect (temperature, height).[1] Yet this effect, even if present in any case, must be very subordinate and narrowly circumscribed. Contrast is a case of extreme difference or dissimilarity; and, so long as we are interested in a relation of contrast, there is no room for any consciousness of similarity. Such an action of similarity, moreover, if it were present, would be very limited. Where there are but two unlike modes of a sensation, as illustrated in the case of hot and cold, rough and smooth, similarity (as homogeneity) might favour, on the recurrence of one, the reinstatement of the other. But where, as in the case of colours, we have a considerable variety of modes with unequal degrees of dissimilarity be-

[1] Drobisch goes so far as to say that, in all cases of suggestion by contrast, the suggestive force resides in the likeness, and not in the contrast. He illustrates this by saying that when a drawing of a group of laughing faces reminds us of another of a group of weeping faces previously seen, the revival "takes place manifestly only through the similarity of the faces in their juxtaposition". (*Empirische Psychologie*, § 32, p. 85.) This, however, is evidently not a case of mere contrast, but a mixed case of contrast and similarity, in which, moreover, the similarity preponderates over the dissimilarity. Many cases of so-called contrast are, strictly speaking, of this mixed type.

tween them, homogeneity, if at work at all, would tend to exclude the revival of the opposite. Thus green would never revive its complementary purple red, rather than some other and nearer colour, merely by reason of their both being colours.

It follows from our analysis that contrast plays a subordinate part in retention and reproduction. Its chief function in connexion with these processes is to intensify attention to certain juxtapositions of presentative elements, and so to secure a firmer hold on these. Such juxtapositions, interesting us in a number of ways by their pathos, their sublimity, their incongruity, and so forth, meet us in the collocations of objects in space, the proximities of events in time, the conjunctions of qualities that make up an individual character, and so forth. And thus the possession of a keen eye for contrast may greatly facilitate the formation of contiguous attachments.[1]

§ 32. *Simple and Complex Suggestion.* So far we have been confining ourselves in the main to the process of suggestion as a simple operation. That is to say, we have supposed that a particular presentation A, has a connexion with only one other presentation, say *a*, or *b*, and tends consequently to suggest this last exclusively. But a little consideration will show us that this is, strictly speaking, never the case. If we confine ourselves to the process of association proper, *viz.*, contiguous integration, we see that a presentative element is never given with only one concomitant element. Every impression that reaches us has contiguous relations to other impressions of the time (simultaneous, antecedent, and consequent), including all the organic sensations, feelings, and other states of the moment. Since, moreover, the same (*i.e.*, approximately indistinguishable) presentations recur at different times and with different concomitants the variety and range of association and suggestive tendency are still more enlarged. The odour of a violet, the sound of a friend's voice, a particular word in common use, come in this way to enter as a common factor into a large variety of connected wholes.

The psycho-physical process of associative integration is here analogous to the weaving of an intricate net-work, in which each element forms a knot connected by a variety of threads with other similar knots. Following the common physiological

[1] On the history of the Laws of Association, see below, Appendix D, ii.

hypothesis we may suppose, indeed, that the several clusters of central nervous elements answering to different presentations do in this way become mutually attached by numerous radiating fibrous connexions.

If, now, to this varied play of contiguous association we add the suggestive tendencies of similarity, we shall materially increase the complexity of the process. A given presentation, say a particular pose or voice-inflexion in an actor, may thus connect itself not only with many separate concomitants, locality, temporal circumstances, etc., but also with a number of like presentations, *viz.*, previous perceptions of a similar pose and tone in the same or in other actors. And through these last, moreover, new and manifold directions of contiguous association will be opened up corresponding to the particular concomitants of each of these previous presentations.

This fact of the complexity of the suggestive process may be viewed under two distinct aspects, or in respect of two distinct effects.

§ 33. *Divergent Suggestion.* The first and most obvious result of this intricate reticular arrangement of our presentative elements is that no presentation is suggestive in one direction only. In other words, all presentations exert a tendency to a multiform or divergent mode of suggestion. Thus, the sight of a familiar room, or the sound of a familiar name, tends to call up a number of images. Since these cannot all be revived together, there results a conflict of suggestive tendencies.

If, now, in this conflict one suggestive tendency greatly preponderates over the others in strength the conflict is at once resolved: the more potent suggestive tendency inhibits the rival tendencies. Thus, in learning the meaning of a word, a child comes, after sufficient repetition, to recall in connexion with it only the constant associate, *viz.*, the idea, and no longer the variable accidental accompaniments, answering to particular applications and varying contexts. In like manner, in all our generalising as to relations of cause and effect, and so forth, the regular recurrence in all cases of the constant or uniform concomitant tends to the instantaneous suggestion of this, and the consequent repression of other and weaker suggestive tendencies answering to accidental conjunctions.

If, on the other hand, there is no marked preponderance of one suggestive tendency there may ensue a confused state of mind owing to the partial or sub-conscious revival of a number of disconnected representations. This state of mind may easily be realised when we are asked a question of the form: "What does this face, this word remind you of?" In most cases, however, this confusion is but momentary, some one tendency proving itself stronger than the rest.[1]

§ 34. *Convergent Suggestion.* This brings us to the second effect of the complexity here dealt with. The process of reproduction is never, strictly speaking, brought about by a single presentative element. As pointed out above, our presentations are complex. Thus, the presence of a person announces itself by a highly complex group of visual and auditory impressions, any one of which may assist in reproducing some presentation associated with the person. All reinstatement of a past presentation is the cumulative effect of a number of such co-operant suggestive forces. The well-known effect of the sight of a locality in recalling a past experience is, in reality, compound, resulting from the suggestive tendencies of a whole complex of impressions. This co-operation of suggestive tendencies in reinstating a particular presentation may be described as Convergent Suggestion.

The process of convergent suggestion assumes a peculiar form in the case of the composite trains already spoken of. When a child learns to repeat a poem from memory we see a number of co-operant tendencies at work. Thus, a given word-sound W^1 tends to revive the proximate member of the sound-series W^2. At the same time, it will revive the correlative idea I^1, and this last will co-operate as a new suggestive factor, tending to revive the connected idea I^2. In this way, as we know, a child recalls the next word, now by the sound-cohesion, now by the help of the ideal connexion as well. Not only so, in recalling a series of such ideo-verbal complexes, the revival of a particular member of the train is not the mere result of the suggestive force of its immediate predecessor, but is a resultant of the sum of suggestive tendencies of the whole

[1] This is fully illustrated in the experimental inquiries already referred to (p. 305) in which a subject is asked to record the first idea suggested by a word. Here, however, it is evident the very conditions of the inquiry impose on the subject the necessity of resolving this conflict as soon as possible.

string of preceding words. Only in this way can we account for the fact that a train which has members common to it and many other trains reproduces itself so correctly.[1] Just as contiguous reproduction is thus commonly a complex process, so is assimilative suggestion. In identifying a person, for example, after a long interval, the revival of the image is a process occupying an appreciable time, and illustrating a like cumulative operation. This particular movement of the features, this tone of the voice, and so forth, adds something to the forces at work, till they are adequate to the reinstatement.[2]

Finally, it is to be noted that the two processes of assimilative and contiguous suggestion may combine in effecting the revival of an image or image-complex. As pointed out before, contiguous suggestion always includes an assimilative factor; and as soon as this latter element grows distinct we have a recognisable case of co-operant similarity and contiguity. This is exemplified in that common form of operation called variously the recognition, the classification, or, by Herbart and his followers, the apperception of an object. Thus, in recognising a person or a place after a considerable interval of non-observation, the process frequently commences with a revival by assimilative suggestion of a vague typical outline of the original, which outline gets filled in with details gradually or suddenly by contiguous suggestion. In this way, I myself often recognise a person whom I have met before by first of all classifying him as a member of a particular profession, or an inhabitant of a particular locality, and only later (if at all) by identifying him as a particular individual with its cluster of determining associates. In like manner, I frequently recall names, lines of poetry, and tunes by first of all bringing them assimilatively under a shadowy typical form or scheme answering to the number and the rhythmical arrangement of the sounds, and then following out contiguously the several details (letters, words, tones).

From this classificatory or apperceptional reproduction there

[1] See above, p. 314 f.; *cf.* W. James, *op. cit.*, i. p. 567.

[2] A like cumulative effect may now and again be detected in the erroneous recollections arising from the play of similarity. Thus, I once had occasion to send a friend the name, Dr. Jenner. Three weeks after he wrote and asked me whether the name I had sent him was not Dr. Ferrier.

is but a step to that combination of assimilative and contiguous suggestion which enters into the mental operations known as constructions, operations to be examined at greater length in the next chapter. It may be illustrated by the imaginative filling up of the idea of an extinct animal from an observation of its skeleton. The general form of this complex reproductive process is as follows : Certain elements, A, B, are given, which have to be supplied by a fitting concomitant or escort, say *c*, *d*, *e*, *f*. This is effected by recalling, through assimilative reproduction, a model typical arrangement, which may be symbolised as *A*,*B*,*C*, etc. The particular representative elements, *c*, *d*, etc., are, in this case, not the direct outcome of contiguous suggestion : the missing portion of this particular animal has, we may suppose, never been seen in reality or in picture. What happens here is a modification of contiguously suggested ideas so as to make, with the given elements, A, B, a congruent group, that is, a group which is seen as a group to resemble the model group or typical plan. A child's first essays in using his mother tongue are an illustration of much the same process. The particular words used are revived by contiguous suggestion, the arrangement and the modifications introduced are due to the workings of "analogy," that is, to the more or less distinct recalling of model arrangements previously heard and used.[1]

Besides these combinations of assimilation and contiguous suggestion which constitute connected intellectual processes, there are others of a looser and a more accidental kind. Thus, in recalling a person's name, contiguous suggestion is frequently aided by the assimilative force of another like name which we happen to be thinking of at the moment.[2] Still more plainly is this fortuitous co-operation illustrated in the common case in which a speaker or a writer gets his current of ideation directed

[1] On the nature of this somewhat complex process, see G. F. Stout, *Mind*, xvi. p. 50 ff. The writer argues that such cases cannot be brought under the rubric of ordinary suggestion. So far as the reproductive part of the process is concerned, it seems to be a plain illustration of contiguous and assimilative revival. What differentiates it from a mere process of reproduction is, of course, the work of selection or modification which enters into what we call construction, and is never wholly absent even in the case of rapid speech.

[2] In most cases, of course, the similar name is revived as an incident in the operation of recalling the right name.

to a particular simile by the aid of the contiguous promptings of the locality and surroundings of the moment. The similes of Wordsworth, hardly less than his descriptions, are a key to the kind of locality and scenery which he frequented. Recency or anterior proximity in time often takes the place of a present circumstance in such cases, as where Scott makes Dr. Dummerar, just after he has been playing a game of bowls, moralise on the uncertainty of human events by help of the simile of a man who aims directly at the jack (forgetting the fact of the ball's bias). (*Peveril of the Peak*, chap. viii.)

§ 35. *Reproduction as a Resultant of a Sum of Tendencies.* If, now, we combine what has been said respecting the frequent co-operation of a number of suggestive stimuli with what was said above on the action of the varying strength of the psychophysical tendencies to revival, due to the greater energy of the original impression or series of impressions, and to recency of impression, we shall see that the actual working of the reproductive mechanism is exceedingly complex, and widely variable from moment to moment. Every reproduction of an image or image-group is a resultant of a system of psychophysical forces, partly stimulatory, and partly inhibitory, acting at the moment. Speaking physiologically, we may say that a certain group of cortical elements, as ABC, is played upon by a number of forces exciting it to its characteristic psychophysical function, while, at the same time, other groups, as FGH, PQR, are also stimulated, and this simultaneous stimulation tends to inhibit the action of the group ABC. Whether ABC is excited to the pitch required for a conscious psychical concomitant will depend partly on the comparative strength of the stimuli acting on this and the rival groups, partly on the comparative strength of the pre-existing tendencies of this and the other group to take on the required functional activity.

It follows that our ideational successions betray a high degree of variability from moment to moment. Thus, Wahle relates that the Gothic Rathhaus near his home failed to suggest the idea of the Doge's palace at Venice, as it might well have done through certain architectural resemblances, till a particular day when it brought up the image with great clearness. The explanation of this particular reproduction was that two hours before he had seen a lady's brooch in the form of a beauteous gondola.[1] A like phenomenon shows itself in the difference in readiness of reproduction of a French or German word when we are called on to give it at home, and after spending a week or two in the country where the language is spoken. In the latter case the tendency to revival has been strengthened by the whole experience of hearing and speaking other words bound up with this one in a particular associative group or system.

The co-operation of the tendencies to revival in the process of reproduction is marked off by the Herbartians as the effect of apperceptive systems. Thus, we speak French or German with so much greater ease when in the country because the apperceptive-system is specially active. A somewhat similar idea of "Systematic Association" has recently been developed by M. Paulhan. So far as this idea involves the sub-liminal persistence of ideas it must be rejected as unscientific. The process of reproduction is precisely that part of our mental life which derives most help from a consideration of the neural factor. It may be further objected that the idea of such separate systems appears to receive no support in the known facts of cerebral physiology, and, viewed from a psychological point of view, seems to needlessly complicate the processes of suggestion. These can all be accounted for by help of the law of (Contiguous) Association and of Suggestion by Similarity working under the varying conditions already referred to, *viz.*, unequal tendency to revival in the case of this, that, and the other idea, and the mutual inhibition of simultaneous ideational excitations.[2]

§ 36. *Active Factor in Reproduction: Recollection.* We have thus far considered the process of reproduction purely as a passive and mechanical one. That is to say, we have supposed that the several suggestive tendencies do their work without

[1] See his article, "Beschreibung und Eintheilung der Ideeassociationen," *Vierteljahrschrift f. wiss. Phil.* 1885, quoted by Ziehen, *Leitfaden der physiol. Psychologie*, p. 119. Ziehen names this factor in reproduction "Constellation".

[2] On the meaning of such apperceptive systems, see a paper on "Apperception and the Movement of Attention," by G. F. Stout, *Mind*, xvi. p. 28 ff.; M. Paulhan's views are to be found in his treatise, *L'Activité mentale et les Lois de l'Esprit.* That the figure of a closed system is inappropriate here seems to be illustrated by the following experience. On my first visit to Norway when trying to speak the language I found myself again and again reproducing Italian words. The explanation of this revival of widely dissimilar sounds, rather than, say, those of the similar German, is, I think, to be found in the circumstance that Italian was the last foreign language which I had had occasion to learn to speak in the country. The new situation brought back the whole mental state of the old one (which had occurred some years before), including the peculiar complex of feelings, and this action of similarity served to reinstate the concomitants of the revived psychosis, *viz.*, the particular articulatory movements corresponding to Italian words.

any conscious active co-operation on our part. And this purely automatic reinstatement of images does undoubtedly occur. We all know what it is to have an idea revived suddenly and forcibly without our actively contributing to the result. The rapid and vivid reinstatements effected by locality illustrate such passive reproduction. In our idle moments, in dreamy contemplation of natural objects, and in twilight reverie, we seem to be merely the sport of suggestive forces, our thoughts being led hither and thither without any exertion of our own.

In this passive process of reproduction the particular sequence followed at any time will be the resultant of all the forces of revival then acting. The whole aggregate of the actual sensations of the time, including all that is peculiar and striking in the bodily sensations, *e.g.*, those arising from a recumbent posture, aided by the after-images of recent events, will constitute so many distinct starting points, and thus give rise to a complex process of suggestion. What particular images are actually revived will depend on the conditions already named, *viz.*, the relative strength of the suggestive action of the presentations, and also of the inherent tendencies of the various images thus attracted to reinstate themselves. The frequent incursion of new and disconnected impressions, starting fresh trains of images, as well as the co-operation of similarity with contiguity, will serve to give to such a purely passive flow of images the appearance of a disorderly chaotic succession.

Such a purely passive process of reproduction is, however, rare. In most, if not in all, cases an effort of attention enters into the stage of reproduction, as into the stage of acquisition. This actively controlled process of reproduction is best marked off as Recollection. We have now to inquire into the nature of the process as thus further complicated. Without attempting as yet to account for the action of attention itself as the result of willing or volition, we may inquire into the way in which attention interferes with and modifies the mechanical processes of reproduction as just considered.

The distinction between merely passive and active reproduction is reflected in most languages. The differentiation of μνήμη and ἀνάμνησις begun by Plato, and carried further by Aristotle, turns on this point of difference. So in modern German the two words Gedächtniss and Erinnerung (*cf.* the French memoir and souvenir) are commonly defined so as to illustrate this distinction. Hamilton, following Latin writers, suggests the expression Reminiscence as marking off active reproduction (*Lectures on Met.* ii. 247); but the term Recollection seems to answer the purpose better.[1]

To begin with, then, the action of attention does not effect a reinstatement of an image independently of the forces of suggestion. All that it can do is to modify this action in various ways, and to aid in the realisation of certain of these tendencies rather than of others.

(*a*) *Fixation of Ideas.* The first thing possible here is the direction of attention to a representation partially revived, or sub-consciously present. In many cases we half recover an image, *e.g.*, of a face, by help of certain suggestive forces. Here, when special interest is developed, we may actively supplement the work of revival by a direction of the attention to the sub-conscious image, and, by fixing this, increase its vividness and distinctness.

This furthering of the rise of an idea commonly has for its physiological concomitant, in addition to the muscular and vaso-motor factors spoken of above, the innervation of the articulatory organ. As pointed out before, our ideas are, in the large majority of cases, called up in connexion with words. These words, moreover, have a marked muscular factor. To imagine a word is to have it "on our tongue," *i.e.*, to have the articulatory apparatus partially excited as in actually uttering it. Vivid attention to ideas appears to be aided by a strengthening of this muscular element.[2]

[1] At the same time, there is no perfect agreement as to the differential definitions of the terms. Thus Aristotle's distinction (ἀνάμνησις) turns in part on the mediate, *i.e.*, the suggestive mode of the revival. (See Hamilton's edition of Reid, note D, xx. p. 892.) Similarly Volkmann makes the distinction of Gedächtniss and Erinnerung coincide with that between immediate and mediate reproduction (*op. cit.*, i. § 83); and, later on, seems to say that Erinnerung refers specially to memory of events or complete reproduction of temporal circumstances (p. 464, Anmerkung 2). Wundt defines Erinnerung similarly (*op. cit.*, ii. 396). Common usage, too, seems to emphasise in the words recollect, sich erinnern, se souvenir, etc., now the activity, now the completeness of the reproductive process, *i.e.*, temporal reference or localisation. All this suggests that a complete reinstatement always depends on a more or less prolonged *active* process.

[2] What may be the exact aid rendered by the verbal motor element in reproduction as a whole is a disputed point. Thus, according to Stumpf, the innervation of the vocal apparatus seems to play a much smaller part in the distinct reproduction of tones than has been supposed, *e.g.*, by Lotze and Stricker. (See his *Tonpsychologie*, i. p. 153 ff.)

It is to be noted that such co-operation of attention in reproduction is nearly always present in some degree. Even in comparatively passive processes of revival certain ideas attain to full distinctness rather than others because of the feeling of interest which they awaken. The sub-conscious representation starts a current of feeling, and this feeling calls forth a reactive process, though it may be so rapid as to escape observation.[1]

(*b*) *Control of Suggestive Forces.* In the second place, by holding certain presentative and representative elements before the mind and excluding others, attention helps to determine the particular directions of revival. Thus, by an effort of attention we may keep before us the several reviving factors in convergent suggestion, and so materially further the operation. On the other hand, we may, by the inhibitory action of attention, work against all divergent suggestion, or, as it has been called in this connexion, 'Obstructive Association,' and so exclude all irrelevant suggestions. In this way we may actively and voluntarily regulate the whole process of reproduction, and secure the realisation of a particular result.

All such regulation of the reproductive process obviously presupposes that we have some previous knowledge of what idea we want, and where (that is, in connexion with what other ideas) we are to look for it. In other words, we know when the right image is reinstated because we *recognise* it as answering in its structure and its connexions to a preceding sub-conscious idea. It follows that the whole process of search for an idea is a transition from a vague sub-conscious mode of representation, a sort of dim presentiment, to a complete and clearly conscious mode of representation. And the feeling of satisfaction which accompanies the full reinstatement of the idea or idea-complex arises from the identification of this with the partially developed representation that has been present throughout the process.[2]

If, as is reasonable, we assume that the sub-conscious stage is correlated with an incipient half-formed nervous process, we may say that the concentration

[1] On this subtle action of interest and selective attention, see Shadworth Hodgson, *Space and Time*, p. 267 ff.

[2] The reader should compare this form of recognition with that which occurs when a presentation is assimilated by help of a sub-conscious representation or complex of representations (see above, p. 285 f.).

of attention in this case in one direction secures the prolonged action of a particular cluster of nervous elements, so that this action reaches the intensity and completeness which are necessary for a full conscious revival. Such furtherance and completion of a partially renewed nervous process may readily be supposed to produce an agreeable effect, whereas a conflicting or inhibitory process would produce the contrary. That this controlling action on certain parts of the nervous mechanism is involved in active reproduction is illustrated in the common experience that, after trying for some time, and apparently in vain, to recall a name, this seems to reinstate itself *after an interval.* The explanation seems to be that we set going nervous currents which afterwards, without any further intervention of consciousness, secure the result we desired.[1]

This controlling or steadying action of attention is seen in all processes of reproduction that we are in the habit of calling recollections. Thus it takes place in the recalling of something learnt by heart, as a poem. Here the child must steady the operation by an effort of attention, or, owing to the divergent suggestions of the several words, he will go off the track, and confuse one verse with another, and so forth.

Still more plainly is this regulative control seen in the common experience of 'trying to remember' something, as a person's name, a process well described by Aristotle by the metaphor of hunting for a forgotten fact (*θήρευσις*). Here we note a severer effort of concentration involving a more prolonged fixation of the reviving elements. The selective and inhibitory (or exclusive) function becomes more conspicuous in this case, assuming the form of a seeking out and fixating all relevant ideas likely to aid in the process, such as the image of the person, that of some other name known to be like, or that of the initial sound of the name, and, on the other hand, of a resolute and rapid repression (by withdrawal of the attention) of all divergent or obstructive suggestion.[2]

This control of the reproductive processes assumes a yet higher form in that lengthy and far-reaching operation by which we overhaul, so to speak, the stores of memory in search of an idea or group of ideas of a particular kind or type. This

[1] On the physiological process involved in this active reproduction, see Maudsley, *Mental Physiology*, pp. 519, 520; and W. James, *op. cit.*, i. p. 583 ff.

[2] The reason why we frequently recover the initial sound of a word first is probably that being the first it is the most striking part of the word, and also perhaps that it is the first part of the complex sound-series which is immediately connected (by contiguous association) with the image which revives it. At the same time, we sometimes recall a name by recovering the final sound first. Binet gives a curious example of this in his *Psychologie du Raissonnement*, p. 114.

is illustrated in such common experiences as trying to find a second case analogous to a present one, to recall some illustration of a principle, and so forth. It is carried to its highest perfection in the search of the poet for his similes, and of the scientific man for an illuminating idea. Such a ready command of images by voluntary attention presupposes that there has been previously an orderly arrangement of the psychical material, that when new acquisitions were made these were linked on (by contiguity and similarity) to old acquisitions. It is only when there has been the full co-operation of attention in this earlier or acquisitive stage that there will be a ready command of the materials gained in the later stage of reproduction.[1]

§ 37. *Perfect and Imperfect Recollection.* Our ability at any given time to recall the impressions of the past varies indefinitely from total inability up to the point at which all sense of effort vanishes and the reproduction is certain and instantaneous. At one extreme we have, apparently at least, total forgetfulness or obliviscence; at the other, perfect recollection; while, as an intermediate condition, we have partial, that is, temporary forgetfulness of greater or less persistence.

Our perfect recollections at any time embrace but a very few of our acquisitions. The conditions of such facile recall are too complex to allow of its realisation in the large majority of cases. A sufficiency of interest and of repetition, together with firm association with what is near at hand and so supplies a starting point in the process of recovery, are all necessary to this result. What we can recollect instantly, and without conscious effort, is either included in, or firmly attached to, our permanent surroundings, dominant interests, and habitual pursuits. Thus we can at any time recall without effort the scenery of our homes, or place of business, the sound of our friends' voices, the knowledge we habitually revert to and apply in our daily actions, our profession, and our amusements.

Next to this perfect recollection comes that which involves a greater effort, and is less uniform and certain. This applies to a good many of our acquisitions which have been firmly

[1] The whole process of active reproduction or voluntary as distinguished from spontaneous Redintegration is well described by Mr. Shadworth Hodgson, *Time and Space*, chaps. v. and vi., and *Theory of Practice*, bk. i. chap. iii.

built up at the outset, but to which we have of late had little occasion to go back. Our knowledge of even the more striking events of the remote past, much of the book knowledge acquired at school, and not turned to practical account in later life, as that of the classics, is an illustration of such imperfect recollection. These acquisitions cannot be recalled at once, but their revival requires a prolonged process of suggestion, in which a number of forces have to co-operate.

§ 38. *Forgetfulness.* This failure of recollection leads on to the subject of forgetfulness or obliviscence. By this is meant the undoing of the acquisitive or retentive process. Forgetfulness implies as its correlative that an impression or group of impressions has been acquired and retained at least for a short time. Thus while we do not speak of forgetting sensations when they gradually sink and disappear, we do speak of forgetfulness in the case of temporary acquisitions, as names, or verses, that we have retained for a short time. Recent experiments have shown that such temporary acquisitions persist in a measure much longer than is commonly supposed.

Reference is here made to the interesting experiments of Ebbinghaus in determining the saving of labour in committing a series of nonsense syllables to memory by previous acquisitions. Among other results he found that the process of forgetting is very rapid up to about eight hours. After that it gets slower. And even after a month, when the subject would say he had wholly forgotten the line, it was found that the impression still preserves about one-fourth of its original strength.[1]

The forgetting or casting off of a large part of our temporary acquisitions is a fact of great psychological importance. We appear to have the power by intense concentration for short periods of building up psycho-physical arrangements which afterwards, when the effort is relaxed, become disintegrated of themselves. The utility of this power is obvious. If we could not dismiss a "got-up" subject of examination, of professional interest, and so forth, when it is done with, our mind would be encumbered, and our brain-powers far more narrowly limited than they now are. Cramming, as has been pointed out by Jevons and others, has thus a value of its own. Wherever the matter acquired is merely of temporary interest the power of casting off is a clear advantage. And this condition holds good

[1] See *op. cit.*, p. 103 ff.

in the case of a large part of the ideas which pass into our mind from day to day, from the temporary circumstances of life, from conversation with others, from the newspaper, and so forth.[1]

Leaving such temporary retentions and coming to more permanent acquisitions we find that forgetfulness manifests itself in close connexion with the processes of active reproduction considered above. Since we only know that an impression is retained by the fact or the possibility of its revival, and since the full action of the forces of revival is only secured when we actively assist in the process, we naturally come to make recollection the test of retention. In other words, that is retained which we can recollect: that which we cannot recollect when we try to do so is regarded as forgotten or lost.

Forgetfulness, as thus understood, appears in two forms. Of these the first is the comparatively unimportant form of partial or temporary forgetfulness, and the second the more momentous form of seemingly complete or permanent obliviscence.

Temporary forgetfulness has just been illustrated in the case of disused school-lore. We may still retain a part of this knowledge, only the recalling of it requires the co-operation of certain reinstating conditions, *e.g.*, in the case of a modern language, a day or two's sojourn in the country where this is spoken.[2]

Such partial or temporary forgetfulness suggests that at any time the sense-impressions and related thoughts which then specially interest us and occupy our attention serve to crowd out the images and ideas which are not of present interest. The field of distinct consciousness has a very limited area, and there is a continual opposition between different and disconnected masses or aggregates of presentations and representations, each tending to expel the other from the region of clear consciousness. This antagonism and rivalry between different mental aggregates shows itself very plainly in the tendency of presentations and representations to exclude one another, and more particularly of the former to exclude the latter. Illustrations of this exclusion will occur to the reader at once. The sensations of light and sound which greet the mind on waking at once extrude the but recently vivid images of sleep. On the other hand, when the senses are at rest, as

[1] On this power of temporary retention, and on the utility of forgetfulness in the case, see Jevons's article, "Cram," in *Mind*, ii. p. 193; also R. Verdon, article "Forgetfulness," in *Mind*, ii. p. 449 f.

[2] Curious forms of temporary forgetfulness occur in certain abnormal conditions in connexion with temporary disturbances of brain-function. (See Ribot, *op. cit.*, chap. ii.)

when we sit and muse in a quiet room in the evening twilight, the force of images preponderates, and these attain a great intensity. In like manner one group of representations may by its persistence effectually exclude another. In this way we account for the banishment of earlier acquisitions by later, and the resurgence of the former when the pressure of the latter is removed, *e.g.*, in old age.

The stage of complete obliviscence is supposed to be reached when no effort of will, and no available aid from suggestive forces, succeeds in effecting the reproduction. In order, however, to determine that a fact is thus irrecoverably forgotten we must see that certain conditions are fulfilled. Thus we must eliminate the effect of temporary obliviscence by varying the time and circumstances of the effort of recollection. Not only so, we must be careful to call in all available resources. Thus we must see to it that all contiguous links that would be likely to assist are present. Further, before we can say that an impression is wholly forgotten, we should apply, if possible, the last test of all, *viz.*, the recurrence of a like presentation, so as to see whether the original impression can be (partially) reinstated by the full force of actual sensation and the process of recognition or automatic assimilation. The effect on Harry Bertram of revisiting Ellengowan, the home of his childhood, so well described by Scott in *Guy Mannering*, illustrates the fact that much which may seem to be lost is recoverable if only these conditions are realisable.

While we may thus, for practical purposes, regard impressions not recoverable by the maximum effort of recollection as forgotten, it is obvious that we cannot demonstrate the fact of their complete or absolute obliviscence. That is to say, we cannot be certain that under some unrealised conditions revival would not take place. There are, indeed, many facts which go to show that the sphere of oblivion is much smaller than we commonly suppose. Thus the recurrence of some rare sensation, as a peculiar odour, or peculiar confluence of organic sensations often recalls a seemingly lost impression. The exceptional revivals of visual imagery that are apt to occur in certain particular states of fatigue and somnolence, and also in the form of dream-images in the peculiar psycho-physical condition of sleep, seem to attest to the possibilities of a range of revival that vastly extends the limits of our ordinary experience.[1] And the same fact is still further shown by the

[1] The imagery of dreams has, in some cases, been traced back (by M. Maury and others) to impressions of early life, of which the subject had no distinct recollection. (See Radestock, *Schlaf und Traum*, p. 134 f.) The effect of a recurrence of peculiar psycho-physical conditions in reviving seemingly forgotten impressions is illustrated in the experience of a man who, when recovering from an anæsthetic, babbled of incidents that had occurred long before, when (for the only time in his life) he was in a state of intoxication.

remarkable reinstatements of apparently forgotten experiences in the yet more peculiar and exceptional conditions of the hypnotic trance, and in the more distinctly morbid psychical phenomena that occur as the result of an injury to the brain, *e.g.*, the development of a second abnormal consciousness alternating with the normal one. Such exceptional reinstatement upon a recurrence of a peculiar complex of psycho-physical conditions, suggests that the range of reproduction is indefinitely enlargeable by removal of the counteractive pressure of habitual and normal conditions. And the same conclusion is shown by the common reappearance of early memories in old age, when the interest of present surroundings becomes reduced. The recognition of all this does not, however, lend support to the conjecture that there is no such thing in reality as forgetfulness, and that even the most evanescent impression leaves some permanent after-trace in the brain, and might conceivably be revived as a conscious image.[1]

§ 39. *Memory and its Varieties.* The foregoing account of the processes of reproduction will help us to understand what is called the power or 'faculty' of memory. By this term is commonly meant the retention of a stock of acquisitions and the ability to recall these as they are wanted. In its higher form of a distinct recalling of presentations in their time-order (memory of events) it involves, as we have seen, a careful association of these with their temporal concomitants.

As already pointed out, memory may be extended (as by Hering and others) so as to include organic modifications due to previous functional exercises not involving consciousness. In this sense we may speak of the hand having a memory of its own, as illustrated in the ready skill, acquired by practice, with which it carries out automatically, or approximately so, habitual actions. An illustration of this unconscious memory recently came under my notice. A young lady, when writing out a number of circulars, suddenly found herself filling in a wrong date, *viz.*, that of some months before. She bethought her that she had about that time written similar circulars, and though she could not consciously recall the exact date of this, she found by reference to a document that her hand had conserved it faithfully. The connexion here touched on between 'unconscious' memory and habit will occupy us further on. For the present we are concerned

[1] This idea of complete retention receives no material support from the fact that persons who have recovered from drowning have asserted that they lived the whole of their life over again. Such a statement is, on the face of it, an exaggeration. To those who, like Hamilton and the Herbartians, hold that all mental activity (presentation) subsequently persists in an unconscious form, a total obliteration of presentations is, of course, unthinkable. On the whole subject of forgetfulness, see Hamilton, *Lectures on Metaphysics*, ii. lect. xxx.; Lotze, *Metaphysic*, p. 531 ff.; Taine, *On Intelligence*, pt. i. bk. ii. chap. ii. v.; Ribot, *Les Maladies de la Mémoire*, chap. ii.

only with memory in its full significance, that is to say, the power of recalling presentations in their connexions of time and place with other presentations.[1]

The reasons for marking off this department of psychical processes by a special name are obvious. As has been stated, retentiveness is an ultimate inexplicable psycho-physical function. And though, as has been pointed out, this function appears at all stages of development, and plays a considerable part in the so-called 'presentations' of sense, it only reaches its full expression in the processes of reproduction or representative imagination. The great practical importance, moreover, of the power when thus developed sufficiently accounts for the fact of our distinguishing it by a particular name.

§ 40. *Memory, a Cluster of Memories.* While thus employing the current term to mark off this sphere of reproductive imagination, we must not be misled into thinking that memory, even when thus limited, is a single faculty. The fact that memory has an organic base, and is, indeed, at once a physiological and a psychical phenomenon, is sufficiently shown in the known variations of reproductive power. Common observation tells us that the memory of one class of presentative elements is one thing, that of another class another thing. That is to say, the retention of tones, colours, forms, and so forth, is each a process by itself, having its own peculiar psycho-physical conditions. This is amply illustrated by individual differences of reproductive power. A boy may have an excellent (natural) memory for one class of sensations, say colours or articulate sounds, and yet fall below the average in respect of other impressions. This relative independence of different modes of retention has been still further shown by the facts of disease, which, by affecting particular regions of the brain, interfere with the reproduction of the correlated groups of impression. Thus in the different forms of aphasia or disturbance of the language faculty we have a loss now of the articulatory, now of the visual element, and so forth.[2]

[1] On the connexion between such biological or unconscious and conscious memory, see Maudsley, *The Physiology of Mind*, chap. ix.; Ladd, *Elements*, p. 548 ff; and Ribot, *op. cit.*, chap. i. Hamilton confines the term memory to the retentive or conservative, as distinguished from the reproductive factor in revival.

[2] As Volkmann says: "There are as many kinds of memory as there are kinds of representations. . . . *A* memory is everywhere: *the* memory nowhere," *Lehrbuch*

That what we call memory is an aggregate of partially independent powers is further seen in the fact already touched on, *viz.*, the unequal revivability, in average cases, of different orders of sensation. Speaking generally, and disregarding individual differences, we may say that the higher the sense in point of discriminative refinement the better, *i.e.*, the more distinct and complete the corresponding process of reproduction. Thus of all presentations visual percepts are recalled the best; then come sounds, touches, tastes, and smells. Since, moreover, the muscular sense is characterised by a high degree of refinement, the retention of motor presentations is in general relatively good.

This arrangement of the senses in the order of revivability of impression is only meant to be a rough guide. That tastes and smells are very imperfectly revivable, though the last have an exceptional value as revivers, is commonly allowed. That muscular sensations can be revived with a fair degree of distinctness is shown by the careful analyses of their experiences by Stricker (*Ueber die Sprachvorstellungen*, and *Ueber die Bewegungsvorstellungen*) and Münsterberg (*Beiträge*, *passim*). The reason why we do not appear to recall motor presentations readily is that, being complicated with passive sensations, *e.g.*, those of touch, they do not stand out distinctly as constituents in our reproductive processes.[1]

It follows from the above that the distinction commonly drawn between general and special memory is not an absolute one. When we speak of a person having a good general memory we mean that the general or average level of his various classes of retentions is high. Such a good average retention has for its nervous correlative a high degree of structural perfection of the brain-centres generally, whereas what is marked off as special memory, *e.g.*, for colours or forms, implies a special development of certain of these central structures. It may be added that general memory, as illustrated in the case of the great scholars Scaliger and others, turns largely on a high degree of *verbal* acquisitiveness.[2]

der Psychologie, vol. i. § 83. The separate disturbances of the mnemonic function in mental disease (partial amnesia) are illustrated by Bastian, *The Brain as an Organ of Mind*, p. 620 ff.; Lewes, *Problems*, 3rd series (prob. ii.), pp. 119, 120; Carpenter, *Mental Physiology*, bk. ii. chap. x.; and Ribot, *op. cit.*, chap. iii.

[1] On the different degrees of revivability of our several orders of sensations, see Herbert Spencer, *Principles of Psychology*, vol. i. pt. ii. chap. v.

[2] Casaubon says of Scaliger: "He read nothing (and what did he not read?) which he did not forthwith remember". Pascal says he never forgot anything

§ 41. *Course of Development of Memory.* The dependence of conscious memory on its organic base is clearly seen in the rise and fall of the power of retention concomitantly with the growth and decay of the brain. A word or two on this parallel movement may well complete our account of the reproductive process.

We set out with the hypothesis that all psychical acquisition (other than momentary and evanescent retentions) involves the building up of new central arrangements, that is to say, the further differentiation of elements and weaving of connecting bonds. The first thing to note is that some time is required before the process of central evolution is carried sufficiently far for stable and lasting retention. As we all know, few persons retain in after-life any impressions of the events of the first three years. A possible explanation of this fact may be found in the circumstance that the nerve-centres have not as yet become sufficiently organised to supply a basis of permanent psychical integration. Impressions remain as yet detached, and are not taken up into that larger and more complex unity which we call our experience, or our history.[1]

When this stage is reached we observe a rapid development of the retentive power. It is not uncommon to meet in autobiographies with minute recollections of events occurring in the fourth year. Thus, for example, Sir Walter Scott tells us that he carried away so distinct and lasting an impression of the Tower of London and Westminster Abbey, which he visited in his fourth year, that on revisiting them after an interval of twenty-five years he found his recollection wonderfully faithful.[2]

which he had read or thought. For other examples of capacious memory, see D. Stewart, *Elements of the Philosophy of the Human Mind*, pt. i. chap. vi. § 3; Hamilton, *Lectures on Metaphysics*, vol. ii. lect. xxxi.; and Taine, *On Intelligence*, pt. i. bk. ii. chap. i.

[1] Wundt points out that the limit of adult retrospection synchronises with the development of self-consciousness, which is but another name for the larger and more comprehensive process of associative integration, *op. cit.*, ii. 396. The truth here referred to that stable cortical formations require years is further shown in the observation of Jastrow, that if a child is overtaken by blindness before the age of from the fifth to the seventh year, visual images are lost (quoted by W. James, *op. cit.*, ii. p. 45).

[2] See Lockhart's *Memoirs*, chap. i. (Autobiography). The reader may also look at the vivid and charming account that Scott gives of his first visit to the theatre when less than four years old, *ibid.* chap. ii., and compare this with Taine's

We see the same rapid growth of retentive power at this point in the facility with which most children from four onwards are able to memorise verbal material, verses of poetry, and the like. Judging by this criterion we may say with Dr. Bain that facility in storing up new acquisitions reaches its maximum about the period from the twelfth to the fourteenth year. At this particular stage, then, we may suppose that the brain-substance is most plastic or modifiable, that new developments of central nervous structure take place most readily.

Later on, no doubt, the retentive power seems to continue unabated, and even to increase; but here the phenomenon is probably a different one. A man of twenty or even thirty will learn many things, *e.g.*, languages, better than the boy of fourteen, not because his brain is more plastic or disposed to take on new structural and functional modifications, but because the stock of acquisitions already hoarded greatly diminishes the labour of further retention. That is to say, since he has a larger store of ideal nuclei, about which he can group, or to which he can assimilate fresh facts, his so-called new acquisitions contain less and less of the really new or unlearned.[1] This economising of work in the acquisitive process, due to the diminution in the amount of new matter to be assimilated, is aided by certain habits to be touched on presently, which are the result of a careful methodical regulation of the memory.

The decline of memory, with the advance of years, illustrates the same close connexion with brain-power. Loss of cerebral vigour shows itself first of all in a failure of memory. More particularly new acquisitions grow difficult, so that recent events, the names of new acquaintances, and so forth, are not firmly held. On the other hand, as already pointed out, the superior tenacity of early years now reveals itself afresh in a

recollection of a like experience when seven years old. (*On Intelligence*, pt. i. bk. ii. chap. ii.) A remarkable example of far-reaching recollection of childhood is George Sand. She tells us that her earliest recollection was of a blow she experienced when a baby in arms, and which " opened my mind to the sense of life ". Pierri Loti, in his charming account of his childhood (*Roman d'un Enfant*) almost equals this range of childish reminiscence.

[1] Such psychical nuclei, or *points d'appui*, involve an organic factor, *viz.*, pre-existing nervous formations disposed to renew a particular mode of functional activity.

revival of seemingly forgotten experiences of childhood and adolescence. Finally, in the gradual senile loss of memory we see traversed a similar course to that gone through in the case of the dissolution of memory by disease. Those retentions disappear first which have been acquired latest, which represent fewest repetitions, and so are least deeply organised in the brain-structures, *e.g.*, proper as contrasted with common names, while those disappear last which correspond to what was learnt first of all, has most frequently been made use of, and so become most deeply organised.[1]

§ 42. *The Culture of the Memory.* Much has been written respecting the improvement or culture of the memory. The object of this culture is to produce what is known as a good memory. Such a memory may be regarded as including (1) readiness in acquisition as measured by the smallness of the number of repetitions necessary, (2) tenacity or permanence of retention as measured by the interval during which an impression has been retained, and (3) the facility or promptness together with the completeness or distinctness of the reproduction.[2]

The development of memory, both generally and in particular directions, is in every case limited by certain congenital organic conditions. The individual has an impassable limit set to his acquisitions in the primordial quality or degree of organisation of his central nerve-structures. At the same time, exercise, attention, and the carrying out of certain methodical habits, greatly assist in those psycho-physical processes which we call the growth of memory. It is only when these factors are present that the full functional activity of the brain as a retentive organ are realised.

[1] On the series of changes making up the growth and decay of memory, see Carpenter, *Mental Physiology*, bk. ii. chap. x. The order of events in the decay of memory is seen most plainly in the loss of verbal memory. (See Ribot, *op. cit.*, chap. iii.; James, *op. cit.*, i. p. 679 ff.)

[2] On the essentials of a good memory, see D. Stewart, *Elements of the Philosophy of the Human Mind*, pt. i. chap. vi. Drobisch recognises four characteristics of a good or 'strong' memory: (1) Facility of apprehension or acquisition; (2) Trustworthiness, or fidelity of conservation and reproduction; (3) Lastingness or permanence; and (4) Serviceableness, *i.e.*, readiness of recollection, *Empirische Psychologie*, § 35. Locke points out that the two main defects of memory are oblivion, *i.e.* (want of tenacity) and slowness (want of readiness in reproduction *Essay on the Human Understanding*, bk. ii. chap. x. § 8.

The foundation of all memory culture is careful observation. What we note closely we remember distinctly. The exercises that enter into memory culture, *e.g.*, learning by heart, obviously include a patient prolonged concentration on the material to be learnt. The closer the concentration, the more completely the several features of the material are apprehended, the more certain will be the result.

Next to this close vigorous concentration under the stimulus of strong interest comes the work of orderly connexion or arrangement. By this is meant a careful consideration of the facts to be learnt in their relations one to another, and also in their relations to previously known facts. Such arrangement when properly carried out involves much judgment or judicious selection. The art of learning readily and lastingly turns not a little on skill in discriminating the important from the unimportant, in selecting central or main points about which to group subordinate matter. To discern where to concentrate, and what to overlook, so as not to burden the mind with useless lumber, is one important secret of a good memory.

§ 43. *Art of Mnemonics.* In connexion with the improvement of the memory, reference may be made to those systems by which it has been hoped to reduce memory-work to an affair of simple rule. Such systems, variously known as artificial memory, systems of mnemonics and *memoria technica,* have as their special object to facilitate the acquisition of verbal and similar matter, such as historical dates. A word or two on their general value must here suffice.

It follows from what has just been said that the improvement of the memory, so far as this is possible, must proceed by a careful regulation of the acquisitive, and, as supplementary to this, of the reproductive, process, by a concentration of the attention. This concentration effects its object by means of the psycho-physical process of association and suggestion already explained. More particularly it proceeds by introducing an orderly arrangement of facts or details, so that they become firmly conjoined, and capable of readily recalling one another.

The ancient and modern systems of mnemonics aim at forming artificial connexions between different portions of the matter to be learnt. Thus, in the systems of the Roman rhetoricans, the various heads of the discourse to be learned by their pupils were to be associated quite arbitrarily with the several local divisions of a building, and so forth. So, in modern systems, the remembering of lists of irregular verbs, of particular series of digits in historical dates, etc., is facilitated by binding together the several constituents, as in giving a metrical form to the words and so calling in the aid of similarity of sound and the interest of rhythm, or in fancifully investing a disconnected series of numbers or letters with the semblance of regularity and connexion. All such devices owe their value to the principles of association and suggestion expounded above, and there is little doubt that they serve a very useful subordinate purpose in the processes of learning. At the same time, owing to the great diversities among individuals, in respect not only of the classes of sensation best recalled, but also of the modes of suggestion that prove most serviceable, these rules cannot be said to have more than a relative and limited validity.

These individual differences become important in considering the value of that scheme of topical or geometrical memory which is illustrated in the systems of Roman mnemonics already referred to. Whether a speaker would derive any aid from connecting his verbal material with the several local divisions of a visual scheme, such as the parts of a building, depends much on the strength of the visual or pictorial memory, and also on the readiness with which sounds enter into (heterogeneous) association with visualised forms. That they do so in the case of many individuals is proved, among other ways, by the curious inquiries of Mr. F. Galton into the way in which people represent (or visualise) numbers. He found that a considerable number of persons have habitually, from early childhood, pictured the numerals one, two, three, etc., in a kind of simple geometrical arrangement as lying in a circle, or along a line changing its direction at certain points.[1]

REFERENCES FOR READING.

A very full and detailed account of the workings of contiguous association is given by Dr. Bain under the head, Law of Contiguity, *The Senses and the Intellect*, "Intellect," chap. i.; and W. James, *Principles of Psychology*, vol. i. chap. xvi. Dr. Ward develops a somewhat original theory of reproduction in his article "Psychology" (*En. Brit.*). The physiological or organic basis of memory is treated of by Hering, *Ueber das Gedächtniss als allgemeine Function der organ. Materie;* by Dr. Maudsley, *Physiology of Mind*, chaps. v. and ix.; and Prof. Ribot, *Les Maladies de la Mémoire.* An interesting account of memory, its varieties and

[1] On the visualisation of number-forms, see Galton, *Inquiries into Human Faculty*, p. 114 ff. On the general value of mnemonic systems, see James Mill's *Analysis*, i. p. 324 f.; Dugald Stewart's *Elements of the Phil. of the Human Mind*, chaps. vi. and vii. I have dealt more fully with the whole subject of the culture of the memory in *The Teachers' Handbook of Psychology.*

the means of improving it, may be found in Dugald Stewart's *Philosophy of the Human Mind*, part i. ch. vi. With this may be compared Sir W. Hamilton's account of memory, *Lectures on Metaphysics*, especially lectures xxxi. and xxxii.; also Mr. Shadworth Hodgson's *Time and Space*, part i. chap. v. The German reader may with advantage consult Volkmann, *Lehrbuch der Psychologie*, i. 4es Hauptstück; Wundt, *Physiol. Psychologie*, ii. 17es cap.; and J. Huber, *Ueber das Gedächtniss*. A historical *résumé* of some of the principal theories of memory is given below, Appendix D. The practical aspects of the subject are discussed by Fauth, *Das Gedächtniss*.

CHAPTER X.

PRODUCTIVE IMAGINATION.

§ 1. *Reproductive and Productive Imagination.* Reproduction involves, as we have seen, the picturing of objects and events in what are called representative images, and is thus a form of imagination. In these reproductive processes, however, the images are supposed to be mere copies of past impressions. In other words, in reproductive imagination we retrace the actual forms and order of our presentative or sense-experience. But what is commonly known as imagination implies more than this. When we imagine an unrealised event of the future, or a place which is described to us, we are going beyond our actual experience. The images of memory are being in some way modified, transformed, and recombined. Hence this process is marked off as Productive or as Constructive Imagination.[1] And the results of the process may be spoken of as elaborated images, in contradistinction to the unelaborated images of memory.

While, however, we thus mark off (productive) imagination as a stage of psychological elaboration going beyond reproduction, it is easily seen that no hard and fast line of separation can be drawn between the two. The reproductive process in its complete form, the dating a past experience, involves, as we saw, a somewhat elaborate mode of construction in the time-scheme employed. Not only so, it is to be noted that what we call remembering or recollecting is by no means an exact transcription of the actual facts of presentation. The

[1] Since this higher formative process answers to the common meaning of the term Imagination, we may for convenience sake omit the qualifying word productive, and speak of it as imagination simply.

record of memory is being continually falsified by the effects of time, the loss of certain constituents of the experience, and the confusion of experiences one with another. And to this may be added that, in recalling past experiences, we tend, without any clear intention, to omit and even to rearrange so as to suit new circumstances, or gratify a new interest. Thus, in various ways, the reproductive process is adulterated by an admixture of sub-conscious production.[1] It follows that what is here marked off as productive imagination consists of those processes where the modification or transformation becomes distinct and prominent, as in picturing others' experiences, or an experience that we regard as possible for ourselves.

§ 2. *Nature of Production.* It is evident that imagination as thus understood stands in a close relation to the processes of presentation and reproductive imagination. That imagination has to do in a special way with the things of sense was recognised by ancient philosophy. Whenever we picture a place, a scene, an event we read or hear of, we are engaged with sensible experience, the impressions of sight, hearing, and so forth. Such picturing is obviously effected by means of a reproduction of past sensations. To imagine 'darkest Africa,' and even the Heaven of Milton or Goethe, is to make use of our past sense-experiences. In other words, the impressions of sense when retained and reproduced supply us with the materials for our imaginative processes. Hence one obvious limit to all imaginative activity : it may produce new modes of combination, but no new elements.[2]

Not only so, the modes of connexion of our experience necessarily reflect themselves in all our imaginative picturings. Thus it is obvious that all production makes use of those forms of combination which seem inseparable from our experience, *viz.*, the order of space and of time. Whenever we imagine, even in the wildest dreams of sleep, though we may be con-

[1] I have given a full description of these processes in my volume, *Illusions*, chap. x. ("Illusions of Memory"). The alterations due to unconscious selection and rearrangement, more particularly in the case of the educated, are illustrated by Volkmann, *Lehrbuch*, vol. i. p. 469.

[2] In addition to such sensuous imagination, there is the imagination of inner mental states, and more particularly feelings, a process that plays a large part in sympathy. But this direction of imagination may be disregarded for the present.

fusing particular positions or dates, we are still grouping objects in space and ordering events in time. Other illustrations of this reflexion of the connexions of our actual sense-experience are seen in our habitual picturing of things as concrete wholes resembling those we know through our senses, of the movements of objects as continuous from one point of space to another, and so forth.

It follows that what we mean by productive imagination consists merely in carrying out certain changes or modifications in that reflexion of our sense-experience which is supplied by the reproductive process. Such changes must in general consist of two kinds: (1) processes of separation and subtraction, and (2) processes of combination and addition. The former is illustrated in all picturing of objects away from their habitual surroundings, *e.g.*, a house on a new site; of isolated parts, features, or qualities of an object, as the head of a decapitated man, the colour of the orange or the gentian apart from its form; and of objects robbed of certain of their features or diminished in their size, as the one-eyed Cyclops, the diminutive Puck, and so forth. The latter process is seen in the imagination of objects with new features or in new circumstances, as in the stock instance, the mountain of gold, the centaur, the mermaid, the coral diver, and so forth.[1]

The processes of imaginative production now to be considered are carried out in relation to all kinds of sense-presentation. Thus, in the domain of hearing, musical tones and articulate sounds are susceptible of endless separation and recombination. So in the region of muscular experience or motor presentation, we may occupy ourselves with taking apart customary complexes, and forming new combinations, as in picturing the motion of flying, and so forth. Since, however, visual presentations constitute the most important class, presenting, moreover, the double complexity of a local juxtaposition of parts, and a combination of the heterogeneous and easily

[1] According to the older theory, there were three kinds of imaginative activity: the abstracting, the determining, and the combining. By the first was meant the isolating activity described in the text; by the second, the supplementary process of filling out the results of abstracting imagination, as in first picturing the sun as a wheel, then as a chariot, etc.; and by the third process, the combining of elements taken from different wholes. (See Volkmann, *op. cit.*, vol. i. pp. 470, 471.)

separable elements of colour and form, the imaginative process as commonly understood is specially concerned with unmaking and remaking visual or pictorial representations.[1]

Such imaginative manipulation of the material of sense-experience plays a large part in mental development. It is very far from being, as sometimes supposed, a mere pastime of the mind, but enters, as we shall presently see, as an integral factor into the development of intelligence.

§ 3. *Limits to Imagination.* It follows from this brief account of the productive process that all imaginative activity is limited by experience. To begin with, then, since production is merely an elaboration of presentative material, there can be no such thing as a perfectly new creation. The greatest imaginative genius would strive in vain to picture a wholly new colour. But, again, the processes of separation and combination are themselves conditioned and limited. When two things have always been conjoined in our experience it is impossible to picture them apart. Thus, though we may imaginatively vary the colour of an object at pleasure, we cannot picture it as having no colour at all.

Not only so, it may be said that the more uniformly two things are conjoined, the more difficult it becomes to dissociate them. Thus it is much easier to picture a moving object, as a man, apart from a definite set of local surroundings, than a stationary one, as a church. On the other hand, the mind finds it difficult to combine images as new wholes when experience suggests that the elements to be combined are incompatible. The Oriental king could not picture solid water or ice. We all find it hard to imagine persons on the other side of the globe with their feet towards ours, and yet not falling downwards. In proportion to the uniformity or invariability of the order of our experience is the difficulty of breaking up and regrouping its several parts. Hence the reason why we so easily imagine objects greatly increased in size, as the Titan or Amazon, and on the other hand greatly reduced, as the African pigmies or Swift's Lilliputians; for, as we have seen, the variation of our visual experiences with changing distance of objects is an everyday fact. In like manner, we can easily invest a

[1] This is clearly recognised in current modes of speech, as when we talk of the eye of imagination, its far-sightedness, and so forth.

thing with a new colour, as in imagining the mountain of gold, for everyday experience accustoms us to indefinite changes of colour in objects with varying illumination.

With these general and fixed limitations there are particular and temporary ones. Thus, our ability to imagine is limited by the actual sensations of the moment. We cannot look at the blue sky and *at the same moment* imagine it red. Similarly, it has been pointed out by Stricker that the bodily position of the moment affects our power of imagining motor experience. Thus when lying down we find it difficult and even painful to imagine ourselves running, for the situation obstructs those nascent motor stimulations which appear to enter into the idea of running.[1]

The reader must be careful to distinguish between the difficulty or impossibility of picturing objects, and that of understanding how they could be as we picture them. The ambiguous word 'conceive,' as J. S. Mill pointed out, covers both meanings. We can picture, for an instant at least, the most grotesque combinations, as Atlas carrying the earth, or a human figure poised in the air, but we cannot conceive the corresponding combinations of objects as possible. So far as the capability of merely picturing is concerned, the freaks of fancy of the young and of all of us in passive conditions of reverie and dreaming would suggest that the only limits to such pictorial combination are the incompatibilities of space and time. We cannot of course picture two objects in the same place at one moment: but our dream fancy does almost everything short of this.[2]

§ 4. *Passive and Active Imagination.* It is customary to distinguish between a passive and an active process of imagination according as the changes just described are carried out unconsciously, or at least without any effort of voluntary attention, or as they involve this active factor. A word or two will serve to illustrate the distinction.

Passive imagination is that part of the unmaking and remaking which is done for us by the so-called spontaneous or mechanical workings of our psycho-physical organism. As already remarked, the images of memory tend to become transformed by a passive, unconscious, or automatic process. Thus the very imperfections of the retentive power lead to a partial or fragmentary reinstatement of percepts, and so bring about a certain amount of separation of presentative material. Thus we often recall a face without the figure, a pair of eyes apart from the face, and so forth. Again, one and the same presenta-

[1] See Stricker, *Ueber die Bewegungsvorstellungen*, p. 12.

[2] While the imagination may thus, in certain directions, transcend the powers of understanding, we shall see in the next chapter that these last may, in other directions, greatly transcend the limits of imaginative activity.

tion may occur at different times with dissimilar and incompatible adjuncts, as when an actor is seen in different characters, or a word appears along with different contexts. In such a case the suggestive forces tend, as we have seen, to counteract one another, and thus it often happens that a partial presentation is reinstated owing to the variation and mutual inhibition of its concomitants.[1]

These same automatic processes, moreover, would introduce a certain amount of recombination of presentative elements. If a common element A occurs in the different combinations CAB, MAP, and so forth, although we cannot at the same moment completely picture A with its two dissimilar surroundings CB and MP, the fact of the common presence of A may beget new combinations among these adjuncts, *e.g.*, MC or PB. Thus in recalling two *rôles* of an actor we are apt to find ourselves picturing a patchwork of two figures, as the cloaked form of Hamlet and the wind-driven locks of Lear.[2] That similarity does thus effect a certain regrouping of presentative complexes is clearly illustrated in our dreams, and more particularly those confused images of persons, places, and so forth, in which we can afterwards detect a partial blending of two distinct images which happen to have certain features in common.[3]

This action of similarity is aided by the effect of plurality of suggestive stimuli, and the workings of divergent suggestion. At a given moment a number of external impressions and organic sensations may occur together for the first time, each tending to recall a separate group of images. These simultaneous tendencies will, so far as incompatible, counteract one another; yet beyond these limits a partial revival of this and of that image or image-complex may take place at such a time, and in this way we have by a purely mechanical process

[1] The full effect of this mutual counteraction by variable adjuncts will be seen by-and-by, when we come to deal with the generalising process of thought.

[2] The recalling of a part played by different actors, say the Gringoire of M. Coquelin and of Mr. Beerbohm Tree, may produce the same result. That is to say, fragments of the form, get-up, etc., of the two representations may be reproduced together in a new grouping.

[3] This partial blending of images in dreams frequently takes the form of a transformation. The dog becomes a wolf, one of the *dramatis personæ* transforms himself into a new personage, and so forth. (See my volume, *Illusions*, p. 163.)

a new juxtaposition and grouping of elements. This process is clearly illustrated in the grotesque combinations that arise quite spontaneously in the childish mind before the habit of inhibiting these as useless has been formed. We can all find illustrations of it in the quaint fancies which occur when, in moments of idle abandon, we give full play to the suggestive forces of surrounding things, including those of people's words, and most of all, perhaps, in the strange imaginative juxtapositions of our dreams.[1] Any emotional excitement greatly aids the formation of such novel image-groupings by increasing the rapidity and range of reproduction, and removing the inhibitory action which, under ordinary circumstances, represses all unwonted and non-significant juxtapositions of elements. Such passive production plays a large part in the imaginative creation of genius, which, from the time of Plato, has commonly been regarded as largely a process of non-voluntary and unconscious 'inspiration'.

The process of passive automatic regrouping here spoken of probably has for its nervous basis a simultaneous re-excitation of different central structures which have not before co-operated in this particular way. That such simultaneous psycho-physical activity should subjectively take the form of an image-combination, *i.e.*, a connected mental whole, would follow from the general structure and conditions of psychical life or consciousness as described above.[2] The typical modes of imaginative combination observable in dreams suggest that in all such cases the simultaneous resurgence and overlapping of as yet disconnected psycho-physical elements begets a tendency, mainly non-voluntary and automatic, to the production of a new integration following the habitual and fixed co-ordinations of experience. Thus in our dreams the multitude of subjective optical sensations forms itself into a swarm, and the simultaneous reproduction of a visual and an auditory image begets the idea of a sounding object, *e.g.*, a person talking, and so forth.[3]

[1] On the co-operation of a number of stimuli, of which organic sensations are one important constituent, in generating the strange combinations of dream fancy, see my *Illusions*, p. 157 ff.

[2] See p. 77 f.

[3] The phenomenon of passive or automatic imagination has not been done justice to by psychologists. It is recognised, but not fully analysed, by Volkmann, *Lehrbuch*, i. p. 468 f.; and by Wundt, *op. cit.*, ii. p. 398 f. The term fancy, as distinguished from imagination by Dugald Stewart, Coleridge, and Wordsworth, appears to point to the difference between a passive and an active process of imagination. (See Stewart's *Elements*, chap. v. § 1; and Wordsworth's Preface to Poems, p. xxxvi). The effect of habitual modes of co-ordination in reducing disconnected images to the semblance of unity is illustrated in the chapter on Dreams in my volume on *Illusions*. (See especially p. 169 ff.)

While, however, much production takes place in this unconscious or sub-conscious manner, the higher and more valuable forms of it involve an active regulative factor. Here, as in the case of active reproduction, we have the work of voluntary attention, the aiding of certain tendencies, and the counteracting of others, in order to reach a particular desired result. It is only when the productive process is thus controlled and guided by the will that it becomes in the full sense what we mean by construction. For the distinguishing feature of this active process is that it is an orderly, methodical bringing together and arranging of parts in a new organic whole. Thus the poet may be said to construct when he consciously sets himself to fashion a beautiful scene, a thrilling action, and so forth, choosing material for his purpose, and gradually working up to a result that satisfies him. It is this methodical constructive process that we have now to examine.

§ 5. *The Process of Construction.* The first thing to be clear about in tracing out this conscious process of imaginative elaboration is that, like all elaboration, it requires as its condition the presence of certain materials. All that the most careful direction of the attention can effect is certain modifications in the spontaneous or automatic flow of images.

These materials are supplied ultimately, as we have seen, by our sense-presentations. The retention and reproduction of percepts is presupposed in all imaginative production. There is no production without reproduction. In trying to realise a scene described by a traveller or a poet I am wholly dependent on the revival of past experiences of my own. Such reproduction will take place by way both of contiguous suggestion and assimilative revival. Thus, in trying to picture out the new scene I shall be recalling this and that special experience by help of this and that word, and along with these experiential elements other and concomitant elements (contiguity); and I shall further be recalling combinations analogous to the one described (similarity). It is only when these revivals take place readily that the constructive process can advance. Hence the frequently observed fact of the vividness, rapidity, and range of reproductive ideation in the case of men of great imagination. A poet's mind must be stored with images of objects, scenes, and incidents, which can be worked up into new products.

In the second place, active production depends on the automatic regrouping of elements just described. Active and passive imagination are not wholly distinct, but the former includes the latter. As already hinted, much of the highest imaginative work of the poet is due to the action of those subconscious forces which are ever at work bringing about novel combinations of imaginative elements. The initial idea is in most, if not all, cases of such active imagination the outcome of this automatic action. We begin to picture some new scene, some new situation in life, by help of a rough draft-image which a new conjunction of circumstances, or a new combination of words, directly suggests.

The conscious elaboration consists in keeping this draft-image fixed in the mind, and improving on it and developing it by the aid of such further image-material as is suggested by the special circumstances of the time. As in the case of active reproduction, the function of voluntary attention is here limited to developing and fixing or retaining certain elements, and rejecting others. Thus, in trying to imagine a new experience, say a day in a country house, a child starts with a crude idea of what it is like, based on a revival of previous analogous experiences. Keeping this idea steadily before his mind, he recalls in close connexion with it, and by the aid now of assimilative revival, now of contiguous suggestion, a number of other experiences. The selective action of voluntary attention here comes in, rejecting what is recognised as unfitting and incongruous, and furthering the reinstatement of what is seen to be suitable. In this way a more elaborate image-structure gradually arises by a process of organic accretion or growth, the whole being controlled by what we call a volitional activity.

That imaginative production sets out with an outline and becomes a detailed picture by successive processes of growth, *i.e.*, a differentiation into parts and integration of these into an organic whole, has been recognised by more than one psychologist. This process of gradual determination by development of detail is not confined to constructive imagination. There is something very like it in a good deal of perception, which begins with a vague general impression and gradually grows into a clear discriminative perception of this particular object. Similarly, in the process of reproduction, we frequently recover a vague idea of a person, a word, and so forth, before we reinstate the complete image. We may say, indeed, that all processes of presentation and representation are a transition from a vague incomplete or indefinite to a clear complete and definite form, that is to say, are processes having the characteristics of all development.

It is evident from our brief analysis of the constructive process that its due regulation depends upon a clear sense or judgment of what is fitting for the purpose in hand. It is, indeed, the degree of fineness of this guiding sense which principally determines the success of the whole operation. According as a poet, for example, has a clear and discriminating, or a dull and obtuse, sense of what is æsthetically valuable, congruous, or harmonious, so will his constructive work be well or ill performed.

This guiding sense must be distinguished from the desire for an end, though they are closely related. A man may have a keen desire to compass some result, *e.g.*, a mechanical improvement, but no corresponding sense of what is fitting to bring it about. Hence the strength of the desire, though an important factor in sustaining the active effort of construction, is less important than the sense of fitness. The nature of this guiding sense or 'instinct' will be more fully understood by-and-by.

The result aimed at, and the corresponding guiding sense of fitness, will differ in different cases. In reading a book of travels, for example, we seek to frame clear mental pictures which fit in with the rest of the series; and we know when we have hit on the right combination of images in this case by a consciousness of the consistency of the grouping and of its agreement with the facts of our experience, in other words, by a feeling of satisfaction which comes of *understanding* what we read. On the other hand, in combining movements in order to bring about a wished-for practical end, we are guided by an instinctive sense of what is feasible, and what will conduce to the desired end.

§ 6. *Receptive and Creative Imagination.* The constructive process just described assumes a variety of forms according to the special circumstances, the materials dealt with, and so forth. One such variation presents itself in the difference between the externally determined or receptive form of the process, and the independent or creative form. The former is illustrated in the realisation of another's ideal grouping through the medium of language. Thus in reading a poem and forming a mental picture of the scenes and incidents described the mind of the reader, though called upon to construct, has the order of construction pre-determined for him by the particular arrangement of the poet's words and sentences. Such receptive imagination is, as we all know, a comparatively simple operation. The imagination of the poet, on the other hand, which first created the combination, had no such lines laid down for its activity. The act of construction in this case is of a higher order, involving more complex processes of reproduction, rejection, and selection, and directed solely by an internal sense of what is beautiful or harmonious. Hence such original or creative imagination is rare, and is always taken as a mark of extraordinary mental power.[1] A like contrast meets us in other directions of imaginative activity, as practical or mechanical construction. It is one thing to learn to construct a new process by seeing another perform it, another thing to discover this process for the first time.

§ 7. *Various Directions of Construction.* It has been remarked above that the process of productive imagination follows more than one direction, forming the essential component in a variety of mental operations. The more important of these may be grouped under three heads: (1) Construction as subserving knowledge about things or Intellective Imagination; (2) Construction as aiding in the carrying out of actions or practical operations, Practical Construction; and (3) Construction as subserving feeling, the satisfaction of the emotions, of which the principal form may be called Æsthetic Construction.

(*a*) *Intellective Imagination.* It must be evident that the expansion of knowledge beyond the bounds of personal experience and observation involves a process of imaginative production. This is seen alike in the *acquisition* of new knowledge from others through the medium of language, and also in the independent *discovery* of new facts by imaginatively forecasting what will be observed, or might be observed. The first illustrates the receptive, the second the creative kind of imaginative activity.

The process of recalling, selecting, and regrouping the traces of personal experience is illustrated in ordinary verbal

[1] Even this 'creative' imagination is limited by the conditions already laid down. It is creative only in the sense that it produces exceptionally new and original recombinations of material.

acquisition. What is commonly called 'learning,' whether by oral communication or by books, is not simply an exercise of memory; it involves an exercise of the imagination as well. In order that the meaning of the words heard or read may be realised, it is necessary to frame clear and distinct pictures of the objects described or the events narrated. Thus, in following a description of a desert, the child begins with familiar experiences called up by the words 'plain,' 'sand,' and so on. By modifying the images thus reproduced by memory he gradually builds up the required new image.

The success of the operation will turn on the recalling of the appropriate image-elements, and only these. The suggestive forces, when uncontrolled, tend to bring up what is not wanted. Thus, in imagining the desert by help of the sand, the child may be led by contiguous association to recall the cliffs and the sea. Accurate knowledge-bringing construction involves a careful process of *discrimination* of the new object, scene, or action, from its prototype in previous experience, as supplementary to the assimilative process.

On the success of this imaginative effort what is known as the *understanding* of verbal description will depend. If, for example, in following a description of an iceberg, a boy pictures a mass of ice, but does not distinctly represent its magnitude, he will not understand the dangers arising to ships from those floating masses. Here we see the close relation between clear imagination and clear thinking, a relation to be spoken of again by-and-by.

The activity of imagination enters not only into the acquisition of knowledge about concrete things and events not directly observable by us, as far-off countries and races of men, and the events of history, but also into the assimilation of scientific knowledge. Science, it is true, has to do with the general, and so makes her largest appeal to other intellectual activity than that of imagination, which deals with the concrete and sensible. At the same time, before the mind can seize the general, it must have clear images of concrete examples. These must of course be based as far as possible on direct perception, or observation through the senses; but this cannot always be done. Thus, for example, the movements of the planets, the circulation of the blood, are things which we are called on to a large extent to imagine constructively by the aid of analogies to previous objects of perception. Even those sub-sensible material elements and processes of which modern physical science tells us so much, as the vibrations of light and heat, the conjunctions and disjunctions of atoms and molecules in chemical changes, have in a way to be pictured by the mind, and so the understanding of these impalpable entities may be said in a measure to exercise the imagination.[1] It is only after clear pictures of the particulars have been formed that the subsequent operations of generalisation and reasoning can be properly carried out.

The kind of imaginative work here referred to, so far from being easy, is exceedingly difficult. It must be remembered that language is in its nature general and abstract. Words (other than proper names at least) tend to call up not a definite image of one particular object, but a typical or general idea of a class. Hence all verbal description of individual scenes, persons, and so forth, has to proceed by a gradual process of qualification or individualisation. That is to say, the general name has to be supplemented by a number of qualifying terms, each of which helps to mark off the individual thing better. Thus the historian depicts a particular king or statesman by progressively enumerating his several physical and mental qualities. Now each of these qualifications, again, like the general name which it qualifies, is in itself nothing but an abstraction. Thus the terms "strong," "wise," and so on, applied to a person are themselves general terms, each applicable to a number of persons. It follows that the process of realising the description turns on the proper *combination* of these several general ideas into the image of a concrete object. The following of a scientific description of a new animal or plant with its highly technical terminology illustrates the difficulties of this process of 'concreting the abstract' in a yet more marked manner. And a still greater strain is imposed by the description of the 'extra-sensible' world of atoms and molecules, with their intricate interactions. To 'visualise' or see with the internal eye what is thus described implies a considerable exertion of the imaginative power.

[1] That is, pictured up to a certain point by the aid of analogous sense-experiences, though, as we shall see later on, there can in this case be no perfect imagination of the objects thought about.

The discovery of new knowledge is largely a matter of careful observation and patient reasoning from ascertained facts and truths. Yet what has been called the "scientific imagination" materially assists in the process. The inquiring, searching mind is always passing beyond the limits of the known, and seeking to grasp the unknown by processes of imaginative conjecture which cannot be reduced to the form of conscious reasoning. The power of thus divining unobserved facts is commonly spoken of as imaginative insight into things. The child shows the rude germ of this capability when picturing to himself the make of his toys, or the way in which plants nourish themselves and grow.

Not only does imagination thus reach out in anticipation of unobserved facts, it is busy devising suppositions (or hypotheses) for the explanation of them. A scientific hypothesis, though, when fully developed, it assumes the form of a general truth, is reached by the help of a process of constructive imagination. That is to say, the mind of the scientific discoverer seeks to realise the action of the forces at work by imaginatively picturing their action in a concrete case, such imagination being carried out by help of facts gained from past observation. Thus the invisible undulatory movements of sound and light were at first 'visualised' by the help of certain sensible undulations, as, for example, those of the sea.

Imagination has thus a close connexion with scientific curiosity. Each reacts on the other. The desire to know stimulates the imagination to frame pictures of unexplored realities; and the activity of imagination, leading to conjectural prevision, quickens the desire to investigate in order to verify the conjecture. It is doubtless true that imagination, if not controlled by a critical spirit, may usurp the place of patient investigation, and the history of science is strewn with the wreckage of wild unverified conjecture. Nevertheless, it is an essential factor in all scientific discovery, and, provided it be always duly guided by judgment of what is appropriate, that is, reasonable and probable, it cannot be excessive. Scientific genius means more than anything else, exceptional power of recombining facts, so as to get new ideas.[1]

[1] "Nourished by knowledge patiently won: bounded and conditioned by co-operant reason, imagination becomes the mightiest instrument of the physical

Imagination, though having mainly to do with the outer sensible world, embraces also the inner world of feeling and thought. And here, too, there is room for processes of discovery analogous to those carried out by the physical inquirer. Our knowledge of ourselves consists not merely in recalling what we have actually felt and done, but in representing how we should feel, think, and act in new circumstances. In anticipating the future we are continually representing to ourselves the effects of new surroundings on our feelings and aims. Not only so, the knowledge of others' mental states, thoughts, tastes, and inclinations, is obtained by means of an imaginative construction of situations and experiences that go beyond the limits of our individual life. In all this realisation of untried circumstance, the reading of others' thoughts and motives, we are building up new representations from materials supplied by our personal experience.[1]

(*b*) *Practical Construction: Contrivance.*[2] Again, the process of construction enters into our everyday practical acquisitions, such as various forms of manipulation, the co-ordinations of the movements of the limbs in new groupings, as in learning to swim, skate, and so forth. A child advances in the command of his limbs, putting them to ever new uses, by modifying already acquired movements, that is to say, breaking up old combinations, and regrouping them in new arrangements. As we shall see more fully by-and-by when we come to trace the progress of this active development more in detail, much of this practical acquisition is suggested by the actions of others. The impulse of imitation leads a child to copy the speech and actions of his parents and companions. Such imitative construction of new motor groupings answers to intellectual construction under the guidance of another's words, and may be marked off as the *receptive* side of the practical imagination.

While much new practical acquirement may thus be

discoverer." (Tyndall, *The Scientific Use of the Imagination*, p. 6. *Cf.* Farraday, *Lectures on Education*, delivered at the Royal Institution, p. 68 f.)

[1] The nature of this process will be elucidated more fully when we come to deal with sympathy.

[2] Although the exercise of constructive activity in practical invention is related to the growth of will, there is some convenience in anticipating and treating it here along with imaginative construction in the narrow sense.

attained by imitation and instruction, it is also gained by individual origination, or what we call contrivance. Thus, as we all know, children work out many new combinations of movement for themselves. Their active impulses find a satisfaction in manual and other experiments. Such activity is, moreover, greatly sustained by the impulse of curiosity, the desire to find out about the make of things, their origin, and so forth. In this way, practical construction, under the form of experiment, greatly assists in the discovery of facts and truths.

More complex examples of this practical construction are seen in all ingenious mechanical inventions, such as the spinning-jenny, the steam-engine, and so forth. It is this higher plane of construction to which we commonly refer when speaking of original practical invention. Here it is evident there enters in much previous knowledge of related mechanical processes, and a specially fine tact or judgment with respect to the adaptedness of this and that agency, or group of agencies, to the particular practical result desired.

In all forms of practical contrivance the general conditions of successful construction hold good. A sufficient store of material, that is to say, a wide and varied experience, fitted to supply constituent elements for the new process, is presupposed. Next to this comes skill in breaking up and rearranging this material in new forms under a clear practical sense of fitness or adaptability to end. These qualifications must, it is evident, be supported by a strong interest in the result, and a steady volition or resolution.

(*c*) *Æsthetic Imagination.* There remains the process of construction as it takes place in connexion with states of feeling of marked intensity.[1] The full understanding of the influence of the feelings on the intellectual processes must be postponed till we come to discuss the former: here it may suffice to indicate briefly the modifications of the form of the constructive operation which occur under the influence of (strong) feeling.

The connexion between feeling and imagination is recog-

[1] As we shall see by-and-by, all intellectual processes have *some* concomitant of feeling. Here we are specially concerned with the influence of feeling in its stronger manifestations.

nised by all. Indeed, when we think of imagination, we naturally conceive of it as impelled and sustained by feeling.[1] We are all most imaginative when we feel most. The activity of imagination in the fine arts, which have as their special function the gratification of the feelings, illustrates this connexion in a particularly clear manner. The poet, who is the "man of imagination" in a special sense, visualises and creates under the stimulus of a dominant emotion. Hence we may call this direction of imaginative production the æsthetic or artistic.

The two main distinctions of such feeling-prompted imagination are the special vividness of the imaginative realisation, and the particular direction of the selective process. Feeling as a form of excitement tends to give exceptional vividness, distinctness, and persistence to the images called up at the time, as is plainly illustrated in the fact that states of preternatural emotional excitement, as terror, are apt to induce an illusory mode of imagination, *i.e.*, one which simulates the vividness and other marks of the sense-presentation.

In the second place, the presence of a feeling gives a particular direction to the imaginative process. Every feeling tends to reinstate those particular images which are associated, and consequently congruous with it. Thus in a state of joy we are disposed to entertain pleasant ideas; in a state of grief, sad or unpleasant ideas. This revival of images congruous with the particular feeling tends directly to the sustaining of the feeling. That is to say, a feeling develops and expands by the help of imaginative processes which, having the corresponding tone of feeling, strengthen and deepen its current. In this way, for example, love expands by indulging in day-dreams respecting its object. Mrs. Pendennis finds her maternal felicity in weaving glowing visions of her Arthur's future. By such means what are called ideal satisfactions add themselves to the real ones, and feeling spreads itself over the larger *terrain* constructed by the imagination.

The range of this feeling-prompted imagination is much larger than is commonly supposed. There is a form of it that

[1] Dr. Bain, indeed, goes so far as to restrict the term imagination to the productive process as differentiated by the presence of feeling (emotion). (See his *Mental Science*, p. 175.)

enters into all *quasi*-poetic contemplation of natural objects. We expand our life of feeling by imaginatively realising the objects that surround us, as when we *feel* the delicious coolness of the summer stream we look at, or the perfect pliancy of the waving grass. Not only so, with that impulse to give life to things that is born with us and never leaves us, we imaginatively or sympathetically project our subjective life into the world of objects. Thus, as is well pointed out by Lotze, we imaginatively extend our sensibility to our walking-stick, our dress, and so forth, incorporating these into our sentient organism.[1] So we vitalise foreign objects, the rustling foliage or corn, the dancing rivulet, and the like, carrying over into these our subjective states, and so expanding and enriching the life of feeling.

The constructive efforts of the poet are but a higher development of these processes. He builds up his beauteous world, where nature is surpassingly lovely, human action præternaturally noble, and so forth, through this selective action of feeling. It is the æsthetic feeling, the love of the beautiful in all its forms and varieties, that prompts and sustains the effort. The images recalled are feeling-coloured, that is to say, images of scenes and incidents that appeal to a sense of the beautiful, the tender, the humorous, and so forth, so that the process of imaginative accretion and arrangement here obeys the guiding and selective touch of feeling.

It follows from this that æsthetic imagination is essentially an *idealising* process. By selectively bringing together only that which answers to a particular feeling, it effects a mode of integration which stands in marked contrast to the associative groupings of our real experience. Here all connexions are determined by the actual order of presentations, the juxtapositions of objects in space, and of events in time. Whether these associative groupings gratify our feeling or no is accidental. In a large proportion of cases they certainly do not constitute a harmonious arrangement fitted to satisfy the needs of our feelings. Thus the beautiful appears in juxtaposition with the commonplace, and so forth. The process of feeling-prompted production just considered makes good these defects and dissonances of actual experience. It is essentially a har-

[1] *Microcosmus* (Eng. transl.), i. p. 588 ff.

monising of facts in conformity with the needs of feeling. Hence all art as such tends to idealise nature, to create situations, types of experience, and so forth, that transcend in their æsthetic value, *i.e.*, as sources of gratification to the æsthetic feeling, those of everyday life.[1]

It may no doubt be said that all imaginative activity, in so far as it is impelled by some motive, involves an element of feeling. Thus in working out some conjectural clue the mind of a lawyer or of a scientific man is stimulated by a feeling of curiosity. In such cases, however, the feeling is present in the highly intellectualised form of a calm motive to action. It is only when discovery is near that anything like an element of emotional excitement presents itself. In the case of what is here called poetic, that is feeling-impelled, imagination, the affective factor is present in a palpable degree throughout the operation. Moreover, the action of the feeling in furthering the imaginative process is largely direct, and does not involve any clearly conscious process of volition (aiming, voluntary selection). This is seen plainly enough in the case of painful feelings, such as terror, the influence of which in keeping certain images before the mind is often distinctly opposed to volition. And even in the case of pleasurable feelings, such as the sense of beauty, the presence of the excitement affects the character of the whole mental process. The end in this case being simply the furtherance and deepening of a feeling already excited in a measure, the whole operation of selective integration of image-elements appears to a large extent to be immediately determined or controlled by the feeling, with only a faint accompaniment now and again of conscious volition.[2]

§ 8. *Relation of Imagination to Intellect.* In these processes of feeling-prompted imagination the limits of truth and probability are apt to be lost sight of. The impelling and sustaining feeling alone determines the direction of the constructive activity. And, as has been just shown, this tends to take us far from the modest confines of fact. The vast domain of golden and intoxicating hope, of poetic romance, attests sufficiently this tendency of imagination to transcend the region of sober reality.

Such free indulgence in the pleasures of imagination has,

[1] Of course this idealisation is not absolute. It is opposed and restricted by the opposite impulse of realism, or the mimetic impulse in art. The way in which these conflicting tendencies are mutually adjusted, which varies in different domains of art, and at different stages of its development, is a subject that we must not enter into here. On the idealising tendency of the æsthetic imagination, see Siebeck, *Das Wesen der æsthetischen Anschauung*, kap. 7.

[2] This properly emotive control of the imaginative process is well illustrated in our dreams. (See my volume, *Illusions*, chap. vii. p. 164, etc.)

it is evident, a bearing on the question of its intellectual value. We saw above that the imaginative process when carried out under certain conditions, *viz.*, the desire for knowledge, and a sense of what is consistent and probable, is an integral part of the operations of intellection itself. And we have now seen that when swayed by feeling and so divorced from the sense of truth and probability it leads in directions away from reality. Now, this might not matter if such indulgence had no relation to belief. But, as we all know, the formation of vivid ideas and the dwelling on these involve the danger of regarding them as representative of reality. Imagination, as we shall see more fully by-and-by, directly fosters belief. We all tend to accept as true, for the moment at least, our visions of the future, and the delightful stories of romance. And thus we find in imagination, as commonly understood, a force at work that is antagonistic to intellect, and the logical end of truth.[1]

It must be confessed that writers on the imagination, here following common opinion, have been wont to dilate on the intellectual dangers of imagination rather than on its uses. By confining their attention to the vagaries of imagination under the stimulus of strong feeling they have overlooked its legitimate function, when reduced to a calm orderly form, in building up the fabric of knowledge. This oversight is clearly illustrated in the old opposition of imagination and understanding. No doubt these two provinces are broadly contrasted, since imagination has to do with the concrete in its fulness of detail, the understanding, with the general in its bareness and simplicity.[2] Yet there is a connexion between the two, which recent psychology has come to recognise. When duly controlled imaginative activity not only leads on to the grasp of new concrete fact, but even prepares the way for the higher processes of

[1] Unbridled imagination is attended not only by this intellectual danger but also by a moral danger, *viz.*, of the substitution of the pleasures of reverie for real satisfactions, with the consequent enfeeblement, and in extreme cases, as that of Coleridge, the paralysis of will.

[2] The broad contrast between the two has been illustrated in a very interesting way by Mr. Galton. As he justly remarks, "our bookish and wordy education tends to repress this valuable gift of nature". (*Inquiries into Human Faculty*, p. 113.)

thinking. By giving mobility and flexibility to the images of memory it is an essential preliminary to the activity of thought.[1] Thus, by breaking up or dissolving complex images and series of images into their parts and allowing of the isolated picturing of objects and events, it facilitates the processes of abstraction, that is to say, the turning of the mind from the complexities of concrete objects. And by rearranging presentative material in new forms it paves the way for the synthetic activity of thought, or the bringing of the thought-elements into new combinations.[2]

§ 9. *Course of Development of Imagination.* The activity of imagination follows a well-marked course during the life of the individual and of the race. And it may be worth while, as in the case of memory, to briefly indicate the stages of this development.

Production being dependent on reproduction, the imaginative process does not begin to appear till the reproductive process attains a certain strength. It follows, moreover, from the fact of the large *rôle* of language in new ideal formations, as in the reproduction of presentations, that the imaginative process only reaches a considerable development after a certain command of the plastic verbal material has been acquired. The child begins to show readiness and boldness in the weaving of new fanciful combinations when it becomes skilful in the manipulation of words, and, through the medium of such word-rearrangement, is able to effect a regrouping of its visual and other images. It has been pointed out by a good observer in the domain of infant psychology that a child will not display an interest in stories until he has had some practice in following a verbal narration of his own past experiences.[3] And it is presumable that the imaginative efforts of the race in the lower stages of culture grew in like manner out of ideal rehearsals of past experience, and in close connexion with the manipulation of language.

[1] Goethe somewhere talks of the imagination as "die Vorschule des Denkens".

[2] The function of imagination in thinking will be touched on again in the following chapter. Its importance in relation to intellect and thought has been emphasised by Mr. Spencer, *Principles of Psychology*, ii. pt. viii. chap. iii. §§ 491, 492; by George, *Lehrbuch der Psychologie*, 2nd pt. v. p. 278, etc.; and by Volkmann, *Lehrbuch der Psychologie*, Section iv. D. § 84, p. 469.

[3] See B. Perez, *Les trois premières années de l'enfant*, p. 163.

When these conditions are satisfied we find that imagination becomes rapidly a leading type of activity in the case both of the individual and of the race. The ignorance of the real world and its laws leaves the child and the uncultured man with a vast domain of the unknown which they are free to fill up with the products of their fancy; and a number of impulses, including a crude undisciplined curiosity itself, lead the uninformed mind to people this large *terra incognita* with forms of its own invention. Hence the rich efflorescence of fancy in the child who, from the age of three or four onwards, is wont to fashion an invisible world of his own, into which he retires in dream-like seclusion as the impulse takes him. Hence the quaint amusing fancies by the help of which he ekes out his sparse knowledge of the material world and human life, grasping and explaining what he sees or hears about in his inimitable childish fashion. Hence, too, the naïve spontaneity and vigour of the imagination of primitive peoples, as attested in the systems of folk-lore and mythology that have come down to us. The child of to-day does but follow the race in anticipating the slow and difficult progress of scientific observation and reasoning by the leaps of a wild and uncontrolled fancy.

The prodigality of this early fancy is strikingly illustrated in the play of young children. Play may be considered from more than one psychological point of view. Thus, looked at one way, it is the region of primitive spontaneous action, the natural vent of the child's active impulses, its inclination to do things, and to find out new ways of doing them. Viewed on another side, it illustrates the imitative or mimetic impulse of children, for play is largely a mimicry of the actions of adults. This mimicry is, however, plainly a make-believe. The child does not seriously follow out the actions of father, nurse, and so forth, when it plays with its hobby-horse or with its doll. All play is thus fanciful. When at play the child realises by an exercise of fancy the scenes and action which he is mimicking. The actual presentations, the doll, the wooden bricks, and so forth, do, indeed, supply a certain basis of sense-reality; and this is of great assistance to the young imagination in attaining to a half-illusory realisation of its images. At the same time, the basis is commonly slender enough.[1] It is only when what has been called "the alchemy of imagination" begins its work that the battered and broken doll becomes in a manner transformed into a living child, and the rude stick into a living, prancing horse. Hence a boy will often derive as much pleasure from a broken and shapeless hobby-horse as from the most ingenious of mechanical toys. Play thus illustrates in a striking manner the liveliness and range of children's fancy.

The nature of children's play, about which much has been written, is by no means fully understood. It is hard to ascertain how far we ought to take children seriously in all that they say and do in their play. No doubt a child has a considerable faculty of illusory self-absorption in its fancies which the older reader of novels may well envy. Images in his case tend to persist and fill his consciousness undisturbed by those critical tendencies which in the case of the educated adult are always at work inhibiting the full florid development of imaginative activity. Yet this childish illusion must not be confounded with an illusion of the senses. A child that will angrily resent your indignities to its doll would ridicule the notion of its bleeding. So far as we can re-construct the childish mind from later recollection it seems to be a hazy and thoroughly enjoyable state of 'make-believe,' that is, of partial abandonment to the leadings of fancy with intermittent critical awakenings from the day-dream. In one of the best adult recallings of childish play, that of George Sand, we are told that the illusory belief in the doll alternates with moments of recoil and disgust in which the object, that a moment before has been cherished as something sacred, is angrily thrown on the ground, or otherwise degraded to the rank of puppet. It is probable that the mental attitude of the savage towards his idol is similar, illustrating the tendency to a *quasi*-illusory belief in its vitality, which every now and again is suddenly arrested by a rudimentary process of critical reflexion.[2]

As we all know, the progress of experience and the growth of knowledge lead, in the case of the child and of the race alike, to a moderation of this prolific primitive imagination. From the first spontaneous form in which it is free to follow every capricious impulse, it passes into the more regulated form in which it is controlled by knowledge, and the sense of probability. The development of the higher forms of intellec-

[1] The aid rendered by the presence of an actual object to the activity of imagination is illustrated in the fact quoted by Mr. Galton, that chess-players can think out a game better when they have the empty chess-board present.

[2] On George Sand's reminiscences of her childish play-moods, see *L'Histoire de ma vie*, vol. iii. p. 181. *Cf.* Madame Necker, *L'Education Progressive*, livre iii. chap. v.; R. L. Stevenson, *Virginibus Puerisque*, "Child's Play". Some good observations on the nature of the play-illusion and its relation to art-illusion are to be found in Lazarus, *Ueber die Reize des Spieles*.

tion, thought carried out upon the results of careful observation, tends to check this lavish profusion of infantile fancy. The child and the race no longer account for rain, snow, and wind by help of mythical personages, personifications of nature's forces, but by what we call her laws. Expectation learns to move along the lines of probability. And the same progress of knowledge and of the logical faculty influences the ideas on art. The child's nursery stories, "Jack the Giant Killer" and the rest, cease to please, because they are now seen in their flagrant and absurd impossibility. In this way the domain of matter-of-fact rapidly encroaches on that of childish myth, and the actual prosaic world becomes supreme.

Nevertheless, although the accumulation of experiences and the development of higher intellectual powers thus tend to restrict the wild play of childish fancy, they by no means arrest or even impede the movements of imagination. It is a mistake to suppose that imagination no longer thrives when these primitive activities become circumscribed. What we dignify by the name of the boldness, the energy of childish imagination, is in truth merely the result of the absence of knowledge. Moreover, these combinations are very easy ones from the child's point of view, being simple in structure and modelled on the pattern of familiar everyday facts. It is to be noted that the child or the savage who is able to weave some picturesque myth could not form a clear mental picture of an animal that was described to him. Imagination passes out of this sportive childish form into a disciplined methodical one in which it becomes capable of more and more complex and difficult operations. In this way it helps, on the one hand, to extend the range of our knowledge, by assisting in the realisation and understanding of all that others tell us, that is to say, of by far the larger part of what the educated know; and, on the other hand, to widen and vary the region of æsthetic enjoyment, by enabling us to transport ourselves more easily and therefore more enjoyably into the wide and well-filled world of modern poetry.

§ 10. *The Culture of the Imagination.* The general conditions of mental development apply to the growth and improvement of the imaginative process just examined, and this circumstance enables us to lay down certain practical rules for its methodical culture. The regrouping of representative materials with a view to the production of new images is an operation sufficiently unlike other mental operations to require a special mode of exercise. Common observation tells us that a person may be finely observant, and retentive of what he observes, and yet comparatively inept in elaborating the material so gained into new forms. The contrast frequently drawn between the observant and the imaginative child, and the logical and the poetic mind, sufficiently illustrates this truth. To follow readily and with pleasure the descriptive words of a writer is in itself an art. There are many boys and girls who receive what is called a good education but who never acquire the art of facile and refreshing reading, just because they have not had a sufficiently wide and careful training of the imagination.

It follows from what was said just now that the full development of the intellectual powers imposes a certain restraint on the vagaries of the primitive fancy. Imagination has, as we have seen, to be brought under control and subjected to the government of the logical faculty. Yet this inhibition of the productive impulse is by no means the only or the main thing to be done even when we confine ourselves to the culture of the intellective imagination. A well-informed mind is one that has stored up a large mass of concrete knowledge gained by conversation and reading; and this assimilation of the results of others' observation and research is essentially an exercise of the imagination. Hence the common remark that the man of quick intelligence and ample and varied knowledge of men and things is the man of trained and ready imaginative insight.

It follows, further, from the severe demands now made on the logical faculty, or the power of regarding things as generalities and abstractions, that the imagination can only maintain a vigorous activity by means of that wider culture which embraces poetry and art. It is, as we have seen, under the vivifying touch of poetic or æsthetic feeling that the imaginative process attains its full strength. The study of poetry and imaginative literature as a whole is thus the great instrument for developing the imagination. Such study helps us to preserve some of the vivacity of childish fancy; for the domain of poetry, in spite of its modern realism and its so-called science, will always retain something of its primitive supernaturalism, and so make appeal to the child's love of marvel that survives in all of us.[1]

REFERENCES FOR READING.

The processes of productive imagination have not been adequately dealt with by English psychologists. The accounts given by Dugald Stewart and Sir W. Hamilton are slight and unsatisfactory. Prof. Bain deals more fully with the subject in his own manner under the head of 'Constructive Association' (*Senses and Intellect*, "Intellect," chap. iv.). Among foreign writers who have treated the subject may be mentioned George, *Lehrbuch der Psychologie*, 2nd part, v.; Volkmann, *Lehrbuch der Psychologie*, Section 4 D, § 84; Ölzelt-Newin, *Ueber Phantasie-Vorstellungen*; and Rabier, *Leçons de Philosophie*, chaps. xvii. and xviii. The nature of the imaginative process in art-construction has been specially discussed by Siebeck, *Das Wesen der æsthetischen Auschauung.*

[1] The cultivation of the imaginative activity in each of its directions calls for special exercise. This is obvious in the case of what we have called practical constructiveness. As we shall see later on, the faculty of sympathetic imagination, that is, of entering into others' ideas and feelings, has its own peculiar conditions.

CHAPTER XI.

PROCESSES OF THOUGHT: CONCEPTION.

§ 1. *General Nature of Thinking.* The intellectual operations hitherto considered have had to do with the concrete, that is to say, the presentations of the senses, and the representations formed on the model of these. To perceive, to remember, and to imagine have reference to some particular object, as the river Thames, or a particular occurrence, as the coronation of the German Emperor (1871), in its concrete fulness as it presents itself or would present itself to our senses. But we may reflect on some one attribute of these, as the movement, or the width of the river, or the splendour of this particular ceremony; and we may reason about rivers or ceremonies in general. When we do thus separate out for special consideration particular attributes or aspects of concrete things, and consider things in their relation to other things, and so deal with them as generalities, we are said to *think*.[1] All thinking is representation like imagination, but it is a different sort of representation. It is not a pictorial representation of an individual thing, as John Smith, or this tree, but an 'abstract' representation of some property or group of properties common to this and other objects, as trees or men generally.

These processes of thought constitute the highest stage of intellectual elaboration (intellection). By taking our concrete percepts and resolving them into so many abstractions (qualities or attributes of things, relations between things) we are enabled to carry up the process of cognition to the last stage of unification. As long as we view a particular object, or an

[1] Here again we have a word used in psychology in a sense somewhat different from its everyday one. We often say we cannot 'think' of a thing when we mean we cannot recall it.

event, alone, apart from other things, we merely *apprehend* it. But when we bring it into relation to kindred things we *comprehend* it. Thus we comprehend the tiger by classing it with other members of the feline group. So we comprehend or understand the movement of the steam-engine by assimilating it to the more familiar action of the steam in the kettle in forcing up the lid. To think is thus to understand, and the two expressions Thought and Understanding are frequently used as synonymous.[1]

Like imaginative production, thinking is nothing but the sum of processes of separation and combination carried out on sense-material. But in this case the elaborative processes assume a new and peculiar form. It is one thing to build up a pictorial image as the poet does, another thing to elaborate an abstract idea, such as the scientific notion of force, fulcrum, and so forth. We must now try to investigate more thoroughly the nature of this thought-elaboration.

§ 2. *Thought as Activity.* It is evident that the processes here roughly described are active processes, that is to say, that they involve a special exertion of the forces of attention. In perception, reproduction, and constructive imagination we have already found this active factor at work. But it is only in thought proper that this activity becomes fully developed. To analytically single out and specially think about a particular attribute in an object, say the colour of a rose, is, as we all know, more or less of a conscious effort or strain. A child first called upon to think about an abstract quality, or a relation between different objects, finds the operation difficult and fatiguing. All thinking is, in truth, an exercise of the higher form of attention, *viz.*, volitional concentration of consciousness. We only think when we have some purpose, as the discovery of the likeness or difference among objects. And such a purpose only develops itself as the individual and the race attain a certain measure of development or culture. The child and the savage, like the animal, get on very well without thinking. And even a

[1] As, for example, by Locke in his celebrated essay. But this usage of language is not universal. Kant, for example, drew a sharp distinction between understanding and reason, and narrowed the province of the former to one department of thought only.

large proportion of civilised adults think only in an occasional and rudimentary way. Thought is thus in all cases a kind of artificial activity sustained only for short periods, and under the stress of impulses or motives which belong to a high stage of intellectual and moral development.

§ 2*a*. *Neural Base of Thought-activity.* It follows from this rough description of the sphere of thought that it presupposes the higher stages of cerebral development, and more particularly the strengthening of those central tracts in the frontal region of the cortex which are supposed to be especially engaged in all the more difficult processes of volitional attention. According to the view adopted above, we may say that the activity of thought presumably involves a special amount of that muscular tension which forms the sensuous base of the attitude of attention. To think is to concentrate consciousness by aid of specially energetic motor adjustments. These, as already pointed out, will include the innervation of certain muscles, more particularly those by which movements of the eyes and head are effected.[1] Again, since, as we shall see presently, thought is carried out by help of word-symbols, which, as articulatory processes, have a motor side, we may suppose that a special feature in the muscular concomitant of thought is the innervation of the articulatory apparatus. To this it may be added that, since all thinking is bringing together in their relations a *number* of ideational elements, the muscular process in this case will be of a specially complex and difficult kind.[2] As suggested above, such special muscular efforts would probably effect a cutting off of other elements, and so subserve that severe narrowing of consciousness which is so marked a feature in thought.[3]

§ 3. *Directions of Thought-Activity.* This thought-activity may be viewed as having two aspects, or as following two directions, which it may be well to consider apart, even though, as we shall presently see, they are inseparable aspects of one process. Just as we saw that all intellectual elaboration is at once differentiation or separation and integration or combination of what is differentiated, so we shall find that thought itself is but a higher development of each phase.

(*a*) *Analysis: Abstraction.* First of all, then, thought may be viewed as a carrying further and to higher forms the process of differentiation or separation of presentative elements by

[1] *Cf.* above, p. 149 f.

[2] *Cf.* above, p. 159 f.

[3] The dependence of thought on the higher form of volitional attention makes it difficult to deal with the former until a general survey of the process of volition has been taken. Hence some psychologists, as the Herbartians and Ward, treat of thought, or, as they call it, 'intellection,' after expounding the general nature of conation.

means of isolating acts of attention. Thus in selectively considering the colour of a rose, or the form of a crystal, we are, it is evident, differentiating what is given in perception as a complex into a number of parts, and rendering one of these specially prominent and distinct. Such thought-separation is commonly spoken of as Analysis, *i.e.*, the taking apart of what is conjoined in a whole, and also as Abstraction or the withdrawal of attention from those parts of the presented material which are for the moment irrelevant, and confining it to one particular point, feature or quality (Latin, *ab* or *abs* and *traho*, to draw, *i.e.*, the thoughts, off or away).

This isolating attention begins, as suggested above, in comparatively early and simple processes. When, for example, a particular feature is specially prominent and interesting the attention will be drawn to it in a reflex manner. Thus the child may be said to isolate the lustre of the sun-lit water, and all æsthetic observation illustrates this selective function of attention under the influence of that predominant incentive or spur which we call special interest.

The analysis or abstraction of thought differs from this easy operation in the fact that volitional effort is required. Thus we carry out a process of thought-abstraction when, by a special exertion of volitional attention, we concentrate consciousness on a particular feature in a presentation-complex which does *not* at the moment strike and arouse the attention, *e.g.*, the precise tint of a very faintly coloured object, a disguised flavour in a dish, and so forth. Here the psycho-physical process of isolating attention is more involved and is attended with a special degree of the consciousness of effort or strain. The presence of other and more striking features which draw off the attention necessitates a severer effort of resistant concentration. Hence the process is abstraction in the complete sense of the term.

It follows that the terms analysis and abstraction are not perfectly synonymous. Analysis occurs in all cases where a complex is resolved or broken up into parts. Thus, as pointed out by Stumpf, there is analysis where we only just distinguish a plurality of constituents in a complex, say tones in an accord, without singling out any one of these for special attention.[1] Abstraction, on the

[1] Stumpf's definition of analysis is given in his *Tonpsychologie*, i. p. 96 ff., and ii. p. 3 ff. A history of the psychological use of the term is added, ii. p. 17 ff.

other hand, always includes this singling out of a particular constituent. Not only so, as a factor in the thought-process it connotes further a volitional effort, or a deliberate selection of some particular feature for special consideration, not because of its preponderant intrinsic impressiveness at the moment, but because we have a particular reason or motive for selecting it.

The term abstraction is sometimes used with special reference to the detection of similarities hidden away among differences. But there is abstraction wherever there is a plurality of stimuli at work and resistance offered in certain directions, *i.e.*, inhibition of the adjustive process of attention. All close concentration on a point is thus abstraction, and is popularly described as such. Such resistance, however, shows itself in a particularly marked form in the analytical singling out of a particular feature or quality of a presentative complex; and it is to such thought-processes that the terms abstract, abstraction, the abstract, are generally restricted.[1]

The nature of this process of analysis or abstract attention is best seen in those comparatively simple operations in which an actual presentation-complex, as a group of tones or of colours, is being analysed.

The carrying out of such a process of analysis is aided by certain conditions, objective or external, and subjective or internal. Thus it is found that the closer the degree of the complication the more difficult the isolating fixation. Thus, while it is comparatively easy to attend to one detail of colour in an object locally separated from other colour-details, it is exceedingly difficult to attend to the brightness or the degree of saturation of a colour apart from the quality of the hue itself. In the case of tone-masses, again, it is found that certain combinations, more especially that of the octave, are difficult to analyse because of the tendency in this case to fusion.[2]

Coming now to subjective conditions we find that the detection of an element in a complex is aided by familiarity

[1] On the meaning of abstraction, see Hamilton, *Lectures on Metaphysic*, xxxiv.

[2] This obstructive effect probably depends in part on a special difficulty in carrying out the muscular adjustments involved in the isolating acts of attention. Thus we may readily understand that aspects of an object, as the brightness and the saturation of a colour, having a common locality, render analytic attention peculiarly difficult. (See above, p. 159.) On the other hand, certain juxtapositions, as the tones of an octave, may, owing to their partial qualitative similarity, or to their previous habitual co-presentation, have a special tendency to fuse, and so to resist analytic separation. This last is the view adopted by Stumpf with respect to tone-analysis. (See his account of the different degrees of fusion, *Tonpsychologie*, ii. pp. 65 and 127 ff.) It is possible, however, that in this case, too, the difficulty is partially explicable by a reference to the muscular concomitant of the process of attention. (See above, p. 159 f.)

with the same apart from its present concomitants. Such previous knowledge gives rise to an *idea* of the constituent which materially aids the process of analysis. Thus the singling out of the partial tones of a clang is greatly furthered by the circumstance that these occur and are known apart from the ground-tone and so are more readily picked out and recognised. This previous experience of the constituent apart or in other combinations may be supposed to aid that ideational process which we have seen to be so potent a factor in all the higher forms of attention.[1]

Again, the separate detection of a particular presentative element is favoured by special interest in the same. A fine ear for clang-effect or timbre can more readily fix its attention on this. Such special interest works mainly through what is known as practice. What we are accustomed to note, and exercised in picking out from its surroundings, we are able to detect readily. The effect of practice in facilitating analysis or abstract attention to this and that constituent of a presentation-complex is abundantly shown throughout the whole domain of recent experimental inquiry into the nature and relations of sensation. Such experiments commonly require a new and highly artificial adjustment of attention, as in specially noting the degree of saturation of a colour, the constituent elements of a clang, the effects of colour-contrast, and so forth. It is found that practice here produces a striking effect; and this not only because like all mental or psycho-physical operations observation grows less difficult with repeated exercise, but because a previous separate consideration of an obscure presentative element leaves us disposed to discern this element again.

Of course all such analytical separation of presentative constituents is limited by certain conditions in our sensibility. Thus the limits of local discrimination obviously confine the range of isolating attention to local detail in our tactual and

[1] *Cf.* above, p. 151; also see what was said above, p. 184 f., on the relation of assimilation to differentiation. According to Helmholtz this previous familiarity with the elements of a composite whole, when it gives rise to a vivid expectation, may produce an illusory analysis, as when certain opticians affirmed that they could detect the supposed constituents of green, *viz.*, blue and yellow, in that colour. See *Physiol. Optik*, p. 273. *Cf.* James, *op. cit.*, i. p. 440 ff. The exact amount of this influence is carefully investigated by Stumpf, *op. cit.*, ii. p. 78 ff.

visual presentations. Since, too, such isolation is differentiation, *i.e.*, the singling out of some trait or feature different in quality or intensity from surrounding features, it follows that our abstraction is in all cases limited by our discrimination. We cannot separately fixate a local detail of colour if this is not qualitatively distinguishable from its surroundings, nor a local detail of form if this is not distinguishable in intensity, *i.e.*, light-and-shade difference, from its *entourage*. Similarly with respect to the difficult analysis of the complexes of tone-presentations or clangs, and of those of taste-presentations, as the mixed flavours of a dish.

(*b*) *Synthesis: Conscious Relating.* In the second place, all thought is integrating or combining; or, as it is commonly expressed, it is a process of Synthesis. In thinking we never merely isolate or abstract. We analytically resolve the presentation-complexes of our concrete experience only in order to establish certain relations among them. The most appropriate term for all such conscious 'relating' or discernment of relation is comparison.

The terms analysis and synthesis, though used with special reference to thought-operations, appear in a germinal form in the lower stages of intellective elaboration. Thus, as we saw in the process of sense-perception, we single out some object (or part of an object) for special notice, disregarding its surroundings. And this selective process of the attention is a kind of analysis. Again, since a percept is a complex psychical product formed by a coalescence of sense-elements, we may say that it is the result of a kind of 'unconscious synthesis'. Once more, in the processes of reproduction we found both a separating of images from their surroundings, as well as a combining of them by an act of conjoint attention. The germ of the operations of analysis and synthesis is still more clearly illustrated in the process of constructive imagination, where elements are loosened from their experiential surroundings and brought into new combinations.

As was seen above, all presentative material is given in certain relations or connexions, including that of co-existence or co-inherence in a substance between the several qualities of a thing. Thus the different parts of an extended body stand in certain spatial relations one to another, one part being situated to the right of the other, and so forth; and, further, the object as a whole holds like relations to other adjacent objects. To these space-relations must be added the time-relations of all events, such as the movements of objects, their changes of form, and so forth. Lastly, with these 'external' relations are given the so-called 'internal' relations of difference and likeness.

As long as we perceive or imagine the concrete object as such we have only a vague 'implicit' knowledge of these relations. Thus a child in looking at a house sees *implicitly* the chimney in a definite spatial relation to the mass of the building, but the clear *explicit* grasp of this relation is a subsequent process going beyond perception, and involving a rudiment of what we mark off as thought. In like manner, when in recollection we recall a sequence of experiences, we may implicitly recognise one as following another; yet it is only by a process of thought that we explicitly single out this relation for special consideration.

The same holds good with respect to the all-comprehensive relations of dissimilarity and similarity. As we saw, a child in perceiving a particular object, say a tree, differentiates it from surrounding objects, other trees, the background of the sky, and the like. And in recognising a familiar object, as his toy, or an orange, he assimilates it to previous like presentations. But in these cases the consciousness of difference and likeness is implicit only. It is some way from this implicit or unconscious discrimination and assimilation to comparison proper, issuing in a clear or explicit consciousness of a relation of likeness or of unlikeness.[1]

All such explicit grasp of relation involves a new direction of adjustive effort, or of (volitional) attention. Just as the analytic resolution of a complex demands a special effort in the way of limited concentration and resistance to irrelevant concomitants, so the comparison of two presentations in order to discern their relation, imposes a further special task in the shape of a comprehensive grasp. The special difficulties of the process have already been touched on. Comparative attention to two presentations, say two colours in local, or two tones in temporal juxtaposition, is not merely the carrying out of a simple adjustive process in one direction only, but the carrying out of a double and yet co-ordinated adjustive process. Such an operation is, as we all know, a difficult one, which has to be learnt

[1] It follows from this that thought grows by minute gradations out of the lower intellective operations. The perception of objects in space, and still more the recollection of events in time, is itself an incipient sub-conscious stage of the thought-process, *i.e.*, grasp of relations. Hence our demarcation of the spheres of sense and thought, of concrete or pictorial and abstract representation, though real and important, are not to be taken absolutely. *Cf.* above, chap. vii.; also Lotze, *Microcosmus* (Eng. transl.), i. p. 655; Ward, *loc. cit.*, p. 75.

by prolonged trial. It is pre-eminently an artificial activity, hardly more developed among uncivilised mankind than among the lower animals.

The nature of such combining or co-ordinating attention, and the question how far it is strictly a simultaneous process or a series of rapid alternative movements from one element to another, have been touched on above under the head of "Area of Attention".[1] The fact that there is a general tendency to simple modes of adjustment subserving a comparatively simple structure or pattern of consciousness, and the fact that complex simultaneous adjustments, as in the case of doing different things at the same time, and in that of the synthetic process of thought, are rare and acquired with difficulty, suggest that a special nervous process is involved, consisting of a double and divergent stream of innervation, each branch of which has to be kept going in certain relations of time, as also of proportionate strength, with the other branch.

The process of synthetic or relating activity just described may take the direction of consciously grasping the relations immediately given along with presentations, more particularly the co-existence of attributes in the same object, and the space and time-relations of presentations. To note the juxtaposition of yellow and white in a daisy, the co-existence of its form and colour, or the spatial inclusion of its yellow centre in an extended whole, is evidently to discern relations and so to carry out a process of conscious synthesis.

It is, however, in discerning the most comprehensive relations of likeness and unlikeness that thought shows itself most clearly to be a synthetic process. Thinking has, in a special manner, to do with the detection of similarity and dissimilarity or difference. Such relating by way of difference or agreement is what we ordinarily understand by comparison. And it is this process that we shall now examine with some care as the second fundamental or constituent process in thought.

The relations of similarity and dissimilarity as comprehensive relations connecting presentations, remote as well as proximate in time, are spoken of as internal, and thus marked off from the external relations of time and place. It is true, as we have just seen, that they are involved along with the latter. Thus, in discerning the relations of the parts of an object we must differentiate, that is, subconsciously at least, discriminate them. Yet the two modes of relating are distinct. I discriminate two colours in local juxtaposition not *quâ* juxtaposed, but *quâ* different in their quality. The juxtaposition may greatly assist the discriminative

[1] See p. 160 f.

process, but this circumstance does not make the juxtaposition and the qualitative difference one whit less distinct as relations.

It may be added that the greater comprehensiveness of the so-called internal relations is seen in the circumstance that the relations of time and place, just like the separate qualities or attributes of objects, are themselves modes of similarity and dissimilarity. Thus the relation of local contiguity between two elements is something *common* to these and other contiguous pairs. Moreover, it is evident that in such a case each element is recognised as having a different position from the other. Similarly with the temporal relations of events.

COMPARISON.

We have now to inquire more fully into the operations here brought under the head of comparison, *viz.*, the calling of different presentative or representative materials before the mind simultaneously and keeping them in consciousness in order to note their relations of similarity or dissimilarity. Here, as in the case of analysis or abstraction, we shall illustrate the process by selecting relatively simple modes of the operation carried out on immediately presented sense-material.

§ 4. *Discernment of Likeness and of Difference.* It has already been pointed out that likeness and unlikeness are two perfectly distinct relations.[1] To apprehend a similarity between two sensations, say tones, is an intellectual process which we all recognise as radically unlike that of apprehending a difference.

Yet while the consciousness of likeness and that of difference are thus radically distinct as psychical processes, it is evident that the relations of likeness and difference are presented together in close connexion. As we all know, similarity discloses itself in the midst of difference. This is obvious in the case of all complex presentations, as when we assimilate two objects on the ground of a colour-resemblance. Since, too, as we saw above, even in the case of sensation-elements, likeness is a thing of degree, shading off from perfect likeness or indistinguishableness to just recognisable affinity, it follows that here, also, likeness and difference are given together in mutual implication.

The only apparent exception to this co-presentation of similarity and dissimilarity is to be met with in two extreme cases. On the one hand, all difference may disappear in perfect similarity, as in comparing two colours which are to us

[1] *Cf.* above, p. 179 f.

indistinguishable.[1] Even here, however, there must be either local or temporal difference in order that there may be two presentations, and so an act of comparison, at all. And it may be maintained that this separation of two impressions as locally or temporarily distinct is the preliminary stage in all comparison. On the other hand, all likeness may become evanescent, and the two presentations stand over against one another as absolutely disparate and incapable of being assimilated. This case is realised in the attempt to assimilate two perfectly heterogeneous sensations, say, a taste and a colour, under a qualitative resemblance. But here, it is to be noticed, comparison, as ordinarily understood, fails altogether. Difference is not only preponderant and triumphant, but its triumph is fatal to the relational act itself. It is only when the two mutually repugnant elements are seen to present some common feature or aspect (*e.g.*, intensity or *Gefühlston*) that we are, strictly speaking, able to compare them, that is, view them as terms of a relation.

Since resemblance and difference are thus uniformly presented together, it is to be expected that comparison will commonly include the two processes assimilation and discrimination. We see likeness amid differences, *e.g.*, a common trait in two faces along with striking dissimilarities. On the other hand, we contrast two objects in respect of some *common* quality, as colour, form, beauty, and so forth, which common element constitutes the ground or *fundamentum* of the comparison.[2]

At the same time, it is evident that the one process usually, if not in all cases, preponderates over the other. We are now specially interested in the likeness of two objects, say two faces, or two literary styles, the moment after perhaps in their difference. Accordingly we may say that comparison is the noting of likeness against a dimly apprehended background of difference, or of difference against a dimly apprehended background of similarity.

It may perhaps be said that the normal course of the whole operation of comparison falls into the following stages. The starting-point is a sub-conscious discrimination or differentiation of two presentative contents, at least as locally or temporally distinct. Then comes a faint consciousness of a similarity in the shape of some common feature (or features), which is the beginning of the act of comparison proper. This afterwards develops into a more definite consciousness of a particular likeness or difference.[3]

[1] On the question, emphasised by Stumpf, whether, considered objectively, there must always be some difference, though this may fall short of our power of discrimination, see above, p. 179.

[2] *Cf.* above, p. 185.

[3] The term comparison, probably derived from the Latin *con* and *par* equal (*cf.* German ver-gleichen), suggests that the operation has specially to do with likeness. As we have seen, this is true so far as that all comparison is based on a more

§ 5. *General Conditions of Comparison.* Comparison, whether specially directed to likeness or to unlikeness, has certain common conditions. These may be divided into objective, or those involved in the nature or concomitants of the presentations considered as objects of common perception, and subjective, or those connected with the nature of the individual mind.

(1) *Objective Conditions of Comparison.* The most important of these are reducible to three heads. (*a*) Strength or intensity of the presentations compared; (*b*) Distinctness of the ground of comparison or common factor; and (*c*) Juxtaposition in time and space. A word or two on each of these may suffice.

(*a*) It is obvious that if we are to compare two contents, these must present themselves with a measure of force and persistence. We cannot compare the pitch of two tones if they fall below a certain degree of intensity, or are not sufficiently prolonged. There is a certain moderate intensity of impression which is most favourable to comparison. We detect the finest difference of brightness in the median region of the scale of luminosity. The difficulty of comparing representations as contrasted with presentations illustrates the same truth, for our images are as a rule too faint and too shifting for clear, steady comparison.[1]

(*b*) As remarked above, all comparison presupposes a *fundamentum*, or common aspect, in the things to be compared. And the difficulty of comparison varies inversely with the distinctness and prominence of this element. Thus, to take an obvious instance, we cannot compare two tones in respect of pitch if this is unsteady and variable from moment to moment, or two colours if they are not pure. Again, speaking generally, it is more difficult to compare two colours with reference to degree of saturation than with reference to their hue: the element of saturation being less obvious, to the untrained eye at least, than that of hue.[2]

or less distinct apprehension of a common feature. But the usages of speech have long since extended the meaning of the word so as to include special discernment of difference as well.

[1] A certain extensity is also necessary to objective impressiveness. (*Cf.* above, p. 153.)

[2] The difficulty is increased when the point of comparison is not sensuous but relational, as in the case of proportions of form; or partly ideal partly emotional, as in the case of art-effects, style, and so forth.

In comparing any two complex contents there is a further difficulty due to the need of a preliminary analysis, the discrimination and selection of the ground of comparison.[1] It is found that the difficulty in this case varies inversely with the prominence of the element. By prominence is here meant its impressiveness relatively to that of the other elements. Thus it is difficult to compare two handwritings, two musical styles, and so on, in respect of some subtle feature that is apt to be overpowered by mere palpable traits. Hence the fact emphasised by Stumpf that sensations are much more easily compared in one particular respect, as tones in respect of pitch, when there are no other differences, *e.g.*, of loudness, to divert the attention.[2]

(*c*) The presentations must be capable of being brought before the mind in the way most favourable to comparison. With respect to temporal conditions, it might at first be supposed that the simultaneous presentation of two impressions is preferable to the successive presentation. But though the simultaneous occurrence of two sensations furnishes one condition of comparison, *viz.*, proximity, it has, in many cases, countervailing disadvantages. This applies to all cases of very like sensations, where there is consequently a tendency to a partial fusion, as in the case of simultaneous tastes, musculo-tactual sensations of weight, tone, and so forth. Thus Weber found that two weights are much less exactly compared when lifted simultaneously by the two hands than when tested successively by the same hand.[3] A further reason for the inferiority of simultaneous comparison in this case is that suggested by Stumpf, *viz.*, the addition of new factors of dissimilarity in the *local* characters of the experience. Lastly, it may be observed that simultaneity often introduces a new and disturbing element.

[1] Strictly speaking, as we have seen, the so-called simple sensational contents offer a certain choice of relational aspect. Thus two tones may be compared in respect either of pitch, of loudness, or of timbre.

[2] See his *Tonpsychologie*, i. p. 348. *Cf.* the effect of unlike intensity on the comparison of tone-qualities. (*Ibid.* p. 236.) A common illustration of this masking effect of concomitant differences is the difficulty of comparing two flavours when complicated by a marked difference of temperature.

[3] The same applies to the discrimination of points by the skin. If the compass-points are very close they may be distinguished as two if made to touch the skin successively, though they fail to do so if simultaneously applied.

This is strikingly illustrated in the difficulty which the unpractised ear finds in saying whether a violin note which makes a dissonance with a simultaneous piano note is above or below this, *i.e.*, sharp or flat.[1]

With respect to impressions presented in space, a certain local proximity is necessary for the finest comparison. Thus the most delicate discrimination of tint shows itself with respect to colours laid side by side, and at their common boundary; and the same holds good of form-elements, as in comparing the direction or the length of two lines.[2]

(2) *Subjective Conditions of Comparison.* (*a*) Since comparison is a mode of intellectual activity involving voluntary attention and concentration of mind, it obviously presupposes all the psycho-physical conditions necessary to such concentration. Thus it implies a favourable condition of the brain at the time, and also a well-practised faculty of mental concentration. Since, moreover, comparison is a special mode of concentration, *viz.*, a viewing of two things under some relation, it depends on previous practice in this particular line of activity.

(*b*) In the second place, the act of comparison varies with the pre-existing attitude of mind with respect to the contents selected and the ground of comparison. In the case of simple sensuous contents, that is to say, sensations, much will obviously depend on the individual's special degree of sensibility in relation to the particular class selected. A good discriminative eye for, and a vivid interest in, colours (which may be supposed in general to accompany the former) are clearly a condition of a nice comparison of the same. In the case of complex presentations our facility in comparing will vary directly with our special familiarity with and interest in the ground of comparison, and inversely as the attractive force of the other elements. This is seen in the case of contents so simple as tones. Stumpf has found that the readiness of musicians in comparing tones in respect of pitch was seriously interfered with by the tendency to attend to their melodic relation. Another

[1] On the conditions of comparison, see Stumpf, *op. cit.*, ii. p. 60 ff. *Cf.* James, *op. cit.*, i. p. 495.

[2] These conditions of just and accurate comparison are fully recognised in that careful, methodical experimentation by which the limits of discrimination in the case of the various sensations have recently been investigated.

illustration is the difficulty of comparing some detail in the faces of two intimate friends. Here the mass of individualising isolating suggestions is often too interesting to allow of an easy abstract attention to the common feature.

(*c*) A word must be added on the effect of mental preparation or preadjustment of mental vision. It is evident that when we are definitely on the look-out for a similarity or difference *in some known particular* the act of comparison will be facilitated. In this case we are saved the labour of analysis and of selecting the ground of comparison. Thus if I am asked to compare two flowers with respect to depth of colour or delicacy of texture, the whole process is shortened by the preliminary act of adjustment.

It does not follow from this that a distinct anticipation of difference rather than of similarity uniformly favours the detection of the former. To give an instance, I recently talked with two persons who had visited the United States, the one expecting to see the people very like the English in ideas, sentiments, manners, etc., the other expecting to find them unlike. The first told me that he had been struck by the contrast, the second, by the degree of similarity. The explanation of such familiar facts is very simple. It is the unexpected that strikes us; and the effect of this must be allowed for in estimating the influence of anticipation. It follows that if we want to pay special attention to the likeness or to the difference between two things, we must make an effort to concentrate the mind in the required direction.

These seem to be the main subjective circumstances which serve to determine the rapidity and accuracy of the comparative act. It is only necessary to add that, whenever the comparison is between a presentation and a representation, or between two representations, an important subjective factor is the individual power of reproductive imagination. In judging of the pitch of a note, of the weight of a letter, of the genuineness of a picture, and so forth, all depends on the accurate reproduction of the past impression (or series of impressions) which serves here as the standard of comparison.[1]

We may now proceed to consider comparison as a determinate process, that is to say, as specially concerned with the detection either of difference or of similarity. In this determinate form of the comparative process we have, it is evident, a special preadjustment of mind for one of the two

[1] Of course if the comparison is between an impression and one preceding it by a short time-interval, as in the experiments of Lehmann already referred to, the subjective condition would have to be stated as duration of after-image. But, as already pointed out, this appears to vary with individual reproductive power. (See above, p. 281 f.)

relations. Thus, in comparing two prints or two coins in order to see their difference, we start with a vague representation of some difference, which representation becomes a definite apprehension by combining with the actual presentation of a certain point (or certain points) of difference in the objects.[1]

§ 6. *Discriminative Comparison.* By discriminative comparison is meant the comparing of two presentative elements in order to consciously apprehend their difference.

The conditions of such conscious discrimination are the general conditions of all comparison together with certain special ones, objective and subjective. Thus, a special objective condition is the amount (intensity and extent) of difference relatively to that of similarity between the presentations. Where this is great discrimination will obviously be furthered.

Among special subjective conditions may be named a strong interest in differences as distinguished from similarities. There is little doubt that as we are affected differently by a similarity and by a contrast, so there are special degrees of interest in the one or in the other. Some persons 'are struck,' as we say, more by a likeness, others by a difference. Such preponderance of interest in difference or similarity generally would favour a habit of attending to the one rather than to the other, and so beget a special facility of detection. In this way we may account for what is sometimes spoken of as a good general faculty of Discrimination or Assimilation.

To this preferential disposition to note difference or similarity generally must be added of course a high degree of "discriminative sensibility" with respect to the particular class of presentative elements compared. This power, as measured by the smallest difference between two stimuli that is barely observable, varies greatly among individuals. It is conditioned primarily by the organic structures involved, as we see in the lessening of normal discrimination of colours and tones in the case of colour-blindness and of note-deafness.[2]

Discrimination is, however, in all cases improvable within certain limits by practice. The effect of exercise in rendering

[1] *Cf.* the way in which the pre-formed image combines with the percept in the case of satisfied expectation.

[2] *Cf.* above, pp. 111, 120.

discriminative sensibility more acute has been touched upon above, and is strikingly illustrated in the fact that Laura Bridgman was found to have a tactual discrimination for two compass points from two to three times as acute as that of a seeing person. Such practice, according to what was said above, modifies the nervous structures engaged, rendering the process more easy and fluent. It also effects a heightening of discrimination by producing lasting psychical effects in the shape of clearly distinguished images of previously discriminated sensations. To this it must be added that the exercises referred to involve a strengthening of the factor of attention.[1]

§ 6*a*. *Varieties of Discriminative Problem.* The comparing of two presentations in order to detect their difference varies according to circumstances, and more particularly our previous knowledge of the things to be compared. Thus, if the presentations to be compared are viewed as simple, the problem may assume the form: "Are these two colours or tones different, that is, distinguishable?" or "Are these two lights or sounds unequal, *i.e.*, distinguishable in intensity?" This form of the discriminative problem is a very common one; and it is to the answering of such questions as these that most of the modern experimental inquiry into the limits of discriminative sensibility has directed itself. Again, it may be asked: "In what way do these two elements, say tones, differ one from another?" *i.e.*, "Which of these is the higher in pitch?" It has been found that a person can distinguish two tones in pitch without, at the same instant, saying which is the higher.[2]

[1] The general effect of repetition and practice on discrimination, as on all forms of simple sense-comparison, assumes a certain course. It increases very rapidly at first. Thus, in the case of Volkmann, the discriminative sensibility of the skin for point-distances doubled itself after a few hours' practice. Later on the effect of improvement declines, so that the curve takes on an asymptotic form. (See Stumpf, *op. cit.*, i. 79 ff.) According to Stumpf, who distinguishes in the sharpest way the sensation and the apprehension through attention of the same (Auffassung), the effect of exercise is in the main, if not exclusively, due to the improvement of attention, together with that of memory. (*Op. cit.*, i. p. 94; *cf.* ii. 9 ff.) As pointed out above, W. James emphasises the ideational effect of practice upon discrimination. (*Op. cit.*, i. p. 508 ff.) The supposition of the concurrence of an organic factor (facilitated nervous action) is supported by the fact that practice has a like effect in shortening reaction-time.

[2] See Stumpf, *Tonpsychologie*, i. §§ 2, 3, and 15. It is evident that a similar problem is possible in other cases, *e.g.*, in the form 'Which of these two colours is

We may now pass to problems having to do with complex presentations or representations. And here we may distinguish a more vague and more definite mode of discrimination. The first would be illustrated by the problem : "Are these two complexes, *e.g.*, two sheep, different in any respect ?" The second would be illustrated by the question : "In what particular (or particulars) do these two presentations differ ?" The first question brings out what we know as "vague impressions," *e.g.*, as to faces, handwritings, literary styles ; the second tests the trained faculty of the expert and the critic.

It is to be noted that all cases of definite discernment of difference between two complexes are aided by previous knowledge and association. Thus the shepherd notices slight differences between two sheep because these have acquired special significance for him. The small amount of presentative difference has become increased by overlayings of ideation or association.[1]

§ 7. *Assimilative Comparison.* Here, again, it is evident that the comparative process will be furthered by special conditions, both objective and subjective. With respect to the former, it is sufficient to observe, as in the case of discriminative comparison, that the greater the amount of similarity as compared with that of difference existing between two contents, the more certain and rapid the detection of it. By amount of similarity is here meant degree in the case of a comparison of simple quality (*e.g.*, tint) or product of degree into number of like points in the case of complexes.

With respect to subjective conditions, it is merely necessary to add that the detection of similarity is aided by a special interest in likeness as such. A person with a strong interest in similarity and relatively weak interest in difference will be quicker than others in noting the presence of a like trait.

Here, too, a word may be said on the effect of practice. Exercise in tracing out similarities will further the future dis-

the warmer, or the more saturated ?' or, again, 'Which of these two lines is the longer ?' With regard to comparisons of intensity, it is pointed out by Lehmann that whenever we distinguish two light-intensities (shades of grey), we can at the same time say which is the brighter. (*Phil. Studien*, bd. v. pp. 119-120.)

[1] *Cf.* the effect of integration of motor elements in bringing out and accentuating the primordial local differences of visual and tactual sensations.

covery of these partly, as already pointed out, by giving a special expectant attitude to the attention. In all cases, moreover, where the assimilation involves reproduction, as in recognising objects after a considerable time, practice will effect a strengthening of the retentive and reproductive factor.[1]

§ 7*a*. *Varieties of Assimilative Problem.* We may now consider the several distinguishable forms of the Assimilative problem, following the same order as that followed in the case of discrimination, beginning with the case of simple presentations. Here the question will be: 'Do these two simple contents resemble one another?' At first sight this inquiry may seem unmeaning, but a little consideration will show that it is apt to occur. Thus a person may be asked whether he regards, or can regard, two colours at a certain distance from one another in the chromatic circle, say, vermilion and yellow, as like one another. The same question might be put with respect to two tastes, odours, or timbres. Such a line of inquiry would serve to determine the limit of the individual's assimilative grasp.[2]

It is, however, in dealing with complexes that the problem of assimilative comparison becomes important. Here, as in the case of discrimination, we may put the question in the vague form: 'Are these two complexes alike in any respect?' This is a very familiar type of inquiry. We are asked whether we find two persons' voices, faces, and so forth, like one another. Or we may make the question more definite, putting it in the form: 'In what respect do these two complexes resemble one another?'

Here, in addition to the general conditions already given,

[1] The effect of practice is well illustrated by Lehmann in connexion with his experiments on Recognition, *loc. cit.*, p. 132.

[2] It is probable that the main circumstance specially affecting this problem is the extent to which past experience has induced a habit of separating the two impressions or qualities as unlike. This may range from zero up to a high figure. A savage or a child who had not distinguished blue and violet or orange and yellow would, it is obvious, necessarily view them as like one another. The more finely the several gradations of colour had been discriminated, and the more habitual the discrimination, the greater the difficulty of assimilating the terms in the series. Thus a painter or a colour-manufacturer would have more resistance to overcome than an ordinary person in regarding, say, violet and blue or violet and purple as similar qualities.

we have to specify as a special negative condition the absence of the deadening effect of familiarity on our power of assimilation. We can all readily discern the common type in the individuals of a family whose acquaintance we are just making, but it is hard for us to detect the common elements of form and expression in members of our own family. Each brother's or sister's face has for us become differentiated and individualised by innumerable associations which, by their superior interest, serve to blind us to the likenesses. There is something similar to this in the growing difficulty of the student of music or other art in assimilating two masters' styles.

It is rarely that the problem of comparison is as simple as is here supposed. Even when we are specially engaged in determining similarity, difference is sub-consciously grasped also, and the comparison has something of the character of a judgment respecting the preponderance of the one over the other. Thus, in determining whether two members of a series, say two adjacent tints in the colour-scale, are like one another, we are sub-consciously representing the whole chromatic scale and complicating the simple problem by vaguely contrasting the proximity of the two given tints with the remoteness of other members.[1]

It is to be added that since both difference and likeness are things of degree a good deal of our actual comparison has explicitly to do with the relative amounts of these, as when we are asked to say which of two particular colours is more unlike (or more like) a given colour, or whether two tone-intervals or two differences of intensity among sounds or colours are equal or unequal, or again (as in Lehmann's experiments), which tone or colour, out of a number, a given one most resembles, and so forth. This secondary comparison, or comparison of the results of comparison, is obviously later and more difficult than the primary or simple types considered above. Experimental psychology has, however, already begun to occupy itself with such advanced problems.[2]

[1] It seems to me that Lehmann's experiments already referred to, in which he requires a subject to recognise a shade of grey, as of this *or* that, *or* the other, degree, are so far from being a simple exercise in assimilation (recognition), as he supposes, that they involve complex exercises of discrimination and assimilation.

[2] Thus Plateau, in the region of light-sensation, has occupied himself with comparing differences of intensity so as to obtain a medium grey midway between white and black. Prof. Stumpf, however, was the first to carefully define this line of inquiry with special reference to tone-intervals, under the heading "Comparisons of Distance" (Distanz-Vergleichungen, see his *Tonpsychologie*, i. § 7). The latest and most remarkable development of this direction in experimental psychology is that of Münsterberg. This investigator has attempted to measure differences of intensity in one domain of sensation, as sounds, against differences of intensity in another and heterogeneous domain, as movements. (See his *Beiträge*, heft iii.) The exactness of his results, however, as also of his interpretation of these by a reference to a common concomitant of muscular sensation, have been questioned. (See Titchener, *Mind*, xvi. p. 528 ff.)

§ 8. *Other Forms of Comparison.* We have here dealt with the process of comparison as employed in the detection of difference and similarity with a view to knowledge. But this is not the only purpose for which the operation is carried out. It plays a large part in connexion with the gratification of the feelings. The unexpected discovery of likeness or of unlikeness in things is a pleasant stimulus, and is made ample use of by the imaginative writer. Thus, in the similes of the poet, ideas drawn from widely remote spheres of experience are brought into a relation of likeness, as when the sound of the summer sea is likened to merry laughter, a crafty man to a fox, and so forth. Here the object of the simile is to intensify the impression of some quality or aspect of an object by help of the image of a second object in which this is embodied in a higher and more impressive form. Since feeling is here the effect aimed at, there is no sharp analysis of likeness as in the case of purely intellectual comparisons. In this respect poetical comparisons differ from those employed for purposes of scientific illustration. Much the same may be said of poetical contrast. The points of difference are brought out in order to make the impression of contrast strong rather than to define with precision the exact nature and limits of the difference. A closer approximation to such precise analytical determination of likeness and unlikeness takes place in many of the comparisons of wit, whose office it is to disclose unexpected, far-fetched, and in some cases apparent rather than real relations between things. The due appreciation of wit involves a fine intellectual analysis of the ideas presented. In this respect, as the etymology of the word suggests, and as is commonly recognised, wit stands in close relation to understanding.

§ 9. *Connexion between Comparison and Analysis.* In bringing to a close this account of the elementary processes in thought, a word or two may be added on the close connexion between the two directions of thought-activity. That there is such a connexion was pointed out above when we were dealing with the general relations of differentiation and assimilation;[1] and the same fact has forced itself upon our notice in dealing with comparison.

[1] See p. 183 ff.

To begin with, it has become evident that in the processes of comparison just described analysis is involved. Sometimes the analysis seems to precede the comparison, as when we are asked to compare two flowers in respect of their colour, in other cases it appears rather as the result of comparison. Thus it is by successive comparisons of members of a class of things, as flowers in general, that we gradually come to analyse out their common features.

While comparison thus involves abstraction, abstraction even in the case of a single object may be said to involve the rudiment of comparison. Thus, in analytically singling out for consideration the spherical form of a rain-drop, we implicitly and sub-consciously assimilate it to other previously known spherical objects. But for this vague, imperfect accompaniment of assimilation the analytic separation of the constituent would be difficult if not impossible. As was pointed out above in dealing with automatic assimilation, such a sub-conscious reference to similar things helps to direct the operation of analysis by intensifying and rendering prominent for the moment the particular constituent assimilated.[1]

It follows that thought is one process having two aspects or distinguishable factors. Either of these may become predominant, according to special circumstances. In this way we obtain two varieties of operation, *viz.*, analysis or abstraction, in which the recognition of likeness is sub-conscious, and (assimilative) comparison, where the process of analysis is preliminary and subordinate to a conscious apprehension of likeness.

A somewhat like relation holds between analysis as a sub-conscious process of differentiation and a conscious act of discrimination. Thus, in analysing a clang, we must, agreeably to what was said above, have a vague impression of the difference between one constituent tone and another. And such sub-conscious differentiation readily becomes the starting-point in a full conscious apprehension by the act of attentively comparing the differences between the several ingredients.

§ 10. *General Thought.* Thus far we have been occupied

[1] The question how far we can analyse a single presentation without reference to other presentations has given rise to much discussion. According to Dugald Stewart and others, abstraction can be carried out on single presentations. It is doubtful, however, whether this ever occurs without some vague reference to other things having the particular attribute specially considered. (See Hamilton, *Lectures on Met.* xxxv.)

with the two fundamental processes in thought, and we have illustrated these in their simplest form as employed about presentations or their equivalents, concrete representations. But, as already pointed out, what we mean by thought is the representation of things as classes or generalities. All the more interesting and momentous problems relating to thought, such as the question whether the lower animals think or reason as we do, have reference to such *general* thinking. We have now to examine the processes involved in this thinking.

These fully-developed thought-processes are marked off by the use of what is known as the general idea or notion, such as *man* or *virtue*. These general ideas, when reduced to a precise form, as by the logician, are spoken of as concepts. And, since the science of logic assumes thinking to take place by help of such conceptual products, we may also speak of these full or explicit thought-processes as Logical Thought.[1]

Such general thinking is a fuller development of the fundamental processes just considered. Thus the idea 'man' represents certain resemblances (common attributes, as a certain physical structure and degree of intelligence) running through a number of individual objects. These common resemblances are plainly discovered by the processes of analysis and comparison. Hence we may say that general thought is effected by a more extended and methodical use of analysis and comparative synthesis (conscious assimilation). General thinking is thus the highest expression of the great intellective function, Assimilation. When we think or reason about a class of objects, as plants, or mammals, we are connecting a multitude of particulars by certain bonds of similarity.

While general thinking is thus obviously assimilation or recognition of relations of similarity, it is, in a less obvious way, conscious discrimination as well. As we shall see more plainly by-and-by, thinking is not merely a movement of mind away from individual differences towards their common resemblances, but a reverse movement back from these last to the first. All clear thinking about things is thus at once a conscious grasp of relations of similarity along with relations

[1] The use of such expressions must not, however, blind us to the fact that a concept, strictly speaking, is something logical, an *ideal* form of the general idea rarely if ever realised in our actual thinking processes. Of this more presently.

of difference. One other characteristic of this (general) thought must be pointed out. It is evident that, as an assimilation of a number of presentations on the ground of a common likeness, it is a process of combination or integration. To this we must now add that it is also a process of contiguous integration. Our general thinking is carried out by help of language, and it is obvious that we connect ideas or thoughts with the appropriate forms of language by a process of associative integration. To this aspect of general thought we may now turn.

§ 11. *Thought and Language.* One characteristic of all conceptual thought is the employment of language, that is to say, a system of general signs, whether words or some equivalent, such as hand or finger movements. The uses of language as a medium of (concrete) reproduction have already been dealt with. We have now to consider another of its functions, *viz.*, its service as an instrument of thought, or, to express it otherwise, its aid in passing from a concrete or pictorial representation of objects to a general or conceptual representation of them.

It is commonly recognised that language is a factor in all general thinking. This is borne out by the fact of the uniform concomitance of language and thought. Thus language is absent in the case of brutes, which think at most in a very rudimentary way. In the case of the child it begins to be mastered and to develop as the power of thought unfolds. And in the case of the human race as a whole we note that the structure of language becomes more complex as the thinking powers strengthen.[1]

Without anticipating our fuller analysis of the process of conceptual thought we may point out, even at this stage, that language is a system of general signs. A name such as *man* or *virtue* has for its peculiar function the marking off of the results of that extended analysis and comparison just spoken of. It is evident, for example, that the name *man* has for its special meaning the common qualities (physical structure and

[1] It is not meant here that the parallelism between the growth of intelligence and of language is exact. It has been pointed out by Prof. Whitney that the Chinese are an example of the fact that "a community of a very high degree of general utility may exhibit an extreme inaptitude for fertile linguistic development". (Quoted by Prof. Hale, *Address on the Origin of Language*, p. 25.)

intelligence) which we have discovered by comparison in this, that, and the other individual. And, as we shall see more fully by-and-by, it is just because we have in a name a means of thus marking a common resemblance among objects by one and the same sound, or other sensuous sign, that we are able to think conceptually at all.

§ 12. *Stages of Thinking.* It is customary to distinguish three stages in the thinking process. First of all there is the formation of the general idea, notion or "concept," which may be said to constitute the element of thought, such as 'material body,' 'weight'. This part of the thinking process is marked off as conception.[1] After this comes the combining of two concepts in the form of a statement or proposition, as when we say 'material bodies have weight'. This is termed an act of judgment. Lastly, we have the operation by which the mind passes from certain judgments (or statements) to certain other judgments, as when from the assertions 'material substances have weight,' 'gases are material substances,' we proceed to the further assertion 'gases have weight'. This process is described as reasoning, or drawing an inference or conclusion.

These distinctions have been fixed by logicians and not psychologists. The mental processes here marked off by separate names are in spite of formal differences substantially the same. Not only so, as we shall see presently, conceiving, judging, and reasoning are not operations which are carried on separately, but rather distinguishable phases of a more complex operation. Nevertheless, since they have a value even for the psychologist as marking off the more simple from the more complex forms of thinking, it is convenient to adopt the distinctions. We shall accordingly in the present chapter deal with the process of forming the thought-elements, or conception, and in the following chapter consider the fuller and more

[1] The reader must carefully note that the term conception is here used in a narrower sense than it frequently bears. To conceive popularly includes the imagination of something concrete, as when we say 'I cannot conceive of his doing it,' *i.e.*, cannot realise in imagination his having the necessary feelings, etc. Some writers, notably Dugald Stewart and Prof. Bain, seek to keep this reference to pictorial imagination. But the fixed usage of logicians renders it desirable to confine the terms conceive, conception, concept, to the operations of general ideation.

complete thought-process as expressed in the terms judging and reasoning.

§ 12*a*. *Logical and Psychological View of Thinking.* The reader must carefully distinguish between the different ways in which the logician and the psychologist view the processes of thinking. The former is concerned in regulating or controlling the operations according to some standard of correctness. He requires a comparatively simple form or type of thinking by a reference to which the value of any specimen of actual thinking may be gauged. Hence he does not need to go into a careful and exhaustive analysis of the ordinary processes of thinking in concrete individual minds. Thus he assumes that all thinking takes place by what he calls concepts, whereas, as we shall see presently, our ordinary general ideas fall very short of the logician's concept. Again, he supposes that such concepts are fully developed before they are combined in judgments, whereas the truth is, as we shall see also, that concepts are gradually formed by help of a series of judgments. Similarly, he assumes that when we reason (deductively) we set out from a general truth in the way indicated by the syllogism, whereas the real movement of thought is, as will be shown, different from this. The psychologist, on the other hand, being concerned not with the question 'How can we think correctly?' but with the question 'How do we ordinarily think?' has to make a much more careful analysis of the actual processes of thinking, to bear in mind their complexity, their variability of form, and their deviation from the forms prescribed by the logician. Thus he has to keep in mind the fact that in our ordinary thinking we do not reach the logical concept, that we do not conceive or form general ideas without at the same time judging, and that our reasoning processes are at once less methodical and more variable in form than is assumed in logic.[1]

GENERAL IDEAS.

§ 13. *Nature of General Ideas.* In seeking to trace the development of this general thinking we have, first of all, to consider the nature and the origin of general ideas. It is evident that we only distinctly think about things under their general aspect when we are able to form such ideas. Thus I cannot think out the proposition 'The mushroom is a fungus' until I am able to form the general ideas, 'mushroom' and 'fungus'. The difficult problems respecting the nature of thought, its relation to language, and its extension beyond man to the lower animals, have been discussed in close connexion with the nature and origin of general ideas.

A general idea may for our present purpose be defined as an idea having a general import or reference. Thus a child's idea of dog, house, or father becomes general when he consciously employs the term as the sign of this, that, and any other

[1] *Cf.* Ward, article "Psychology," p. 78.

particular object which may answer to a certain description, or be found to present certain characteristic attributes or traits. Or, as the logicians express it, a general idea is a representation of a class of things.

The reader must be careful to distinguish the meaning of the term class as here used from its meaning when applied to a definite number of objects viewed as a collection, as a class of children in a school. In thinking of man as a (logical) class, I do not represent a definite number at all; nor do I represent men as a collection. It would be more correct to say that I am representing, in a more or less distinct way, the fact that this, that, and an indefinite list of other things are related as like or answering to one description. How this mode of representation is effected will appear presently.

Now it is evident that general ideas as thus defined are reached slowly and by degrees. It is exceedingly doubtful whether any of the lower animals acquire them. The baby does not possess them, and even after attaining to speech remains for a long time with only the rudiments of them. In their perfected articulate form, as required for exact scientific thought, they are confined to a few highly-trained minds.

§ 14. *Generic Images.* The first stage in the formation of such general ideas is the welding together of a number of concrete images into what has been called a generic image. The idea 'tree' or 'house' may be taken as an example. Such generic images may be supposed to be formed by a process of assimilative cumulation. Let us imagine that a child, after observing one dog, sees a second. In this case the strong resemblance in the second to the first effects a process of assimilation analogous to the automatic assimilation already described. That is to say, the percept corresponding to the second animal is instantly fused with the surviving image of the first by reason of easily-apprehended points of likeness. By such successive assimilations a cumulative effect is produced which has been likened to that of the superimposing of a number of photographic impressions taken from different members of a class (*e.g.*, criminals) whereby common features become accentuated, and so a typical form is produced.[1]

[1] For an account of such composite photographic pictures and their analogy to generic (mental) images, see Mr. F. Galton's *Inquiries into Human Faculty*, Appendix, "Generic Images".

This process, the deepening and accentuating of common traits and the effacing of individual or variable ones, can only be looked on as a tendency never perfectly fulfilled. Interesting differences would in all cases tend to reinstate themselves. Thus my generic image of a church is a building with a tall spire, because the main church in my native town was of this form. Recent examples would also tend to contribute variable peculiarities. Thus the baby's generic image of a dog would have the special characters of the dog last observed.

Such a process of cumulative assimilation would be largely passive, and independent of those active processes of comparison just described. It would further be capable of being carried forward (to some extent at least) independently of language. Hence we may, with some degree of confidence, attribute generic images to the child before he comes to the use of words as well as to many of the lower animals. Thus it is highly probable that a baby of six months forms a generic image of the human face out of the percepts answering to that of its mother, its nurse, and the like, and that when suffering from loneliness it has this image in its mind. Similarly, a predatory animal may be supposed to compound a generic image out of the percepts gained from this, that, and the other specimen of his prey, so that when seized with hunger this typical image is recalled.

In order to illustrate what is meant by a generic image, it is important to take the case of a pure representation detached from a presentation. Thus we cannot say that because a diving bird recognises a new sheet of water it must have at the moment a generic image answering to water. As was pointed out above in dealing with automatic assimilation, the recognition of a thing does not imply a distinct representation of the thing as previously seen. The presentative and representative ingredients are fused in this case, or, to express it otherwise, the image is latent and undeveloped. Similarly with respect to such rudimentary processes of conception or general ideation as those here considered. We can only attribute a developed and detached generic image to baby or animal when we have reason to think that these occur in the absence of the percept, *e.g.*, in states of desire, in dreaming, and so forth.[1]

§ 15. *Relation of Generic Image to General Idea.* The question still remains how far such generic images are, properly speaking, *general* ideas in the sense defined above. Is, for example, the typical face that is pictured by the lonely infant

[1] The argument in support of the proposition that generic images or (as the writer calls them) "recepts" are actually reached by the lower animals is ably set forth by Romanes, *Mental Evolution in Man*, p. 51 ff.

thought of as something common to this, that, and the other concrete object? Does it carry with it any clear consciousness of a class of things? There is no evidence to show that this is so. As has been pointed out above, the mental image corresponding to one and the same individual object, as the infant's mother, is composite also and in the same way as the generic image. Thus the baby forms an image of its mother out of a number of partially unlike percepts, corresponding to varying appearances of the object in different positions, different lights, different dress, and so forth.[1] Generic images accordingly differ not in kind but only in degree (*viz.*, proportion of common to variable features taken up and accentuated) from particular or concrete images. And so long as they remain merely pictorial *images* there seems no reason to attribute to them any general function or import.

The true process of conception, as generalisation or general ideation, that is, a conscious representation of something as common to many as distinguished from one, involves the active processes of thought, analysis and synthesis, abstraction and comparison. It is only when the child begins consciously to break up its images, to distinguish this element or feature from that, and by help of such analysis to recognise and mark off common features, that general thought, properly so called, begins. In this way it reaches a distinct idea at once of an individual thing, and of general or common aspects among individuals. We have now to examine into this true thought-process.

§ 16. *Transition to Conception Proper.* The transition from merely imagining to thinking proper is effected by processes of reflective attention in which abstraction and comparison play a chief part. In order to understand how this occurs, we may suppose the process of automatic assimilation checked by the introduction of some impressive difference. Thus a child proceeds to play with a visitor's dog, and finds it wanting in the friendly sentiments of his own pet. Here difference, which in the earlier stages of automatic assimilation remained indistinct in the background of consciousness, is brought forward. The unlikeness of *morale* in spite of the likeness of *physique* is forced

[1] *Cf.* above, p. 260 f.; also Taine, *On Intelligence*, pt. i. bk. ii. chap. ii.

on his attention, the present percept is separated from and opposed to the image, and a step is taken in marking off likeness from surrounding difference.

As differences thus come into distinct view and impress themselves on the mind as the constant accompaniment of likenesses, a new and explicit grasp of likeness-in-difference ensues. This starts from a mental separation of the several perceptual constituents of the generic image, and a reflective comparison of these one with another so as to demarcate common features or likenesses from peculiar features or unlikenesses. Such comparison, or series of comparisons, begins with incomplete analysis and vague apprehension of likeness, and ends in a more complete analysis and more definite apprehension of likeness. In this way, for example, the child waking up to differences, say among apples, goes back on his various experiences, and by noting and setting aside variability of taste, size, and so forth, gets a clearer grasp of the common essential features. Such a conscious active separation of definite points of resemblance from among a confusing mass of difference is what psychologists and logicians more especially mean by Abstraction.

§ 17. *Differentiation of Notions of Individual and Class.* As was pointed out just now, the co-existence of likeness with unlikeness in the child's experience may mean one of two things, *viz.*, persistence or identity of one individual object, in spite of certain changes, or a general similarity among a number of different individuals. The process of conception is sometimes described as if the child started with a definite knowledge of individuals, and then proceeded to generalise or form a class-idea. There is, however, every reason for saying that the two modes of interpretating likeness-in-difference are reached concurrently and by processes largely similar. Thus it seems most reasonable to suppose that the baby which 'da-das' every bearded person it sees is as yet clearly conscious neither of individuality nor of generality. In other words, we must not assume that it is stupidly confounding its sire with a stranger, or, on the other hand, forming an idea of a general class. At this stage the child merely recognises certain interesting similarities, and proceeds to express the fact. We have to suppose that the clear apprehension of individual sameness is reached but slowly and in close connexion with the first clear consciousness of different things attached by a bond of likeness.

To say that the child's knowledge begins with the concrete individual is not to say that it attains a clear consciousness of what we mean by an individual thing, persisting and the same (in spite of change), before it begins to generalise. As was pointed out in the brief sketch of the process of identification in connexion with sense-intuition, the cognition of "thing" as persistent and continuous is the result of lengthy and complex processes of comparative reflexion. To individualise is thus to think, just as to generalise is to think.[1] In truth, the psychological development of the idea of individuality proceeds along with that of generality, each being grasped as a different way of interpreting partial similarity among our percepts.[2]

§ 18. *The Process of Generalisation.* When once this differentiation of the individual-idea from the class-idea has advanced far enough the process of generalisation proper, or the grasp of common or general qualities, is able to be carried out in the way usually described by psychologists. That is to say, a number of individual things, represented as such, are now compared, the attention withdrawn by a volitional effort from points of difference and concentrated on points of likeness (abstraction), and so a true process of generalisation carried out.

The common account of conception here followed, as made up of a sequence of three stages, comparison, abstraction and generalisation, rather describes the ideal form of the process as required by logic than the mental process actually carried out. As we saw above, a vague analysis or abstraction precedes that methodical comparison of things by which the abstraction becomes precise and perfect, that is to say, definite points of likeness (or unlikeness) are detected. With respect to generalisation, it has already been pointed out that this is to some extent involved in abstraction. To see the roundness of the ball is vaguely and implicitly to assimilate the ball to other round objects. It is to be added that an imperfect grasp of general features as such commonly precedes the methodical process here described. The child realises in a measure the general function of the name 'horse' before he carries out a careful comparative analysis of the equine characters. At the same time the use of the word "generalisation" is important as

[1] *Cf.* above, p. 233 ff. Hence the logician can speak of the idea answering to a proper name as a singular *concept*. (See Lotze, *Logic*, p. 34.)

[2] "A singular individual is as much *conceived* when he is isolated and identified away from the rest of the world in my mind as is the most rarefied and universally applicable quality he may possess. (Sh. Hodgson, quoted by James, *op. cit.*, i. p. 479.) The question of the priority, in the development of the child, of the knowledge of the individual or of the general class, the question known as the *primum cognitum*, has been much discussed in connexion with the linguistic problem whether names are first used as singular or as general names.

marking off the clear mental grasp of the class-idea as such, that is, the idea of an indeterminate number of objects, known and unknown, answering to a certain description.

§ 19. *Conception and Naming.* We have so far supposed that the processes of conception are carried out without any help from language. But it is exceedingly doubtful whether any such orderly process as that just described, the comparison of a number of percepts and the marking off of common attributes, could be achieved without the aid of words or some equivalent. It is probable that even a grasp of individual things as unities and as permanent identities depends on the use of a name (proper name), which as one and the same sound serves to mark in an emphatic way the continued oneness of the object.[1] And the same applies still more manifestly to the apprehension of a class of things. It is certain that in later life at least all clear thinking takes place by help of language. The general idea is held together and retained by means of a name. And, as already pointed out, it is very uncertain whether in the absence of such general signs the infant or the lower animal ever attains to a clear consciousness of the 'one in the many,' the common aspect of a number of different objects.

§ 19*a*. *Is Generalisation possible without Language?* The question how far we can generalise or form a general idea apart from the use of names or other signs is one of the standing *cruces* in psychology. Judging by introspective examination of our own processes, we might infer that intellectual operations of a *quasi*-general character can be performed with little if any help from words. Yet it is doubtful whether we attain a clear consciousness of the *generality* of our thinking in this case. It must be remembered, too, that even if we may, as is alleged, employ a particular image or succession of images as representative of generalities without any aid from language (as when we intuitively follow the proof of a particular case in geometry and at the same time recognise its general validity), we are employing powers of thought that have been developed by help of language.[2]

If now we turn from the developed to the undeveloped mind, and ask whether children think apart from the use of language, we find the question exceedingly difficult. It has been alleged that a born-mute reached, prior to his mastery of a deaf-mute language, the highly abstract idea of maker or creator, and applied this to the world or totality of objects about him.[3] It must be borne in mind, however,

[1] It seems to follow that animals cannot attain the clear consciousness of individual things as permanent unities in the way in which we attain it.

[2] On the nature of such speechless thought, see Venn, *Empirical Logic*, p. 147.

[3] See a very interesting account of the experience of a born-mute by Prof.

that born-mutes make a certain spontaneous use of articulate sounds as signs, and such articulation, though unintelligible to others and not even heard by themselves, may be of great assistance in carrying out the process of abstraction. It must be further remembered that a normal child understands others' words, and may probably make some internal use of them as signs before he proceeds to imitatively articulate them.

Lastly, with respect to the lower animals, it must be admitted that they display something closely resembling the germ of general thinking. Yet it is manifest that we cannot, in this case, be certain of the degree of clear consciousness of generality attained. The actions of a fox caught in a difficulty and inventing a way of escape seem indistinguishable from those of a man thinking by help of general ideas and general rules. Yet the mental process may, after all, be non-conceptual and pictorial.[1] It seems safe, therefore, to conclude that apart from verbal or other general signs the full consciousness of generality does not arise.

§ 20. *Psychological Function of General Names.* The psychological process of word-formation has already been described in connexion with the linking together of contiguous trains.[2] Here we have to inquire how the name which we have seen to be at once a motor action (articulation) and an auditory sensation (articulate sound) assists in the formation of truly general ideas.

A name is commonly defined as a mark or sign by the help of which the idea of a thing may be called up in our own mind or in the mind of another. Signs are either self-explaining, as a drawing or an imitative gesture or sound, or conventionally attached to objects, as the larger number of linguistic signs or names, the symbols used in music, etc.[3] Language-signs consist either of articulated sounds or other percept-producing movements, as the finger movements used by the deaf and dumb.[4]

S. Porter in an article "Is Thought possible without Language?" in the *Princeton Review*, January, 1881. *Cf.* James, *op. cit.*, i. p. 266 ff.

[1] It must be remembered that some of the most intelligent of the lower animals, *e.g.*, ants, have a system of tactile signs analogous to our language. On the whole subject of the germ of linguistic and conceptual power in animals, see Romanes, *Mental Evolution in Man*, chap. v. and following.

[2] See above, p. 310 ff.

[3] Articulate sounds, so far as imitative (onomatopœtic words), are of course to be classed with self-explaining signs.

[4] On the general function and the possible varieties of language-signs, tone-language, gesture-language, etc., see Romanes, *Evolution of Mental Faculty*, chap. v. and following; *cf.* Venn, *Empirical Logic*, chap. vi.

A name may be given to one thing (proper name) or to a general class (common or general name). In either case, as explained above, it is, psychologically considered, the expression or indication of a similarity among our percepts. To name a thing is thus the outward manifestation of a process of assimilation.

As was pointed out above, the name (articulation-sound complex) becomes attached to the idea it stands for by a process of contiguous integration. Looking now at names as accompanying and perfecting the process of assimilation, we may say that, whether as employed by ourselves or as heard when used by others, they become specially associated with, and so expressive of, the similar features in our perceptual experience. Thus the name 'home' specially emphasises the recurring or constant features of the child's surroundings, the name 'house' the common features of structure in the objects so named. The name thus becomes specially attached to, and so a mark of, the effects of superposition of common presentative elements in our experience.[1]

§ 21. *Use of Names in Early Life.* In the beginning of life linguistic signs are used in close connexion with the process of automatic assimilation. Thus the recurrence of the presentation-complex answering to a particular animal, as the dog, calls forth, by a process analogous to a reflex movement, the articulation, let us say, of the sound 'bow-wow'. This use of words by the child to mark likeness is partly spontaneous, partly imitative. As is well known, children often invent names of their own, as in their pet-names for nurse, doll, and so forth. Thus one child used the sound 'mum' as a name of eatables generally, and another the sound 'appa' as a name for this, that, and the other animal (kitten, chick, etc.). Children also spontaneously extend the use of names supplied by others, as when the sound 'ba' (ball) was applied to a bubble and other

[1] This is well brought out in Herbart's view of the general idea as the result of 'apperception' or the coalescence of a new presentation with previous like representations (apperceptive masses). Such apperceptive fusion or assimilation would, according to Herbart, help to explain the prominence or distinct emergence of the common element in a new presentation, while the particular or variable features fall back into indistinct consciousness. (See Stout's account of Herbart's view, *Mind*, vol. xiv. p. 15.)

round objects. This spontaneous use of names gives place in time to an imitative use of them as heard by others.[1]

From what was said above we have to suppose that names are used at the beginning neither as proper or singular, nor as general names. They merely serve to mark off and register common features of the child's experience. It is only as the processes of comparison gain in strength and the difference between the individual and the general class becomes distinct, that the two uses of names as singular and general grow clearly differentiated. Thus the names Charles, Papa, Rover, and so forth, come to be marks of particular things, those organised experience-unities which are thought of as having continued existence independently of our intermittent percepts. Similarly, the general names 'dog,' 'man,' and so forth, come to be consciously applied to a number of such object-unities on the ground of common attributes.

§ 22. *How Names aid in Conception.* At first we find this use of general names confined to classes of objects having numerous points of similarity, and so easily representable in the pictorial form of generic image, as "dog," "house," and the like. Here, as pointed out above, the name is not used with a clear consciousness of its general character or function. Yet the very application of one and the same name to successive percepts is an important aid to those processes of reflective comparison and selection of common features by which the apprehension of generality arises. To begin with, any use of a name to mark the result of an assimilative process serves to call attention to and to emphasise the existence of like features. Not only so, the name being applied to each of a series of percepts is a valuable means of recalling these together, and so furthering that extended process, the comparing of a number of things, which underlies generalisation. More than this, since the name from the beginning serves to emphasise and register the fact of likeness, it greatly facilitates the subsequent careful analysis and definition of the common features. Of special service here is the hearing of names applied by others to a variety of

[1] For interesting illustrations of children's spontaneous invention of names and extension of names, see Preyer, *Die Seele des Kindes*, 3er theil; Perez, *The First Three Years of Childhood*, chap. xii.; Taine, *On Intelligence*, book iv. chap. i. § 1; and Darwin's notes on his child, *Mind*, vol. ii. p. 285 ff.

things, as when a multitude of unlike things are called 'plants,' and so on. Such announcement of likeness as yet undiscovered by the child serves, as we know, as a powerful stimulus to a comparative examination of the things, and thus urges the child on along the conceptual path.

The greatest use of general names, however, in connexion with general ideation or conception is in definitely marking off and rendering permanent each new result of analysis and comparison. Thus on reflecting on dogs, with a view to see in what exactly they do agree, in spite of their differences, and on gradually gaining clear consciousness of this, that, and the other characteristic feature of form and action, a child demarcates, and definitely registers these results of abstraction by help of the name. That is to say, the name is used as a defining mark, as one might mark off an ill-defined local feature in a piece of board by drawing a chalk circle about the spot. When the name is thus definitely and exclusively applied to such products of comparison and abstraction it henceforth serves as a means of recalling these, and of keeping them distinctly before the mind.

§ 23. *Use of Names as General Signs.* When thus definitely attached by association to the points of similarity singled out by abstraction from a number of particular objects the name is used as a true general sign. The image now takes on a much more definite function as a typical or representative image through the circumstance that, by help of the demarcating sign, certain features stand out distinctly, and are at the same time realised as belonging not merely to one particular thing, but to what we call a class. Thus the name 'dog,' though probably still calling up an image of a more or less concrete character, that is, including traits of some particular individual or variety, becomes a general sign inasmuch as it thrusts prominently forward, and so secures special attention to, certain definitely apprehended common class-features (the canine form, action of barking, etc.).[1]

[1] Since the result of abstraction though representing concrete things does not represent them fully and exhaustively, we may, with Mr. Spencer, call the general or abstract idea a re-representation. (See his *Principles of Psychology*, ii. p. 513.) The nature of this consciousness of general representativeness is well illustrated by W. James by help of his figure of a psychic fringe or tendency. (*Op. cit.*, i. p. 477.)

Used now in this way as a general sign of certain definitely apprehended points of likeness or common qualities, the name acquires the double function attributed to it by logicians. That is to say, it *denotes* any one of a certain order or class of things: this class or group being determined in respect not of the number of things included, but only of the common qualification or description of its members, that is to say, of the qualities which the name is said to *connote*.[1]

§ 24. *Formation of more Abstract Notions.* A similar process of comparison and abstraction, clenched by a linguistic sign, takes place in the formation of those general ideas which answer to few common qualities, and are altogether removed from the plane of the generic image, as, for example, 'animal'. It is obvious that we cannot compound a *quasi*-concrete image of the animal, as we can, roughly at least, compound an image of the dog. There is no common form running through the vast variety of animals which renders this possible.[2] There is, indeed, an image-element here too. In thinking of animal, most people probably image imperfectly one of the more familiar quadrupeds. Here the vicarious or general function of the image called up is still more evident. Hence a child cannot form the idea 'animal' till he has attained a considerable skill in the use of verbal signs as general; for in order to do so it is needful to repress the tendency to image particular concrete examples, and to give special and exclusive prominence to a few properties, such as spontaneous movement and sensation, which can only be grasped by a special effort of abstraction, and can only be brought before the mind by the medium of a verbal sign.

These higher steps in the thought-process become possible by means of the verbally embodied results of the lower steps. It is after the child has formed the general ideas, 'dog,' 'horse,' and so forth, that he climbs to the more difficult, more comprehensive, and more abstract idea, 'animal'. In this way we may say, with Hamilton: "Language is to the mind precisely what the arch is to the tunnel. The power of thinking and the power

[1] According to logicians a general name denotes certain things (members of a class) and connotes certain qualities in these things. For the terms denotation and connotation, extension and intension are often substituted. (See Jevons, *Elementary Lessons in Logic*, lesson v.)

[2] *Cf.* Lotze, *Logic*, p. 38.

of excavation are not dependent on the word in the one case, on the mason-work in the other; but without these subsidiaries neither process could be carried on beyond its rudimentary commencement." (*Lectures on Logic*, viii. pp. 138, 139.)

It is not meant by this that the child progresses regularly from notions of a comparatively small range to more comprehensive ones. It must be remembered that it is often easier for him to form an idea of a larger class or classes than of one of its constituent sub-classes or species, *viz.*, when the former presents prominent easily-discernible points of likeness, and when the distinctive features of the latter are obscure. Thus many a child uses the name tree before he uses the name oak-tree, and so forth. This is what is meant by saying that the child sees likenesses before he sees differences. (*Cf.* above, p. 184.)

§ 24*a*. *Names as Substitutes for Ideas.* One other feature of verbal signs requires to be noticed in this connexion, *viz.*, their tendency with repeated use to drop all distinct ideational suggestiveness, and to serve in themselves as substitutes for ideas. This function of names will grow clearer to us when we come on to consider the complex processes of thought, but it may be illustrated, to some extent, at the present stage of our exposition.

It follows from the very nature of a name as a general sign that its meaning will only be distinctly grasped in exceptional circumstances, when a special effort of attention is given. Thus I have to fix my thoughts on so familiar a name as "metal," "crystal," "nation," and so forth, if I want to have a full and clear idea of the corresponding thing (or class of things). It is obviously a much easier and shorter process to recall an 'internal' name, and even to speak or write one, than to develop clearly the corresponding idea. Hence in all those everyday processes of thought in which a full and distinct ideation is not required, that is to say, where relations among ideas may be clearly apprehended with only the faintest representation of the particular kind of object dealt with, we tend to use names as substitutes. Just as in algebraic processes the symbols, x, y, etc., though representing something (*viz.*, all or any number) are used for the moment as if they themselves were the ideas they signify, so in much of our ordinary reasoning it is sufficient to attend to the relations of the names themselves, in order to carry out the process. Thus in following out the simple process of thought "a bat cannot be a bird because it suckles its young" I can see the relation with only the very faintest representation of what the terms bat and bird signify.[1]

In this brief account of the name-embodied concept reference has been made only to those names which grammarians call nouns, and of these only to such as are names of things. By the same mental process by which the child reaches the idea orange it reaches the idea yellow, round, and so forth. The clear use of adjectives, as qualifying epithets, marks a higher stage of analysis than the first use of nouns, *viz.*, the separating out for special consideration of *single* qualities in things. Hence, in the imitative speech of the child, the first use of adjectives follows by an appreciable interval that of nouns.[2] This separate apprehension of single qualities becomes still more distinct when abstract names, such as whiteness, height, come to be used. As the etymology of such names shows, they come after concrete nouns in the development of the thought of the race and community, and are invented by help of the latter. The individual only acquires the use of these abstract names when intelligence has developed under the stimulating and controlling influence of education.

It is only when analysis is thus carried up to the point of a separate consideration of single qualities that the class-notion, the representative of a *group* of qualities, becomes definite and precise. As we shall see presently, a perfectly clear general idea means one, the constituent elements of which we can separately attend to and name.

§ 25. *Conception as Dependent on Social Environment.* It is evident from this brief sketch of the development of the general idea that it is a process that is largely dependent on the action of the social environment. Language is pre-eminently the invention and instrument of social life. It is the medium by which we communicate one to another our ideas, wishes, and so forth. In the early years of life the undeveloped intelligence of the child is continually stimulated in the way described above by the common use of general names. The results of ages of thought-processes embodied in the language of educated men

[1] On this aspect of naming, see Taine, *On Intelligence*, pt. i. bk. i. chap. iii.; W. James, *op. cit.*, i. p. 270.

[2] One or two adjectives, as ni-ni (nice), are used along with nouns from the first, but these probably so far as names are on the level of nouns, *i.e.*, names of things as concrete wholes. It must not be supposed, however, that the child or the race begins with a clear apprehension of one class of words. The several classes of words distinguished by the grammarian are confused at first, and are only differentiated as intelligence advances. All that is meant here is that the child knows and names things as concrete wholes before it begins to qualify them or discern particular qualities in them. On the differentiation of nouns, etc., in the early use of language, see Romanes, *Mental Evolution in Man*, p. 218 f., p. 295 f.

and women are thus brought to bear on the growing mind, and these constitute a main ingredient in the educational influence of the community upon the individual. The profound and far-reaching influence of this medium of common word-embodied ideas is clearly seen in the arrest of intellectual development where contact with the general mind, through language, is excluded, as in the case of neglected deaf-mutes, and, to a lesser degree, of those who from the isolation of circumstances are withdrawn from the stimulating influence of the higher phases of thought as expressed in the language of educated persons. As Professor Huxley says: "A race of dumb men deprived of all communication with those who could speak would be little indeed removed from the brutes".[1]

§ 26. *Psychology of Language.* The precise psychological function of language has given rise to much discussion. That names are a material aid to the formation of general, or, as they have been called by Locke and others, 'abstract' ideas, is certain: yet there is little agreement as to their exact function. According to some, the general idea is something distinct from the image, and has a certain stability as a general idea apart from the name. This view has been held by the Conceptualists. The Nominalists, on the other hand, have maintained that the general idea is nothing but an image with certain of its features or aspects specially accentuated, such accentuation being due to the use of the general name, or one and the same sign for a number of partially like presentations.[2]

According to the view here adopted, the auditory-vocal complex which we call a name fulfils a much more important function in general thinking than in concrete imagination. The mind often pictures things without recalling their names; but in thinking proper it seems always to be aided by language, either audible or inaudible.

It appears to follow that the nervous processes involved in general thinking have the action of the speech-centres as one of their main elements. In forming a general idea by help of a name, we may suppose that definite nervous connexions are established between the centres of ideation and these language-centres. Pathological evidence goes to show that the integrity of the centres of speech is necessary to a due performance of the processes of abstract thought.[3]

[1] Quoted by Prof. Horatio Hale, in *The Origin of Language*, p. 42.

[2] For a brief account of this dispute, see below, Appendix F.

[3] For a fuller account of the physiology of speech, and the kindred processes of reading from visual symbols and writing, see Dr. Maudsley, *The Physiology of Mind*, chap. viii.; Dr. Ferrier, *The Functions of the Brain*, chap. xi.; Dr. Bastian, *The Brain as an Organ of Mind*, chap. xxix. *Cf.* F. Paulhan, "La Langage intérieure et la pensée," *Revue Philosophique*, Jan., 1886. On the whole question of the psychological function of names in connexion with general ideas, see Taine, *On Intelligence*, pt. i. bk. i. chap. iii.; G. H. Lewes, *Problems of Life and Mind*, 3rd series, prob. iv., especially chap. v.; Egger, *La Parole Intérieure*, especially chap. v. and following; and Stout, "Thought and Language," *Mind*, xvi. p. 181 ff.

As was pointed out above, language is at once a system of sensory (auditory) impressions and one of (articulate) movements. This double aspect of language, as heard and spoken, points to the fact that it is a social phenomenon, having its origin in communal relations, and for its function to subserve the communication of mind with mind, and the formation of that organised body of common experience which we call knowledge.

The close correlation between language and social life only becomes apparent when we regard it in its full significance as a system of *general* signs. Particular impressions are (to a large extent at least) confined to an individual, or at most to a few individuals: they depend on the accidents of time and place. The common body of knowledge is thus necessarily general. It consists of the particular observations of many individuals compared and organised into general truths. And this generalising or universalising of knowledge, this piecing together and elaborating of the individual fragmentary portions of knowledge into an organic unity, is effected, and can only be effected, by the aid of general speech.

This being so, we see that speech is the medium by which a double process is continually going on. On the one side, by the use of a common language, the social mind is working on the individual mind, communicating of its store of knowledge, and bringing the individual intelligence into conformity with its fixed modes of activity or 'forms of thought'. This side of the process answers to instruction and intellectual education in the wide sense of the term. On the other side, by falling in with the common speech, the individual is continually adjusting (consciously or unconsciously) his intellectual habits to these common forms as a standard. Every time he uses general language he is virtually stepping away from the isolated individual point of view, and adopting the common social point of view. To employ the common speech is thus a social act, a recognition of an authority above the individual. Not only so, this use of the organised speech-structure by the individual implies social co-operation. By employing it he puts his private or particular knowledge in a form which renders it generally available. In this way the individual mind reacts on the social mind, contributing, in the measure of its intelligence, to common thought and its correlated linguistic forms.

In considering language as a social phenomenon we are naturally led on to inquire into its origin and development in the history of the race. The problems here opened up—such as, what divides human from animal intelligence, how man acquired language, and so forth—are too large and difficult to be discussed here. It may be added that though these problems have an important indirect bearing on the psychological development of thought and speech in the individual, they are in certain material respects distinct problems falling under the special head of racial or anthropological psychology.[1]

§ 27. *Conception as Synthesis.* Many of our notions involve, in addition to a process of abstraction and analysis, one of combination or synthesis. That is to say, we require to regroup the results of abstraction in *new* combinations. Thus, in the study of history, we have to build up out of the results of observation and abstraction such notions as 'Roman Emperor,' 'feudal system,' and the like.

[1] On the difference and points of connexion between the individual and the race problem, see Appendix G.

This synthetic formation of complex concepts goes on in close connexion with a process of constructive imagination. By this last an image (or a number of images) is first elaborated, which gives the peculiar form or structure to the concept. In this way, for example, we should form an idea of a class of objects lying outside the range of our personal observation, as Roman consul, volcano, and so forth.

In a certain class of cases this basis of constructive imagination assumes the peculiar form of an incomplete or partially baffled imagination. The general notion here becomes still further removed from the sphere of concrete or pictorial representation. This transcending by thought of the limits of clear imagination is illustrated in the formation of ideas of objects of great magnitude and of these magnitudes themselves, such as nation, planet, a century, a thousand miles, and so forth. All such notions are reached by a process of prolonged summation or addition of magnitudes which are themselves intuitable and picturable. Thus, in forming an idea planet, we have to take some familiar magnitude, say that of a school globe, and imaginatively amplify this by successive additions.

The nature of this process is clearly illustrated in the ideas of all the larger numbers.[1] It is evident that the smaller numerical groups as three, six, etc., present certain visual peculiarities, and as such can be seen or sensibly intuited. Hence the child's ideas of these smaller numbers are obtained in close connexion with sense-perception by comparing different local arrangements of the same aggregate of objects, as six marbles, or numerically similar aggregates of different objects, as six pebbles and six sheep. Even in the case of these smaller numbers, however, a process of taking apart and putting together (analysis and synthesis) is necessary. We only fully apprehend 5 or 6 as a particular number when we know its mode of production by a summation of units. In the case of the larger numbers, 20, 100, 1000, etc., this process of summation makes up the whole meaning of the number-symbol. The symbol 100 corresponds to no clear intuition of sight, consequently to no clear visual image. It stands for the unpicturable result of a

[1] All distinct ideas of magnitudes which are not imaginable are of course formed by the aid of numbers. We can have no idea of a vast distance except as determined by a definite number of unit-measurements, *e.g.*, feet, yards, miles.

prolonged process of summing, counting, or reckoning, performed on units (or small groups of these) which are themselves picturable.

This peculiarity of our ideas of number is illustrated in the lateness of their formation in the development of intelligence. The lower animals have but a germ of the idea of number. A bird will notice certain differences, *e.g.*, the withdrawal of two eggs from a nest of four, but such differences are probably not realised as numerical. Similarly with the ideas of number of primitive man. The aboriginal Australian can rarely count his five fingers, and no Australian language contains numerals above four, all numbers beyond this being described as 'many'. In the case of a child educated in a civilised community, it is some time before numbers are clearly apprehended as such. Thus, a child of three and a half, generally observant and intelligent, and capable of comparing the magnitudes of things (*e.g.*, the heights of two persons), showed an almost complete inability to apprehend relations of number. Though taught to say one, two, three, etc., in connexion with concrete objects, he persisted in confounding number or discrete quantity with magnitude or continuous quantity. For example, on seeing beads of three sizes, he called the smallest 'four,' those next in size 'five,' and the largest 'six'.

It is to be added that a process apt to be confounded with counting takes place when one or more definitely remembered individuals are missed from a group. Thus a shepherd may at once see without counting his sheep whether they are all present provided he retains a distinct visual image of the several individual members of his flock. It is probable that some of the remarkable stories of discrimination of number by animals, as rooks, are explicable in this way. The fact that savages and most children use their fingers shows that the primitive ideas of number are reached by help of the fingers of the two hands, a conclusion further verified by the decimal notation employed by civilised communities.[1]

It may be added that certain notions of magnitude and number illustrate the reverse of the process here described. In forming an idea of a molecule, or of a millimetre, we are breaking up or dividing an intuitable whole into its parts and carrying the process beyond the limits of imagination. So of the ideas of all

[1] For an interesting account of the origin and growth of our ideas of number, see the anonymous volume, *The Alternative* (Macmillan & Co.), bk. i. chap. xix. The psychological process by which number-concepts are reached is described by Waitz, *Lehrbuch der Psychologie*, § 52, p. 599, etc. On the so-called counting of animals, and the limits of savage counting, see Romanes, *Evolution of Human Faculty*, p. 56 f., and p. 214 f.; and Tylor, *Anthropology*, p. 18, and p. 310.

small abstract quantities represented by fractions. We may form an image corresponding to $\frac{1}{3}$ because we may picture an object separated into three parts: but our ideas of $\frac{1}{100}$, $\frac{1}{1000}$, and so forth, clearly transcend the limits of distinct picturing.

The synthetic construction here described is illustrated in a somewhat different way in the formation of another class of notions. Our idea of a mathematical line, a circle, and so forth, does not exactly answer to any observable form. No straight line, for instance, discoverable in any actual object perfectly answers to the geometric definition. Even the most carefully drawn line would be found on closer inspection to deviate to some extent from the required type. It follows that these notions involve more than a simple process of abstraction, such as suffices, for example, for the detection of the quality, colour, or weight. They presuppose in addition to this a process of idealisation, that is to say, the perfecting by help of symbols beyond the limits of clear imagination of some feature or attribute presented in a rough or imperfect form in actual objects. A like process of symbolic idealisation enters into some of the conceptions of physical science, as a smooth plane, a rigid body, and so forth.[1]

§ 28. *Logical Control of Conception: the Logical Concept.* This is not the place to trace out in detail the processes by which logic seeks to transform our first crude general ideas into true concepts. A word may, however, be given to these processes so far as they illustrate the carrying forward of the psychological process of conception as here described.

A child's first general ideas are apt to be imperfect in more ways than one. Thus to begin with they are commonly wanting in distinctness and precision. A child and an uneducated adult are wont to use terms, as 'water,' 'metal,' 'plant,' and so forth, with only a very vague representation of the common qualities possessed by the objects making up these classes. That is to say, the process of comparing things and analytically marking off common features is incomplete. As a consequence of the connotation of the name being thus hazy, the denotation

[1] For a good account of these ideal notions, see Taine, *On Intelligence*, bk. iv. chap. i. § 2. The distinction between notions answering to distinct mental images or pictures and those which cannot be reduced to images is described by Leibniz and others as that between intuitive and symbolic knowledge. For a brief account of the distinction, see Jevons, *Elementary Lessons in Logic*, lesson vii.

remains uncertain. Thus, owing to a vague apprehension of the essential characters of a plant, a child may be uncertain whether the sea-anemone is a plant.

In addition to this indistinctness the general idea may become positively erroneous as judged by the standard of the common, or rather what is called the correct, usage of the term. Thus through the narrow range of his experience a child is very apt to import non-essential elements into the represented class-features, and by thus unduly adding to the connotation to unduly narrow the denotation of the term. Thus he makes 'rose' stand only for red roses, 'book' for printed book, 'metal' for solid metal, and so forth. And while he thus tends, in one direction, to make the connotation of his words too full, and so their denotation too narrow, he tends, in another direction, to the reverse error. Since he cannot at first detect the deeper and less conspicuous resemblances among things, he is liable to omit some of the essential qualities of the class, and so to unduly widen its extent, as when he uses the word 'fish' for all animals that live in the water, not noting the important structural peculiarities that constitute the true fish.

These defects are rectified by the processes of education and scientific training. By these agencies the mind is disciplined in a more cautious, far-reaching, and methodical process of conception. A larger number of representative instances of the class are examined. The analysis of points of likeness is carried further, so as to be made logically complete, that is, adequate for purposes of scientific classification. The crowning phase of this logical regulation of conception is known as definition, or the gathering up and fixing in precise and appropriate language of each of the essential and fundamental attributes of the class.

One other feature has to be noted in this logical treatment of the concept. We have supposed that the process of conception is wholly occupied with disengaging similarities. But all thinking processes illustrate at once the two fundamental intellective functions, discrimination and assimilation, though one of these may preponderate, and be more conspicuous in particular cases. This applies to the formation of general notions. Although in forming the concept 'animal' we are explicitly setting forth similarities among diverse things, we are implicitly marking off the class from other things (plants and inanimate objects) which lack these similar features. The logical manipulation of the concept renders this apprehension of difference explicit and clear. Thus the process of defining a class-name includes in its most complete form an examination not only of things denoted by the name, but also of things not so denoted, in order to see what features they are wanting in. This consideration of differences becomes a prominent feature in the marking off of one idea from a kindred yet partially dissimilar idea, as metal from mineral, wise from learned, and so forth, a process that plays a large part in the definition of general names.[1] Finally, in what is known as logical Division or Classification, where things are systematically arranged in higher and lower groups, attention is paid at once to points of similarity and to points of difference.[2]

REFERENCES FOR READING.

On the general nature of the thinking process and its relation to language, see Ward, article "Psychology," *Encyclop. Britan.;* Volkmann, *Lehrbuch der Psychologie*, ii. p. 223 ff. On the process of abstraction and the formation of concepts, consult Sir. W. Hamilton, *Lectures on Metaphysics*, lect. xxxiv.; Prof. Bain, *Mental Science*, bk. ii. chap. v.; M. Taine, *On Intelligence*, pt. ii. bk. iv.; and Lotze, *Logic*, bk. i. chap. i. For an account of the early development of the generalising power the student may turn to the articles already referred to in *Mind* (1877) by Mr. Darwin and M. Taine. The work of Prof. Preyer, *Die Seele des Kindes* (3ter theil), gives a very full account of lingual progress during the first three years. *Cf. The First Three Years of Childhood*, by Bernard Perez, chap. xii. On the practical side of the subject the reader would do well to read Locke's valuable chapters on the imperfection and abuse of words, *Essay*, bk. iii. chaps. ix.-xi.; and Mill's *System of Logic*, bk. iv. chap. iii. and following chapters.

[1] The marking off of an idea from other ideas tends, according to the language of Locke, to make it 'distinct,' whereas the bringing out of the several constituent qualities making up the connotation of a name would serve to render an idea 'clear'. But the terms clear and distinct as applied to our general ideas are not used by all writers in this way. (See Locke, *Essay*, bk. ii. chap. xxxix. § 1 ff.; Hamilton, *Lectures on Logic*, lect. ix.)

[2] On the process of logical division and definition, see Jevons, *Elementary Lessons in Logic*, lesson xii.; and Bain, *Logic*, bk. iv. chap. i. The special logical problems involved in clearing up the meaning of common terms for philosophical purposes are dealt with by Locke, *Essay on the Human Understanding*, bk. iii. chap. ix. and following; and J. S. Mill, *System of Logic*, bk. iv. chaps. iv.-vi.

CHAPTER XII.

PROCESSES OF THOUGHT (CONTINUED): JUDGMENT AND REASONING (KNOWLEDGE).

Thinking, considered formally or as logic treats of it, includes, as we have seen, besides the elementary stage of conception, or the process of forming concepts, the more complex operations commonly marked off as judging and reasoning. Having a concept we may go on to apply this to some individual thing or class of things, as when we decide that a particular piece of stone is granite, or that diamonds are combustible. We are then said to judge, or form a judgment.[1] And having framed such judgments we may, setting out from these, pass on to others, as when we conclude that air has weight because all material substances have weight. We are then said to reason. These two fuller processes of thinking, which are closely connected one with the other, are to be the subject of the present chapter.

JUDGMENT.

§ 1. *The Mental Process in Judging.* In everyday discourse the word judge is used to express the process of coming to a decision about a thing, when we do not reason out a conclusion explicitly or formally, but apply in a rapid and automatic manner the results of past experience to a new case. Thus we judge that a man is sincere or insincere, that a plan is good or bad, and so forth.[2] For the purposes of psychology

[1] It must be noted that the term judgment as commonly employed means both the product and the process. It is at once the name of the decision reached, and of the mental operation by which this is reached.

[2] This, at least, is the more common meaning. The term is used too for the process of forming an opinion as to the rightness of conduct, or the beauty of an object by referring it to some standard for comparison. The expression is one of

and logic it is usual to extend the application of the term to all those mental operations which underlie what is called assertion or predication. We judge in so far as we assert something, or, as logicians put it, predicate something of a subject, or are prepared to do this, whether we reach this state of mental decision immediately by observation, as when we say 'This rose is blighted,' or mediately by a process of inference, as when we conclude from certain signs in the sky that it is going to rain. The mental operation here described may provisionally be defined as an explicit apprehension of a relation between two things (or a thing and its quality) as distinguished from a mere apprehension of a thing or a class of things.

This definition of the process of judgment by reference to its verbal expression suggests that the two are organically connected. And this is the case with all clear and explicit judgment. The connexion between judging and asserting in words is precisely similar to that between forming a concept and naming. At the same time it is important to note the fact that there is a rudimentary process of judging which is prior to and independent of language. Thus the lower animals are capable of reaching decisions respecting the proximity of their prey and so forth; and the child begins to judge before it can set forth its decisions in clear articulate propositions. Not only so, we all carry out in connexion with perception implicit acts of judgment which do not clothe themselves in language external or internal, as in determining the size or distance of an object, or its position in relation to a second object; in recognising a person as the same as one previously seen, and so forth.

The range of this præ-propositional judgment, as it may be called, is not easy to define. As already pointed out in dealing with comparison, we form something analogous to a judgment when we compare two sensations and consciously apprehend their relation. These sensuous judgments (sinnliche Urtheile) when carried out precisely are, however, aided by language, and clothe themselves in a propositional form. For the rest all *quasi*-judgments not aided by language, as in perceiving distance, recognising an object, and so forth, are implicit only. That is to say, the relation is not clearly apprehended, as the proposition with its formal separation of subject and predicate enables us to apprehend it.

great ambiguity, and consequently not easily susceptible of exact definition. On its various meanings, see Locke, *Essay*, bk. ii. ch. xi. § 2, and bk. iv. ch. xiv.; Dugald Stewart, *Elements*, ii. p. 15 ff.; Bain, *Education as a Science*, ch. iv. p. 122.

Looking further at the propositional or worded judgment, we see that it is made up of two representative ideas or notions, which are brought into a certain relation one to another. Of these notions the one answering to the predicate, or that which is asserted, is always general. On the other hand, the idea answering to the subject may be either a singular or a general notion, and in this way we get the distinction of singular and universal judgments, *e.g.*, 'This cat scratches,' 'All cats scratch'.

Reference is here made to the type of judgment commonly selected by logicians in which both subject and predicate are names of things or of attributes (abstract names). There are, however, as we shall see presently, other forms of judgment, some of which appear at first sight to contradict the statement that the predicate is always general. If, for example, I say "Peter is like John," both subject and predicate seem to be singular names; but in truth what is predicated here is, as we shall see, a relation of likeness, which, as a relation, is something general.

It is to be added that the difference between the logical and the psychological view of thought comes out in the distinctions of judgment. To the logician the important distinction (of quantity) is that between universal and particular (*e.g.*, 'All men are mortal,' 'Some men are civilised'), and he classes singular judgments as equivalent for his purposes with universals. But to the psychologist the significant distinction is that between the singular and the universal. The earliest and simplest form of judgment is the singular, whereas, as we shall see by-and-by, the universal involves a comparison of singular judgments; and the same may be said of particular judgments so far as they assert what is common to two or more members of a class.

§ 2. *Relation of Judgment to Conception.* According to the formal logical view of the matter, judgment differs from conception, is more complex, and presupposes it. In order to judge in the explicit propositional form we must start with two notions corresponding to subject and predicate. From this logical point of view we may say that judgment differs from conception in that while the concept combines a group of elements in a single representation, the judgment expressly sets forth two elements as two, and at the same time as related in a particular way.

This logical view of the matter is, however, from our psychological standpoint, artificial, and even inexact. It is now generally recognised that what we call a concept has no separate existence. We never say or think 'man' out of all relation to other things. Hence we must regard the judgment as the starting-point in thought, and the simplest process of thought properly so-called. What is artificially set out by the logician as a detached concept or element of thought is, in reality, the last stage or the product of a judgment, or rather of a series of judgments. Since we form our general notions by discovering similarities among things, and since the clear explicit recognition of a relation of similarity is a true judgment, it follows that judgment is essentially involved in conception. Not only so, since the discovery of such similarities among things is gradual, less obvious features being discovered after more obvious ones, it follows that in the process of forming the complete concept we may and commonly do employ the propositional form of judgment. Thus on discovering pips in apples the child expresses the fact by saying "Apples have pips".

We may say then that the two processes marked off by logicians as Conception and Judgment are not essentially different. As formally distinguishable phases of the thought-process they react one on the other. We only reach a general notion at all by means of a comparative detection of likeness, which, when explicit, is a judgment. Conversely, since our ordinary judgments involve general notions, we may say that conception prepares the way for the higher and more elaborate type of judgment.

This relation has often been imperfectly apprehended, as by Hamilton, who, as Mill points out, seems to contradict himself by saying in one place that judgment is the recognition of a relation between concepts, and in another place that a concept is built up by a succession of judgments. The word judgment is here evidently used in two senses: a narrow logical sense for those judgments which involve a combination of two notions, and a wider psychological sense for all clear explicit recognition of relation.[1]

It may be added that the propositional scheme recognised by logic, a subject notion and a predicate notion bound into a unity by a copula, is not the only or the most fundamental form of a propositional judgment or statement. According to the views of recent philologists, the first crude form of language is a sentence-word, that is, a word which serves as a sentence (statement, wish, etc.). Children probably employ words at first in the same way. Thus the child's sound 'ba-ba' (sleep) may stand for 'I am sleepy,' 'He is asleep,' etc. What are known as impersonal judgments, *e.g.*, 'It rains,' are presumably relics of this earlier stage of

[1] On the relation of the concept (Begriff) to the judgment, see Volkmann, vol. ii. § 122, where it is pointed out that just as the concept only becomes perfect through the judgment, so the perfected judgment may lapse into the concept, a fact evidenced in the transformation of the predicate into the form of adjective (*e.g.*, 'snow is white' into 'white snow'). (See p. 260. *Cf.* Wundt, *Logik*, 1er absch., 2er cap. 2.)

language-formation in which the several classes of words (parts of speech) were undifferentiated.[1]

§ 3. *Judging a Process of Mental Synthesis.* To judge, according to logical form, is, as we have seen, to combine two notions answering to the subject and the predicate of the proposition. Thus when a child judges that his milk is hot, or that pussy is cross, he is, it is manifest, bringing the two ideas milk and hot, pussy and cross, into mental juxtaposition, and connecting them one with another. This connexion between the ideas or notions involves a representation of an objective relation between the corresponding things. Thus in judging that his milk is hot the child is attributing the quality or state of heat to the object milk. This conscious apprehension of a relation between two things is, as was pointed out above, what is known as mental synthesis. We may say then that judgment is the full explicit carrying out of a process of synthesis.

The relation between things thus consciously apprehended in judgment varies in different cases. Thus in the instance just given the child is connecting an attribute with a substance in what has been called the relation of co-existence (by J. S. Mill), and may be marked off from other forms of co-existence, as inherence or co-inherence (Bain).[2] In other cases the relation set forth is one of difference, as when a child judges that his mother is taller than he is, or one of similarity, as when he judges that a drawing of a lady is like mamma.

If now we ask how this process of combining ideas in the form of a judgment comes about we see that it is only a further illustration of the three intellective functions, discrimination, assimilation, and associative integration. Thus every judgment respecting difference or likeness in things is but the final outcome of that process of reflective comparison dealt with above. In other words, every detection of unlikeness or likeness when it grows clear and explicit expresses itself in a judgment of the form: 'A and B are like' or 'unlike'. Further, every clear

[1] On the early use of words by the race and the child, see Romanes, *Mental Evolution in Man*, chap. xiv. On the logical treatment of the impersonal judgment, see Venn, *Empirical Logic*, p. 233 ff.; Lotze, *Logic*, p. 54 ff.

[2] We may speak of the quality inhering in the substance sugar, or co-inhering with the other qualities constituting the sugar.

apprehension of a relation of time, place, conjunction of qualities is an object, or other mode of contiguous conjunction of presentations, issues in a judgment. In this way we obtain such forms as: 'A is after B' (in time), 'A is at the side of B' (in space), 'A has the quality B'. We may thus say that the full reflective carrying out of each of the three intellective functions expresses itself in the form of a judgment.

FORMS OF SYNTHESIS IN JUDGING.

§ 4. *Assertions respecting Difference and Likeness.* It is not necessary in a psychological work to enter upon the discussion of the question what are the precise relations set forth in the judgment. The treatment of this subject falls under logic or theory of knowledge.[1] We may adopt the common view that the relation specially set forth in a judgment differs in different cases, and may confine ourselves to a brief account of the psychological development of the corresponding modes of synthesis.

After what has been said under the head of comparison on the detection of the fundamental relations of difference and likeness little need be here added. That we bring things into a relation of likeness, as when we judge that a violet is like a pansy, that two lines are equal (*i.e.*, perfectly like) in length, seems intelligible enough. The working of the forces of assimilation (suggestion by similarity) tends, as we have seen, to bring about this comparison of things, and the interest in tracing out resemblance acts as a strong stimulus to the analytical separation of points of likeness.

It is somewhat otherwise in the case of detecting difference. Difference does not seem to be a binding relation in the same sense as likeness. To see things merely as different is to separate rather than to combine, and does not give rise to any customary form of judgment. Thus we do not think or say that the colour red is different from the taste of a walnut, or that roast beef is different from an eclipse of the sun. As pointed out above, we do not under ordinary circumstances

[1] It has been discussed by J. S. Mill and others under the head: "Import of Propositions".

occupy ourselves about mere difference.[1] Nevertheless, a large number of our judgments undoubtedly have to do with the setting forth of difference. Thus we are interested in and observe differences among homogeneous presentations, as when we say two colours differ in respect of hue, intensity, and so forth. As regards complex presentations, as has been shown above, we only discriminate where, at the same time, we virtually class or assimilate, *e.g.*, a man and a wall in respect of height. And here it is evident that we do carry out a process of synthesis, that is, a combination of two notions by means of a relation. To think of a particular wall as higher than the average human height is to bring the object into a definite relation, to effect a connexion of thought. This establishment of a relation is especially manifest in the case of all impressive contrasts in which the element of feeling serves, as we have seen, to fix the connexion in the mind.

§ 4*a*. *Relations of Quantity.* Under the general head of relations of likeness and difference come relations of quantity. The relations specially set forth in the science of quantity, arithmetic, geometry, etc., are those of equality and its correlative inequality, in its two aspects greater or less. This equality (or inequality) may hold with respect to discrete or numerical quantity, *e.g.*, $3 + 2 = 5$, or to continuous quantity, *e.g.*, "The angles at the base of an isosceles triangle are equal to one another". Such equality is plainly likeness in respect of quantity or amount. It constitutes the type of perfect likeness. To this extent judgments of quantity differ psychologically from other judgments. The source of this peculiarity in mathematical judgment, *viz.*, the detection of perfect likeness or equality, lies in the very perception of quantity. Thus, as is well known, the exact comparison of two lines in respect of length is carried out by means of juxtaposition by which the eye at once sees whether the one extends beyond the other. With respect to numerical equality the exact judgment grows out of those processes of number-formation already referred to. Numerical equality is equality or equivalence in respect of

[1] Hence the truth in the observation of Hume: "Difference, I consider, rather as a negation of relation than as anything real or positive," quoted by Ward, *loc. cit.*, 80, col. 1.

counting or summation of units; and in the process of summing, *e.g.*, in counting a succession of beats, we gain in the apprehension of the whole succession as a number the most definite and exact appreciation of what we call quantity, or the definitely measurable aspect of things.[1]

§ 4*b*. *Identity.* Closely related to the relation of similarity is that of identity or sameness. Many of our everyday judgments have to do with this relation. Thus we speak of one colour being the same (or not the same) as another, one person being identical with himself, and so forth.

We may here distinguish between what has been called "material" identity, that is, the presence in two or more things of a common element, as a particular colour, and "individual" identity. The former, being a point of likeness, that is, a perfectly similar element, recurring at different times, is opposed to difference of kind. Thus the same colour is opposed to a discernible difference in colour. The latter, which is the relation of identity commonly spoken of, is opposed to numerical difference or individual distinctness. The idea of the same man is opposed to that of two distinct men.[2]

The germ of identification proper, that is, the identifying of an individual thing, appears in perceptual recognition. Here, however, what we call recognition is at first not more than an act of assimilation or the detection of a material sameness, *e.g.*, the common presentative constituents in the group answering to 'mother,' 'dog,' and so forth. Before the clear consciousness of individual sameness arises the child must have advanced some way in the formation of the idea of the external world as a permanent arrangement or system. Thus when he says 'This is my doll,' he must realise not merely that the present presentation is materially the same as, that is, perfectly like (in certain features), previous presentations, but

[1] For an examination into the kind of relation set forth by mathematics, see Bain, *Logic*, v. chap. i.

[2] Hume brings out this distinction in his discussion of sameness. The two kinds of 'difference' here referred to are of course not absolutely distinct. Plurality, numerical difference, involves a difference of kind, if only in spatial and temporal marks. It has been much questioned whether we should speak of two presentations occurring apart in time as the same. The fixed usages of language, however, make it impossible to ignore this meaning of the word. (*Cf.* Hume, *Treatise*, bk. i. pt. i. § 5.)

that it has persisted in the interval as a renewable presentation under certain conditions (*e.g.*, movement to a particular place). In other words, a judgment of sameness involves the idea of the temporal continuity of our presentations, or their permanent renewability. The child who says "This is my doll" has already begun to represent the doll as existing from moment to moment, whether he happens to be actually seeing it or not.[1] In addition to this temporal continuity the relation of sameness involves the idea of spatial continuity. By this is meant that what we know as an object maintains one place or position, or, if it alters this, does so continuously by what we call movement. Thus the assertion 'This is my doll' means 'It is the thing I left here,' or 'the thing which somebody has carried from where I left it to this place'.

When this consciousness of continuous objective existence in a particular place (or succession of related places) independently of our occasional perception grows clear, the child learns, as was hinted above, to recognise a thing as the same in spite of considerable difference. Thus he recognises the broken toy as the same as the once intact plaything, just because he realises the continuity of existence under the altered conditions. When the temporal and spatial continuity is doubtful he will, as we know, hesitate to call a thing the same. The suspicion of a covert exchange of toys, for example, will lead him to hesitate in judging of sameness, even though the substituted toy is scarcely distinguishable from the original.

The popular idea of individual identity is based on continuity and material sameness (similarity) conjointly. The introduction of a considerable amount of change, especially if sudden, as in the restoration of a church, makes people hesitate to attribute identity, even where the object preserves an unbroken continuity of existence as a whole. The importance attached to similarity is seen in the fact that we hardly speak of the oak tree as identical with the acorn, out of which it has nevertheless grown by a series of perfectly gradual changes. This shows that a clear conception of individual identity, as based on continuity of existence, belongs to a comparatively high stage of intellectual development. A new basis of identity is arrived at when the idea of substantial continuity is formed. Thus to the scientific mind the water is in a sense the same as its constituents, in spite of the numerous and palpable differences of sensible quality between the compound and its ingredients. This idea of substantial identity, again, introduces a further difficulty into the apprehension of organic sameness after it is recognised that organisms undergo a

[1] *Cf.* above, p. 234.

continual change of material constituents. The conception of organic sameness, as residing in the continuity of a sum of vital forces, and in the unbroken renewal of a similar structure, modified only by those perfectly gradual changes which we call growth, is the highest development of the consciousness of identity.[1]

§ 5. *Relations of Space and Time.* In addition to judgments which have to do with likeness and unlikeness there are others which especially set forth relations of space and time. Thus a child observes the position of an object, and sets forth the fact, as in saying 'Puss is under the table'; or he observes the succession of two events, as when he says, 'Carlo is gone after father,' and so forth.

As has been pointed out above, in the account of the development of the perceptions of space and time, all presentations have what may be called spatial and temporal marks by the help of which we localise them in space and in time. Imagination which, as we have seen, is limited by the conditions of our perceptual experience uniformly sets its objects in place and time. The relation thus realised may be very indefinite, as in the common form of child's story beginning 'Once upon a time,' or 'A long, long way from here'. Still these relations are present, and the clear apprehension of them becomes more and more a part of our ordinary thought as intelligence advances. Thus in different ways the propositions of geography, astronomy and geometry set forth the relations of space, and the propositions of history and natural science, the relations of time.

§ 5*a*. *Substance and Attribute.* Closely connected with the apprehension of time- and space-relations is that of the relation of an attribute to its substance (co-existence or co-inherence), as when the child says, "The grass is wet". This relation plays so large a part in our everyday thought that logicians often speak of it as if it were the only relation set forth by propositions. The psychological development of the idea of substance as the groundwork of the presentative, or,

[1] In this slight account of the relation of sameness no reference has been made to personal identity or the identity of the conscious self, a point that has been much discussed in the history of philosophy. This will occupy us later. The student who requires a fuller analysis of the notion of identity should consult Hume's examination of the idea in his *Treatise*, bk. i. pt. iv. § 2, and the careful discussion in Mr. G. S. Fullerton's volume *On Sameness and Identity, a psychological study* (Philadelphia, 1880).

more correctly, the presentative-representative unity which we call a percept, has been traced out above. The idea of the substantial reality, table, sugar, and so forth, is derived from the experience of active touch. When, therefore, we qualify such a substantial reality, as in attributing sweetness to the sugar, we are connecting the sense-experience underlying the idea of sweetness with this fundamental touch-experience. As was pointed out above, the relation of co-existence here referred to involves at once a temporal and a spatial relation. The conjunction sweet-sugar or sugar-sweet is arrived at by repeated co-presentations of the two sense-experiences in close temporal proximity. Further, the qualifying of the sugar as sweet, and so the incorporating of the sweetness as a quality into the tactuo-visual unity known as sugar, involves the apprehension of a spatial relation. The thing sugar becomes the sweet thing just because in the act of tasting it the child localises the taste at the very point where he tactually perceives the thing. All attribution of quality to things is thus based on a spatial identification of, or a recognition of spatial equivalence in, the experiences answering to the particular substance and the particular quality conjoined.[1]

§ 5*b*. *Causal Judgments.* One other class of judgments requires to be mentioned here on account of their importance and the large place they fill in our everyday thought, *viz.*, those which have to do with agency, production of effect, or, as it is commonly called, causation. A child reaches such a judgment when he says, "Bow-wow makes a noise," "Nurse is getting breakfast," and so forth. All ascription of action to agent takes the form of a causal judgment.

The idea of the causal relation is developed gradually and by the aid of certain experiences. The relation as popularly conceived involves a sequence, *e.g.*, a blow and the succeeding pain. Not every succession, however, suggests the relation of cause and effect. First of all, the effect must be impressive or interesting, so as to attract the attention. We find that the savage and the child alike begin to note the production of effects which are of immediate practical interest, more particularly those affecting their bodily comfort. In the second

[1] *Cf.* above, p. 260.

place, causal agency will only be noted where the effect follows the cause immediately, and where the succession repeats itself with something like regularity.

The conditions here named will, it is evident, be realised in the case of the individual's own actions. When a child by a movement immediately gains some benefit, as in chafing an irritable spot on the skin, he has presented a succession of great practical interest, and one which, by repetition, easily lends itself to the discovery of a regular connexion. But this is not all. The child's movements, even before they take on the clearly voluntary character, involve as muscular actions palpable changes in his consciousness which he can hardly fail to note. It is, indeed, only when we ourselves produce an effect by the use of our muscular powers that we have a direct consciousness of causal agency so far as this involves the idea of force or power. When action grows distinctly volitional, and the result following has previously been foreseen and intended, as in breaking a thing by a blow, the dependence of the effect on the conscious action is driven home in a new way through the agreement of the actuality with the expectation. Hence it seems natural to suppose that the race and the individual acquire their first dim apprehension of the causal relation through the observation of their own actions.

That it is this experience which supplies the crude form of the idea of the causal relation seems to be shown by the fact that the first verbal expression of a causal judgment is the setting forth of a conscious action of man or animal, as in the proposition, 'The dog barks'. At this stage of intellectual development all natural processes are viewed as analogous to such actions. Thus, the ball 'strikes' just as the child himself strikes, the arrow 'flies' just as the bird flies, and so forth. The child is here in much the same mental condition as the savage who personifies inanimate objects, regarding them as the source of *quasi*-conscious actions resembling his own.

This anthropomorphic view of causal agency is further seen in the attribution of something analogous to an end or purpose to physical actions. "What is the snow sent for?" is just as natural a question to the childish mind as "Where does the snow come from?" A child of two years accounted for a pebble in his box of bricks by the supposition that it wanted to play with the bricks. In truth, like his prototype, the savage, he can only conceive of natural phenomena as serving some purpose, that is, as controlled by some volitional agency.

It may be added that, long after the idea of physical causation has been differentiated from that of action for end or final causation, the former retains marks of its psychological origin. We cannot represent natural objects as agents save by forms of language which betray a fixed and unalterable habit of regarding all changes in our environment as a product of *quasi*-human action or voluntary movement. This applies not only to the vivid poetic representation of nature in the figure known as personification, but even to scientific thought itself. The ideas of force, energy, and so forth, which science makes use of, are intelligible, just because we bring them into relation to our own experiences of muscular exertion.

The apprehension of causality as a constant element in the events taking place about us is reached, if at all, but slowly. In the case of the race and of the individual alike we see that the mind remains for a long time satisfied with the reference of a comparatively few phenomena, *viz.*, those involving personal benefit or injury to causal agency. With respect to the vast majority of the changes in the environment, it shows itself incurious. The predominance of the anthropomorphic view, moreover, tends to confine the application of the causal idea to cases where there is a discoverable analogy to human action, and more particularly the movements of things. The first indication of a grasp of the wider domain of causation is seen in the crude inventions of superstition by which the race and the individual are wont to refer occurrences of practical moment, changes of fortune, and the like, for which no apparent productive agencies are discoverable, to the occult influence of the stars.

The more scientific idea of causation develops as the result of a number of co-operant thought-processes. Thus the child passes from the first crude conception of a cause as a single agency to the more accurate one of a complex group of agents or conditions. The flame is no longer made by the match, it arises from a particular arrangement or collocation of a number of chemical agents. Again, the idea of the range of causal action expands, embracing not merely the immediate effects but later effects also. In this way, for example, the child comes to apply the causal judgment to the more distant physical and moral effects of his own actions. Conversely, it may be said that the growth of a more scientific idea of causation tends to transform the first naïve idea of a sequence of two separate occurrences into that of a single continuous process. Thus the child passes from the first crude judgment, "Eating too much sweets makes me poorly," to an apprehension of the whole continuous process of which these two experiences are the first and the last stage.[1] The final outcome of this scientific development of the causal idea is the view that cause and effect are but different aspects of one and the same process, a view which plainly tends to the subsumption of the causal relation under that of identity.

In tracing the psychological development of these ideas of relation no reference has been made to the question whether they are in any sense, and if so to what extent, innate or connate. According to the common form of the evolution hypothesis any cerebro-intellectual products which reform themselves regularly from generation to generation tend to transmit an intuitive predisposition to that particular mode of psycho-physical formation. According to this view, it is at least supposable that the individual inherits in his cerebral organisation a formative tendency corresponding to the uniform relations of space, time, substance and attribute, and causal agency. The rapidity with which the child acquires ideas of things as distinct wholes or unities, of space- and time-relations, and of making or producing, appears to bear out this supposition. Yet there seems no way as yet of separating and quantitatively estimating this inherited factor in thought.

§ 6. *Complication of Syntheses.* While we have thus treated the different forms of thought-synthesis as though they occurred apart, we must bear in mind that these are to some extent conjoined in our concrete judgments. Thus difference and likeness may both be said to be involved in every variety of judgment. The relation of difference is implicitly asserted in the separation (in the common logical type of judgment) of the subject and the predicate as distinct elements of thought. It is, as we shall see presently, more explicitly set forth in all negative judgments. With respect to likeness, it has already

[1] On the psychological development of the idea of cause, consult Ward, *loc. cit.*, p. 82; Höffding, *Psychologie*, v. b. 4. The difference between the crude popular and the scientific idea of the causal relation is well brought out by Venn, *Empirical Logic*, chap. ii.

been remarked that logicians are wont to reduce all judgment to the form of an assimilative one. According to this view, the common form of proposition setting forth inherence of quality in a substance, *e.g.*, 'The sugar is sweet,' can be rendered 'Sugar is like other sweet things'. Here, however, the relation of likeness is only implied, and not explicitly set forth. This is especially clear in the case of a universal judgment. When, for example, we say 'All men cook their food,' we must not be taken to mean that there are other culinary animals to which we are assimilating men. At the same time, as we shall see presently, the universal judgment, just because it is universal, implies, or rather sets forth, a relation of similarity in another way; for to say that men (or even certain men) have a given quality or perform a given action is to say that they resemble one another in this particular circumstance.

This complexity of the synthetic process becomes clear in those forms of judgment which involve reference to a standard, and more particularly in the æsthetic or critical, and the moral judgment. The critic who pronounces a picture right in tone of colour, balance, and so forth, may be said to be assimilating the particular object to an idea in his mind, that is to say, a typical image (formed out of many particular presentations) of a right or standard distribution of light, and so forth. It is true, of course, that the critic of a work of art, or the judge of a moral action, is attributing a quality to the particular thing under discussion: but the peculiar circumstance here is that the presence of the quality only discloses itself as the result of a comparison of the individual with the generic image which supplies a standard measure of the artistic or moral rightness.

The idea that all judgment is assimilation is involved in the common logical interpretation of the proposition as bringing the subject "under" the predicate, or referring the subject to the "class" denoted by the predicate. J. S. Mill examines and rejects this view of predication in his *Logic*. He admits, however, that judgments which directly have to do with co-inherence, as 'sugar is sweet,' imply a relation of likeness as well. It may be added that in certain cases this implied relation of likeness grows distinct and explicit, as when we ascribe the colour apple-green to a fabric, and so in the very act of attributing a quality to a thing indicate its resemblance to something else.[1]

[1] For Mill's view see his *System of Logic*, bk. i. chap. v. §§ 3 and 6. Mill, with his characteristic fairness, allows that in describing simple presentations, *i.e.*, sensations, as when we say 'This colour is green,' 'This tone is G,' we affirm likeness

It is to be added that our concrete everyday judgments involve a much greater complexity of synthesis than the logical examination of propositions discloses. In other words, the complexity of the grammatical sentence (which the simplifications of logic are apt to hide from view) answers to a number of relations rather than to a single relation. Thus in the sentence, "He is the man who wrote such and such a book," we have, it is obvious, a relation of identity and of causal agency. Again, 'He was standing at that spot at the very moment that his brother was behaving in this way,' sets forth, it is evident, a relation of place, of time and of causation.[1]

§ 7. *General Antecedents of Judgment.* By help of this examination of the customary forms of the thought-synthesis we may indicate the more general psychical antecedents of the process of judging. We judge when our attention is specially drawn to a relation of difference, likeness, identity, and so forth. Hence a common stimulus to judgment is the observation of some change in our surroundings, as when a child notes that pussy is dirty, that his hat is on the floor (a new relation of place), and so forth. Along with change in the surroundings we may take as its equivalent the discovery of some new feature in a thing, as when the child finds out that puss has claws. All new juxtaposition of things obviously excites the mind to judge by bringing out relations of likeness and difference.

Next to these presentative conditions of judgment we have certain representative ones. It may be said that we never judge without making use of pre-existing ideas. Even when the child says, 'Puss is dirty,' he must, it is obvious, be in possession of the idea of dirtiness. The assimilative function, which, as we have seen, runs through all varieties of judgment, depends on a firm retention of ideas. We cannot say 'This tone is a C,' without having in the mind a clear standard-idea of that note. The same remark applies to all our judgments with respect to change: for we cannot say that a thing is different from what it was unless the idea of the previous state is present.

Again, since the suggestive processes always involve relations of contiguity or similarity, we may expect that these will play a large part in the formation of our judgments. Indeed,

and nothing else. If, however, the name of a colour or other physical attribute is nothing but a likeness, it would seem to follow that when I say "This rose is yellow," I really set forth a double relation, *viz.*, of co-inherence and of likeness which may be expressed in the form 'There inheres in this (subject) a point of likeness to certain other things'.

[1] *Cf.* Ward, *loc. cit.*, p. 79, col. 2.

when not immediately prompted by a presentated relation, our judgments must be formed by help of such suggestion. This applies to all relations of time, place, substance, and cause that disclose themselves by means of a process of contiguous reinstatement. Thus, when looking at the low evening sun and judging that it is about to set, our thought obviously follows the lead of contiguous association. Similarly, when both terms are representative, as in judging from memory that Rome is north of Naples, that the Stuarts followed the Tudors, that the Dover cliffs are white, and so forth. Also it follows from what has been said that the workings of assimilative suggestion are a main stimulus to judgment. So far as judgment involves classification it directly depends on this process. Thus we judge that a particular colour is apple-green, that a painting is the work of an impressionist, and so forth, as the direct consequence of an assimilative reproduction of an idea.

§ 8. *Judgment as Conditioned Process: Activity in Judgment.* Our inquiry has shown that the combination of elements into a judgment is determined by certain conditions. We do not find the two related terms apart, and then arbitrarily attach them. The synthetic process in judgment is the conscious realisation of a connexion which is brought before the mind either in the fact of a co-presentation of the two terms at the moment, or by the mechanism of suggestion (contiguity or similarity). It is rendering explicit in clear consciousness something that was obscurely presented in the mental complex.[1] At the same time, while the combination of elements is always ultimately conditioned, it involves in all its more explicit forms an active and selective factor. Thus even where the relation is directly presented, *e.g.*, in the spatial relation of two simultaneously perceived objects, it is evident that the attention must direct itself to this relation, and selectively bring it into mental prominence. In many cases, too, this active element becomes more marked, as where the complex reproductive processes are involved, and associative tendencies have to be controlled. Thus in answering the question, 'Who was the author of such a work?' the active element takes the form of a volitional control of the suggestive mechanism,

[1] This is well brought out by Wundt, *Physiol. Psychologie*, ii. p. 387.

fixing or keeping before the mind what is helpful, and excluding irrelevant suggestions. Finally, this active control becomes still more conspicuous in those cases of complex judgment, to be referred to presently, where a comparison of alternatives is offered, as in the question 'Which of two authors' styles does this poem most closely resemble?'[1]

Reference is here made only to judgments as developed into explicit verbal form, and as arrived at for the first time. So far as repetition and habit come in, the presence of the active selective element becomes less marked. Thus, in answering the question 'Who wrote *Hamlet?*' or 'Which comes first, the Stuart or Tudor dynasty?' the previous firm establishment of the thought-connexion expressed by the answer allows of a rapid *quasi*-automatic response. This, however, ought perhaps to be classed as pure process of associative reinstatement rather than as a judgment in the complete sense. The effect of such repetition shows itself not only in the re-formation of previously reached syntheses, but, in a less impressive manner, in the formation of syntheses like those previously formed, *e.g.*, in the instantaneous discernment of space- and time-relations, "right and left," "before and after," and so forth. All this shows that, in the case of the higher processes of intellection, as well as in that of the lower, what we call practice, *i.e.*, the repetition of the psycho-physical processes involved, tends to induce a sub-conscious and mechanical mode of performance. This has been recently illustrated in some remarkable experiments of Münsterberg, in which it was found that under particular conditions a question might be complicated up to a certain point without the reaction-time (*i.e.*, the interval between the hearing of the question and the giving of the reply) being materially increased, and without the intervention of any clearly conscious activity in the shape of choice.[2]

[1] The function of the will (voluntary attention) is much the same here as in the case of selective reproduction. (*Cf.* above, p. 346 ff.)

[2] The increase of complication in the questioning may be illustrated by the two following: "Which is the most important German river?" "Which lies more to the west, Berlin or the most important German river?" The exact meaning of the results reached by these experiments is not as yet quite clear. It is to be noted that such question-extracted 'judgments' are carried out under highly artificial conditions. Thus there is a very severe preliminary adjustment of attention. This may be supposed to effect a commotion of particular cerebral tracts answering to the particular plexus of ideas dealt with, and as a result of such commotion to further a subsequent unconscious working out of the result, just as when we have been trying to recall a name it is apt to revive after a short interval without any further exertion of attention. It must be noted, moreover, that in most, if not all, of these cases of so-called judgment (including the answering of questions that seem to involve an appeal to a preferential selection, *e.g.*, "Which is the finest of Goethe's dramas?") we readily recognise the fact that the decision has been carried out with some degree of explicitness long before the experiment begins, and is thus susceptible of being renewed by a process of verbal suggestion. (See, for Münsterberg's own interpretation of his results, *Beiträge*, i. cap. ii.)

§ 9. *Synthetic and Analytic Judgments.* Logicians distinguish between judgments which combine with the subject-notion a new element, as 'iron rusts,' and those which simply unfold a part of what was contained in the subject-notion, that is to say, of the connotation of the term, as 'iron is a material substance'. The first are specially marked off as synthetic judgments, while the second are distinguished as analytic judgments, that is, such as subserve the analytic setting forth of the constituents of the subject-notion. The most important class of analytic judgments are definitions. It is evident, however, that such an analytic judgment, though of great service in clearing up an obscure concept, is wanting in the characteristics of a true (synthetic) judgment, *viz.*, a connecting of two distinct notions, and the representation of a corresponding relation between the two things.

The distinction of the synthetic and the analytic judgment here referred to is a logical one, drawn for the purpose of guiding our processes of thought according to a normal or common standard. It assumes that we all know the full meaning of our terms, and use them in the same sense, that is, give them the same connotation. The psychologist, however, is interested, as we have seen, not in the normal regulation of thought according to an objective standard, but in the growth of such thought in the individual mind. Hence, if he applies the terms analytical and synthetical to judgment, he must do so with reference to the individual's previous knowledge. According to this view, a judgment is (psychologically) analytical when it sets explicitly forth some element in a pre-existing idea, synthetical when it adds to this idea. Using the terms in this sense, we may say that our judgments illustrate partly the one, partly the other process. It has been suggested above, in our account of general ideas, that they are first formed as an undistinguished complex of marks. The child knows the dog as a presentative whole before it knows the constituent elements composing this whole. The gradual singling out and rendering clear of each of these may be called in a sense an analytical judgment.

Not only so, as was pointed out above, since all comparison involves analysis, every judgment of likeness and difference may be said to be in part, or regarded under one aspect, an analytical process. Thus if I say that this fruit is a melon, this man a Hindoo, it must be because in the given presentation I analytically single out a certain group of marks on the ground of which I classify it. We may say, then, that judgments of likeness (and of difference), while synthetic in the sense of establishing a relation, are analytic in the sense of detecting and setting forth in a new presentation-complex certain known elements.[1]

On the other hand, all advance in knowledge illustrates, as we have seen, the synthetic function of judgment. Thus in the development of our concepts we go on to observe new, *i.e.*, as yet unobserved, features or marks, and join these by a synthetic process to previously observed marks. In this way our notions of things, *e.g.*, the qualities of minerals, plants, etc., become more complex. Synthesis thus supplements analysis in the formation of our ideas of things.

§ 10. *Judgment and Belief.* Our examination into the synthetic process of judgment has disclosed the fact that every judgment involves a psychical element which is best marked off as belief. To judge that sugar is sweet, that Peter is like John, that the wind causes waves, and so forth, is to express our belief or conviction that the relation holds of the objective things or realities. This is commonly expressed by saying that when we assert anything we imply that the proposition is true, that is, corresponds to something real in the world of objects.[2]

The presence of belief may be made the test of a genuine act of judgment. Thus, if ideas are brought together by the capricious movements of fancy, as in idle reverie, and no belief accompanies the juxtaposition, there is, properly speaking, no judgment. Similarly, of course, if we repeat mere hearsay, of the truth of which we have no individual conviction, or, worse still, state that which we know to be uncertain or even untrue.

The precise psychological character of belief is a matter of dispute. We commonly speak of it as a feeling ('I feel sure,' 'I feel convinced'), and this suggests that the mental state is

[1] This is brought out by Volkmann in his treatment of the analytic judgment as a mode of apperception. (See his *Psychologie*, ii. § 121.)

[2] We are commonly said to believe in a proposition; but the object of belief, as we shall see by-and-by, is always the reality to which the proposition refers. In believing in a proposition we believe in its truth, that is, its correspondence with such reality.

not a purely intellectual one. The attitude of mind expressed by the word plainly involves an objective reference, or, as it has been called, the "objectivity of thought". To believe is to have the idea of reality, to envisage the object of thought as a part of the real world. Hence it will be better to postpone the fuller examination of belief until we have completed our psychological account of the formal distinctions of thought, and can take up the subject of reality, so far as it comes into the psychological domain. For our present purpose, it is enough to define belief as the state or feeling of restful assurance which is always present in some degree when we judge or decide upon a matter, and which gives to our judgment its characteristic psychical colouring.

§ 11. *Affirmation and Negation.* Closely connected with the problem of belief is the distinction between Affirmation and Negation. In the preceding account of the synthetic process in judgment we have supposed that the mind is engaged in establishing a connexion, or in positive affirmation. Thus, to think the connexion snow-white in the proposition "Snow is white" is obviously to affirm the existence of this particular relation. The ideas snow and white are in this case conjoined, and firmly held together by means of the relation here thought of. Hence we speak of the psychical process as one of combination or synthesis.

If, on the other hand, I say "This snow is not perfectly white," the process of combination is wanting. The two ideas are not brought into the relation required for the synthesis 'Snow is white'. They refuse to cohere as parts of a stable thought-synthesis. The relation suggested is, in this case, rejected by the mind, and we are said to negate or deny the corresponding affirmative proposition.

While negation is thus an arrest of mental synthesis, it always involves, as we have seen, the setting forth of one relation, *viz.*, that of difference. Thus, to say that this snow is not white involves the discriminative judgment. "This snow differs from pure white snow." Just as far as affirmative judgment is concerned about similarities, so far may the corresponding negation be said to concern itself with differences. This appears plainly enough in the systematic process of scientific classification when we mark off one class from another on the ground of the distinction involved in the presence and the absence of a quality, *e.g.*, in the bipartite division vertebrate—non-vertebrate. As pointed out above, however, the bare assertion of a difference between two things can hardly be said to establish a relation between them; and consequently a judgment that merely negates is not a synthesis in the sense in which an affirmative judgment is one.

It appears to follow that, psychologically, affirmation is prior to negation. And observation bears out this conclusion. The child affirms before it denies. In the case of one child observed by the present writer who was fairly quick in using language, a negative statement was first noted some time on in the third year. Negation arises when vivid expectation is frustrated. Thus, a predatory animal, after following up the tracks of his prey and not finding this, may be supposed to go through a mental process answering to a negation 'It is not here'. Children's negations are called forth partly by disappointment of expectation, as in noting the absence of a person customarily present (*e.g.*, 'Sister not here'), partly through the suggestions of other persons. More particularly, negation becomes a clearly conscious process of rejecting a proposition through the agency of the question, *e.g.*, 'Is baby hungry?'

§ 12. *Judgment as Selective Decision.* When we deny we express the mental state of disbelief or the complete exclusion of the state of acceptance or belief. Here there is no uncertainty, but the mind is satisfied, or convinced, just as in affirmation. The difference between belief and disbelief is thus a logical difference rather than a psychological one. In saying 'This fruit is not ripe' I am, it is true, rejecting the proposition, 'This fruit is ripe,' but I am still in a state of belief with respect to what logicians call its contradictory. This is clearly shown in our customary forms of speech. I express one and the same mental state when I say, "I do not believe this fruit is ripe," and when I say, "I believe this fruit is not ripe". Belief and disbelief are thus two co-existent phases of one state of mind, expressing the difference of its attitude towards two conflicting or contradictory statements.

It follows from this relation of belief to disbelief that judgment is always, more or less consciously, a process of selective decision. In judging that this fruit is ripe I am choosing one of two alternatives: 'This fruit is either ripe or not ripe'. That this is so is borne out by observations of the first implicit judgments of children. Thus, for example, it was observed that a little boy, when in his third year he began to use the negative form, did so by appending the negative particle to a kind of self-framed question, thus: "A (his name for himself) go in water—no". It was further observed in the case of this child and of his sister that about the same age they habitually coupled affirmative and negative statements, thus: "This I's (my) cup, not mamma's cup"; "This a nice bow-wow, not a nasty bow-wow". In later life, no doubt, in cases where the ground of the judgment is clearly manifest at the outset, we may not consciously realise the two alternatives; but a moment's reflexion will at any time suffice to make clear this element of selective decision. The very history of the word judge, indeed, referring as it primarily does to the judicial function, *i.e.*, the deciding of a dispute, shows how prominent an element is this decision in the popular conception of the process.[1]

The selective aspect of judgment here referred to becomes more clearly marked where an alternative is distinctly presented to the mind, whether by the presence of conflicting marks in a thing, *e.g.*, the presence of some of the marks of a genuine coin and the absence of others, or by the suggestive force of a question, *e.g.*, 'Is this a genuine coin?' Here it is evident the process of judging becomes a fully conscious comparison and selective decision. Similarly of course in the more complicated forms of judgment, as in deciding which of two Roman generals fought in a certain battle, which among three, four, or more authors most closely resembles a given author, and so forth.[2]

§ 13. *Suspension of Judgment: Doubt.* The situation just dealt with, *viz.*, the having to choose between two contradictory statements, gives rise to a psychical phenomenon of great importance, that known as Doubt or Uncertainty. To reflect, for example, whether or not this coin is a genuine antique is, for the moment, to be uncertain. All careful consideration of a point raised thus involves at least a momentary doubt. Doubt, in its fuller and more intense form, appears when the mind re-

[1] The idea of choosing or picking out one of two alternatives is still more plainly seen in the Greek term κρίνω (whence κρίτης). *Cf.* the German *ur-theilen.*

[2] *Cf.* the problems of comparison investigated by Münsterberg, referred to above, p. 451.

mains uncertain after reflexion, and as the result of a full reinstatement of considerations for and against a point. Such doubt means a pulling of the mind in two directions, that is, a state of discord or conflict due to the action of two incompatible and antagonistic thought-tendencies (forces of association). In this case, it is evident, judgment is altogether arrested or suspended. It is this state of doubt or uncertainty, and not that of disbelief, which is the proper psychological opposite of belief. In belief the mind is at rest, the impulse to inquire is satisfied, and the volitional activity involved in thought is quieted. In doubt, on the other hand, we are in a state of unrest, conflict, or baffled activity.[1]

From this slight account of the state of doubt we shall expect it to appear much later in the development of intelligence than belief. Belief is primitive and natural, doubt acquired and artificial. Doubt is more complex than belief, depending on a recognition of a number of opposing considerations. Hence a child will much more readily believe or disbelieve than doubt. Doubt arises, in the first place, only where conflicting facts present themselves in such a way that the child can hardly fail to note them, *e.g.*, in seeing a favourite fruit and at the same time the signs of rottenness. Hence it only fills a considerable place in our intellectual life as memory develops and the complexities and apparent contradictions of things bringing disappointment of expectation come into view and are carefully attended to. It may be added that, since all doubt is a painful condition of conflict, it is an unstable attitude, and as such very hard to maintain. To be willing to remain in a state of uncertainty when circumstances require it, *e.g.*, in investigating a difficult question requiring a long and patient examination of facts, is the mark of a high intellectual culture and self-discipline.

REASONING.

§ 14. *Transition from Judgment to Reasoning.* Hitherto we have been considering judgments, so far as this was possible,

[1] The etymology of the word (*dubio*, from *duo*, *cf.* German *zweifeln*, from *zwei*) suggests this oscillation of mind between two conflicting alternatives.

without any reference to the question whether we reach them directly and independently of any process of inference from previous judgments, *i.e.*, of reasoning, or indirectly by way of such a process. This distinction is a much more important one from a logical, than from a psychological, point of view. For, as we shall see, many judgments which can be grounded on other judgments are not, in the first place, reached by way of these as their psychical antecedents. Nevertheless, the difference does roughly answer to a psychological distinction. For whenever inference precedes judgment the psychical process is by this circumstance rendered a more complex one, and the belief finally adopted differs to this extent, that it is consciously based or grounded on other beliefs.

It follows from our examination of the process of judgment that many forms of it are reached without any conscious process of inference. Thus the early form of singular judgment, growing out of direct observation, *e.g.*, 'This plate is cracked,' 'These two coins are similar,' seems altogether free from inference; it is a judgment of observation. The same thing holds good of judgments based directly and exclusively on memory, *e.g.*, 'I met A. B. yesterday'. Such judgments growing immediately out of observation and memory may be marked off as intuitive judgments.

While we thus mark off certain earlier and simpler judgments as intuitive or non-inferential, it may be doubted whether any explicit judgment is wholly devoid of some germ of inference. As we saw above, much of what is commonly regarded as immediate perception (*e.g.*, the visual cognition of distance) is analogous to inference. This rudiment of inference becomes still more clear in those judgments of observation which involve the recognition of a thing by help of certain characters. Thus when a chemist identifies a substance from its odour, or an expert recognises a coin or a gem as an antique, it is evident that the mind moves inferentially from the observation of certain traits to the existence of other conjoined qualities. It is much the same in the case of the immediate belief in memory. In all our more reflective acceptances of the deliverance of memory we are more or less consciously relying on the general trustworthiness of memory as proved in previous cases. It follows then that what is here spoken of as "intuitive" judgment is judgment in which the inferential element is relatively small, inconspicuous, and not fully conscious or explicit.

It is evident that a large number of our judgments, both singular and universal, are reached by a conscious process of inference. By this is meant that we derive the judgment as a conclusion from previously gained judgments which in relation to the last are our starting-points or "premises". Thus in the common forms of expectation and prediction, as when we assert that it is going to rain because the barometer is falling, we are, it is evident, drawing an inference or a conclusion from certain data. All judgments derived in this way by a process of inference from other judgments may be marked off as reasoned judgments.

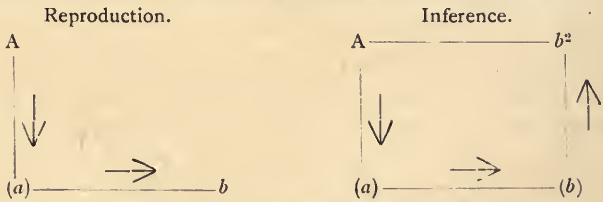
It is to be remarked that there is much the same relation between judgment and inference or reasoning as we found to hold between conception and judgment. Our first judgments are 'intuitive,' the element of inference present being implicit only, and not distinctly realised in thought. When intelligence develops, and thought grows more explicit, the differentiation of intuitive and reasoned judgment becomes clearer. As we shall see presently, our judgments, so far as inferential, are consciously derived from, or based upon, other judgments. On the other hand, all judgments thus reached by a conscious process of reasoning are capable of becoming starting-points or premises in further processes of reasoning.

§ 15. *The Mental Processes in Reasoning.* To reason is, as we have seen, to pass from a certain judgment or certain judgments to a new one. This implies an intellectual movement, a progressive transition from one piece of knowledge to another. It implies, too, that the mind accepts or believes in the conclusion thus reached through or by means of the premises. In other words, the resulting belief is in this case due to a recognition of a logical relation between the new and the old judgment, of the fact that the conclusion follows or flows from the premises. What, it may be asked, is the essential intellectual process here? What relation does the mind detect between premise and conclusion in thus passing from a belief in the one to a belief in the other?

In order to ascertain this, let us take a simple example of inference from child-life. A boy of two sees the steam coming out of his food and infers that it will burn him. Supposing the child to draw this conclusion with full reflective consciousness, he may be said to go through the following steps. He first identifies the presentation, rising steam, with a past like presentation or presentations, *viz.*, the appearance of the steam on former occasions. If he had never had any experience like this of the rising steam, he could, it is evident, carry out no process of reasoning in this case. But, in the second place, in thus assimilating a present presentation to previous ones, he goes beyond this particular experience altogether, and, using it as a mark, infers another and heterogeneous experience, *viz.*, that of common and tactual sensation involved in a burnt mouth. In other words, the identification of a presentation carries the child on by a process of contiguous association to the representation of one of its most interesting and impressive concomitants.

From the examination of this simple example of reasoning, *viz.*, inferential expectation, we see that it is compounded of an assimilative process and one of associative integration. It differs, however, from the process of associative suggestion described above, since the mind does not specially recall and fix its attention on the past experience, *viz.*, that of the previous burning or burnings, but passes on in the attitude of expectation to the idea of a recurrence of this experience in the present case. That is to say, the child does not so much recollect the fact that it was burnt, as draw the conclusion that it will be burnt now (if it takes the steaming substance into its mouth).

We may symbolically represent the difference between the reproductive process (memory) and the inferential process (expectation) in the following way :—



The symbols corresponding to the past experiences as *a* and *b* are here placed in parenthesis to show that the ideas of these past experiences are not distinctly recalled.[1]

§ 16. *Reasoning as Synthesis.* It is evident, further, from our examination of this example that, like judgment, reasoning is a process of synthesis. A relation between the presence of steam, and the sensation of heat, is established here, too ; only that whereas in the mere judgment the relation is apprehended

[1] On other psychical differences between memory and expectation, see above, p. 317.

directly, both of its terms being presented together; in the process of reasoning it is established indirectly, one term only being presented and the other being reinstated as the result of some previously apprehended relation. This indirect or mediate synthesis, moreover, is carried out by means of the identification of a common, *i.e.*, perfectly similar, term in the two relations (present steam, past steam).

As in the case of judgment, so here it is necessary to add that the synthesis reached, though determined by the suggestive tendencies that underlie and ultimately condition all our thinking processes, involves the active element of thought, *viz.*, voluntary attention. Even in the simple example of reasoning just given we can see that the inference is not drawn save where the presentation steam is selectively fixed so that its suggestions may be fully developed. And in the more complex cases of reasoning, where associative tendencies diverge, the active element becomes still more prominent as a selective fixation of particular elements in given presentative or representative complexes and particular suggestions of these. It is this regulative action of the will in thought which is specially marked off when it is described as a process of active combination or of construction.[1]

§ 17. *Reasoning and Discrimination.* While reasoning thus involves the two intellective functions, assimilation and association, it includes also, though in a less obvious way, the third function, discrimination. The detection of difference does not, indeed, constitute the fundamental part of the process as the detection of similarity does. A mere discovery of a difference

[1] Reasoning is thus seen to be a complex of processes, a fact not always recognised. Thus the assimilative element is accentuated by Dr. Bain, who treats reasoning (mainly) under the head of agreement or law of similarity (*Compendium*, bk. ii. chap. ii. § 16), and by Mr. H. Spencer, who reduces all intellection to the type of classification (see especially *Principles of Psychology*, vol. ii. p. 117). The dependence of reasoning on association is well brought out by Münsterberg, *op. cit.*, i. p. 141 ff. Wundt, by contrasting apperceptive combination with association, gives what has been regarded as excessive emphasis to the active element. (See *Physiol. Psychologie*, cap. xvii. § 3; and better, *Logik*, 1er abschnitt, 2er cap. 2, especially p. 53 ff.; *cf.* Münsterberg, *loc. cit.*) The constructive aspect of reasoning is well brought out by Mr. Bradley, *Logic*, bk. ii. pt. i. chap. iii.; *cf.*, however, the same writer's identification of reasoning with association in an article on "Association and Thought," *Mind*, xii. p. 354.

carries us no further. Thus we cannot infer from the fact that A is not B that A is wanting in the concomitants of B. The identification of a common element is thus the essential preliminary in reasoning. At the same time, the noting of differences is an important auxiliary to it. By a discrimination of things we see where resemblance ends, what is the exact extent of the similarity disclosed, and thus grow cautious and exact in our reasoning. Thus, by noting the visible difference between a scented violet and a dog violet we check the impulse to expect the sweet odour when we see the latter. Even where, as in negative reasoning, the relation of difference becomes prominent in reasoning it never usurps the place of similarity as the connecting bond. This is seen in the fact that a negation must always be combined with an affirmation before it leads to a conclusion. From all which it appears that it is the power of detecting resemblances that makes a man ready in reasoning: the person who cannot see similarity is stupid and intellectually inert. On the other hand, he who sees resemblance only will be hasty and inexact in his reasoning. A fine perception of differences is an essential characteristic of the cautious critical reasoner.

§ 17*a*. *Common and Logical Reasoning*. We see from the above example of reasoning that the common supposition of logicians, *viz*., that the mind starts with some known fact or truth as a premise, does not describe the process which actually takes place. In ordinary, everyday reasoning the conclusion presents itself first. In the above example the sight of the steam leads the child to expect the sensation of burning before he mentally realises the ground of this conclusion, *viz*., the previous experiences, steam followed or accompanied by burning. In other words, the reasoning process in its first spontaneous form simulates the guise of a mere process of judging. The grounds or premises of this conclusion, if they become distinct in consciousness at all, do so rather as an afterthought, being distinctly recalled (by aid of assimilative and associative revival) when it becomes necessary to set them forth, as, for example, if the child were asked: 'How do you know the milk will burn you?' In other words, in the spontaneous reasonings of daily life, as distinguished from reasonings reduced to the forms prescribed by logic, the synthetic process involved in the conclusion is first performed, and the ground of this is only consciously apprehended as such where a hitch or a difficulty occurs, and the whole process becomes reflective and critical. We may say, then, that the act of drawing, with full consciousness, a conclusion from data or premises, that is to say, the explicit act of reasoning as differentiated in its form from a mere judgment, rather appears as a part of the final revisional process of *proof*, than of the first process of spontaneous inference. Here again we must be on our guard against taking the logician's account of how our processes of thought may be carried on as representing faithfully the manner in which they actually take place in ordinary cases.[1]

§ 18. *Implicit Reasoning*. Again, this more reflective process of reasoning in which the mind passes from previous judgments to a new one may assume one of two well-marked forms. In the first place, we may, as in the above instance, pass directly from one or more singular judgments to another singular judgment without clearly setting forth to our minds the ground of our conclusion under the form of a general truth or principle. Thus a boy having observed on one or more past occasions that a piece of wood floats in water will conclude directly in a new instance that a particular piece will float. This imperfect mode of inferring from premises has been called reasoning from particulars. It may also be called implicit reasoning, because, although a basis of inference is apprehended under the form of a previous like experience, this is not clearly thought out into the form of a general ground or universal principle.

This form of reasoning is the simplest and earliest in the order of mental development. The reasoning of the lower animals, when it is conscious inference from something already known, must be supposed to assume this form. Most of the reasoning of children is of this kind too. In all these inferences the mind passes from one or more old experiences, some or all of which are distinctly recalled according to circumstances, to new ones without seizing the general rule or principle involved

[1] On the nature of such inference, see Herbert Spencer, *loc. cit.*, p. 102. The differentiation of judgment and reasoning from a common intellectual germ is well brought out by Mr. Bradley, *Logic*, p. 440; *cf.* Stumpf, *Tonpsychologie*, i. § 5, pp. 89, 90.

in the procedure. And even adults in the large number of cases reason in the same way. In drawing conclusions about matters of everyday experience, even when general assertions are available, we do not need always to consciously go back to these. And in not a few cases, *e.g.*, in concluding as to the motives or reasons of other persons' conduct, we should find it very hard to connect the conclusions reached with any such universal judgments.

It may be said that the actual process of reasoning never corresponds to this type of a conscious movement of thought from particulars to particulars. Of course, it is true, as pointed out above, that in ordinary cases the previous experiences are not clearly represented as the groundwork. Thus in the case supposed the number and variety of the instances of the floating wood already experienced would prevent distinct reproduction, their effect being rather to induce an associative disposition to think the fact 'floating' in connexion with the presentation 'wood'. This is probably the case in most animal inference, *e.g.*, reasoning as to the whereabouts of prey, devising means of escape from imprisonment, and so forth. At the same time, children and adults frequently do adopt this mode of inference. Thus when asked for a reason they not uncommonly recall a similar or analogical fact, *e.g.*, 'A horse goes up hill better after going down because my hoop does so,' 'Pussy is tired after play because I am so'. There may be, no doubt, in many of these cases a vague apprehension of a universal truth, but the nature of the reasoning precludes this supposition in all cases.[1]

§ 18*a*. *Practical Judgment: Tact.* Closely connected with the crude form of reasoning so far considered, *viz.*, direct transition to conclusion without distinct apprehension of any ground, and transition with apprehension only of a particular ground, is what is variously known as practical judgment, sagacity, or tact. By this is meant the power of rapidly and only half-consciously adapting previous experience to new cases without a clear representation of the experiences thus adapted. Such a sub-conscious type of adaptive inference is apt to show itself wherever the marks from which we conclude are numerous, or obscure and difficult to seize, *e.g.*, in judging of a person's age, or when the new case is materially different from known cases, and could not easily be exhibited as a parallel case, still less as an instance of a general rule, *e.g.*, in judging of a person's fitness for a new office. Such practical inference is, to a large extent, the working out of an organised associative tendency to think a particular kind of connexion, *e.g.*, such a plan will succeed, such a person is untrustworthy. The intellective process is here largely automatic, and has a close analogy to action under the impulse of habit, a phenomenon to be considered by-and-by. It is probable that in each case the result is dependent on firmly established nervous connexions. How little conscious reference there is to previous knowledge in these cases is seen in the familiar fact that many persons who can (in most cases) reach sound conclusions are quite unable afterwards to justify them. Not only have they no guiding general

[1] On the whole subject of such reasoning from particulars, see Mill, *Logic*, bk. ii. chap. iii. § 3; Bradley, *Logic*, bk. ii. pt. ii. chap. ii.; James, *op. cit.*, ii. p. 361 ff.

principles, they have not a full mental retention of the facts which when clearly set forth would supply the starting-point, or analogical basis. This applies with especial force to conclusions formed about practical matters. A man of ' practical judgment' is one who can rapidly adapt the aggregate results of his past experiences in this automatic way to new cases. Joseph Hume, a man of this sort, often resorted to for his valuable advice, was accustomed to say: "Such is my opinion, but I cannot tell you how I arrived at it".[1] What is meant by quick intuitive insight into others' feelings or character, tact in dealing with persons, presence of mind in quickly adapting actions to unforeseen circumstances, all illustrate the operation of such automatic intellectual tendencies in slightly different forms. In each of these highly useful qualities we have the effect of numerous past experiences and observations no longer individually recoverable, but associated in an indissoluble psychical product, a firmly fixed tendency to judge in a certain way in a particular set of circumstances.[2]

§ 19. *Explicit Reasoning.* It is evident from our illustration of the process of implicit reasoning, or reasoning from particular instances, that we do virtually assume a general truth. Thus the boy in our example may be said to tacitly affirm the universal judgment, 'All wood floats'. If he were not sure of this he would have no adequate logical ground for concluding, 'This piece of wood will float'. And when his reasoning power develops, and he clearly apprehends what is meant by an adequate ground or reason, he will explicitly put forward this universal proposition as his justification. The reasoning may then be said to become explicit, and to take on a distinct logical form. In so far as we reflect on our reasoning operations we naturally tend to bring them into this form. The capability of carrying out such a logical type of reasoning is one of the most important results of the possession of general terms, and thus marks off human reasoning at its best from animal inference. The growing resort to this logical or overt form of reasoning is one of the main evidences of the growth of human thought. It reaches the highest degree of perfection in what we call Science, that is to say, that most highly organised body of knowledge which exhibits a vast array of facts as illustrations or consequences of a few comprehensive principles or laws.

This full explicit process of reasoning by way of a universal

[1] See Carpenter's *Mental Physiology*, chap. xi. p. 478.

[2] For a fuller account of this capability of automatic inference, see J. S. Mill, *loc. cit.*; Carpenter, *Mental Physiology*, bk. ii. chap. xi. The psychology of tact is fully dealt with by Prof. Lazarus, *Das Leben der Seele*, band 3.

judgment is commonly said to fall into two parts or stages. Of these the first is the process by which the mind passes from a survey of particular observations, *e.g.*, 'This stone sinks in the water,' 'That stone sinks,' and so forth, to the universal judgment, 'All stones sink in water'. This is known as Generalisation, and also in its more cautious form as Induction.[1] The second stage is the proceeding from the universal proposition thus reached to some particular case (or class of cases), *e.g.*, from the universal proposition, 'All stones sink,' to the proposition, 'This stone will sink'. This is known as Deduction. Induction is an upward movement of thought from particular instances to a general truth, principle, or law; deduction, a downward movement from some general statement to a particular statement, or at least a statement less general than the first.

§ 20. *Inductive Reasoning.* The psychological process in passing from a survey of particulars to a general truth illustrates the essential process of all thinking, the detecting of similarity amid diversity. Let us examine an instance of inductive reasoning. The child observes that his toys, spoons, knives, he himself, and a vast multitude of other objects when not supported fall. He gradually compares these facts one with another and seizes the essential feature in them or the general truth implied in them. He discovers by comparison and analysis that what all these things have in common is that they are material bodies. He then extricates this general conception, and along with it a particular circumstance, *viz.*, falling to the ground, which has invariably accompanied it. That is to say, he judges that all material bodies have a way, when not prevented, of falling.

The process here briefly described is clearly similar to that of the generalisation already considered. In both cases the essential activity of thought is the comparing of a number of single experiences or particulars, and the analytical separating out of some common or like feature or features. Induction differs from conception in the mode of the assimilative unifica-

[1] The reader will note the fact that the same word 'generalise' is used both for conception and inductive reasoning. The points of community in the two will appear presently.

tion. In conception we trace out similarities in a number of objects viewed as detached wholes, *e.g.*, particular trees. In induction, on the other hand, we are finding out a general relation between things, or a similarity in the way in which things are conjoined, *e.g.*, the common or general relation of concomitance between material body and the tendency to fall or gravitate. Such an assimilation of things as held together by a common relation is a more complex and more difficult thought-process than an assimilation of things as having a common trait or traits. Thus the universal judgment, "Bodies gravitate," implies both the assimilation of a variety of things as bodies, and along with this the assimilation of them as related to the extraneous circumstance, falling to the ground.

It is important to add that the process of induction as reasoning involves more than a mere summarising of observed similarities. The universal judgment, 'All bodies gravitate,' is obviously a movement of thought beyond the limits of observed facts. Just as in forming a class by help of the general name the mind implicitly comprehends a vast array of individual things not actually observed, so in induction the resulting judgment embraces an indefinite number of unknown cases along with the known. It is only because it is thus universally comprehensive that it serves its subsequent purposes as a principle of reasoning.

The essential psychical factor in the inductive process, *viz.*, the comparison of instances with a view to eliciting a common relation, extends beyond the limits of logical induction, that is, the arriving at universal propositions respecting classes. It is seen in our comparison of the successive observations of one and the same thing so as to arrive at a knowledge of its fixed or permanent quality. Such a comparison becomes necessary where the quality is disguised and presents itself in a variety of external manifestations. This applies emphatically to the mental and moral qualities of ourselves and of others. We only attain to clear apprehension of the possession of such qualities as truthfulness, scrupulosity, refinement of taste, and so forth, by a comparison of varied or partially dissimilar actions and the detection of a common underlying quality. It may be added that the particular judgments which logicians contrast in quantity with universals are psychologically reached by a quite similar process. A child learns that some dogs are snappish by comparing different actions and extracting a common feature, just as he learns that all dogs crack bones.[1]

[1] 'Some' is of course here taken to mean more than one in order to mark off this form of proposition from the singular proposition. Volkmann points out that in the order of psychological development the singular judgment precedes the universal, while the partial (particular) judgment comes last, *op. cit.*, ii. p. 261.

§ 20*a*. *Development of Inductive Process.* The generalising or inductive process here spoken of presents itself in a very crude form at first, and only attains to a more perfect form with intellectual development and with the discipline supplied by education. Thus, as in the case of conception, there is a gradual movement from relatively concrete generalisations answering to palpable similarities to more abstract generalisations answering to more obscure, and in general more widely-distributed similarities. The child, for example, begins to note that some varieties of living things, *e.g.*, flies or birds, die. He then compares these results, and, extracting the common relation, finds his way to the more comprehensive generalisation "All animals die". Later on, he compares this result with what he has observed of flowering and other plants, and so reaches the yet higher and more abstract generalisation "All living things die".

Again, the development of the inductive process involves a transition from impulsive, hasty generalisation to a more reflective and cautious type. At the outset the child is disposed to expect too much similarity in things, and he will often generalise from an absurdly inadequate range of observation, as when he argues that all children, like himself, have a nursery, a rocking-horse, and so forth, or that animals feel and act precisely as he himself does. As experience widens and intelligence advances he begins to note the points of diversity as well as those of uniformity in events, to make a more extended examination of instances, and to take some pains to limit his conclusions, *e.g.*, in saying "Some birds eat fruit," "Most birds sing," and so forth. In close connexion with the carrying out of this wider examination of examples he makes a closer inspection of the events that present themselves, so as analytically to detect the essential element with which some concomitant is conjoined. Thus, for example, he finds that stinging goes with and is dependent upon the possession of a sting, and so, instead of generalising as at first, "All insects sting," learns to generalise more thoughtfully, 'Animals with a sting can sting us'.

This development of inductive reasoning shows itself in a much more careful investigation of things with a view to discovering their causes (or their effects). The finding out of the (common) cause of a phenomenon, *e.g.*, of things floating or sinking in water, is one of the main directions of inductive reasoning. The young and the uneducated are characterised by hasty inference in respect of causation, *e.g.*, taking what is the agency in some cases to be the agency in all cases, or what is a mere accidental accompaniment to be a part of the essential conditions, or lastly, a part of the real conditions for the cause, that is, the whole sum of conditions. Here, also, development of reasoning power means a more patient searching out of instances, and a more careful analysis of a complex of circumstances, so as to mark off the essential features on which a result really depends.

§ 21. *Deductive Reasoning.* By induction the child reaches a large number of general or universal judgments. Having these universal judgments as rules or principles, he is able to pass on to the second stage of explicit reasoning, namely, deduction, or reasoning *from* a general principle. Thus a child who has been told that all persons are liable to make mistakes is apt to apply the truth by arguing that his mother or his governess makes mistakes. The type of deductive reasoning when fully set forth in its logical form is known as a syllogism, of which the following is an example :—

	All M is P.	Everything made by labour costs money.
	S is M.	A toy is made by labour.
Therefore	S is P.	Therefore a toy costs money.

It is evident from this example that deduction, no less than induction, conforms to the common type of reasoning as explained above. That is to say, it is the indirect establishment of a synthesis by help of given syntheses. The process sets out with an identification, *viz.*, toys with things made by labour, and by help of such identification of a common term reaches by contiguous suggestion the required supplementary term and the relation connecting this with the other (co-existence of the properties, labour-produced and costing money).

In thus describing the psychological process in deductive reasoning, we must, as in the case of implicit reasoning, distinguish between the logical order required for purposes of proof, and the actual psychological order. In our ordinary everyday deductions we rarely proceed in the formal way here set forth, that is to say, setting out with two antecedently known judgments or premises and passing on to a third judgment as a conclusion. In many cases the conclusion is the first that distinctly presents itself to the mind, and the other judgments rise into distinct consciousness later. In many other cases, moreover, we do not at any stage distinctly think both of the premises logically involved.

In cases of simple deductive reasoning, where both premises are well known beforehand, the mind may pass at once to the conclusion by means of the process of suggestion already explained. In these circumstances it only distinctly recalls the grounds of the judgment afterwards by way of justifying it or finding a reason for it. In many cases, however, we do explicitly refer to one of the premises before reaching the final judgment. The reason why in these instances we do not explicitly refer to both is that we rarely obtain the two pieces of knowledge at the same time. Sometimes we first of all reach the former (the major), at other times, the latter of the premises (the minor). As soon as the second piece of knowledge is reached, the mind tends to pass at once from this to the conclusion with only a very indistinct reference to the first and familiar truth. Thus a child who already knew that toys were made by labour might, on first learning that things made by labour cost money, pass directly from this judgment to the judgment, 'Toys (as well as other things) cost money'. Similarly, if the second premise happened to be the later piece of knowledge, his mind would not distinctly recall the first.

Induction is sometimes spoken of as a process of analysis, and deduction of synthesis. And there is some ground for this distinction. Induction, as was pointed out above, is very similar to conception, and proceeds by way of analysis, *i.e.*, the separating out of a common element. In deduction, on the other hand, the analysis has already been carried out, the point of similarity detected and marked off by the universal proposition; and all that has to be done is to recognise this analysed element in a new case. Since analysis is thus only a subordinate factor in deduction we may describe this as (mainly) a process of synthesis or combination, *viz.*, the bringing together of two judgments for the first time and thereby reaching a new conclusion. In deduction, moreover, the final judgment illustrates that more perfect form of synthesis in which two portions of knowledge are brought together by the assimilative function of the mind, and not directly associated by a connexion in our experience. At the same time, the distinction between induction and deduction is very imperfectly expressed by the terms analysis and synthesis: for, first of all, induction is a synthesis since it establishes a general relation; and, secondly, deduction is analysis in so far as in assimilating the new case to the known principle we have to note and identify the common element in this new instance.[1]

[1] The precise nature of deductive reasoning has been much discussed by logicians. It is doubtful, as Mr. Spencer and others have pointed out, whether the syllogistic form described in the text is capable of representing many of our processes of deductive inference; and whether even those inferences which are susceptible of being thrown into this schematic form, are actually carried out in this way. (See his *Principles of Psychology*, vol. ii. part vi. chap. viii. § 305, etc.)

§ 21*a*. *Finding Applications and Finding Reasons.* Deductive reasoning may begin at one of two ends. In many cases we have a principle given us and proceed to draw conclusions from it. This is known as the application of a principle, or the discovery of a new illustration of the same. Here the mind, taking the principle as a guide, is engaged in seeking out and assimilating new examples among its store of facts. The possession of a principle may thus serve as a stimulus to a process of search with a view to connect it logically with an as yet disconnected particular fact. Thus, after a child has learnt that it is bodies lighter than water which float on its surface, he proceeds to conclude that the ice which he sees floating is lighter than water, or to deduce some as yet unobserved fact, *e.g.*, that cork, the lightness of which he notes, will float.

In other cases, we set out not with a general truth but with a particular fact, and seek for a principle to which we may assimilate it. This is described as finding a reason for a statement, or as explaining a fact. Here the psychical process is, as in the other case, the search for points of similarity. The difference in this case is that whereas when we start with the general rule we have the essential feature already distinctly set forth, when we set out with the unanalysed particular we have to carry out a fuller process of analysis. Thus a child when asked to say why an action is wrong must, it is obvious, analytically detect the element in the action that brings it under the rule to be recalled.[1]

In this slight account of deductive reasoning we have been concerned with the form commonly illustrated by logicians, and with this only as a psychical process and not as valid or trustworthy. How the syllogistic process may best be formulated, so as to exhibit its binding character, is a question appertaining to logic.

With respect to other modes of deduction not dealing with co-existence or inherence of qualities in things, *e.g.*, reasoning with respect to relations of quantity, it is now recognised that the syllogistic scheme is an inadequate mode of formulating the processes involved. Such reasonings as $A = B, B > C \therefore A > C$ do not lend themselves to syllogistic expression. The psychological process involved is similar to that considered above, inasmuch as here, too, there is an indirect establishment of a synthesis, by means of two syntheses of which a common term is

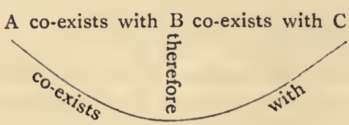
[1] W. James describes this factor in reasoning, *viz.*, readiness in picking out and recognising abstract features or characters in things, as sagacity, *op. cit.*, ii. p. 343 ff.

identified. At the same time, the peculiarities of the quantitative relations dealt with differentiate the process to some extent from the type examined above.[1]

§ 22. *Other Types of Reasoning.* The simple type of reasoning examined above develops into a number of complicated forms which it is the province of logic to distinguish and set forth. In what is known as Probability, for example, and also in Analogy, the psychical process assumes a peculiar complexity through the new element, a comparison or weighing of evidence for and against a conclusion. In these cases the reasoning process takes on the form of a selective decision or a "judgment," in the complete sense of that term. Again, in the large substitution of supposition or hypothesis for the results of induction in the deductive reasonings both of everyday life and of science we have, as a further element of complexity, the constructive process involved in the formation of such hypotheses. This, the highest form of the synthetic or constructive function of thought, is closely related to the constructive imagination examined above, and may be said, indeed, to be a special development of it for purposes of scientific reasoning.[2]

§ 23. *Activity of Mind in Reasoning.* From this brief account of the chief varieties of the reasoning process the reader will see its close dependence on the earlier intellectual processes, observation and reproduction. In order to carry on a process of reasoning it is necessary that our mind be well stored with facts gained either by personal observation or by instruction. It is further necessary that we have a number of clear concepts and clearly thought judgments with which these facts may be

[1] The mathematical type would be approximated to the above (qualitative) type were we to follow Mill, and to regard the latter as consisting in the combining of two relations of co-existence having a common term, and so establishing a relation between the two others, thus:—



On the psychical process in syllogistic reasoning, see Mill, *Logic*, bk. ii. chap. ii.; *cf.* H. Spencer, *Psychology*, pt. vi. chaps. vi. and vii.; Bradley, *Logic*, bk. iii. pt. ii. chap. i.

[2] *Cf.* what was said above, p. 375, on the scientific imagination.

brought into relation. To this must be added facility in construction, in forming new notions and hypotheses.

Nor will all this avail without a considerable development of voluntary attention and the power of concentrating thought on particular ideas and trains of ideas. To reason out a thing frequently implies intense and prolonged activity of mind. Thus, in seeking an explanation of some obscure fact, say the odd conduct of one of our friends, we have to perform an elaborate process of search. In carrying this out we need, from the beginning, to keep steadily in view the object of this search, that is to say, to fix the attention on the particular features of the case which require to be assimilated. We have, further, to single out for special consideration from among all the thoughts called up by the various suggestive tendencies of the moment those which are seen to be analogous to, or to have a bearing on, the case. Thus in the instance supposed we fix our attention on other actions of the same person, or of other persons, on familiar principles of human nature, and so forth, in the hope of finding by the requisite assimilative stroke the key to the puzzle. Not only so, when the process is perfect the will is called on to resist the tendencies to irrelevant thought, and the influences of feeling and bias, which, as we shall see, serve to mislead the mind from the truth. The greater the concentration, the more perfectly the representation of the desired result is fixed by the attention so as to dominate all the mental processes of the time, compelling them to converge on this result, the higher will be the quality of the reasoning.[1]

§ 23*a*. *Mechanical Aspect of Reasoning.* Here, again, as in the case of judgment, it must be pointed out that our analysis applies only to the fully developed process, in which all the stages become fully explicit in consciousness, and in which a special "effort of thought" is involved. But this type is only realised occasionally where the conditions are new and complicated, and each element has to be carefully attended to. In a large part of our everyday reasoning the effect of previous practice comes in to shorten the process and to reduce it to some

[1] Compare what was said above on thought as activity (p. 389); also on the element of activity in judgment (p. 450 f.).

extent to a sub-conscious and mechanical form, that is, to a process in which the volitional factor becomes evanescent.

The effect here spoken of may be described as the result of Habit, using this term to include all the effects of previous exercises of a like kind. We carry out a process of reasoning, just as we go through a series of words, more and more easily as the result of having carried it out before. Such a reduction by practice of the factor of effort and consciousness in general is, as already pointed out, the subjective side of a physiological change, *viz.*, the more perfect organisation of certain central arrangements, as a result of which a particular chain of neural processes is rendered certain and rapid. The highest processes of the mind are in this way attached to an organic base.

This effect is exhibited most strikingly in the deductive process of reasoning, since it is in these that words play an essential and prominent part. As already pointed out in dealing with the relation of language to thought, words are capable of being used as substitutes for ideas in many of the simpler processes of reasoning. Where the relations dealt with are plain we can apprehend these, and so reason without any distinct realisation of the several ideas underlying the words. Thus in such forms as the following: "Since A is greater than B, and B than C, therefore A is still greater than C," a mind practised in tracing relations and drawing out conclusions from known truths in which they may be seen to be implicated will run through the stages of the process in a semi-mechanical way. When the same argument has to be gone through again and again this reduction of the process to an automatic form becomes still more marked. In going through a familiar mathematical, philosophical, or political argument often traversed before, we are, it is evident, increasingly aided by the processes of verbal association.

§ 24. *Logical Control of Thought-Processes.* In a psychological examination into the nature of the actual thought-processes, we do not need to consider the rules by which their logical control is effected, save in so far as they themselves give rise to new forms of the psychical process. Here, as in the case of the logical control of the concept, we shall see that the regulation consists in developing the functional activities of thought to a more explicit or conscious mode of elaboration and expression.

Thus, in the rules by which the formal correctness of the judgment is secured—*viz.*, the choice of perfectly clear and unambiguous terms, the bringing out of the quality and quantity of the judgment, together with a clear realisation of all that is involved in the proposition, excluded by it, or left doubtful by it—logic compels the thinker to bring into clear consciousness all that he is implicitly thinking in the particular case. Similarly with respect to the syllogistic rules drawn up in order to secure formal correctness in the reasoning process. They aid us by enabling us to arrange our thoughts in such a way that we can fully realise all the implied relations.

With respect to material correctness, that is, the correspondence between thought and real fact, logical control seeks to secure its result by insisting on a more exact and scientific form of observation, *e.g.*, that secured by an experiment carried out amid known conditions, and by supplying certain rules of induction. Here, again, no new mental process is introduced, and the regulated type of procedure consists, as already hinted, merely in carrying out the first crude spontaneous thought-operation in a more prolonged, patient, and cautious manner; in other words, with more of what we call volitional control. The logical value of the result reached by such a regulated process of thought may differ enormously from that attained by the first unregulated venturesome inference; but, from a psychological point of view, the process remains the same in its essential factors.

SELF-CONSCIOUSNESS.

§ 25. *Development of Idea of Self.* In the above account of the thought-processes we have been concerned with ideas of outer things, with perceptual and conceptual knowledge of the external world. In addition to this common cognition of an external world or macrocosmus, there is the individual's cognition of his inner world or microcosmus, and we have now to examine into the psychological development of this idea or consciousness of self. Self-knowledge, it is to be observed, though in its higher forms more abstract and difficult to attain than knowledge of outer things, is, as we shall see, developed along with this, and is indeed to some extent involved in a fully explicit logical thought about the world. It is only taken up at this late stage for the purpose of simplifying the exposition of the subject.

(*a*) *The Pictorial or Bodily Self.* As pointed out above, the first crude idea of a self arises in the child's mind in connexion with the perception of his own organism. This is from the outset known as an object different from external objects, partly by its continuous presentation, and still more by its intimate connexion with the child's painful and pleasurable sensations.[1] It is only gradually that the child attains to this first differentiation of the self from the not-self. Thus it has been observed by Preyer that his boy when more than a year old bit his own arm just as though it had been a foreign object.[2] This first stage of self-representation, in which self is the ever-present body that feels, seems to correspond roughly at least to the early period of life in which the child speaks of himself by his proper name.[3] In this crude idea of self, before the meaning of "I" becomes clear, we have to suppose that the child does not fully realise the opposition of self and not-self, but rather tends to regard himself as a kind of thing after the analogy of other objects.

It seems to follow that the common notion that the consciousness of self arises concurrently with that of not-self in the act of sense-perception is an error. There may be in the first experience of impeded movement a dim apprehension of the me and not-me, but it is very long before the relation becomes clearly apprehended in consciousness. The child does not, then, first know things as different from, or opposed to, himself: he first knows things as such, and can only think of himself as a kind of thing. The psychological order here, as elsewhere, differs from the logical: the knowing subject comes after the known object.[4]

[1] See p. 264.

[2] *Die Seele des Kindes*, p. 360.

[3] It is sometimes said that the use of the proper name is a mere consequence of imitation. M. Binet has, however, shown by some interesting observations of children that this mode of speaking of himself asserts itself when others do not habitually address him by his name, and concludes from this that it corresponds with some deeper impulse of child-nature. (See his article "Perception d'Enfants," *Revue Philosophique*, Dec., 1890.)

[4] It is a noteworthy fact in this connexion that in the gradual extinction of consciousness under the influence of anæsthetics object-consciousness survives that of self. (See James, *op. cit.*, i. p. 273.) Another and more palpable error is to suppose that in having sensations before percepts the child has knowledge of these

(*b*) *The Inner or Mental Self.* This pictorial representation of the body remains an integral part of the idea of self throughout its development, forming, indeed, its fixed presentative base. The next stage in the development of the idea of the ego is the separation of an inner or mental self from the body. The child is led on to this by growing attention to his pleasurable and painful sensations, more particularly the organic sensations, with their preponderant accompaniment of feeling, which play so prominent a part in early life, and which are known to constitute the organic basis of the later self-consciousness. As he learns to abstract from outer things and attend to his sensations, his desires, and his actions, he begins to form a dim conception of an inner self. His power of doing things *when he wishes* would be among the most interesting of the manifestations of this self, and among the first to attract his attention.

This idea of an inner self would not, however, attain any great clearness until the development of the life of ideation, as distinguished from the observation of external things, had reached a certain point. It is only when this inner representative life is sufficiently strong and coherent to assert itself against the more powerful stimuli of sense, and when as a consequence of this the child begins to realise the difference between imagining (what is not present) and actually perceiving, that he is able to demarcate the self from the not-self.

This attainment of an idea of a self is greatly aided by language. The fact that the child is always addressed by one and the same name has a powerful effect in impressing on his mind the fact of his individuality. Still more effective is the use of the second person, you (or thou), in bringing home to him this idea of himself. By the use of such language, as in condoling with the child when hurt, in inquiring as to his feelings, in asking him whether he wishes to do something, and so

as subjective states *before* he acquires any knowledge of objects. (*Cf.* above, p. 207 f.) The external knowledge of self as body has been named by Mr. Chauncey Wright outward self-consciousness. Dr. Romanes points out that this crude form of self-consciousness may be attained by the animal mind. (*Mental Evolution in Man*, p. 199.)

forth, his companions have a very powerful means of directing his attention to his inner states.[1]

As the history of the race and of the individual tells us, the first conception of an inner self is materialistic, showing that the objective attitude of thought is still predominant. The inner self of the savage and of the child is a *quasi*-material thing resident in a definite part of the body, and more particularly the breast. How materialistic is this first conception is shown in the fact that primitive man and the child alike think of this self as a sort of attenuated inner body, modelled on the pattern of the outer, which can now and again pass out of its more palpable envelope.[2] In this way they explain such phenomena as echoes, shadows, reflexions in still water, and dreams of absent, including dead persons. This consciousness of an inner *quasi*-bodily self is probably reached by the child during the period in which he speaks of himself in the third person.[3]

This materialistic conception gives way to a more spiritualistic one, as the power of reflexion, *i.e.*, isolating attention to psychical states, is developed. How difficult this is in early life is known to all who have to do with the young. In the case more particularly of lively and vigorous children absorbed in outer things, and full of active pursuits, the reflexion demands a severe effort. Want of outer interest, on the other hand, driving thought in on itself, as in the case of many a morbid, dreamy child, expedites the process of self-reflexion. It is to be added that this clearer consciousness of self as the permanent feeling, thinking, desiring subject is greatly aided by the action of the social environment already alluded to. The constant use of the same name (*e.g.*, John, or its substitute, you) serves to

[1] It has been pointed out that the habitual use of one name in addressing an animal, as a dog, would tend to develop an obscure consciousness of self. (See Volkmann, *op. cit.*, ii. p. 171, anmerk. 2.)

[2] *Cf.* above, pp. 2, 3.

[3] The early animistic idea of an inner *quasi*-material soul that could separate itself from the body led to the conception of distinct and separate selves. (See Tylor, *Primitive Culture*, vol. i. chap. xi.) George Sand, in her delightful autobiography, tells us that the first hearing of her own echo led her to think of having a double existence. Similarly, Hartley Coleridge when a boy is said to have distinguished the shadow Hartley as well as the picture Hartley from the real Hartley.

impress on the child his identity from moment to moment. As Goethe has it: "The name is not worn as a dress, but grows on to us layer upon layer, like our skin".[1] Again, social intercourse and moral discipline, by taking back the child's thoughts to his past, as *his*, serves to develop a clearer consciousness of his personal identity.

(*c*) *Idea of Self as Enduring: Personal Identity.* All reflexion on self and its states is a kind of retrospection. The full consciousness of self as an unity, that is, a permanent subject, only arises after a considerable development of reproduction. It is by retracing past experiences and apprehending them as a succession in the way explained above, that the fuller realisation of the idea of self emerges. Here, again, the bodily self continues to furnish a bond of unity. It is the constant presentative complex, the body with its relatively fixed mass of organic sensation more or less distinctly accompanying all the changing states that make up our history, which serves to weld these into an unity as parts of the one self.

This close dependence of the consciousness of a permanent self and of personal identity on the organic sensations and the presentation of the body to the higher senses is seen in the effects of sudden changes in these factors. Thus we all know that a very decided change in dress gives a strange feeling of altered self.[2] The altered look due to illness introduces a like sense of confusion. In the case of longer periods, as when we are shown a portrait of ourselves taken in childhood, the sense of identity becomes still further perplexed. Lastly, a bare reference may be made to those disturbances which are known to be occasioned by any considerable functional changes involving serious modifications of organic sensations (cœnæthesis).[3]

This co-ordination of successive experiences, recalled by the reproductive process, into the unity of the permanent self, is

[1] Quoted by Volkmann, *op. cit.*, ii. p. 171. This writer remarks that among certain savage tribes it is the custom to change the name of a sick child.

[2] This illustrates the fact that our idea of self is largely a reflexion of others' perception of us.

[3] On these modifications (to be spoken of again by-and-by), see Ribot, *Maladies de la Personnalité*, chap. i., where the effects of abnormal organic conditions on the feeling of personality are fully discussed. *Cf.* Maudsley, *Pathology of Mind*, p. 369 ff.; Mercier, *Sanity and Insanity*, p. 323 ff.; and James, *op. cit.*, i. p. 371 ff.

never carried out as perfectly as is sometimes represented. Not to speak of such obstacles to the realisation of continuity as the periodic rupture of sleep and illness, we may observe that the lapse of years, by effacing a large part of our memories, renders anything like a complete realisation of identity impossible. Not only so, this flux of time brings about profound changes in our tastes, aims, and so forth, and in this way serves to arrest the endeavour to identify our present with our past self. We are the "same" as we were when children more through the assurances of others than through our own recollective consciousness.

It is frequently contended that in memory we have a direct apprehension of personal identity superior in value to that of material identity already examined. It is no doubt true that the knowledge of ourselves as permanent is based to a certain extent on retention and reproduction. In the very process of consciously recalling an experience with its attendant feelings, *i.e.*, remembering something, I realise this experience as mine. The definite localisation of the experience in the time-order making up the past history aids this apprehension by bringing out the continuity of my past experience with the present. But memory only carries us a certain way here. We may fail to recall, *i.e.*, meet with a gap in the past: or we may recall what is so foreign to our present selves that we cannot appropriate it as ours. All this shows that the idea of a personal identity is based not merely on memory but on imagination and inference. In other words, it is largely a construction, in which the fundamental idea of self, *viz.*, of the body with its concomitant complex of organic sensations which only slowly changes, is a chief contributing element.

It may be added that, apart from these limits of recollection, the complexity of our mental life tends rather to the development of the idea of different selves than of one simple self. In such states as doubt, hesitation in following an impulse, and still more in the reflective processes of intellectual and moral self-criticism, our conscious life seems to lend itself rather to the scheme of a duality of selves, a lower impulsive and a higher contemplative ego ("moi spectateur"), which are somehow conjoined with a single body.

A final stage in the development of self-knowledge is the attainment of a consciousness of a personality, that is, an individual character with certain (relatively permanent) intellectual and moral attributes. The attainment of this cognition evidently presupposes the highest exercise of abstract thought. In order to know our intellectual weakness or strength we have not merely to abstract in the sense of withdrawing attention from sense-presentations and fixing them on inner states, but to abstract in the sense of comparing many remembered mental processes so as to discover their common aspect. Such self-knowledge, which, as we shall see, plays an important part in the best logical thought about the world, as also in the highest artistic and moral effort, is one of the rarest of attainments.[1]

§ 26. *Notions of Others.* In close connexion with the growth of the idea of self there is developed that of others like "myself," having feelings and thoughts as I have them. In this way knowledge of things becomes completed by the apprehension of a world of sentient and conscious beings.

The first crude consciousness of self, both in the child and in the race, appears to be that of one among a number of like beings. The animal and the child no doubt each distinguishes his own body from other like bodies by reason of the differencing marks already spoken of. Yet, from the first, there seems to be an impulse to endow other bodies similar to his own with an analogue of his sensations. In the instinctive sympathy of animals, in the infant's responsive smile, we see an interpretation of others' manifestations of feeling which precedes all definite reflective self-consciousness. At this stage there is rather a vague consciousness of self and others, or of self among others, than a differenced consciousness of self and of others.[2]

It is to be added that this primitive projection of sensation into material bodies, other than my own, extends beyond the limits of the species and of the animal world, embracing plants and even inorganic bodies. We see this impulse at work in the naïve attribution of human thoughts and feelings to animals by the child and by primitive man, and in that far-reaching

[1] On the development of the idea of self and of personality, see Ward, *loc. cit.*, p. 83; Taine, *On Intelligence*, pt. ii. bk. iii.; Waitz, *Lehrbuch der Psychologie*, § 58; Volkmann, *op. cit.*, ii. p. 105 ff. On the child's first consciousness of self, see Preyer, *Die Seele des Kindes*, cap. xx. On the first crude conceptions of the soul in primitive thought, see Tylor, *loc. cit.;* and Siebeck, *Geschichte der Psychologie*, "Einleitung". (*Cf.* above, pp. 2 and 3.)

[2] On this instinctive reading of others' feelings by the animal, see Romanes, *Mental Evolution in Man*, pp. 197, 198.

personification of inanimate objects that fills so large a place in the early thought of the race and of the individual. In this way the child, like his primitive ancestor, first conceives of the world as a group of sentient beings of which he is one.[1]

As intelligence develops this first crude thought about the world gives place to a more exact conception. The differences between things are noted by the child, *e.g.*, "me" and the grown-up person, 'me' and the animal, men and animals, and so forth. The attribution of sentient life to other things takes on here more of the character of a consciously inferential process. The child now recognises definite marks of sensation, inferring the existence of the sensation when the marks are present, and refraining from doing so when they are absent. In this way it gradually reaches a view of the world as made up of grades of existence, as the not-living and the living, the animal and the man.

It is to be added that the later developments of the knowledge of others stand in intimate connexion with that of the knowledge of self. A closer attention to our own mental states enables us to understand others better: we know mankind through self-study. As we shall see by-and-by, it is personal experience and reflexion upon this which helps us to enter sympathetically and intelligently into the mental life of our fellows.

At the same time, it must not be supposed that self-consciousness is developed before any idea of others arises. The knowledge of self and of others grows *pari passu*, each reacting upon the other. The influence of the latter in the cruder form of social consciousness is seen plainly enough in the fact that the child forms the idea of his moral self, and to some extent even that of his physical self reflexly, by hearing and adopting what he hears others say of him. It is the objective sound, the name given to him by others, which first forces the attention on self. In fact his consciousness of self is never a pure result of his own perceptions and reflective processes, but is largely a reflex projection of what others say about him.[2] In the higher stages of self-knowledge, too, we

[1] On this naïve attribution of life to inanimate objects, see above, p. 379.

[2] This reflex of others' ideas and feelings is well described by W. James under the head "Social Self," *op. cit.*, i. p. 293 ff.

come to know ourselves better through a closer study of others. Sympathetic intercourse with those whose experience is wider than our own opens up new vistas of self.

INTELLECTION AS KNOWLEDGE.

§ 27. *Cognition of Reality: Belief.* We have now carried the examination of the process of intellection far enough to consider it in its relation to its object; in other words, to view our thought as the cognition or knowledge of something real. The full inquiry into the relation of thought to reality would plainly carry us beyond the scope of psychology into the domain of philosophy or theory of knowledge. At the same time, the psychologist is called upon to inquire into the psychical characteristics of knowledge, to analyse the cognition of reality so far as this is a mental product having its own distinguishing elements and structure. In this way psychology leads up to the properly philosophical inquiry into the validity of such cognition.[1]

If now we consider thought in its objective aspect, that is, as representative of reality, we find its most essential and characteristic element to be *belief.* To know a thing as actually existent, to apprehend an object as real, is to be the subject of belief or assurance, belief being here understood to include the higher as well as the lower degrees of assurance.[2]

§ 28. *Nature of Belief.* The precise psychological nature of belief is, to some extent, a matter of dispute. Most writers regard it as an intellectual phenomenon. It is evident that it has an intellectual aspect. Belief being realisation of an idea or apprehension of reality in some form and with some degree of strength, it follows that it is in one important respect a mani-

[1] *Cf.* above (p. 12).

[2] Popularly, no doubt, the word belief is used more narrowly than this, *viz.*, with reference to matters of probability, where room for doubt is supposed. We do not commonly speak of believing that we have a pain, that we hear a sound, or that two and two make four. Psychology, however, requires a single term to denote all varieties of assurance from mere conjecture up to reasoned certainty, and the word belief, in English psychology at least, has come to be used in this sense. James Mill, in his *Analysis of the Human Mind*, may be said to have first apprehended and defined the full extent or range of belief as a psychological phenomenon.

festation of intellect. Viewed in this way the term belief serves to mark off the objective attitude of ideation or thought, or, in other words, the fact of its representativeness. When I think, for example, of gold, I represent the thing gold as really existent, and as having such and such properties. This reference of thought beyond itself to a real object is a part, and a very important part, of what is meant by belief.

At the same time, as pointed out above, belief involves an element of feeling: when we believe we are satisfied or at rest. Hence the common forms of speech: "I feel sure," and more elliptically: "I feel it must be true". Certain psychological writers (as Hume) do not hesitate to classify belief among feelings or affective phenomena.[1]

Lastly, it is recognised that belief stands in a close and organic connexion with conation or action. To believe is to be ready to act. Thus to be satisfied that the weather is changing, that a man is honest, and so forth, is to be prepared to act on the assurance. Here, indeed, we may easily see that the state of assurance is immediately attended with nascent promptings to act, *e.g.*, to walk out, to trust the man. This forward aspect of belief, as readiness to act, is especially manifest in all forms of expectation.

The several constituents or aspects of belief are not equally prominent in all cases. Thus there is the calm belief of the astronomer in the laws of planetary movement, a belief that is scarcely tinged with feeling, and seems to have no distinct reference to action. In contrast to such speculative assurance, "intellectual" belief, *par excellence*, there are the beliefs that affect our welfare, *e.g.*, our hopes of good and fears of evil, and our practical beliefs, as our confidence in our own powers, in which the element of feeling and the bearing on action become more manifest.[2]

[1] 'The difference between fiction and belief lies in some sentiment or feeling which is annexed to the latter and not to the former.' (*Inquiry*, sect. 5, pt. ii.) In the *Treatise* he seems to regard it as a mere matter of vividness in the idea (pt. iii. § 7). The late Walter Bagehot explicitly speaks of belief as an "emotion". (See his essay "The Emotion of Conviction," *Literary Studies*, i. p. 412 ff.: *cf.* Prof. W. James, *op. cit.*, ii. p. 308.)

[2] On the psychological character of belief, see Dr. Bain, *Emotions and Will* (3rd ed.), p. 505 ff.; also my volume, *Sensation and Intuition*, chap. iv. p. 75 ff.; and W. James, *The Principles of Psychology*, ii. chap. xxi.

Belief being thus a compound of three factors—intellectual representation, feeling, and active impulse—a complete account of the genesis of belief would include an examination into each of these constituents. Since, however, we have not yet examined into the workings of feeling and conation, we must at this stage dwell mainly on the intellectual factor in belief, merely indicating by way of anticipation how the other influences complicate the process.

§ 29. *Intellectual Conditions of Belief: (a) Belief and Ideation.* The primal source of belief lies in the relation of representative ideation to actual presentation. We assume here that what we call the real is presented in sense-perception, that when we speak of a real object we refer to the experience of direct sensuous apprehension, and more particularly that of sight and touch.[1] Now we have seen that a mental image is a copy and representation of the percept. Hence to imagine is to represent an object actually existing, as we should apprehend it in sense-perception. This reference in ideation to the immediate grasp of reality in perception is, of course, most manifest in the reproductive processes, in which the revival of an image is immediately attended with what we call memory, that is, the recalling of a past percept as such. When I recollect a person, or a scene, it is evident that I have the direct assurance of having seen the object.

This same implication of belief in ideation is seen in imagination and conception. Hume drew a sharp distinction between merely imagining and believing. We may picture a centaur or a hobgoblin without believing in its actual existence. Yet all imagination, just because it is only a further product of perceptual experience, carries with it a tendency to momentary belief. And if only the image is vivid and sufficiently coherent and stable, it assumes the form of a representation of a reality, that is to say, of an object existent in the external world. This tendency to give reality to images is abundantly illustrated in the beliefs of the savage and the child in the existence of supernatural beings. It is further illustrated in the fact that Dickens and other novelists have, through a vivid and protracted imagination of their

[1] *Cf.* above (p. 233 ff., and p. 259 f.).

characters, been subject for a time to a firm persuasion of their real existence.[1]

What applies to imagination applies in a less marked manner to conception. A general notion is, as we have seen, always based upon a mental image, more or less distinct, and in this way includes a representation of something real. This is plain enough where the class represented corresponds with actually observed objects, as 'man' or 'mountain'. And even where this is not the case, as in forming the idea 'angel,' we may see that the idea is accompanied by a pictorial representation of an object (or group of objects) which is at the moment realised or apprehended as existing in the real world.[2]

The belief here referred to is vague and inchoate only. The reality more or less distinctly apprehended is not placed in a world of connected parts in space and time. The naïve fancy of the savage and the child, at its best, localises its supernatural fictions in remote space and remote time, *e.g.*, in prefacing a story with the words: "Long, long ago," "Far, far away". Such belief, moreover, is in normal circumstances momentary only, being immediately corrected by reflexion. This is illustrated in the way in which the child arrests and corrects the illusory tendency to believe in its doll as alive, as when like the savage it is overtaken with a sceptical revulsion and dashes its idol to the ground.[3] It is further seen in our habitual restraint of the tendency to an illusory belief in the reality of the novelists' inventions. We have now to pass to a more definite form of belief: that which accompanies the com-

[1] On the tendency to believe in all that we vividly imagine, see Dugald Stewart, *Elements of the Philosophy of the Human Mind*, pt. i. chap. iii.; and Taine, *On Intelligence*, pt. i. bk. ii. chap. i. § 3.

[2] This at least is the first instinctive mode of conceiving of a *quasi*-material object. Of course, a moment's reflexion may suffice to check the tendency. Thus, in the representation of a centaur or a griffin we instantly inhibit the impulse to project into the real world, by substituting a picture or a statue for the living reality, or even by recognising that all the reality in the case is a conventional agreement to adopt a certain fiction. Some good remarks on such secondary and lower realms of reality will be found in Venn's *Empirical Logic*, pp. 36, 37. (*Cf.* W. James, *Principles of Psychology*, ii. p. 287 ff.)

[3] These alternations of childish faith and scepticism are excellently described by George Sand, *Histoire de ma Vie*, iii. p. 181.

plete process of synthetic thought or judgment, and depends upon an associative connexion of ideas.

The vague belief illustrated above may be said to correspond in the region of judgment with what logicians call existential propositions, *e.g.*, "God exists". The crudest form of belief is a vague, unqualified apprehension of something existent, 'somewhen' and 'somewhere'; the space and time reference now taking on the form of a projection into the remote and inaccessible, now, in cases of more vivid imagination, approximating to a *quasi*-hallucinatory projection of the idea into the surroundings of the moment, to an expectation of something about to manifest itself.[1]

(*b*) *Experience and Association.* It is commonly admitted that the great source of all definite connective belief is experience and association. Reality is given us in our common sense-experience as a tissue of connected parts, *e.g.*, qualities conjoined in things, a succession of connected changes in things. These connexions in our presentative experience determine by the processes of association the order of our representations. As we saw in our examination of the process of judgment with which all definite belief is bound up, suggestion is the great determining condition of thought-combinations. We may say, then, that all belief tends to take on the form of an apprehension of an objective connexion or relation, which relation is suggested by a process of reproduction.

As pointed out above, the process of contiguous association is that by which the order of our ideas is determined to follow that of our perceptual experience. Hence contiguity is the main intellectual factor in belief. To realise an idea by setting it in definite relations of space and time is only possible through the workings of contiguous association. This was illustrated above in the case both of memory and of expectation. To remember an incident so as to project it as a real experience in the time-order of the past is, as we saw, to retrace a succession of presentations by means of processes of contiguous revival or suggestion. In like manner, the forward direction of belief in expectation or the fore-grasping of a real experience is determined by a contiguous bond.[2]

[1] On this tendency to realise what is vividly imagined as near or proximate, see my essay on "Belief," *Sensation and Intuition*, p. 84 f.

[2] *Cf.* above, p. 316 f.

(*c*) *Belief in Past and in Future.* The points of difference between the two modes of belief in memory and expectation were touched on above. The apprehension of a reality in the future has in general more liveliness and is more exciting than that of a reality in the past. The latter, when consciously apprehended as past, is put aside as done with. On the other hand, the future reality, just because it is future, is eagerly attended to, rousing the whole mind to an appropriate pre-adjustment. More particularly, as we saw, expectation involves a high degree of active or muscular tension, *e.g.*, in looking out for an object, in preparing to meet a person, and so forth. Further, as was pointed out also, the state of expectant belief is complicated by the difference in the conative concomitants according as we anticipate something agreeable which attracts us, or something disagreeable which repels us.

It has been shown that both memory and expectation have to do with the actual present as their starting-point. Now we have seen that belief in reality has reference to an actual perceptual experience. We may thus say that both the recollection of a thing and the anticipation of a thing as a mode of assurance are effected through the connexion of an idea with the actual presentation of the moment. And the closer this connexion, the stronger is the belief. Our confidence in that which has just been experienced is of the very strongest ; and, as we shall see presently, the same applies to that which is suggested by the present as immediately about to happen. The effect of actual objects in aiding belief in the images immediately associated with these, as illustrated in the fiction-building of children on a basis of sense-reality, *e.g.*, their toys, as also in the value of religious symbols as aiding in a realisation of the unseen, and of personal relics in helping us to recall the reality of the past, is due to this circumstance.[1]

(*d*) *Belief as Inference.* The conscious transition from the memory of a fact to the expectation of a like fact is, as we have seen, a simple type of inference. We have now to indicate the psychological character of such inference as a particular variety of belief.

All clearly inferred belief, that is to say, every conclusion consciously derived from data or premises, depends on the firm establishment by means of certain given presentations or representations of a particular ideational connexion or structure. Thus, in inferring from known instances of thunderstorms that another thunderstorm is coming on, my new inferential belief arises through the inevitable reinstatement of a particular expectation by a group of recollections. Every time I recall the past experiences, and along with these note the signs of the moment, my mind is irresistibly borne on to a new belief. We may thus say that all inferred belief is the extension of the feeling or attitude of belief from something already known

[1] *Cf.* James, *op. cit.*, ii. p. 302 ff.

to a new ideal complex which firmly attaches itself by the cementing forces of association to the pre-existent cognition. In other words, inferred belief arises through the establishment of a new ideational structure, a part of which is already, as cognition, attended with belief.

It follows from this view that the strength or intensity of such an inferred expectation will depend on the vividness and stability of the reinstated ideational connexion. Thus it is strengthened by all that tends to secure vivid reinstatement, as the exciting character of the original impression. A curious illustration of this is seen in the effect of a recent similar experience. If, for example, I have just seen and heard a gun fired off, the expectation developed while watching the reloading of the gun will be exceptionally lively, and the assurance proportionately stronger. For a like reason, the expectation of an event standing in close temporal proximity to the actual present, being more vivid than that of a remote consequent, will be attended with a stronger or more lively assurance. Thus we have, in general, a more vivid fore-realisation of the immediate consequents of our actions than of the remote consequents.

This applies not only to forward inferences or expectations as commonly understood, but also to backward inferences, or inferences as to what has preceded the actually observed fact of the moment. Thus we realise the immediate antecedent of the wet pavement, *viz.*, the rain, more distinctly and vividly than its remote antecedent, *e.g.*, the formation of the clouds. This principle, as is well known, was used by Hume in trying to account for the special strength of belief in causation. It is to be added that these conditions apply only to belief in its primitive form. Logical training modifies this primitive tendency by helping us to distinguish between the vivid imagination of an event and the realisation of it as a proven certainty.

Next to such conditions of vivid reproduction we have the great force of repetition. We have seen that the strength of association varies (*cæteris paribus*) with the amount of repetition, and with the degree of uniformity of the connexion. This effect of repetition and uniformity is seen in the stability of all thought-connexions which answer to recurring and invariable conjunctions, *e.g.*, signs with their significates, causes with their effects, and so forth. And it is here that we see inferential belief at its strongest. Thus we have the fullest assurance that sea-water is salt, that tears betoken grief, that rough and hard substances hurt, and so forth. On the other hand, where experience is variable, belief is apt, as we have seen, to give place to doubt or uncertainty.

It is not meant by the above that belief begins by being weak and goes on increasing in strict proportion to the number of the experiences. It has been pointed out by Dr. Bain that a number of conjunctions of experience is not a prerequisite of a lively confidence. A single experience, if of an impressive kind, will suffice in the naïve type of intelligence of the child and the savage to generate a strong inferential expectation of a like experience.[1] This primitive credulity is rather determined by the force and interest of the impression than by its recurrence. Hence we may say that belief does not grow *pari passu* with the repetition of experiences. If only all the suggestive force is in one direction it matters little whether the suggestion represents a large or a small number of experiences. Yet, since repetition is a general condition of an enduring association, it may be said to be involved in the larger number of our beliefs. The importance of a number of conjunctions comes into view where experiences are no longer uniform, and belief takes on a more reflective and logical character, as in inferences with respect to probability.

§ 30. *Verbal Suggestion.* Closely connected with the effect of experience and contiguous association on belief is that of verbal suggestion. The instant excitation of a more or less distinct belief by another's word, *e.g.*, when a man shouts 'Fire!' illustrates the force of words in reinstating vivid ideas. The peculiarly close connexion of words and ideas is, as already pointed out, the effect of great frequency and perfect uniformity of associative conjunction. To this it must be added that every connected form of words or verbal statement presents itself to us as the direct expression of another's judgment and conviction. As we saw above, the proposition is the normal and customary embodiment of the internal judgment, and as such stands in the closest possible associative connexion with this last. Hence the tendency to accept another's statement automatically and quite apart from any process of 'weighing testimony'. The combination of words in this case serves to effect in the hearer's (or reader's) mind the corresponding combination of ideas, and so to excite a nascent belief in the reality. We see this effect of verbal suggestion in the un-

[1] On this primitive tendency to belief in advance of experience, see Dr. Bain's account of 'Primitive Credulity' in his volume, *The Emotions and the Will*, 'Eelief,' § 7 and following.

reasoning acceptance of traditional statements, and in the momentary tendency to believe even an extravagant assertion. Thus, as has often been remarked, flattery is pleasing, even when we discern its hollowness, through its momentary suggestion of excellence. Sir Walter Scott well points out that "censure, as well as praise, often affects us while we despise the opinions and motives on which it is founded and expressed".[1] It is illustrated, too, in the reflex effect of our own utterances in strengthening our belief. As Hartley has observed, a person by the mere act of repeating a story which he does not at first credit comes in time to believe in it.[2] Lastly, it is strikingly illustrated in the nascent illusory beliefs excited by fiction, which by adopting the guise of narration, and moreover presenting by its verbal medium a complex of consistent and connected parts, produces for the moment the analogue of historical belief, or belief in a series of past events.[3]

While belief is thus mainly determined by the working of Contiguous Association, it illustrates to some extent the effects of assimilative suggestion. This is seen most plainly in the tendency to take a thing for what it resembles. In the illusions of childish play, as when, for example, the hobby-horse is half believed to be the living animal, we see this effect of assimilative reinstatement on the apprehension of reality. Similarly in the case of the animistic fancy of the savage, who takes the rock or log for that which it symbolises.[4]

§ 31. *Effect of Feeling on Belief.* While belief is thus in the main the product of the intellectual mechanism, it is powerfully affected by the feelings and desires. There is no such thing as a perfectly cold belief into which no feeling enters. We must be interested in a truth if we are to give it our full conviction. Our strongest beliefs are those which connect themselves closely with self and its interests. The immense influence of this affective element in belief is illustrated in the way in which it tends to counteract or overpower the intellectual tendencies. In the unregulated beliefs of the uneducated this setting aside of thought by feeling is habitual. Thus, in

[1] *Bride of Lammermoor*, chap. xxiv.

[2] *Observations on Man*, pt. i. chap. iii. § 4, p. 390.

[3] For a fuller account of this kind of belief, see my volume, *Illusions*, p. 311.

[4] That is, so far as such symbolism is based on resemblance and not on associations of time, place, etc.

the superstitious beliefs of the savage in the reality of that which strikes the imagination and awakens fear, in the tendency of the vulgar to believe in the miraculous, in the impulse which we all experience to believe that which we wish for, and in all that is known as prejudice and bias, we see illustrations of this disturbing influence of feeling.

This action of feeling on belief is in every case mediate; that is to say, it works by modifying the processes of ideation themselves. It is by giving preternatural vividness and stability to certain members of the ideational train called up at the time, *e.g.*, ideas of occurrences which we intensely long for, or specially dread, and by determining the order of ideation to follow not that of experience but that which answers to and tends to sustain and prolong the feeling, that its force serves to warp belief, causing it to deviate from the intellectual or reasonable type. In the case of recurring and dominant feelings, which tend to keep particular combinations of ideas in consciousness for long periods, we see this effect of feeling on belief in its most striking form. It is in the rooted beliefs of the romantic dreamer, the enthusiast, and so forth, that we may best study the action of feeling in consolidating particular ideal attachments and giving them the semblance of firm and well-weighed judgments.

It follows that when belief is thus sustained by feeling the decline of feeling will tend to undermine the belief. This result is seen in the occasional lapse of religious and other beliefs through the cooling of emotional fervour. The imagination, wanting its emotive stimulus, fails to rise to the needed point of vividness. The mind loses its hold on the reality and falls into a depressed state of doubt. It may be added that the same effect shows itself in the domain of sense-perception, that is, the immediate apprehension of reality itself. Thus, in certain pathological states involving a considerable lowering of feeling or sensibility, the patient loses his hold on sensible realities, feeling "as if there were a wall between me and the outer world".[1]

[1] Quoted from Greisinger by W. James, *op. cit.*, ii. p. 298. It is to be added that this mode of doubt, arising from a conflict of desire to believe and inability, differs from the more logical form considered above in which opposing considerations or grounds present themselves to the mind. *Cf.* what Bevan Lewis says

§ 32. *Belief and Activity.* As was observed just now, belief stands in a peculiarly close relation to activity. In most cases at anyrate it involves the incipient excitation of impulses to look out for a result, and to follow a line of action.

Owing to this organic connexion with action, belief may be influenced by strengthening the active element. Thus, as we all know, an eagerness to do something tends to favour the belief that would justify us in doing it, *e.g.*, our power to accomplish our purpose, the rightness of the action, the worthiness of the object, and so forth. As will be shown more fully by-and-by, belief, in the form of a confidence in our active powers, is the characteristic of sanguine youth with its strong desires and active impulses. Doubt and hesitation, on the other hand, only arise where these impulses are in a measure toned down by the lessons of experience. The contrast which thus shows itself in the case of eager youth and cautious age discloses itself in a less marked way in the case of the practical and the speculative mind. The former, strongly impelled to act and therefore to decide somehow, is impatient of that state of uncertainty which with the speculative mind is a frequent, and, with respect to certain matters, a permanent one.

It follows that belief and activity react one on the other. Firm conviction favours action; and, on the other hand, a strong desire to act predisposes the mind to accept something as certain. It is often difficult to say which is cause and which is effect. Thus it is difficult to determine how far the confidence of youth is the result of ignorance, that is, of the limitation and consequently the uniformity of his experience, and so a condition of its active eagerness; and how far it is the outcome of the strong active impulses themselves. It may be added that the reflex influence of active impulse on belief is, like that of feeling, mediate, working through the ideational processes. To desire a thing strongly is to represent this vividly and fixedly. In this way the promptings of our active nature break in on the intellectual processes modifying the suggestive forces of the moment.

§ 34. *Logical Control of Belief: Knowledge.* In the foregoing account of the several factors in belief we have been occupied merely with its primitive or instinctive form. We have now to see how the process of logical thought serves to transform this crude type of belief into that reasoned or systematised form which we call knowledge.

respecting the loss of "object-consciousness" in states of melancholia, *A Text-book of Mental Diseases*, p. 116 f.

As we have seen, logical, that is, fully explicit thought, proceeds by clearly setting forth our judgments in a verbal form, and in tracing out their logical relations, consistency and inconsistency, and dependence of conclusion on premise or reason. The expression of a belief in a definite propositional form is itself an important step in the direction of reflective or rational conviction; for the belief when thus expressed is in a manner objectified or thrown into the form of an object, which calls our own attention to itself as well as invites the critical inspection of others.

A yet more important step is taken in the logical organisation of belief when thought explicitly assumes a general form, that is to say, proceeds by way of a universal proposition. As may be seen from our short account of the process, generalising means the unification of a multitude of particular beliefs, including the observations which were the starting-point in the process as well as all the imperfectly thought-out expectations answering to the unobserved cases. Thus, when the child first begins to realise the universal truth that all living things die, his belief in the fact of death undergoes, through the very apprehension of the truth as universal, at once a vast extension and a firm consolidation. It may be added that this explicit throwing of belief into the universal form tends very powerfully to stimulate reflexion. The fully conscious acceptance of a universal proposition as universal compels the mind, by reason of its large and impressive scope, to examine into its grounds and evidence, and so directly furthers a logical control of belief.

It seems to follow from our account of the concept as representing (by means of one or more images) an indefinite number of things, *viz.*, members of a particular 'class,' that our belief in a universal proposition is resolvable into an indefinite, that is, imperfectly realised, group of particular or concrete representations. Thus the truth, "Living things die," is realised by the child as, "This, that, and the other living thing will die," or, if it be a thing of the past, "has died".[1]

The formation of an explicit universal judgment is, as we have seen, the process by which our particular beliefs come to

[1] I have elsewhere sought to show that these imperfectly-thought particular beliefs in a universal judgment are analogous to expectations. (See my volume, *Illusions*, p. 307 ff.; *cf.* James Mill's *Analysis of the Human Mind*, ed. by J. S. Mill, Editor's Note, p. 413 ff.)

be logically tested. The universal is a principle of reference, to which we appeal for confirmation of that which illustrates and fulfils it, and rejection of that which collides with or contradicts it. In this way our beliefs attain a certain degree of systematic co-ordination or organisation into a consistent and compact structure. In the measure in which the unifying process of general thought is carried out does this reference of each newly formed belief to a controlling principle or law advance. In scientific knowledge we see this process of organisation carried to its highest degree of perfection. Here the generalising operation of thought aims at the carrying up of all truths into one or two supreme principles or laws, by help of which a vast multitude of diverse phenomena are at once explained and organically connected.

In this organisation of a stable structure belief does not change its nature, but only its form. Reality is still determined by the direct presentations of sense. And the observations of sense, when scrutinised and reduced to pure observations and otherwise rendered exact by scientific method, remain the ultimate test of all theory. Thus belief in its most speculative flights is always harking back to the lowly but firm territory of sense-perception. The theory that started from the senses has to return to the senses for its verification.

It is not meant by this that our sense-perceptions can, under all conditions, be accepted as true intuitions of reality. They are, as has been pointed out above, frequently illusory, and have to be corrected by a process of reflective comparison and reasoning. To this extent thought, as a generalising, unifying function, controls and determines the validity of sense-perception itself. All such rational correction of sense-illusion is, however, as I have elsewhere shown, only a new appeal to the general validity of sense-apprehension itself.[1]

The transformation of primitive belief by this rationalising process of thought is seen in a striking way in the change it effects in the original disposition to believe, to accept statements as true. The primitive mind is credulous: it casts itself confidently on the first suggestion of the moment. Thus the mere hint that something is going to happen induces expectation. The development of experience and thought tends to substitute a more cautious, critical attitude for this credulous

[1] See my volume, *Illusions*, especially p. 123 ff. and chap. xii.

one. Through the disappointment of expectation and the contradictions of life there is developed in the practical man a slowness to believe. This cautious attitude shows itself in what we commonly describe as a man of "judgment," that is, one who pauses before deciding, taking the trouble to investigate the problem in all its complexity, to recall from his past experience all that bears upon it, so as to arrive at a sound and reasonable conclusion. Much the same result is seen in the effect of scientific discipline. The investigator into nature's processes has in his pre-existent knowledge a criterion by which he judges of the truth of any new theory; and he is disposed to accept only that which harmonises with, and can be taken up into the structure of, this pre-existent knowledge. In this way the growth and consolidation of knowledge, while they serve in one direction to greatly extend the possibilities of belief, tend, in another direction, to limit its scope.

§ 35. *Knowledge as Social Product: The Common Mind.* Along with this co-ordination of partial knowledges into a total organised knowledge there goes another process, *viz.*, the logical adjustment of individual to common beliefs. What is meant by knowledge in its complete sense as apprehension of reality always has reference to such a community of intelligences, or a system of individual minds capable of comparing their ideas one with another, and so developing them into the form of common cognitions. This mutual adjustment of personal belief into a system of common cognition is carried out by the mechanism of language. Our systematised body of knowledge has, together with the language by help of which it has been formed, been developed along with, and in satisfaction of the growing needs of, social life. In its completely organised form, then, knowledge involves the existence of the "social organism," and is a social product.

We see this sociality of knowledge in the simplest form of apprehension of reality, *viz.*, sense-perception. The objective character of an individual's percept, say the visual apprehension of a star, involves the agreement of his percept with that of others under similar conditions of place, time, etc. Whatever else 'the real world' may mean, it certainly includes the fact of a common sense-experience. Hence it is only as the child's consciousness of itself in its solidarity with others grows clear that it clearly apprehends the external world as real or objective.

Much the same thing is observable in the later forms of belief which accompany the development of ideation and logical thought. Thus, in the process of reproducing past experiences, we compare our recollections with those of others who have taken part in them, and so acquire a much firmer grasp of the reality recalled. In general or conceptual thought, again, a like process of social adjustment is carried out. Thus the very employment of a common language has for its purpose to bring the concepts of each into agreement with those of others; and this process of social adjustment is perfected by a more precise fixing of the conceptual standard through logical definition. Similarly with propositions. The embodiment of our belief in a propositional form is the means by which it enters into that organic structure which we call common knowledge. More particularly in the case of universal judgments, the process known as the logical control of thought obviously consists in assimilating individual belief to a commonly accepted type. Thus the universal propositions of science are put forward as of common validity, claiming acceptance from all men so far as reasonable.[1]

§ 35*a*. *Common Belief: Common Sense.* The process of socialising belief or assimilating it to a common type leads on to the solidification of a mass of generally accepted propositions in the form of *quasi*-intuitions, that is, independent or self-evident convictions. The processes by which these common beliefs were reached come in time to be forgotten, and they take on the appearance of original or intuitive beliefs. Thus the generally accepted principle that changes are brought about by causal agency has long since taken its place, with the more thoughtful at least, in this firm substratum of common cognition. In addition to the principles which underlie speculative thought, there are others which lie at the base of practical thought, *e.g.*, the belief that life is good, that it is right in general to pursue our own interest, and so forth. In what has been called Common Sense we

[1] The relation of the universality of belief to its objectivity is more fully dealt with in my volume, *Illusions*. (See especially p. 337 ff.)

see this solidification of belief into a generally accepted body of truth.[1]

§ 35*b*. *Influence of Tradition.* This mass of consolidated belief works as a powerful influence on the development of the individual mind. It is highly probable that in the case of the more fundamental part, or at least that which has been longest fixed, the individual inherits in the constitution of his brain a disposition to take on these particular forms of 'intuitive' belief. However this be, the forces of tradition, including all that is meant by instruction, are a powerful agency for assimilating individual belief to the common type. If we bear in mind the supremacy of this agency in early life, when most of the individual's convictions are acquired, we may easily see how much tradition has to do with the formation of the beliefs of each one of us. All men in their first years, and most men throughout life, take the larger part of their convictions on authority, that is to say, to a large extent on trust, their individual experience serving merely to give a slight additional strength to the conviction.

We are not concerned here with the logical question, the general value of human assertion, or, as it is commonly called, human testimony. No doubt the belief in testimony when reflected on and rationalised may be rested on the general agreement of assertion and fact. As James Mill remarks, even "the greatest of liars speak truth a thousand times for once that they utter falsehood".[2] The child very early begins to recognise this conformity of assertion to fact, and so far to transform his belief into a conscious inference. But, as pointed out above, belief in assertion has a wider and more instinctive base than any such consideration of its evidential value. Verbal suggestion produces belief by a process that is not consciously inferential at all. In the case of propositions put forward by numbers, or by persons invested with special authority, as the parent, or the teacher, this tendency is greatly increased by the workings of the feelings, such as love and reverence.[3]

§ 35*c*. *Authority and Individuality.* The conscious action of the community on the individual through the traditional agencies of instruction gives rise to what is known as the

[1] On the various meanings of "Common Sense," see Hamilton, Edition of Reid's Works, note A: *cf.* Carpenter, *Mental Physiology*, bk. ii. chap. xi.; and *Illusions*, p. 346 ff.

[2] *Analysis*, i. p. 384.

[3] On the nature of our belief in testimony, see Prof. Adamson's article "Belief," *Encyclop. Britann.* (9th ed.).

claims of authority. Thus, in science, in morals, and in religion, we see the tendency on the part of the community or the majority to require the individual to conform his beliefs to the common standard.

With the precise logical validity of these claims we are not here concerned. That the requirement is a just one within certain limits is evident, and follows, indeed, from our conception of reality as that which is valid for all. A disregard of others' experience, which collectively reduces our own to very small proportions, and of the common forms of thought in which the experience of the race has formulated and conserved itself, whether in the truths of science, or in the wisdom of practical life, would be absurd presumption. To disallow the full weight of this slowly gathered body of common knowledge is the mark of the uneducated, narrow-minded, and obstinate man, who will believe only what he himself can see.

At the same time, these claims of authority are opposed to what is known as individuality of conviction, the impulse to think out our knowledge for ourselves from the particular data of our own experience. The collision of the two impulses to assimilate our convictions to the common pattern, and at the same time to realise them by a clear process of individual experience and reflexion, gives rise to a new psychological type of belief, *viz.*, belief which we realise as ours through a process of self-conscious reflexion. Our cognitions first form themselves as common cognitions, and the child says (or thinks) "*We* know" before it says "*I* know". It is only as the discrepancies of experience and of conviction emerge, and the collision of the individual with the common thought is felt, that our belief becomes in this sense fully self-conscious.

Hence it is an error to say, as some do, that all logical or conceptual thought is as such self-conscious. The concept is a representation (of a particular mode or structure) of real objects, and to conceive is to be in the objective attitude of thought, that is, mentally engrossed in objective reality, quite as much as to perceive. So far as self-consciousness is involved here, it is, as we have seen, in its first vague form of a consciousness of 'myself along with others'. A fully developed process of self-conscious thought, that is, of thought realised as 'my' thought, presupposes for the moment the absence of the sense of solidarity, whether because I am reaching a new conclusion in advance of others, or coming into direct antagonism with them by taking up the attitude of dissent from a commonly accepted proposition.

At the same time, the impulse to generalise our thought in the sense of ascribing to it universal validity never ceases to act. Even in the case of the dissenter from the accepted code of belief, there is a firm persuasion that others, if they were equally enlightened, would agree with him. In this way the individual appeals as he thinks from an actually existent and imperfect standard to an ideal and perfect one. Not only so, as the history of human thought tells us, the man who thinks out a new belief for himself is, at least when perfectly sane, not satisfied to remain an isolated outsider. The impulse to bring personal conviction into harmony with common belief still asserts itself, only in another way, *viz.*, in an effort to modify others' beliefs in conformity with the dissenter's own. It is by this reciprocal action of the individual on the common mind that traditional belief is kept from utter rigidity and intellectual progress is rendered possible. How deeply rooted is this impulse to bring about a harmonious relation of individual and common belief has recently been illustrated in the autobiography of Charles Darwin, who, notwithstanding the exceptionally careful way in which he had collected and sifted his facts before working out his theory of natural selection, was wisely concerned on publishing that theory to secure the confirming opinion of two or three of the most competent of his contemporaries.

§ 36. *Common Distinction of Belief and Knowledge.* The psychological relation between individual and common belief here set forth is indicated to some extent in the current forms of language. It has already been pointed out that in the popular use of the term belief is not co-extensive with knowledge. The word rather marks off a particular sphere of conviction from that of cognition proper. To begin with, belief is commonly regarded as below knowledge in point of surety or certainty. We are wont to say "I know" when we are in the highest region of the scale of certainty, whereas we fall back on the form "I believe" wnen we are not quite positive and are ready to admit the possibility of doubt.[1]

Again, since agreement of belief with that of others is in general taken as the criterion of certainty, it follows that when we find ourselves differing from others we are apt, through modesty at least, to speak of belief rather than of knowledge. To say "I know" in the face of another's explicit disagreement savours of presumption

[1] Hence the limitation of the term belief by Hume to matters of fact and probability as distinguished from relations intuited by reason or thought. On the nature of belief in probability and its relation to certain knowledge, the student should consult Venn, *Logic of Chance*, especially chap. vi. and following.

and conceit. Even where our individual conviction is strong, the recognition of a difference of opinion rarely fails at the moment at least to suggest the possibility of error.

It is not, however, till we think of belief as susceptible of being systematised and rationalised that the full significance of the difference between belief and knowledge as popularly understood comes into view. Knowledge in its popular contradistinction to belief is more than anything else that which has been carefully reflected on and thought out into a clear rational form. Belief is blind; knowledge is clear-sighted: belief is instinctive, a matter of feeling; knowledge is carefully reasoned out and seen to be inevitable or necessary. Thus the common type of religious belief, though of the strongest, is rarely spoken of as knowledge, but as faith or conviction.

Now, considering the large area of erroneous individual belief which arises from defective observation, from the failures of memory, from hasty and imperfect reflexion, and lastly from the warping influence of the feelings, we may say that the necessity of confronting our individual beliefs with those of others serves on the whole to rationalise them or make them approximate to a deliberately reasoned form. To this extent, then, the two distinctive meanings of "knowledge," *viz.*, common as distinguished from individual belief, and reasoned as distinguished from instinctive or spontaneous belief, may be said to coincide.

Such coincidence, however, as hinted above, is not perfect. As it becomes recognised that all the higher sorts of exact knowledge are only attained by careful processes of observation and reasoning, the tendency to emphasise this aspect of cognition becomes more and more marked. As used by more thoughtful persons, "to know" comes to mean more and more that which is carefully organised, that is to say, thought out in the light of principles. This tendency of the word is illustrated in the general readiness of the modern mind to accept as knowledge the rationalised experience of an expert in science, even when this collides with common belief. It is still more apparently illustrated in the modern educational use of the word knowledge. We are beginning to understand that the learner knows a thing, not when he passively accepts traditional propositions, but when his individual mind has gone through the processes needed for their logical establishment.[1]

REFERENCES FOR READING.

On the processes of thought and the psychological treatment of knowledge, see Spencer's analysis of reasoning, *Principles of Psychology*, vol. ii. esp. ch. viii.; also Ward, article "Psychology," *Encyclop. Britan.* p. 75 ff.; Lotze, *Microcosmus*, bk. ii. chap. iv.; and Höffding, *Outlines of Psychology*, v. D. The reader of German and French may further consult Volkmann, *Lehrbuch der Psychologie*, vol. ii. § 117 and following; Horwicz, *Psychol. Analysen*, 2er theil, 1e hälfte (*Analyse des Denkens*); Lipps, *Grundtatsachen*, 4er abschnitt (esp. kap. xx.); and Rabier, *Leçons*, chap. xxv. ff.

[1] The distinction of belief and knowledge has played a large part in the history of thought. (See Hamilton, *Lectures in Logic*, ii. lect. xxvii.; J. S. Mill, *Examination of Sir W. Hamilton's Philosophy*, chap. v.; and Adamson, article "Belief," *Encyclop. Britan.*)

END OF VOL. I.