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THE LEARNING PROCESS

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THE LEARNING PROCESS

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TO THE MEMORY OF

MY FATHER

PREFACE

In the present work the attempt has been made to analyze the fundamental conceptions and facts relative to the learning process, and to show their significance by discussion and illustration as it appears in theory and practice in instruction in the elementary and the secondary schools. A wider application also has been made in so far as these theories and facts have been considered in relation to the learning of the mature student and in the conduct of the affairs of daily life. The materials for discussion have been drawn principally from the results of experimental psychology and pedagogy. Theoretical considerations in the fields of psychology and biology have also been made use of from time to time.

For aid in the preparation of this manuscript, by means of helpful suggestions, I have to thank particularly my colleagues, Professor W. C. Bagley and Professor B. H. Bode, and for material assistance in the revision of proof, my colleague, Dr. A. H. Sutherland. My thanks are also due to Professor E. B. Titchener, of Cornell University, for a detailed statement of certain aspects of his doctrine of attention, particularly in relation to his distinction between attributive and cognitive clearness.

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INTRODUCTION

The point of view that is held to throughout the following discussion in the interpretation of the learning process, and the states of consciousness attendant on it, is a thoroughgoing functionalism and pragmatism. It is assumed that the reactions of an organism, its modes of behavior, furnish not merely the criteria for an objective determination of the learning processes of the organism, but that these reactions constitute the means by which the learning takes place. Without reactions learning would be impossible; behavior is essential in learning at all stages of development, both in the child and in the race. There is no learning that does not express itself in adjustment; there is no learning that is not acquired through adjustment. Thus the adjustments become the function by which learning is made possible, and the practical significance of learning is measured in terms of the successful character of these adjustments.

It should not be assumed for this reason, however, that the conscious correlates of these adjustments, ranging from the simplest sensations to the most complex rational processes, and tinged by feelings and emotions of greater or of less intensity, are to be ignored, or to be passed over slightingly. The fact that adjustment is necessary for learning does not imply that the conscious factor is not also an essential. Consciousness appears as the accompaniment of all complicated adjustments; possibly as the accompaniment of all adjustments, even of those of the most simple nature. What the relation is that exists between the adjustments and the conscious processes that appear in connection with them, it may be difficult to decide. Whether consciousness causes these adjustments or is caused by them, or whether, finally, there is no actual causal relation existing between conscious states and the bodily processes connected with them, but rather such a relation that they appear together without any interaction, is a matter not for an empirical science, but for philosophy to determine. Whatever the relation may be, whether of interaction (*i.e.* direct causal connection) or of concomitant variation (*i.e.* a parallel relation between bodily and mental processes without actual causal connections), it must be assumed from the empirical point of view, that consciousness is practical; that it arises in a clear form when there is a need for it (*i.e.* when the organism can no longer adequately adjust itself in a reflex or mechanical way). Consciousness, therefore, is always useful, and exists only as long as it can be of service. This is its pragmatic sanction. Its existence is conditioned on its service to the organism, this service being that of adequately adjusting the organism to its environment.

When we turn to a more detailed examination of consciousness itself, and inquire into the manner in which the elements that compose it group themselves, we discover that this grouping obeys a fundamental law that differentiates conscious phenomena in a striking way from those of the material world. Material phenomena obey the law of efficient causality, the law that asserts that every effect is traceable to a preceding cause, or a series of causes, that absolutely condition it. In the world of matter complete determinism prevails; the present is accounted for entirely and adequately in terms of the past.

Conscious phenomena, on the other hand, group themselves under the law of purpose or end. A conscious event cannot be given an adequate explanation in terms of efficient causality. It is not what has gone before, but what is in the future, that explains the way in which mental processes develop. In the highest forms of conscious groupings we have clearly defined ends, which are held in the mind and in which the conscious processes terminate; we meet here the phenomena of deliberation, comparison, and choice that are the characteristics of volition. Here the purpose is explicit, the aim recognized. Below the level of deliberative choice and conscious adjustment to ends more or less remote, we have still conscious groupings that are dominated by purpose in a less explicit sense. Desire and impulse, if the adjustment is not purely automatic, point to something beyond, something not yet realized, but to be attained. The desire regulates the groupings in this stage of consciousness, just as truly as does the more definite purpose regulate the thought processes in rational and deliberative modes of behavior. Even in the subconscious realm the groupings are to be explained, if explicable at all, in terms of consciousness rather than in terms of mere nerve physiology. Here, it is assumed, exists an unrecognized end that dominates these states of mind.

The explanation of conscious phenomena in terms of purpose will be often met in the following pages. This explanation will appear in the discussion of perception, of memory and association, of interest and attention, and particularly it will be emphasized in the chapters on the higher thought processes. Indeed, wherever conscious processes are discussed it will be shown that whatever the source of the elements that constitute those processes may be, and whatever the explanation for the emergence of these elements in consciousness, the fundamental law by which they are arranged is always to be conceived as some form of purpose or end, either clearly observable or implicitly present. When no such purpose can be discovered, we must then conclude that we are dealing with phenomena whose explanation lies within the physiological or physical realm.

In the discussions that are to follow there will likewise be found numerous references to the significance of adjustment in determining the nature of learning. The earlier chapters, which are primarily biological in their nature, will emphasize the factor of adjustment and the part that it plays in the learning of the individual and of the race. In the later chapters, in which the conscious aspects of learning are more particularly emphasized, the significance of adjustment as a mental factor will be discussed, and the motor aspects of consciousness will be given a large share in the structure of mental states. It will be insisted that adjustment and meaning go hand-in-hand, and that kinæsthesis is an indispensable factor in all forms of learning, from the lowest to the highest.

Thus the attempt will be made to develop around these two basal concepts of adjustment and purpose a system of educational psychology that will include the most important facts that have been revealed by experimentation, observation, and reflection. It will further be attempted to show in a concrete manner the application of the various facts and theories presented to the practical problems of education in the school and in the home. Much material will be found that may not seem to be necessarily included in the plan outlined above; that would, for example, be presented in a discussion in which other conceptions as to the meaning of the learning process and the nature of consciousness prevailed. The justification for the introduction of such material in a book that attempts to set forth, in part at least, a system of interpretation, is, that this material must be considered as final data; as ultimate elements which are to be organized in terms of the learning process. Mere desultory memory must be taken as a fact largely of physiological significance; the instinctive interests must be accepted and interpreted as to their origin in biological terms; the physiological basis of fatigue must be recognized. On the other hand, all these and other similar data are to be dealt with in considering the principles of learning as the materials and circumstances from which, and conditioned by which, mental organization takes place. We cannot explain in physical concepts, origins in dealing with the cosmos. We take the ultimate elements for granted, and attempt to relate them in terms of physical laws. No more can we explain in psychological concepts the appearance of ultimate psychic elements. When they make their appearance we must accept them as given and attempt to relate them in terms of mental laws. This does not preclude the treatment of the origins of mental elements in purely physical and physiological terms; it does, however, mean that we must frankly recognize that in these cases we are not on psychological ground; and it further means that we are justified in our physical or physiological treatment only in so far as we show the manner in which a higher psychological treatment can be applied in the grouping and functioning of these elements in mental complexes.

THE LEARNING PROCESS

CHAPTER I

FUNDAMENTAL ELEMENTS IN THE LEARNING PROCESS

The learning process defined.

THE learning process may briefly be described in its most general terms as the modification of the reactions of an organism through experience. An organism which is incapable of modification in its reactions cannot be taught. In using the term "experience" we refer to the modification of adjustment in the individual organism as distinguished from those modifications that take place in racial development. It is possible to conceive racial modifications as in a sense a gradual learning through the process of evolution. Racial learning consists either in the elimination of less fit forms through natural selection, or in the acquisition of acquired characteristics by individuals, which latter can be transmitted to their descendants through heredity.

The transmission of acquired characteristics (that is, of modifications acquired during the life of the parent as a result of environmental conditions) to the offspring of that parent is at present generally considered improbable. Thomson, in his excellent discussion of this question in his treatise on "Heredity," concludes that there is slight scientific warrant for at present accepting the doctrine of acquired characters.[1]

Although we may seriously question the possibility of securing the transmission of acquired modifications from one individual to another through inheritance, it is, nevertheless, desirable from the standpoint of educational procedure to bring about such modifications, since they can be transmitted from individual to individual through the social me-

[1] See Chapter VII of Thomson's book for a comprehensive discussion of the entire matter.

dium. Indeed, a large amount of the best things that have come to the race have been transmitted in this way. To use the words of Thomson,[1] "Unlike the beasts that perish, man has a lasting external heritage, capable of endless modification for the better, a heritage of ideas and ideals, embodied in prose and verse, in statue and painting, in cathedral and university, in tradition and convention, and above all in society itself." *Thus from the standpoint of practical pedagogy, the question of the possibility of the transmission of acquired characteristics is one primarily of theoretical importance.* It makes little difference to educational procedure whether the modifications secured are transmitted directly from father to son, or are transmitted in a more roundabout way through the social environment, which has become modified through the education of the individuals that constitute the social group.

Transmission of acquired characteristics through the social environment.

For example, if the possibility of the transmission of acquired modifications be admitted, we might assume that the perfecting of an individual, or a number of individuals, in the technique of playing some musical instrument might be perpetuated in the generations succeeding by the direct physical inheritance of this technique. Therefore, the education of such individuals would be of more than individual significance. On the other hand, the possibility of this wider education would still exist if direct inheritance of this musical technique were impossible, since the education of these first individuals would result in the education of others in their immediate environment, and these could transmit such education to still others, and so the process could be continued indefinitely, the final results being even greater than if the direct transmission alone were possible.

The transmission of the modifications produced in one generation by environmental conditions to succeeding generations by means of the social milieu is one of the striking differences between brute and human societies, and accounts in a large measure, for the infinitely greater progress of the human race than that of the brute creation.

[1] *Op. cit.*, p. 249.

While it is possible that in lower organisms modifications of experience may occur without a conscious accompaniment, in all higher learning the psychic factor is an indispensable consideration, and to attempt to account for learning merely in physical and physiological terms is totally inadequate. We must assume that wherever there is marked modification of animal behavior in the course of the life history of the organism, there exists a conscious element which must be accounted for in order adequately to explain the learning. No consideration of the learning process which does not take into account the determining factor of mind, and make it a basal element in all learning, would be adequate. At the very outset of our discussion, then, it will be necessary to consider something of the nature, scope, and significance of consciousness.

Learning involves a conscious factor.

Many recent attempts have been made to give an adequate definition or description of consciousness. None of these has entirely succeeded. Indeed, it is hardly to be expected that a completely satisfactory definition will ever be framed. Consciousness is the most fundamental and final fact of the universe. It is, therefore, impossible to give a definition of consciousness in terms more elementary than consciousness itself. Most definitions have ended either by describing certain elements that go to make up consciousness, or in explaining consciousness in terms of the physical or physiological circumstances that condition it.

Consciousness often defined by describing elements or phases that constitute it.

For example, some psychologists, in framing their definition of consciousness, do not attempt to do more than merely to enumerate the various aspects of our conscious experiences, such as perceiving, attending, imagining, willing, and feeling. But in doing this they have simply called to mind experiences which have meaning only for those who possess them. While this procedure emphasizes these various aspects of consciousness, it throws no added light upon the nature of consciousness itself.

Again, in attempting to explain consciousness in terms of a physical stimulus and the resulting physiological process, the nature of the stimulus is described as well as the mechanical or chemical changes which are aroused by the stimulus affecting a sense organ, and the effects are further traced through the nervous system to the appropriate brain centers.

Consciousness explained in physiological terms.

For example, in the sense of vision the physical waves of light are analyzed and described, the chemical changes that occur when these light waves fall on the retina are considered, and the physiological processes in the visual centers of the brain are discussed. The facts and hypotheses involved in this procedure, while interesting and not unimportant, do not reveal to us the final nature of the visual experiences of color and light.

Obviously, such a description as this is a description in terms that are extramental, and which presuppose a relation between consciousness and the physical world that is hypothetical and in a measure unsatisfactory.

Although consciousness cannot be adequately defined, there are certain important aspects of it which should be kept in mind in a preliminary discussion of the psychology of learning. In recent years there has been an increasing tendency to consider consciousness from the biological standpoint, treating it as the means by which the organism secures a proper adjustment to its environment. The more complex and variable this adjustment, the greater the complexity and variability of consciousness. On the lower level of habitual action, consciousness, as a determining factor, may be disregarded, and for all practical purposes treated as non-existent. However, on these lower levels the question of actual learning does not occur. *Wherever there is variability in response, there we may assume is a consciousness, which may be legitimately interpreted as being instrumental in this response.*

Consciousness as a biological phenomenon.

As James has so clearly pointed out, *consciousness is not a thing, but a process*. To understand its nature, it cannot, therefore, be adequately studied as static, but as something flowing on toward a more or less definite goal under the dominance of certain laws. The following analogy may serve to illustrate the difference between consciousness as a process and consciousness as a mere unrelated set of occurrences. On a June evening, we are often attracted by the countless fireflies as they flash forth in points of light in the darkness and then disappear from view. Between these points of light there seems to be no connection, and the flashes appear in no apparent order. So consciousness might be pictured as sparks of intelligence glowing here and there on the dark background of the unconscious. This may be a true picture of the most primitive forms of intelligence, but with such intelligence the present discussion has nothing to do. The light of consciousness that we are to consider forms an uninterrupted train of brightness, and the point from which it issues and the goal in which it terminates can be traced with relative definiteness. *Consciousness is an event, or better, a series of related events, harmoniously joined and leading to a final conclusion.*

Consciousness not a thing, but a process.

Perhaps the most important viewpoint from which we may consider consciousness is that of the fundamental law which underlies all conscious groupings. As has been pointed out in the Introduction, this is the law of purpose or end of action, and differentiates the psychic world from the universe of material relations. In the material world all events are to be explained as due to a preceding set of efficient causes that absolutely predetermine every physical occurrence. In the interpretation of the phenomena of this world, all purpose, design, and aim must be rigorously excluded. *In the world of consciousness, however, the reverse is true. No happening can be adequately explained in terms of efficient*

The most fundamental law of conscious processes.

causality. The real explanation of a grouping, or constellation of conscious factors, is to be found in the meaning or end around which they are grouped. In order to satisfactorily account for the appearance and grouping of mental states, we must be able to show the end, aim, or purpose toward which the mental processes are moving. Where we cannot show an end, either consciously or subconsciously present, we have a materialistic rather than a psychical explanation.

The two principal criteria for the appearance of consciousness.

The question naturally arises: At what point in the animal series does consciousness first appear? A similar query asks: At what point in the development of the individual does consciousness arise? Neither question can be easily answered. Logically, there is no certain line of division between the conscious and the unconscious, neither in the animal series nor in man. On the other hand, it is quite evident that consciousness in any significant and valuable form can hardly be assumed to exist in the lower levels of animal life and in the human individual in his prenatal development. Certain specific criteria for the appearance of consciousness have been suggested by various writers, but they reduce themselves in the main to two, namely: first, the argument from similarity of bodily structure (particularly of the nervous system) to the similarity of conscious states arising in connection with bodily processes, and second, the argument from similarity of behavior to the similarity of the mental phenomena accompanying this behavior.

The criterion of structure.

Among the higher vertebrates, including man, the resemblance between the central nervous systems of the various individuals is so great that there is a high probability of a substantial likeness in the mental states of these individuals. As we descend the scale of animal life, the resemblances in nervous structure and the end organs connected with the central nervous system (the eye, the ear, etc.) become less marked, and, as the higher centers become relatively less important and finally disappear, the probability of a conscious life similar to that existing in the higher organisms grows less. When we arrive at the final stage in the descent, we find the amœba, a single-celled, structureless bit of protoplasm, without a nervous system even of the most rudimentary sort. If consciousness exists in such an organism, it certainly cannot be inferred from its structural resemblance to that of those higher animals in which we must assume that a psychic life is present.

The criterion of behavior.

When we turn to the criterion of behavior, as indicative of consciousness, we find greater evidence of a widely extended psychic life than we do when we consider structural resemblances alone. There is, indeed, but slight resemblance in structure between the amœba and man, yet the behavior of these lowest forms of animal life is not absolutely unlike that of the highest forms. Indeed, Jennings [1] has asserted that were the amœba an animal as commonly observed as the house dog, to it would be attributed, because of its behavior, a consciousness not dissimilar to that of the rudimentary processes of the higher animals.

Mere response to stimulation not an evidence of mental life.

While behavior, or movement, is in general an indication of consciousness, not all movement should be taken as showing evidence of mental life. Mere response to stimulation is characteristic of all protoplasm. In this connection the biological theory of tropisms may be noted as set forth by Loeb and others. Loeb says: "The tropisms are identical for animals and plants." They are mechani-

[1] See "Behavior of Lower Organisms." On page 336, the author says, "If Amœba were a large animal, so as to come within the everyday experience of human beings, its behavior would at once call forth the attribution to it of states of pleasure and pain, of hunger, desire, and the like, on precisely the same basis as we attribute these things to the dog."

cal in their nature, and depend on the specific irritability of certain elements of the body's surface.[1] In organisms relatively high in the scale of existence, as well as in those of lower orders, a large number of bodily movements must be considered as being initiated entirely within the nervous system, and in no way directly connected with conscious processes. Reflex and automatic activity are of this type. *Only those activities that are classed under the head of purposive reactions can be taken as necessarily implying consciousness.* Purposive reactions, so called, are not to be considered as evidences of consciousness, unless it can be shown that the purpose is internal. The reaction, for example, of plants to light and to other stimuli has been interpreted under the concept of purpose; however, this alleged purpose is not an end of action as we ordinarily understand the term.

Educability a mark of intelligence.

One of the marks of "internally purposive," or voluntary movements, is that they do not appear with mechanical regularity, but are varied to suit the environmental conditions. An organism that varies its reactions in this way evidently profits by experience, and thus shows educability. It must be assumed that any animal that is capable of modifying its behavior in an essential way through experience is possessed of an intelligence of a fairly high order. To the criterion of educability may be added that of response to a novel situation. The significance of this latter criterion will be pointed out more fully in a subsequent part of this discussion. Here it is sufficient to say that *the habitual, the customary, the common, remain in the realm of the subconscious or the unconscious. Only when a thought crisis arises does a genuine experience occur.* This thought crisis is due to the fact that the customary environment has been in some way changed, so that the habitual reaction is no longer possible,

[1] See H. S. Jennings's "Tropisms." *Rapport présentée au VI^me congrès international de psychologie.* Genève, 1909.

and the thought processes necessary for the solution of the presented difficulty emerging in consciousness as a problem, accomplish an adjustment that was no longer possible on the lower level of habitual activity.

Various coördinations possessed by animals at birth.

Animals at birth, from the lowest to the highest forms, are equipped with certain coördinations through which they are adapted, without previous experience, to their environment. These coördinations are reflex and instinctive, and serve to bring about a more or less adequate adjustment prior to all experience. The lower down the scale of animal life, at least as far as the vertebrate series is concerned, the greater is the importance of these adjustments in the total reactions of the organism. The higher forms also possess at birth certain diffuse and uncoördinated reactions that seem to serve no immediate purpose, since they are not definite enough to bring about any helpful adjustments. An example of these latter reactions may be found in the ill-directed and seemingly wasteful movements of the infant, who on seeing a brilliantly colored ball suspended before it, makes a multitude of movements, none of which may accomplish the result of obtaining the ball. The visual stimulus of the colored ball sets up in this particular instance a nervous activity that finds no direct and definite discharge, spreading itself over the entire nervous system, innervating many muscles, but issuing in no successful series of adjustments. These diffuse movements, however, have an important function, since from them, by a process of selection, are chosen certain movements that later on become of the greatest value in the adjustment of the organism to its environment. Indeed, it is from the reflex, instinctive, and diffuse movements that the various complex adjustments of later life are developed. The learning process must make use of these primitive forms of adjustment in constructing the more complicated varieties that arise in the later experience of the organism. It is not so much that absolutely new adjustments are created, as that out of a large number of reflex and instinctive and diffuse activities, those that are most suitable for the proper adjustment of the organisms are selected.[1]

Learning through trial and error.

One of the most important means by which the animal learns new adjustments is through trial and error.[2] This is the hit-and-miss process by which, through slow stages of individual and racial experience, better adaptations have been effected. There are countless illustrations in the learning processes of man and brute alike of this method of arriving at more satisfactory adaptations to environmental conditions. In animal experimentation, this means of learning is the one which has been almost universally found to explain the behavior of the organisms studied. None of the lower animals seem capable of learning by any other means. The trial and error method is blind at the outset. A reaction is called for which has not been completely mastered. Repeated failures correct themselves gradually, and finally a reaction suited to the situation is acquired. The process of trial and error is extremely slow and wasteful, and it has played the chief rôle, not only in the learning of animals, but in the progress of the human race from savagery to civilization as well. Obviously such a method of learning is one which must be superseded in large measure by a

[1] This thought is clearly expressed and amplified by Dexter in the *Educational Review*, Vol. XXIII, pp. 81–91, 1902, in an article entitled "Survival of the Fittest in Motor Training." The writer says: "It is futile to attempt to teach a child a movement till the elements of the movement make their appearance naturally, in accordance with the laws of growth. . . . When the new coördination first makes its appearance, it is easier to suppress its unfavorable variations, and hence, in common parlance, to learn to act with precision. . . . Coördinations which have previously been set up in accordance with the laws of growth, but have not at the opportune time been selected for survival, may at a later period be made prominent, but not with the same ease, nor with the same success, as then."

[2] See Hobhouse, "Mind in Evolution," London, 1901, Chapter VIII.

shorter and more efficient process in the higher forms of education.[1]

A concrete illustration of this method of learning is found in the so-called puzzle-box experiment, which, under various forms, has often been employed in testing the learning processes of animals of various degrees of intelligence. In one experiment of this type the animal is placed in a box provided with a door, and secured by a lock or bolt or some other similar device, while outside as a stimulus, or incentive to escape, is placed food. The animal may open the door and obtain his freedom by a few simple movements, such as pulling a string or turning a button or sliding a bolt; but he goes about his task in a random fashion with no definite point of attack. He makes pawings or other characteristic movements. Finally, and by mere chance, he hits upon the right method of opening the door, escapes, and is rewarded by obtaining food. When a second time he is placed in the box, he perhaps succeeds a little better; and finally, after many trials, he learns to open the door of the box immediately and with accuracy. In this hit-and-miss manner he has finally acquired a habit which adjusts him to the specific situation that confronts him. If, however, the method of opening the door is changed to a considerable degree, the animal will probably find himself helpless again, and must once more learn through trial and error how to adjust himself to the new conditions that confront him. It is obvious, however, that if the animal could have acquired, in the first series of reactions, a general notion or idea of procedure, he could have applied this idea to the opening of the door under modified conditions.

This is the test of intelligent adaptability, namely, Can the individual adjust himself to a new situation without going through the slow process of trial and error, and secure an adequate set of reactions by means of his previous experience? In the last analysis, it is the aim of education to secure this adaptability.

The ability to form "free ideas," as they have sometimes been called, through which new situations are met and adequately solved, has quite generally been denied to

[1] Ruger, "The Psychology of Efficiency," *Archives of Psychology*, June, 1910, has shown that human beings also employ wasteful methods of learning, particularly in situations that are unusually novel. In solving complicated puzzles they exhibit to a considerable degree the same hit-and-miss type of learning as do animals.

animals in any large measure. This ability is probably present in the highest vertebrates in a rudimentary form, but is of little practical significance in their learning, which is confined, almost entirely, to trial and error and imitation.

Can animals form free ideas?

Psychologists have often raised the question as to whether animals are capable of imitation, and various experiments have been conducted to discover their ability in this direction. Before the question can definitely be answered, it will be necessary for us to consider three different senses in which the term "imitation" can be used.

The place of imitation in learning; Baldwin's "circular activity."

Baldwin[1] uses the term in its most fundamental biological meaning to cover a large number of phenomena that ordinarily are not classed as imitative. This he does by employing the notion of "circular activity." He sets out with the thought that all pleasurable activities heighten the tone of the organism, and, therefore, tend to repeat themselves. "Increased vitality tends to enlargement, range of movement, activity; while lessened vitality and organic decay tend to the opposite series of effects, *i.e.* shrinking, contraction of range, torpidity." Excess activity, with its tendency to repeat a movement once initiated, manifests itself "in the whole range of motor accommodations, from the protozoa which swarm to the light to the most difficult feat of the acrobat." The activities that come under the head of excess discharge, however, tend to form a circle of repetition, each succeeding one, in a sense, imitating the act that has gone before.

An illustration of circular activity is found in the manner in which infants, during the latter period of their first year, begin to acquire the rudiments of a language. The seemingly purposeless babblings of the little child, his ba-ba-bas, pa-pa-pas, and the like, come under this principle of circular activity. The sounds, at first spontaneously hit upon, give a physiological pleasure to the infant, and they are thus repeated.

[1] See, "Mental Development, Methods and Processes," N. Y., 1906.

By such means as these the child unconsciously acquires a set of useful adjustments which later on may be employed in a highly purposive manner.

A large number of the activities of animals which are perfected by repetition really belong to this class of imitation through circular activity. While there is no directed learning here, we find in these cases nature's most primitive attempt to teach her children.

Instinctive imitation.

Another sense in which "imitation" is used may be described for lack of a better term by the name "instinctive imitation," *i.e.* the impulse to copy without the consciousness of purpose. This sort of imitation is found in herds of animals, in groups of children, and in mobs of adults. The flock of sheep follow their leader quite without any purpose of imitating his movements. Children manifest this same general tendency in their plays and games. A determined leader is all that is necessary to excite the mob to acts of greatest irrationality. It is possible, because of this, to stampede conventions, lead bands of men to the cannon's mouth, and even to change the fashions of speech and dress. A few religious enthusiasts, returning from the Holy Sepulcher during the Crusades, set all of Europe dancing in an ecstatic frenzy. Few of us realize how much of our conduct, how large a proportion of our speech and manners, are traceable to this one fundamental principle.

Imitation as the conscious attempt to reproduce a copy.

Imitation in the narrowest sense of the word is the conscious attempt to reproduce a copy. While it is clearly evident that many animals are imitative in the first two meanings of the term as discussed above, there is considerable doubt as to the extent of their imitative powers in this latter sense. Recent attempts, however, seem to indicate that primates possess, to a degree, the ability to copy consciously. However, it is man alone that uses, in any large measure, conscious imitation.[1]

[1] See Hobhouse, *op. cit.*, Chapter VII., particularly pp. 149–151.

Learning on the highest levels involves abstracting from concrete experience general principles of procedure. This is the learning by formation of free ideas that we have spoken of above. In this stage of learning, past experience modifies the reactions of an organism, not in an unconscious way, but because the past experience has been raised to the level of reflective consciousness, and its bearings upon the immediate situation more or less clearly considered. The man who learns how to manipulate one piece of mechanical contrivance is better able to manipulate another that has certain aspects of similarity with the first, because he has been able to abstract from his earlier experience general points of view which are applicable in the new situation. Racial development is in no small measure due to the ability of human beings to employ this highest principle of learning. It has made social and individual progress possible.

The highest type of learning.

The methods by which the infant modifies his reactions to his environment are practically identical with those of the animal, discussed above. The child at birth, like the animal, possesses numerous reflex and instinctive activities, and gives expression to a large number of diffuse and uncoördinated movements, which later are to be used in a purposive way in the more complex adjustments of a wider environment. The primitive method of learning in the case of a child is the simple method of trial and error. Imitation in its various forms plays an important rôle, especially, as has already been pointed out, in the acquisition of language. The imitation is at first without purpose, but gradually the conscious aspect becomes more and more important, although purposeless imitation always forms a large part of the learning of both child and adult.

The learning methods of little children.

James has described the consciousness of the infant immediately after birth as a state of confusion. The senses of the child are assailed by a large variety of stimuli affecting the various end organs, all of which are functional in a more or less perfect way within a short time after birth. The fact that the child has these possibilities of experience does not mean, however, that he has any single completed experience, or that he has a world of definite objects of any sort. Not only must the sense organs themselves be capable of response to stimulation, but the proper connections with the higher nerve centers must be perfected. Such connections are in many instances lacking at birth. Further, in order that the child may, through sense stimuli, acquire a perception of the objects in the environment, it is necessary that he *react* to the specific objects in this environment. It is an important law of all learning that sense stimuli must be carried over into motor expression, manifesting themselves in specific movements directed more or less definitely toward or away from the source of stimulation. In other words, *a completed experience is not merely sensory, it must be motor as well*, or, to put it in another way, an object is not merely something to be sensed, it is something likewise to be reacted to, and its meaning grows and develops as the reaction becomes more comprehensive, accurate, and satisfactory. An object is, in the last analysis, constituted by a set of definite and consistent reactions.

A completed experience is motor as well as sensory.

The first things which a child knows in any real sense are those to which he has adequately reacted. Therefore, the first objects in his world to separate themselves out from the confusion of his dawning consciousness, are those objects in connection with which he has been provided with definite reflex and instinctive coördinations. These objects are the things that appeal to his fundamental organic needs, the satisfaction of which must be accomplished prior to any extensive experience, if life is to be sustained. The most primitive movements, like suck-

The first objects in the child's world those to which he definitely reacts.

ing, reveal to him the mother's breast or the nursing bottle as an object of definite experience. Later other objects which center around these organic needs and instincts, and to which he learns to adjust himself, become definite parts of his world, and gradually there evolve, out of the chaos of his beginning life, a few objective points, by which he reacts in an ever more adequate manner to his environment.

The pragmatic character of learning.

The learning process, at least during the first months of the child's life, is almost exclusively, if not completely, confined to gaining knowledge through the practical necessities that confront him. This is a fundamental law of learning for child and brute alike, and covers the widest ranges of racial and individual experience. It is for this reason that *knowledge is termed practical or pragmatic. It becomes an instrument by which the proper adjustment is accomplished.* Thus learning develops as there is a need and in direct response to this need.

Curiosity an incentive to learning.

It is, however, an error to suppose that the only incentive to learning is of this directly and immediately practical character. The instinct of curiosity, which leads the organism to explore its environment beyond the immediately pressing aspects of that environment, has resulted in an extension of experience which has been of the greatest benefit. Thus finally curiosity, which impels the organism to explore without any purpose beyond the satisfaction of that curiosity, becomes of the highest practical importance in the adaptation of the organism to its future environment. Curiosity is the means by which the individual stores up for future use information which may serve in the time of need. It is this primitive impulse which in its highest development lies at the basis of scientific inquiry.

Play, like curiosity, is an important factor in the learning process. It, too, has no ulterior motive, but finds satisfaction in its own expression. There are three principal theories in regard to play. Formerly the most commonly expressed theory, the one advanced by Herbert Spencer, held that play is to be explained as the result of the surplus energy of the organism. Excess vitality leads to movements that have no utilitarian value. More recently Stanley Hall[1] has set forth the theory that play is atavistic; it is the rehearsal by the organism of certain ancestral activities that no longer possess utility. Doubtless, there is a truth in both of these theories, but the one which is most significant from the standpoint of the psychology of learning maintains that the real philosophy of play is that it is a preparation for future activities. This is the standpoint of Karl Groos, as set forth in his works on the "Play of Animals," and the "Play of Man." Thus play, like curiosity, although it serves no immediate purpose, prepares the organism for a future environment to which it must adequately adjust itself for survival and progress. It thus appears that through curiosity and play both the child and the animal are capable of going beyond the immediate and practical environment, in this manner extending their control, so that they shall be better able to cope with those conditions that shall ultimately demand attention.

Play a factor in the learning process.

[1] "Adolescence," New York, 1908, Vol. I, p. 202. "The view of Groos that is practice for future adult activities is very partial, superficial, and perverse. It ignores the past, where lie the keys to all play activity. True play never practices what is phyletically new. . . . It exercises many atavistic and rudimentary functions. . . . I regard play as the motor habits and spirit of the past of the race, persisting in the present as rudimentary functions sometimes of, and always akin to, rudimentary organs."

CHAPTER II

PRACTICAL APPLICATIONS OF THE GENERAL PRINCIPLES OF LEARNING

Possibilities of education through social inheritance.

We have already seen that the education acquired by an individual in all probability cannot be transmitted through physical inheritance to his descendants. The skill gained in playing the piano ends with the person who has gained it, unless he teach the technique to others, or by his skill as a player inspire others to emulate him until they master the technique that he has acquired. *The skill as such cannot be inherited.* The son may be taught by the father, or because he is reared in a musical environment, he may turn his attention to the learning of the technique of the piano or of some other musical instrument. This learning, however, is not inherited, but it may become something vastly important in the scheme of education. If the skill were merely inherited, it could at the best be handed on but to a few by direct transmission. On the other hand, a great genius may profoundly affect many individuals in his generation, and through affecting them cause the widest modifications in generations yet to come.

The teacher must aim to make the pupil socially effective.

Here lies the greatest opportunity and hope of an educational system. *The individual must be so educated as to be made socially effective.* The educational ideal must always have in mind the welfare primarily of the social group, rather than of the separate individuals that compose that group. It should, therefore, be the aim of the teacher to make the pupil socially efficient to a maximal degree, and he should give his best and highest efforts to those pupils who possess the greatest talents, particularly if these talents are joined with evident possibilities of social dominance. The mediocre pupil may be raised through the efforts of the teacher to a moderate degree of efficiency, but it is doubtful whether the teacher can make such a pupil sufficiently effective to modify to any marked degree the *milieu* in which that pupil is placed.

The necessity of providing special education.

It may be seriously questioned whether the democratic ideals of a similar opportunity for all in education should not be radically modified. If the aim of education is to promote social efficiency, then it is perfectly obvious that this aim can be realized not by giving equal opportunities of education to all, irrespective of their individual abilities, but by selecting the most capable and by giving these special opportunity. We recognize to-day the necessity of providing special education for mentally backward and defective children. We justify these special schools in part because we argue that these defectives may be educated sufficiently to be made self-supporting. Very largely, however, the reason for the existence of such schools is to be explained as due to the sympathy which society has in the unfortunate class as such, apart from any consideration of the social value of these defectives. *Every argument that applies to the special treatment of the subnormal classes, applies with far greater force to special opportunities for those possessing superior talent or genius.* The education of the talented pupil up to his highest potentialities means a tremendous social asset. For this reason the most advanced and most specialized schools should be supported by the state; schools from which no individual is theoretically debarred, but which only the few who have the greatest abilities can actually enter.[1]

[1] See Stern, "The Supernormal Child," *The Jour. of Ed. Psychol.*, II, pp. 181–190. At present there are special classes for gifted children in the public schools of Baltimore, Worcester, Indianapolis, and Cincinnati.

It would be a wrong inference, however, to conclude that, because there is a special need for educating the talented child to the fullest extent, the middle class of children should be ignored. Even if we should maintain that the great mass of children have no rights as individuals, but only as parts of a great social scheme, we should still be obliged to recognize the fact that even the greatest genius cannot accomplish social betterment in an environment that is hostile to him, and does not comprehend or sympathize with his aims and purposes. Therefore, *the great mass of children must be educated to their highest efficiency in order that the social ideal may be realized.* It is not that education should do less for them than it does at present; it doubtless should do more. On the other hand, the necessity of providing a special and superior education of the few most capable individuals must be clearly recognized if our social progress is to be satisfactory.

The entire mass, however, should be educated to their highest efficiency.

The standards of efficiency in the schools are not to be too narrowly interpreted. Efficiency must be recognized not alone in the traditional school subjects and by the customary school tests, which often are entirely inadequate in determining the pupil's greatest ability. Provision must be made for the discovery of efficiency of all sorts by offering opportunities in the school curriculum for the expression of varied ability. The recent emphasis of industrial training is most important in this connection. The advance that is being made in the psychology of individual differences is likewise of promise.[1]

The school must seek to discover efficiency.

[1] Applied psychology is recognizing more and more the necessity of studying the individual as distinguished from the mass. In Germany, under the leadership of Stern, Lipmann, and others, extensive plans are being perfected for the determination of those factors which are important in individual variation. The psychology of individual differences is particularly important in

The trial and error method, so important in all stages of learning, even in the highest, must be minimized in all formal and systematic education, although it never can be entirely eliminated. The actual try-out of experience is at every level a necessary means of acquiring knowledge and skill. As higher and more rational forms of learning are developed, the range of trial and error should become less, since the field within which it has scope can be very much narrowed through a conscious direction of the learning process. A person who is acquainted with the general principles of machinery, on attempting to operate a new machine, will be obliged to investigate it in order to discover just how it works. However, in this try-out there are many details which he will not attempt to investigate, because his general knowledge will give him information concerning them. There are some particulars, however, which he must discover by actually trying how the machinery works. The person unskilled in the use of machinery may, after a long and elaborate exploration, in which he uses almost entirely the process of trial and error, finally

Effort should be made to narrow the field of trial and error.

the schoolroom. No system of grading, however perfect, is adequate unless the children so graded are recognized as separate individuals with peculiarities and capacities which demand oftentimes particular treatment. It is no longer possible, in the light of modern investigations, to hold that any one method of instruction, or plan of procedure in school technique, can be applied with like favorable results to all children, not even to all normal children. A method of instruction in reading, for example, which will be effective for the child possessing strong visual imagery, may be of very doubtful merit when used in instructing a child of the motor type. It is to be hoped that the time is not far distant when certain standard tests may be devised to determine the sensory and intellectual differences of children, to the end that instruction may be modified and adapted to suit individual rather than general needs. Not only is the psychology of individual differences important in its bearing on the methods of instruction ; it is likewise important in ascertaining the interests and capacities of children and adolescents for various kinds of school work and for various kinds of occupations in the life outside the school. No one course of study can be ideal when considered from this point of view.

find out how the machine is to be manipulated. The skilled individual, on the other hand, consciously limiting the scope of his inquiry, and thus the field of trial, will arrive very much more rapidly and directly at the goal of his endeavors.

Trial and error in aviation.

An interesting illustration of the workings of the principle of trial and error when under conscious direction is found in the new science of aviation. The crude beginnings were made by constructing machines from general mechanical principles already known, but accurate knowledge in regard to atmospheric conditions was soon found to be surprisingly slight. The Wrights and other pioneers in this field worked with gliders to ascertain the principles of support, balancing, and soaring. These principles could be determined only by an actual try-out, and could not be deduced from any known laws. When motors were used, it was found that there was a marked difference in the behavior of powerfully driven machines from that of the slowly moving gliders. Under these new conditions it was found necessary to unlearn a large part of what had already been learned. "We have flown and flown till we hunted out the reason for these things, and found how to modify the machine to prevent them." [1]

Frederick Todd [2] gives an interesting description of the atmospheric conditions with which the aviator must experiment in the actual try-out of experience in flying. At the outset he had no generally known laws to guide him. Todd says: "Every man with whom I have talked who has been up in the air upon any kind of a flying-machine says the same thing about the turmoil of the air above the surface of the earth. It is incessantly moving, yet never moving along steadily. It goes by fits and starts and it dearly loves to go into whirls. . . . The surface

[1] See *World's Work*, XVI, p. 10809.

[2] *Op. cit.*, pp. 10659–10680, and 10802–10819.

winds strike against houses, trees, fences, in their flow, and bound upward. . . . Light aeroplanes feel a difference in the upward push of heated air rising from different fields, as when passing from a potato field to mown stubble. Five hundred to a thousand feet up within the zone of surface winds, breezes may be encountered flowing in different directions."

The swirl and buffeting of the air currents result in condensations and rarefactions of atmosphere that are a constant menace. It was a "hole in the air" that sent the expert aviator Hoxsey to his death on December 31, 1910, at the Los Angeles meet. Under such novel conditions as these it will probably be a long time before aviation will have passed entirely beyond the stage of trial and error into that of finally established scientific principles. This period of trial and error will cost much in money and in life. It is, however, necessary for ultimate achievement in any new field.

In this discussion it must be remembered that trial and error among the lower orders of animal life and in man may mean something so essentially different that a confusion is likely to arise if we do not take account of this difference. Among zoölogists trial and error signifies merely the attempt of the organism to adjust itself to new external conditions in such a way as to secure a better adaptation to its environment. This in no way implies a conscious try-out on the part of the organism concerned. When, however, we have reached a higher stage of development, particularly in man, we may assume, as we have already pointed out, that trial and error is something more than a mere hit-and miss process through which an adjustment is finally secured. The trial becomes a conscious one, and is self-directed.[1]

[1] "The application of the phrase 'trial and error' to lower organisms arose as follows: These organisms react to changes in the conditions by movements of a peculiar character, which subject them to various environmental changes. Some of these changes cause them to react further, still further changing the conditions. Finally, as a rule, their continued movements bring them into conditions which do not cause them to react by further movements." Quoted from Jennings, "Comparative Psychology," *Amer. Nat.*, October, 1909.

When the individual cannot of himself exercise this direction, it may be in a way done for him by another who purposively narrows the scope of trials within a certain definite series of phenomena. It is the business of the teacher to thus consciously limit the field of exploration for the child by laying down rules and giving instruction in general principles of procedure; by acquainting the child through various methods of instruction with a large body of facts, which have been laboriously discovered through the experience of the race, but which the child cannot find out directly, because to do this would preclude all possibilities of advance from one generation to the next. Still, it should be remembered that there are certain things the child should be allowed and even compelled to find out for himself. The so-called inductive method of instruction has a place here, but probably a very much more limited place than its advocates have supposed.

The teacher must limit the field of the pupil's exploration.

There is a prevailing opinion among certain educators that one of the best methods of teaching a lesson in physics, for example, is to require the class to go through a large number of details in the collection of materials for a physical experiment and in the conduct of the experiment itself. Suppose that a seventh grade class is to be given instruction in the making and use of the electric battery. The children may be required to get together with a great deal of difficulty and pains the materials necessary for the construction of the battery, — the glass jar, the copper and the zinc, the wire, the acids, and so on; then they are told in the class to make the proper connections with the various batteries so that the current may ring an electric bell. After a great amount of trouble, and no little expectation, the wiring is completed, but the bell does not ring, and the class ends with the experiment unsuccessful. When we are told that this sort of a result is the one to be desired, and that the child will be taught by his first failure to see his mistakes and to profit by them, we may question the legitimacy of such a conclusion. The very fact that the whole procedure has been unsuccessful, and that the children have no real knowledge of why it has not succeeded, since they have not sufficient acquaintance with the principles of electricity to narrow the field of their attention to the essential difficulties with which they are confronted, causes a confusion and misunderstanding which is not likely to be cleared up by their own investigations. It is probable that eventually the teacher will be obliged to point out to them their mistakes and to suggest the proper remedy. It is by no means certain, however, that the children will carry away from this experiment a sufficiently comprehensive knowledge of the right method and the principles underlying it to compensate for the great loss of time and the possible erroneous conceptions which may grow out of their failures. If in the first place the teacher had provided the pupils with the materials and had directed the children carefully in their manipulation of these materials, the initial result would have been successful, and a great saving in time would have been achieved. It would then have been possible for the class to follow out the method of the teacher with a clear understanding of the aims, means, and results.

To compel the pupil to follow out the roundabout method of trial and error in gaining knowledge is to put him on the level with the animal, which cannot learn through instruction and intelligent imitation, but which can succeed only after repeated failures and many trials in arriving at a simple and habitual series of reactions.

Danger of university methods in elementary and secondary education.

The fault of generalization from a large mass of particulars that cannot be readily mastered and unified is again illustrated in some of the methods in the teaching of history that have been recommended and practiced in the higher grades and in the first years of the high school course. Among the gravest errors here is the attempt to bring university methods down to the period of later childhood and early adolescence. Such methods are continually advocated.

For example, in the report of the Committee on Methods of Teaching and Study of the New England Teachers' Association, among many excellent suggestions, we find the following, which for the age in question is distinctly unpedagogical:[1] "The raw material should be put before the student, he should organize it for himself, take his own point of view, draw his own conclusions, formulate his own statements. The teacher appears only as a guide and critic." The Committee of Seven likewise recommends that the pupil get ideas and facts from various books and put

[1] See *Journal of Pedagogy*, XIV, pp. 130–140 (1901).

these facts into new form as a mental training. Now, while it seems quite possible that such a method of comparison and analysis may have a value for older pupils in the high school, it can have no other effect than to add confusion to the already confused minds of the younger pupils. Akin to this fault is the practice of sending pupils to original sources of history on account of a supposed greater attractiveness and value of these sources, or because of a desire to train the pupil in methods of historical investigation. "Collateral reading," says the report of the Committee on Methods of the New England History Teachers' Association, "should be done as largely as possible in the sources of history, for such reading reveals to the student the inner spirit of the age, puts him in sympathy with its people, shows him their ideals and their aspirations as well as their achievements." Equally unpedagogical are those texts, once somewhat in use, that are composed largely of quotations from original sources connected by a meager sentence or paragraph of the author's compiling.

The fundamental error lying behind all these methods is found in the assumption that the child, with his limited viewpoint and slight powers of attention, can gain from a large mass of material the results which have been obtained by the deductive and inductive methods of mature mind.[1]

The educative method of nature.

We have already seen that through curiosity and play, nature has provided a means whereby the organism is enabled to adjust itself to a future environment. It is the province of education to do consciously and systematically that which the natural instincts accomplish on a lower level of learning. Apart from these instinctive factors, the only education that nature affords is an adjustment to an environment, immediate and present, an environment that "selects" without real choice, and plans without conscious "purpose."[2] This environment works by favoring those variations in an organism which are best fitted to enter into harmony with the immediate external conditions. Other variations may be ideally more worthy or better adapted to a future environment, but that is not the test applied. The future suitable

[1] See Bagley's "Educative Process," pp. 276–277.

[2] See discussion in *Educational Review*, XXIX, pp. 510–515 (1905).

and desirable must always yield to the present necessary. In a primitive society the individual possessing the latent capacities for a superior intellectual and moral attainment might readily be crowded out of existence by competitors whose only claim to survival was mere brute force. The environment asks no questions concerning the future desirable. The organism that survives must be efficient in the present and the present alone.

The environment to which education seeks to adapt the individual.

How far a natural environment differs from that to which education should seek to adapt the individual needs scarcely to be set forth. *It is the future environment that education, whether it be practical or theoretical, material or spiritual, must consider.* How often does it place the child out of harmony with the present, in order to secure his adaptation to the future non-existent and ideal. If the test of immediate adaptability were brought to bear, the gamin would be better educated than the schoolboy. The dog is *trained* by an immediate environment to do a few things well, interpreted in terms of that immediate environment. The child should be *educated* to do many things well, interpreted in terms of a future environment. The adjustment demanded in the learning process is not an adjustment to a brute fact, but to a world of meaning, present, yet remote, real, but also ideal. It should further be remembered that perfect adjustment for the human being is no longer the criterion of adaptation and survival, as it is in all nature below man; for perfect adjustment would mean stagnation, and finally intellectual and moral death. Since the adjustment demanded in the higher learning processes is so largely a future adjustment, educational values must have as their final justification an ideal. So the philosophy of education must first formulate its ideal before it can discuss intelligently the problem of adjustment, either from a normative or a historical standpoint.

Would not the Spartans have agreed that education is adjustment to environment, if you had allowed them to define that environment in terms of their ideal, military prowess? The Athenians, too, would have consented on similar terms, insisting that the true environment was not only physical, but intellectual and æsthetic as well. Plato would have found such a definition in harmony with his philosophy, but would have told us that we should not confuse a real environment with this world of shadows. We should rather prepare the youth for association with the world of changeless and eternal ideas, for Plato the sole reality. The Epicureans, as well, would have found no fault with the conception of adaptation, but would have insisted that the only environment to be considered is the one giving hedonic enjoyment. Likewise the Stoic would have consented, but would have told us that the environment to which we are to conform is our highest self, objectified in a world of pure reason. The Neo-Platonist, so badly adjusted to this world that he sought in the Beatific Vision to escape it, would have been quite content to subscribe to the terminology of adaptation, but he would have understood by it adjustment to the Ineffable One. And so the Christians of the Middle Ages would have agreed, with a similar thought, that the true environment is to be found in a world beyond. Education in terms of adjustment would have meant to the Renaissance, in its revolt from mediævalism, adjustment to a present world, not of cold facts, but of æsthetic realities; and so on through the list, until we come to our own time, with its exaltation of practical utilitarianism. *Education is always adaptation, but it is to an ever changing environment, determined by the meaning which the conscious idea gives to this environment.*

Educational ideals of various periods of history.

The mistake must not be made of supposing that the child can be prepared for this future ideal environment, except through the present environment. Therefore, *formal education, like the unsystematic education that the* *environment imposes on the individual, must make use of those capacities for adjustment already present in the individual.* It must select from the various reactions present those that should be preserved or modified, and should not expect to create any absolutely new adjustment. The future environment to which the child is to be adjusted may be entirely incomprehensible to him in his present stage of development. We have already assumed that the aim of education is social efficiency, and the child is to be educated toward this efficiency. In the last analysis no education can justify itself which does not tend to make the child a more helpful and better member of society. It by no means follows, however, although some educators and theorists seem to have made the assumption, that the child himself can be made to understand the nature of this aim, and to be stimulated by it in his school work. Very often, probably generally, the immediate ends that spur the child on to his highest endeavors in his school environment, are of a different nature. The social efficiency which he comprehends is of a much narrower and less exalted type than that which education has as an end. The child who is socially efficient from his own standpoint is the one that succeeds in his school activities, and in competition among his fellows in his play and work.[1] The spirit of competition may bring about beneficial results when systematically applied to school methods. The old-fashioned spelling match, which, doubtless, at one time was carried to an excess, had much to commend it for this reason. Its judicious use as a school exercise is not without value to-day. The matching of one room against another, likewise, has a stimulating effect and tends to arouse and maintain interest.

Education must make use of the child's capacities.

The mistake has been made of assuming that the

[1] Compare in this connection Chapter IV and Chapter XIX.

interests which dominate the social organism and which appeal to the child as a part of this organism are exclusively practical, particularly in the narrower economic sense of the term. It has already been pointed out that curiosity and play are important factors in the education of the child and of the brute as well. Curiosity of the intellectual type often becomes a motive for the child's endeavors, just as truly as it does for the adult's. Further than this, the spirit of play, when introduced with proper precaution into the school exercises, is a stimulus to the child.

The child's interests not exclusively selfish.

Play gives incidental instruction in a variety of ways when properly devised. It is a valuable aid to drill, and by means of different plays the form of presentation may be varied, while the essence of that which is taught remains the same. This prevents monotony, which is often the greatest evil of drill, and which may make the effect of repetition, after a short time, negative.[1]

[1] An example of incidental instruction through play is to be found in "the spelling game" in the first primary grade. The teacher writes on slips of paper a dozen or more words and arranges them, face upwards, along the chalk trough of the blackboard or some other convenient place. One of the children is told that he is to find the word *i-s* (spelled out by the teacher) from the list of words that have been previously written and arranged. He is sent out of the room for a moment while the words are arranged, and then comes back to search for the proper word. As he moves about trying to find it, the children clap, softly if he is far away from the word, and louder if he is near it. When he finds the word, they clap with all their might. He picks it up, spells it out, and pronounces it, handing it to the teacher. The game is continued with other children, and in this way a number of words are learned so that they can be recognized when seen, and also can be spelled out.

In this connection may be mentioned the classic instance of education through play, as portrayed by Dickens in "Oliver Twist."

"There, my dear," said Fagan. "That's a pleasant life, isn't it ? They have gone out for the day."

"Have they done work, sir ?" inquired Oliver.

"Yes," said the Jew ; "that is, unless they should unexpectedly come across any when they are out ; and they won't neglect it if they do, my dear, depend upon it. Make 'em your models, my dear. Make 'em your models," tapping the fire-shovel on the hearth to add force to his words : "do everything they bid you, and take their advice in all matters — especially the Dodger's, my dear. He'll be a great man himself, and will make you one too, Play, as the expression of the dramatic instinct, may be made serviceable in the study of literature. The dramatization of "Hiawatha" and similar poems is a case in point. The presentation by the older pupils of some of the plays of Shakespeare, or perhaps better, parts of them, is always sure to secure interest, and aid in the understanding of these plays. Curiosity should be legitimately stimulated whenever possible. The school readers should contain stories that have a genuine interest for the child, and which tempt him to read beyond the extent of the day's lesson. In assigning lessons, it is possible for the teacher to make suggestions that arouse the curiosity of the child, and call his attention to the important aspects of the assignment.

The importance of self-expression.

We have already seen that mere sensory experience is insufficient to give a world of objective reality. *Every completed experience involves an adjustment.* The sensory motor arc must be traversed. This general principle is of fundamental educational significance. In the last analysis it means that there must be some form of self-expression on the part of the child if any real learning is to take place. This does not, of course, necessarily mean that the child must be required to execute with his hands, although various forms of industrial training in the grades and secondary

if you take pattern by him. Is my handkerchief hanging out of my pocket, my dear?" stopping short.

"Yes, sir," said Oliver.

"See if you can take it out, without my feeling it, as you saw them do when we were at play this morning."

Oliver held up the bottom of the pocket with one hand, as he had seen the Dodger hold it, and drew the handkerchief lightly out of it with the other.

"Is it gone?" cried the Jew.

"Here it is, sir," said Oliver, showing it in his hand.

"You're a clever boy, my dear," said the playful old gentleman, patting Oliver on the head approvingly. "I never saw a sharper lad. Here's a shilling for you. If you go on in this way, you'll be the greatest man of the time. And now come here, and I'll show you how to take the marks out of the handkerchiefs."

Oliver wondered what picking the old gentleman's pocket in play had to do with his chances of being a great man. But, thinking that the Jew, being so much his senior, must know best, he followed him quietly to the table, and was soon deeply involved in his new study.

schools are chiefly to be emphasized for this reason rather than for their practical significance. The child should be required to do something in connection with all the subjects of the curriculum. For example, in literature he should be required to express the classics which he studies orally, with understanding and sympathy; in nature study he should collect specimens and care for plants and animals. Map drawing and clay modeling are interesting and instructive activities which are extremely useful in the study of geography. In number work the pupil should be given actual problems to solve, and construction work should be made an essential part of the study. There is no aspect of education so abstract that it is entirely removed from the possibilities of self-expression. It should, however, be remembered that this expression should be something which naturally inheres in the subject matter, and not something which for pedagogical purposes is artificially attached to it. Such artificiality should never be encouraged; in the end it defeats its own purposes.

CHAPTER III

REFLEX-ACTION, INSTINCT, HABIT

The relation of consciousness to reflex activity.

THE simplest activity of the nervous system is represented as due to a stimulus affecting an end organ, traversing a sensory nerve to a specific brain center or centers, and then transferring itself to a motor nerve that innervates a muscle and results in an adjustment. Angell defines a reflex activity as one "in which a muscular movement occurs in immediate response to a sensory stimulation without the interposition of consciousness." As Angell points out, consciousness may be aroused in connection with this reflex activity, but this consciousness does not initiate the activity, nor in any way control it.[1] The consciousness is purely incidental to the activity itself. One of the simplest examples of reflex activity is found in the pupillary reflex. The retina is so constructed that varying intensities of light act as a stimulus that increases or decreases the size of the pupil. Here we have an entirely unconscious adjustment, both in the sense that there is no conscious control of the pupil, and also that the individual himself is unaware, except by indirect means, that the adjustment is taking place. When the child puts his hand out and touches the glowing stove, he draws away his hand in a purely reflex manner. In this second case, however, although consciousness does not control the act of drawing away, the child is presumably conscious of the movement that he has made. Simple reflex activities of such a character as above described do not require the intervention of higher nerve centers in their activities.

[1] See "Psychology," 4th ed.; revised, New York, 1908, p. 337.

Beside the simple reflex activities, which are primarily executed in the lower nerve centers, there are other activities of a non-voluntary type that function either at birth or arise later in the life of the organism, and which are not due to experience. From the simple reflexes may be distinguished the so-called impulsive activities, the origin of which is to be found within the body and which are not due to external excitation. Changes in circulation, digestion, and the like, and modifications within the nerve centers themselves may be responsible for the expression of these activities. The squirming, crying, and kicking of the infant are, in a large measure, the expression of activities of this sort.

The nature of impulsive activities.

The most complicated sort of non-voluntary activities are the instinctive. A confusion is made by some authorities between the simple reflex and the instinctive expressions. The distinction between them is rather a matter of degree than of kind. Instinctive activities, as has already been said, are complicated in their nature. The simple reflex activity involves relatively few paths of stimulation and discharge. The instinctive activities, on the other hand, may involve many coördinated and interrelated paths, issuing finally in some purposive reaction. Simple reflex activity is often unaccompanied by consciousness, while on the other hand the instinctive activities may have a large conscious accompaniment, which is necessary not for the expression of the instinct itself, but for the direction of various details in the complex process. For example, the nest-building activity of the bird is purely instinctive, and is in no way the result of previous learning; yet the visual and other experiences which arise in the actual building of the nest are necessary in the details of its construction. The general direction of the activity is, nevertheless, entirely independent of these experiences. In the nest-building activity is found also a third distinction that exists between the

Instinctive activity distinguished from simple reflex activity.

simple reflexes and instinct, namely, that in the latter there is a degree of emotion, while in the former the affective, or feeling element, is for the most part absent. *An instinctive activity may then be defined as a group of reflexes organized toward some definite goal and accompanied in their expression by a conscious correlate of more or less clearness, and attended by an affective tone of greater or less intensity.* Where the simple reflexes and impulsive activities leave off and the more complicated instincts begin, it is difficult to say. No two writers would probably agree upon any definite line of demarcation between simple reflex activity and instinct. Indeed, as has already been pointed out, some give the name of instinct to practically all non-voluntary activities furnished to the organism through inheritance.

A list of the most important human instincts.

While it has not been possible to determine with more than relative accuracy the instinctive tendencies and interests of human beings, certain general facts of significance to education seem reasonably well established. The most important instincts from the standpoint of the learning process, some of which have been discussed in another connection, are the following: —

Fear, anger, sympathy, affection, play, imitation, curiosity, acquisitiveness, constructiveness, self-assertion (leadership), self-abasement, rivalry, envy, jealousy, pugnacity, clannishness, the hunting and predatory instincts, the migratory instinct, love of adventure and the unknown, superstition, the sex instincts, which express themselves in sex-love, vanity, coquetry, modesty, and, closely allied with these, the love of nature and of solitude, and the æsthetic, the religious, and the moral emotions.

The above list does not pretend to present all of the human instincts that have been cited at various times in the literature on the subject. Nevertheless, it is fairly comprehensive. A more difficult problem than the enumeration of important instincts is raised in connection with their classification. The foregoing enumeration has presented the various instincts somewhat in their genetic order, *i.e.* in the order of their development in the life of the child and adolescent. There is a general agreement that fear is among the earliest instincts to appear, both in the child and in the race. Anger, and rage likewise, show themselves at an early period of development, while sympathy and affection appear somewhat later. The play instinct in its most primitive form, together with imitation and curiosity, are fundamental instincts. The more distinctly social instincts follow in time these earlier tendencies. The sex instinct, both in its direct and indirect forms of manifestation, does not appear in its complete expression until the onset of puberty.

Classification of the instincts from the genetic standpoint.

Another classification of instincts divides them into egoistic, altruistic, and mixed forms. Fear, anger, self-assertion, rivalry, envy, pugnacity, and the like clearly center themselves in the individual that gives expression to them; while sympathy, affection, and the higher moral emotions belong to the class of altruistic tendencies that have regard for others. Of the other instincts, several at least have both egoistic and altruistic aspects. This is true, for example, of sex-love, and even of the religious instincts.

Egoistic and altruistic instincts.

Still a third classification of instincts groups them as personal and impersonal. The personal instincts center around human beings, and, through a natural extension, animals as their objects, while the impersonal instincts express themselves in relation to inanimate objects. Among these latter may be mentioned the love for nature and solitude and the appreciation of artistic products.

Personal and impersonal instincts.

A few of the instincts discussed above do not easily fit into any of the foregoing classifications. They have been termed the adaptive instincts. They include play, imitation, curiosity, acquisitiveness, constructiveness, and are the most important of all the instincts from the standpoint of the learning process, since, as we have already seen in the case of play, their peculiar function is to adapt the organism to its environment in advance of its actual needs.

The adaptive instincts.

In this connection the thoroughgoing classification of Kirkpatrick[1] may be mentioned. He gives the following: —

(1) Individualistic or self-preservative, expressed in securing food, avoiding danger, and in fighting enemies and rivals. (2) Parental or racial instincts, expressed in sexual reproduction and the care of the young. (3) Social instincts, expressed in coöperation among the various members of the group. (4) Instincts in the higher animals and in man that are correlated with these principal groups, including the adaptive instincts (play, imitation, and curiosity) and many specialized instincts such as the constructive and collecting instincts; the æsthetic instinct; leadership, teasing and jealousy; the expressive instinct, a special form of the social instinct that leads animals to make sounds indicating their own bodily or mental states, "and further results in man in the creation of art and literature, and the regulative instinct that manifests itself in its highest forms in moral and religious behavior."

Not all reflex and instinctive activities with which the organism is equipped through its inheritance are functional at birth. Some appear at certain periods during the development of the individual. One of these, at least, the sexual instinct, shows relatively slight evidence of its existence until puberty, and many others are delayed for some time. The infant, for example, during the first weeks of its life generally shows no evidence of fear. Yet without any reason, as far as the environment is concerned, he develops what sometimes amounts to a state of terror in the presence of strangers. There are many other examples of fears that, as Hall[2] believes, are

Gradual appearance of instincts.

[1] "Genetic Psychology," New York, 1909.

[2] "Childish fears are among the very oldest elements of the soul, and the fact that they do not fit present conditions, but do fit a past environment so well, is the basis of some of the strongest arguments for psychogenesis." "Adoles-

due to racial experience, and not to any learning on the part of the individual, which appear at various stages in the life history of the child. Curiosity, imitation, and play are instinctive activities which are not present at birth, and a large number of other similar expressions make their appearance from time to time without any definite reason as far as the experience of the individual is concerned.

In connection with the principle of the gradual appearance of instincts must be mentioned another fact which is of great educational importance, namely, that instincts, when they appear, if they are not given the proper environment for their expression, may pass away without ever becoming established as habits in the life of the organism. As has often been pointed out, the instinct for following a moving object develops in the chick at a certain time after its emergence from the shell. If the chick, however, is kept in confinement, and does not have the stimulus of the mother hen, or some other object to call this instinct into play, the tendency to follow will gradually die out, and later on it cannot be taught to the chick.

Instincts must be made permanent through expression.

In the third place it should be borne in mind, that reflex and instinctive activities, while they are directed toward certain ends, are more or less variable in their application. For example, the chick, a short time after emerging from the shell, will perform the definite coördination of pecking at a grain placed on a piece of white paper. Here there is an activity due to the light stimulus from the object falling upon the retina of the chick, with the transmission of the stimulus to the higher sensory centers and its subsequent transference to the motor nerves, which transference results in the proper muscular adjustment. However, the chick soon learns through experience to distinguish between those particles which are pleasant

Variability of instinct.

cence," II, p. 371. See also "A Study of Fears," *Amer. Jour. of Psychol.*, VIII, pp. 147–249 (1897).

and suitable for food and those which are disagreeable. Thus the instinct, which formerly was general, has been so modified as to be applied only to certain kinds of objects which the chick sees. In a similar way the human infant, after the first few months of its development has a tendency to pick up and put into its mouth any object that comes conveniently at hand. Through its experiences, however, it after a time learns the difference between candy and a quinine tablet, and modifies its instinctive reaction accordingly.

Modification and elimination of instincts.

In the fourth place, instinctive and reflex activities can be modified, and, perhaps, if not too fundamental, entirely eliminated, by bringing them into competition with other activities of a similar nature. For example, the instinctive activity of the child to fondle animals may be completely inhibited by a scratch from a frightened cat or the bite of an angry dog. As a corollary to this statement, it should be borne in mind that no instinctive or reflex activity can be created *de novo*. Further it must be remembered that many instincts cannot be entirely eliminated, and that all that can be done is to direct them in the way in which they should discharge.

Pleasure-pain in relation to the activities of an organism.

As we have already said in the discussion of the circular-activity theory of Baldwin, pleasure heightens the vital tone of the organism and increases its activity, while pain, lowering the vital tone, has the opposite effect. Pleasure in itself is always immediately beneficial to the organism; the unpleasant, always harmful. Under the direction of these two opposing experiences the activities of the organism are furthered or hindered, as the case may be. The child who, seeing the stick of candy, reaches out and gets it and puts it in his mouth, has thereby the reaching and the sucking instincts more fully confirmed. On the other hand, the chick, pecking at a bad-tasting worm, learns through the guidance of the disagreeable experience to refrain from pecking that sort of an object again. The many diffuse movements with which the organism is provided are selected and preserved or discarded in proportion as they result in pleasurable experiences or their opposite. It is, then, through this underlying principle of pleasure and pain that the development of the organism's adjustments to its environment progresses.

Pleasure not the conscious end of activity.

The mistake should not be made, however, of supposing that pleasure and pain are the end toward which the adjustments are made. These adjustments occur not to secure satisfaction, but satisfaction arises when the adjustments are satisfactorily made, while dissatisfaction indicates a maladjustment. This law may be made more definite by a concrete illustration. The infant who sees the red ball suspended in front of its chair, and who reaches out and grasps the ball, does not execute this activity because of a desire to obtain pleasure. The activity is of a spontaneous or instinctive character, and the pleasure issues simply because the end of the activity has been gratified. The principle involved may be expressed by the statement that *pleasure is not the conscious end of activity, but is the necessary accompaniment of all activities that result in adequate adjustment.*

The neural basis of habit.

Habit can be explained, like instinctive and reflex activities, in terms of the neural basis on which all habits are supposed to rest. James pictures habit as being set up through paths of least resistance, formed in the nervous system by repeated stimulation and response in certain definite directions. We may look upon the nervous system in its early stages of development in the race and in the individual as being relatively undifferentiated, although the coördinations already discussed that exist at birth must be regarded as based upon certain most permeable tracks in the nervous organism.

The explanation for the diffuse movements already discussed is to be found in the circumstance that the stimulation which reaches the higher centers finds at first no direct and simple path of discharge, and, therefore, spreads out in various directions; but after a time, since it happens that discharge in certain of these directions results in more suitable reactions than in others, the discharge in these directions is furthered, until at length the stimulus finds only one path for its outlet. Gradually as the nervous system develops in perfection, paths of preferred conduction become more numerous. Those which arise through inheritance are of the reflex and instinctive type. Those that are due to experience are habits. *A habit may then be defined from the neurological point of view as a path of preferred conduction between stimulus and response set up by and due to the life experiences of the organism.* The great difference, then, between habits and the activities previously discussed is in the manner of their acquisition. They resemble each other in that they probably have a similar neural basis, and that they are definitely coördinated and take place without conscious control. Habits, of course, cannot be present at birth. Some instincts are, but, as has been said, a large number of them appear later in life. The fundamental difference between habit and instinct lies in the fact that the former is due to the organism's experience, while the latter arises independent of such experience. *Habit is the result of the learning process, while instinct and reflex activity are elements which lie at the basis of learning.*

Comparison between habit and other non-voluntary activities.

Experimental psychology has, during the last twenty years, given no little attention to the question of habit formation. Among earlier investigations may be mentioned those of Bryan and Harter[1] and of Bour-

[1] "Studies in the Physiology and Psychology of the Telegraphic Language," *The Psychol. Rev.*, IV, pp. 27–53 (1897).

don.[1] Among more recent investigations may be mentioned the various studies of Swift,[2] that of Book[3] on the acquisition of skill in typewriting, and a study in learning to solve complicated puzzles by Ruger.[4] There is substantial agreement in these investigations on some of the most important aspects of habit formation.

Experimental results in regard to the formation of habit.

The general conclusion to be deduced from these experiments is that rapid improvement in learning a skillful act is made at first. This is the time of the formation of the more simple adjustments, and it is also the period when the work is undertaken with a zest, because of its novel character. As the adjustments increase in complexity, and as the initial interest disappears, the progress becomes less marked and the learning curve shows fluctuations, with falls when there are relapses into less skillful methods of work. There are also long periods of no improvement. However, the ability to improve seems to have no fixed limits. Very few habits are so perfectly formed that further practice may not increase the efficiency with which they are executed.

Improvement in learning relatively rapid at first.

Bryan and Harter, in their pioneer study, pointed out the fact that in learning the art of telegraphy there were periods of a considerable extent during which no progress was made. To these they gave the name of "plateaus," a term that has been ac-

Significance of "plateaus."

[1] "Recherches sur l'habitude," *L'Année Psychologique*, VIII, pp. 327–340 (1901).

[2] "Mind in the Making," New York, 1908. This brings together the results of investigations previously appearing in other publications. A chapter is devoted to the statement of the manner in which certain habits connected with learning acts of skill are formed. The habits investigated by Swift were ball-tossing, typewriting, and the like.

[3] "The Psychology of Skill," *University of Montana Publications*, Bulletin No. 53, Psychological Series No. 1 (1908).

[4] "The Psychology of Efficiency," *Archives of Psychology*, No. 15 (1910).

cepted by subsequent investigators. While the existence of these plateaus has been conclusively proved, their cause and general significance is somewhat a matter of dispute. Bryan and Harter explained them as arising when a lower order of habits (habits more elementary and less complex in nature) "are approaching their maximum development, but are not as yet sufficiently automatic to leave the attention free to attack the higher-order habits." Therefore these plateaus are necessary stages, from this point of view, in the acquisition of skill. Later investigators, particularly Book, take issue with this interpretation. It has been pointed out that no one order of habits is entirely perfected before habits of a more complex order make their appearance. Indeed, Swift holds that all factors in a complex group of habits are present to a degree from the start. Book believes that the plateaus are due to lengthy periods of "lapses in attention, relaxations of interest and effort." They are "critical stages" in the learning, and the rapidity with which they are transcended is important. They are often accompanied by the attempt on the part of the learner to make up through the application of voluntary attention and by the use of excessive effort, the loss of the earlier interest that accompanied the learning. This sometimes leads to a relapse into more elementary and less valuable methods of procedure, with the result that there is an actual breaking down in the learning and a retrogression in general facility. *Therefore these stages of arrest in learning should be avoided if possible, and never extended over a longer period than is actually necessary.*

The appearance of helpful variations.

Improvement in habit formations is not due simply nor largely to the making of habits already acquired more facile and automatic. Advance is achieved by making "cross-cuts," by reducing roundabout methods to more direct means of getting the desired results and by the appearance of new adjustments that are more desirable than the old. These helpful variations in method seem to appear by chance, and may remain for some time unknown to the learner. Ruger, however, emphasizes the importance of getting them into attentive consciousness as soon as they appear, in order that they may be utilized to their greatest extent. He points out the danger and the waste in time of leaving their perfection to mere chance.

Objective and subjective factors that hinder or aid learning.

A number of factors that impede or facilitate learning, some subjective and others objective, have been pointed out by the various investigators who have undertaken the analysis of habit formation. The relative difficulty of the work is one of the most evident of the objective conditions. However, when the material remains practically the same during the course of the learning, there still appear "good work days" and "bad work days." Among other objective conditions, certain physiological rhythms are important. There are times when the learner feels "fit," while on other occasions he lacks something in his bodily tone, and this is accompanied by an inability to give concentrated attention, and is manifested on the mechanical side by a general slowing down of the speed of performance and an increase in errors. The subjective factors, which have been revealed by detailed introspection, are found to play an important part in the efficiency of the work from day to day and in the rapidity with which the habits are acquired. *A favorable attitude toward the work seems absolutely necessary for the highest efficiency.* A feeling of confidence is also essential, while discouragement precludes the possibility of improvement. When the learner distrusts his ability and is anxious about the results of his accomplishment, he is apt "to go to pieces." Success generally acts as a stimulus for continued satisfactory performance. Book has outlined the general course of the feelings during a complex and extended experiment in the acquisition of skill. In the beginning all the learners show considerable interest in the work; continued practice, however, results in the loss of spontaneous interest, and a general feeling of monotony, often amounting to disgust, tends to arise, but as greater skill is acquired, a permanent interest appears. "When an expert skill was attained, a habit had been formed of keeping attention so constantly applied to the task in hand that nothing could distract it."

The importance of the proper intellectual attitude in learning.

In addition to these distinctly "feeling" attitudes, Ruger has pointed out the importance of the proper intellectual attitude in learning. The learner succeeds best who continually strives to keep his methods of procedure in consciousness, until they can be surrendered over to the automatic level of action. Such a person does not trust to chance in the formation of his associations. He analyzes, generalizes, classifies and eliminates under the direction of focal consciousness. He is critical of his own methods, and is always ready to change old methods when better ones offer themselves.

Among other facts of importance that have been deduced from the above cited experiments may be mentioned the following: (1) After an interval of rest in learning, Book found that on the resumption of practice there appeared to be an actual gain over the best previous performance. This somewhat surprising result has been noticed by previous investigators, particularly Bourdon and Swift, and has been amply confirmed by a series of experiments at the University of Illinois that have not as yet been reported. Book attributes this result to the dropping out of the partly-formed bad habits during the interval of rest. (2) The value of putting forth a maximal effort to gain a permanent improvement has been emphasized, particularly by Bryan and Harter, who say: "One conclusion seems to stand out from all these facts more clearly than anything else, namely, that in learning to interpret the telegraphic language, *it is the intense effort that educates*." Swift, while agreeing with this conclusion in general, adds the caution that spurts cannot be relied on to accomplish this result. The effort must be sustained, and not sporadic and haphazard. (3) Book emphazises the fact that a balance must be preserved between accuracy and speed. The imperfectly formed habits must be mastered before substantial progress can be made. They should be acquired as rapidly as possible, but not so rapidly that speed shall be gained at the expense of accuracy. "The desire to hurry on must be nicely balanced with due caution."

Consciousness appears only when a need for it exists.

In the discussion of the previous pages and in that which is to follow, the point of view, either expressed or implicitly assumed, is that habits when fully set up proceed without conscious direction. The individual starts his life with a few perfected coördinations. In learning others, consciousness is functional up to the point where new adjustments which adapt the organism to its environment are perfectly formed. Then it is that consciousness as a directive influence recedes, and the organism adjusts itself with automatic precision and regularity. The biological view asserts that consciousness arises both in the race and in the individual only when there is necessity for it; that, in other words, it appears when there is only a partial or imperfect adjustment to a situation. *If the adjustment is adequate, then there is no further need of conscious direction, hence consciousness tends to disappear.*

Habits of thought and feeling.

This point of view seems simple and entirely consistent, until we consider that the term "habit" is used to mean not only habits of adjustment, but also habits of thought and feeling. We can think, for example, of a train of ideas as having an habitual connection; we speak of a habit of thinking clearly or loosely; we recognize emotional habits in our friends and acquaintances. Now in these latter cases we have conscious elements that are united in what may clearly be considered habitual ways, and it, therefore, seems as if our statement that habit functions below the level of consciousness were open to serious objections. These objections, if carefully considered, are, however, more apparent than real. In the first place, it must be kept in mind that the point of view above urged has not maintained that habits are unaccompanied by consciousness, but only that a perfectly developed habit does not require consciousness for its expression. For example, the perfected act of walking may be regarded as a habit set up on an instinctive basis. The fact that it is accomplished with accuracy and with rapidity is due to the unconscious manner in which the function is performed. However, there are various stimuli, such as the pressure on the soles of the feet, that are necessary for the habit to be carried out with nicety. These stimuli may arise clearly above the threshold of consciousness, and further the muscular adjustments necessary in the habit. They also mediate sensations more or less dimly recognized.

How essential these sensations are in the accurate carrying out of the habit may be shown in pathological cases. In the disease known as *tabes dorsalis*, one of the most striking symptoms consists in the peculiar manner in which the patient raises his feet awkwardly and uncertainly in his clumsy walking. The reason for this is not because of paralysis, but because of an insensitivity in the soles of the feet, which prevents the adequate stimulus on which the act of walking depends from being fully operative. Again, if through disease the sensations arising from the contraction of the muscles and tendons and the rubbings of the joints were deadened or entirely destroyed, the habit of walking would be greatly interfered with, if not made impossible. These illustrations go to show that a certain amount of consciousness may be necessary in the perfect carrying out of our most habitual processes.

In the thought processes we have a similar state of affairs, even when they move along in an entirely habitual manner.

The method of thought may be quite mechanical.

Under such circumstances the direction of the thought may be determined by a consciously controlled end or purpose; the stimuli necessary to arouse it and the resulting thought product may be entirely within the realm of consciousness, although the methods by which the thought attains its end are entirely mechanical. Take, for example, the state of consciousness that arises in the mind of the adult when he hears three times eight spoken. He arrives at the result twenty-four in a perfectly habitual way. The fact that he is conscious of the spoken words and of the result arrived at does not imply conscious direction. The condition is similar to that of the expert piano player who is conscious of the instrument before him and the harmony he is producing, but not of the details of the technique of the piano playing.

Habits in various stages of completion require consciousness.

Further, it should be remembered that habits, whether merely physiological or intellectual, are generally in various stages of completion, and never so adequately perfected that their course may not be broken in upon. In such cases consciousness to a greater or less degree must be present, in order to control those parts of the activity that are not at the time perfectly habituated.

Intellectual processes involve habits of attention and the like.

We must also consider the fact that in our highest intellectual processes, where thought controls a very large part of the field of activity, there are certain elements of adjustment which have been reduced to habits, and which, therefore, tend to give in varying degrees habitual aspects to our highest conscious activity. To think accurately, we must attend, and attending in many of its essential features is a matter of habit.

Habitual thought complexes coördinated, through conscious control.

It should also be borne in mind that what we sometimes call a single habit is really a group of habitual and instinctive coördinations. Consciousness emerges and functions in linking this group together, while the individual reflexes proceed with automatic regularity, unaccompanied by consciousness. In the rational process, as in the habitual responses, we have a similar state of affairs, certain parts of this process that have been fully set up and formulated following entirely mechanical laws without the intervention of consciousness. They form the habitual phases of the thought process. On the other hand, where the necessity of coördination and grouping arises, there we find elements of conscious control.

Again, in our thought processes we often react to ideal rather than concrete situations. It is this ideal that controls the conduct. If the ideal is one that has been established as a habitual mode of thought, it functions without being clearly present in consciousness as a controlling principle. On the other hand, if it does not come as something old, it is kept in consciousness with more or less effort, and the thought process then proceeds for a large part on a non-habitual level. For these various reasons, then, it seems probable that wherever there is a fully set-up conscious activity directing an adjustment, there is a maximum of voluntary activity and a minimum of habit. It is relatively certain, on the other hand, that if our lives could be entirely reduced to habit, the existence of clear consciousness, perhaps of any consciousness at all, would be unnecessary. Indeed, an habitual activity may be interrupted by thinking about its expression and attempting to control it.

Ideals and habits in the control of thought processes.

One of the most important questions which arises in connection with habit formation, and one which, as we shall see in a later discussion, has a pronounced educational significance, is the possibility of the formation of a generalized habit. It is denied by many writers that such a thing as a generalized habit is possible. As Bagley[1] puts it, "a simple habit is a specific response to a specific stimulus; a generalized habit would be a specific response to a number of different stimuli." There seems to be no reason in the nature of the case, as far as the mechanism of the nervous system is concerned, however, why we may not think of several stimuli resulting in a particular response along a definite path of conduction, or why, on the other hand, we may not conceive of a single stimulus forming several passages of discharge. Passing by this rather problematical consideration, we may consider several senses

It is contended that a habit cannot be generalized.

[1] "The Educative Process," p. 203.

in which we are warranted in assuming practically the existence of a generalized habit. Such an expression seems to be admissible under the following conditions.

A generalized habit as a definite response common to a variety of situations.

(*a*) When the specific stimulus that calls forth a specific reaction is common to a large variety of situations, which situations may have little in common beyond the presence in each of the specific stimulus.

For example, the soldier who has learned to come to attention at the word of command will do so on the parade ground or the street. It, of course, may be said that for the soldier who so responds the actual situation is the same under these varying conditions. However, this is true only as far as the dominant element in the situation remains similar, this dominant element being determined not by its objective importance to the general observer, but by the fact that the soldier does thus react under various circumstances. For the ordinary observer, however, this dominant element may be of but slight importance, and thus in his relations with his fellow men, the soldier may appear to have acquired a generalized habit.

As a specific reaction under the dominance of a mood.

(*b*) There is another class of habitual reactions which do not seem to be called forth by any definite objective stimulus, but which appear under a large variety of objective conditions in which no single common element can be found. These latter cases arise when the reaction is under the dominance of a mood or emotion that so colors the objective environment that several different stimuli may call forth the habitual response. A person, for example, of a choleric disposition may have established a very definite set of reactions which habitually express his angry moods. The insignificant external causes that set off these definite responses may vary greatly, and it may thus be urged that not one stimulus, but many stimuli, are involved in producing the reaction. In the case of morbid pity, irrational fear, religious enthusiasm, and the like, the object which arouses these moods is apparently indifferent.

(*c*) We may also have in any definite reaction to a given situation not merely one elementary adjustment, but many adjustments both positive and negative. Let us suppose that a child in the schoolroom is being taught to correctly form the letter A in his copybook. Here we have the example of training in a special habit, in which we have a definite stimulus of sight, namely, the letter A of the copybook. This letter constitutes the essential stimulus to which there is a specific response, the writing of the letter A. This response gradually becomes more and more an habitual process, and we have set up a definite habit of stimulus and response. However, beside this specific stimulus of the written or printed A of the copybook, there are other stimuli which constitute the total situation, which stimuli might function equally well for copying B or any other letter. We have momentarily the specific A-copying reaction, but we have as well a more general reaction based on the seeing of the copybook, the "feel" of the pen, etc., which may be termed the "copybook" reaction; beyond this we have a still more general group of motor expressions and inhibitions which constitute the "school" reaction, as such, and differentiate it from the "home" reaction, for example. Now in the copying of the letter A all these various reactions are involved, but only a very small part of the total reaction functions solely for the A-copying habit; much of it might function equally well for the reading habit, or the number-work habit. There is, then, a considerable part of the A-copying habit that is not specific in the sense that it is confined to the one particular of copying the A. It is general in the sense that it concerns itself with many other school activities. For example, the ignoring of the noises on the street, the holding of the body in the proper position at the desk, etc., are reactions concerned with the business of copying the A.[1]

As a complex set of activities functioning in various situations.

[1] See Colvin, "Some Facts in Partial Justification of the So-called Dogma of

One great value of habit lies in the fact that it mechanizes and facilitates reactions, making them accomplish their function with directness and a minimum of effort. As has often been pointed out, if it were not for habit we could not do the most simple things of life without a large expenditure of time and energy. For progress, the formation of habits is absolutely essential. While it is true that we must acquire as many useful habits as possible, it is equally true that we must not come under the complete domination of habit. The person whose life moves in a circumscribed circle of habit, loses the possibility of reaction on a higher level and, therefore, the possibility of further education. It might be inferred from the general nature of the evolutionary process and the demands of adjustment, that the organisms that have acquired a large stock of habits are for that reason the best equipped for survival, since they are more perfectly adapted to their environment than are those organisms which have not acquired such habits. In a sense this is a true statement of the case, but it applies only to those animals whose possibilities of education are limited to a definite number of reactions in a relatively simple environment.

Habit facilitates response, but deadens consciousness.

The human being has an environment of tremendous complexity to which he must adjust himself, and he never can acquire all the adjustments necessary and bring them under automatic control. If his life is reduced largely to habit, it means that he has arbitrarily limited the environment to which he is to react, and, therefore, has shut out the possibility of further development. He has become, as James expresses it, an "old fogy." In this sense habit deadens and reduces the life of the individual to the level of non-voluntary activity. These considera-

The human being must have before him new spheres of activity not yet mechanized.

Formal Discipline," *University of Illinois Bulletin VII*, No. 26 (1910, 2d ed.).

tions do not mean that the individual should not acquire a large number of habits, but they do mean that also there should be beyond the sphere of habitual activity an unlimited place for the further development of habits. *The difference between the person who continues to make progress all through his life, and the one whose real life is ended in his early manhood is that the former always possesses an open mind and the attitude of finding in his environment further possibilities of adjustment.* It has sometimes been said that most school teachers end their effective period of usefulness in the early years of their professional careers. If this were true, it would be because they originally approached their profession with mind open, and because they found in their school environment new situations to be solved. Those who after a brief period of teaching have become dead are those who have been satisfied in limiting their activities to the things which they have learned in the first years of their professional work. The environment presented by the school may be regarded as a relatively simple one that can be readily comprehended, and the reactions to which can easily be mechanized, or it may be regarded as perhaps the most complex of all environments, in which the possibilities of new adjustments are practically limitless. It is the teacher who regards the school in this latter way who never ceases to grow.

The human environment infinitely complex.

It may easily be seen from the foregoing that the environment to which the intelligent human being is to react is one whose complexity is determined very largely by the attitude which the individual brings to that environment, and not by the environment as objectively considered. If the environment were merely objective and contained a certain definite number of parts or elements to which the organism was to adjust itself, why, then, it would clearly follow that the organism best adjusted was that organism which had mechanized the largest number of possible reactions. But since the environment is constructed in a large measure by the individual's attitude toward it, the number of possible reactions can never be determined. In other words, the environment, while not infinitely extended, is infinitely extensible.

The possibilities of forming new habits.

It has been for a long time the prevailing opinion that, except under unusual circumstances, the lives of those who have passed beyond the stage of early manhood are completely surrendered to the sway of habit. James, in his brilliant chapter on "Habit," has emphasized this view. It is, however, probable that the plasticity of the nervous system is greater than has been supposed. There seems to be no period in the life of the individual, before senescence, where a definite limit can be set to his ability to acquire new habits or to his power to break off old ones. There is doubtless great individual variation in plasticity, and, therefore, in the tendency to acquire habits.

CHAPTER IV

THE EDUCABILITY OF INSTINCTS AND HABITS

THE most fundamental instincts cannot be entirely eliminated. Since they represent those impulses which have been tried out through countless years of racial experience, they are too closely interwoven with the life of the individual to be set aside. When entirely checked in their expression, they subject both the individual and society to the gravest of dangers. If the social organism becomes so complex that these instincts find no natural outlet, society itself must either change its form or perish.

The fundamental instincts cannot be eliminated.

However, it does not follow from the above that it is impossible to educate and to modify instincts.[1] No instinct can express itself except under environmental conditions more or less adapted to that expression. As has already been pointed out, instincts, when they appear, if they do not have the proper environment for their expression, may, if not too fundamental, pass away without ever having become established as habits. The obvious educational application here is that the greatest care should be taken, both by parents and teachers, to see to it that undesirable instincts find no soil in which they may take root. This would be true, for example, of certain instinctive fears, if perchance they exist, such as the fear of the dark. It is, however, to be

However, instincts can be directed and modified.

[1] The philosopher Schopenhauer maintained that these instinctive impulses, which he identified with will, could not be educated, and that the only way to rid the world of an evil will was to destroy it. He, however, did not take into consideration the fact that the direction of the expression of this will can be modified through environmental conditions.

doubted if there are many instincts which *in toto* are undesirable, and the problem which education has before it is not to any great extent the elimination of instinct, but the turning of instinct into proper channels.

Substitution, not prohibition, the rule in directing instinct.

Here the rule must be laid down that if a certain form of instinctive expression is considered undesirable, it is absolutely essential that the educator and the social reformer find some new avenue for the expression of the instinct that shall be desirable. Mere prohibition must always fail, if the prohibition aims at some fundamental and deep-seated tendency in the life of the child or of the adult. The boy who has the impulse within him to go out beyond his narrow environment, and in search for adventure, perhaps to run away from home, is expressing, in a way, a primitive instinct of the human race; one which has led the explorer in his painful march to the frontier, and has established civilization in the remotest ends of the earth; an instinct of inestimable value to the human race, but in the particular form of its expression dangerous to the boy. The parent and the teacher can certainly not eradicate this instinct by simply prohibiting it; they can, however, provide the boy with stories of adventure, or encourage him to write such stories himself in his composition work in the school. If in fear of this instinct the child is carefully guarded from literature of this sort in the school and the home, the result may be the loss of the taste for all such literature; or this repression may lead to the breaking forth of the instinct in a more violent form.

The migratory instinct which expresses itself in the love for adventure and in the discovery of the unknown, may find a legitimate satisfaction in the form of the school excursion, in explorations in local geography, in the gathering of geological specimens and the like. The sex instinct, which at first appears strongly during the adolescent years, may find safe expression in properly supervised social gatherings. These the schools should encourage to a reasonable extent and with necessary limitations.

The tremendous significance of the play instinct in the learning process has already been touched upon in the preceding pages. It may be added here that in the modification and control of other instincts it serves an important office, since through play the experience of the child may be in imagination extended to those objects which are the ends of other instincts. In play the boy may safely satisfy his instinct for adventure, his hunting and predatory tendencies, his desire for combat and the like.

The importance of the play instinct.

In the first school years play interests occupy a large part of the child's attention. The earliest plays are of the romping variety, full of movement and strikingly like those of animals in their aimless abandon. These plays are largely atavistic in their character, and are suggestive of Hall's theory of the origin of play. In their more organized forms these plays appear in the hunting and fighting impulses of boys, and in the tendency of boys to form gangs and secret clubs of various sorts. The organized plays of girls are more imitative, generally speaking, though they have an evident basis in the maternal instincts. Girls play dolls and house; boys build forts and play at soldiers and Indians. The later plays are less instinctive in their nature, and their forms are primarily due to the suggestion of the environment. Here belong numerous games, some of them centuries old and but slightly changed in the course of the ages, such is the wonderful conservatism of childhood. In definitely planning plays for educational purposes, we should strive to select those forms of play activity that are spontaneous with children. One of the most serious criticisms that has been brought against the plays of the kindergarten is that children do not play these when they are by themselves. It should further be remembered that too much supervision in play may be undesirable. The playground movement, which at present is claiming much attention among social workers, may be criticized from this standpoint.

The remaining adaptive instincts have a regulative value similar to that of play. Imitation and curiosity have already been discussed at some length. It is obvious that instinctive tendencies of all sorts are essentially modified by the influence of the environment, which is consciously or unconsciously imitated. It is, of course, highly desirable that

The value of the other adaptive instincts.

the environment be of such a nature as to lead to the proper expression of the various instinctive tendencies. Generally much more can be accomplished in the realm of taste and morals in training instincts in the proper channels through this means than by any obviously direct methods. The school must, as far as possible, set the proper standards in etiquette and general conduct. If this is done, many of the instincts will be properly regulated without more direct methods.

Curiosity affords a most desirable means for restraining certain instinctive tendencies, and for redirecting others. For example, if the teacher can arouse in the pupil's mind a genuine interest in any of the subjects of the curriculum, he has done more than merely to gain attention for that one subject; he has turned the mind away from other interests. The boy who has aroused in him curiosity to learn is less liable to yield to the migratory instinct, for example, and run away from school or home. What is true of curiosity is similarly true of constructiveness. Many a boy has been kept in school because of carpentry and forge work; not a few girls have found the curriculum attractive because of cooking and sewing. The strictly commercial courses, too, appeal to the instinct of constructiveness as well as to distinctively utilitarian ends. This appeal is primarily the justification for their introduction into the curriculum. Acquisitiveness manifests itself early in the child's life in the form of the collecting and hoarding instinct. Children accumulate all sorts of objects with little definite purpose. Later their collections are made with a more conscious aim. Generally the nature of these collections is determined by the suggestions of the environment. Children collect stamps, cigar and tobacco tags, cigarette pictures, insects, geological and botanical specimens, dolls' dresses, birds' eggs, picture cards, coins, buttons, marbles, shells, rocks, etc., as the fashions and interests of the children dictate.[1] The value of this instinctive tendency in the learning process is too obvious to require extended comment. Like the other adaptive instincts, it possesses both a positive and a negative value; positive in furthering desirable tendencies and negative in inhibiting the undesirable. One of the less desirable

[1] For a careful study of the collecting instinct, see "Caroline F. Burk," *Ped. Sem.*, VII, pp. 179–207 (1900). This article is reprinted in "Aspects of Child Life and Education," by G. Stanley Hall, Boston, 1907. This book contains other reprinted articles on important instincts, — "Curiosity and Interest," "The Psychology of Ownership," and "Fetichism in Childhood."

forms that this instinct sometimes assumes is that of a strong development of the money-earning interest. As a result, the boy is drawn away from school at a time when he is ill prepared to enter upon the serious business of life. The instinct in this form should be held in check, and other instinctive interests that center about the school and its activities emphasized.

The function of the undesirable instincts.

While it is doubtless true that there are no instincts that have come up through the long try-out of racial experience that are absolutely unworthy, nevertheless there are some of the more crude instinctive tendencies that were of greater service to the race in the earlier stages of development than they are to-day. Indeed, in society as it is at present constituted, some of these are usually undesirable. Fear, as irrational terror, is always to be eliminated. Yet under proper conditions it may rise to the dignity of one of the most important of the regulative instincts. Throughout the history of the race it has served as an important corrective influence in the modification and elimination of less powerful instinctive tendencies.[1] The claim is often made that the child should be taught not to fear. This can, however, mean only that the child should be taught not to have irrational fear. *Education may be defined, from one point of view, as the process of teaching the child to fear aright; to fear those things that will work him harm.* The fear of disobedience, of social disapproval, and the like, must be confirmed in the child. Any form of education that tries to banish fear in all its aspects will ultimately prove a failure.[2]

Through the fear of punishment both the child and the race have been taught the safe path to follow. Reward and punishment, which have been the unvarying accom-

[1] "Fear or anticipatory pain is probably the great educator in both the animal and the human world."— Hall, *op. cit.*, II, p. 370.

[2] Aristotle, centuries ago, made a clear distinction between fear and foolhardiness. The courageous man must have a knowledge of the dangers that beset him, to have true courage. It is a mark of intellectual and moral superiority to know where the danger lies.

paniment of the learning process in its earlier stages, can never be entirely superseded, and they must continue to exercise their selective influence. Some educators advocate that mere learning should be a sufficient end in itself, and that the child should never be compelled to do any school work for a motive ulterior to that work itself. There are many studies whose immediate values cannot be shown the child, especially at the time when it is necessary to drill him in their fundamental elements. Other reasons than the ultimate aim and value of these studies must be the ones which appeal to the child at this stage of his learning. A proper and rational system of rewards and punishments will create an interest in the school work which it does not intrinsically possess. It is the opinion of many teachers that corporal punishment is not desirable. There are, doubtless, extreme cases when it may be necessary.[1] Many other forms of punishment which were in vogue years ago have been shown by experience to be ineffectual and unworthy. Such, for example, is the adding of extra tasks of excessive length for poor work, and the holding up of the child to the contempt of his schoolmates by putting him in a ridiculous light before them. The teacher should be extremely careful, for example, in the use of sarcasm at the expense of the pupil. Much has been said and written in recent years about the evils of the marking system. Teachers, however, are aware of the fact that children demand grades, and pupils often cannot comprehend the value of their school work without them.[2] Grades represent objectively the attain-

Reward and punishment must exercise their selective influence.

[1] Hall, *op. cit.*, Vol. I, p. 402, says that "to flog wisely should not become a lost art."

[2] In experiments conducted with school children by the Department of Psychology at the University of Illinois, it was found necessary by the experimenters in order to keep the interest of the children at an optimal intensity, to assign to them marks indicating their accomplishments in these experiments. The pupils could see no utility in the work until it was expressed in the form of a numerical grade.

ment of the child, and are a form of social approval or disapproval. Low marks for the normally ambitious pupil will generally act as a punishment severe enough to stimulate him to better work.[1] Whatever form of punishment the teacher employs, he should be careful to make certain that this punishment actually associates itself with the misdemeanor that is punished. As Bagley[2] has pointed out, the punishment of keeping a child after school and compelling him to study a lesson for the following day is likely to associate itself with the lesson rather than with the offense that has been committed. When possible, the punishment should follow the offense immediately.

Envy, jealousy, anger, and superstition of service if properly directed.

Like fear, envy, jealousy, anger, and superstition, if they are properly directed, may be of value. Superstition passes over, by almost imperceptible degrees, into religious awe and veneration. A proper attitude toward sacred things is one of the most important elements in a religious education. It is one of these elements, however, which the present age, with its scientific spirit and its utilitarian ideals, is not likely to inculcate in the minds of children and youth. It is well, therefore, to develop in the child a certain feeling of awe and mystery in regard to the higher things that surround him. Extreme intellectualism in religion will ultimately fail in bringing about the proper attitude toward the universe in its totality. Life is too uncertain and human knowledge too fragmentary to dispense with the mystical religious attitude. Just as superstition may be transmuted into something of value when it is turned in the proper direction, so too envy, jealousy, and anger may be made worthy instincts, if they are properly controlled. We should envy another his happy disposition ; we should be jealous of a good reputation, and we should be thrilled with genuine anger at a base action.

[1] Compare Chapter II, p. 29, and Chapter XIX.

[2] "Class Room Management," p. 164.

The instincts of adolescence.

The most difficult problem in connection with the direction of instincts arises at the adolescent period of development. At times the gravest tragedies have taken place through the attempt to prohibit instinctive desires, when absolute prohibition is manifestly impossible. Fortunately youth is strongly idealistic, and in young men and women is often a passion for the noble and the beautiful. Hence the sex instinct may be held within proper limits by idealizing the object toward which it is directed. This is the time to inculcate in the minds of young men the spirit of chivalry, courtesy, and honor, and in young women that of modesty and good taste. It is doubtful if coeducation at this period is desirable, since it tends to remove from the minds of young people some of the lofty ideals they naturally possess in regard to the opposite sex.[1] At this period the religious and moral emotions, too, should be glorified by the noblest ideals. The adolescent should have constantly before him examples of beauty in art and literature; he should be led into friendly communication with nature; education at this period must not appeal to him too exclusively from the merely intellectual standpoint. Not only should his mind be made to know the truths that lie about him, but his heart should be made to throb in sympathy with the beautiful and the good that permeate all life and to which he is now more susceptible than he ever will be again. The period of drill and mechanical regimen has passed, and the period of comprehension, self-direction, and sympathetic appreciation begun.

The question of promoting the child in his school grade is closely related to the problem of the development of

[1] Hall has expressed this thought as follows (*op. cit.*, II, p. 635): "Coeducation should cease at the dawn of adolescence, at least for a season. Great daily intimacy between the sexes in the high school, if not in the college, tends to rub off the bloom and delicacy which can develop in each, and girls suffer in this respect, let us repeat, far more than boys."

instincts. The intellectual attainments of the child, particularly in the fundamental subjects of the school curriculum, as tested by the common methods in vogue for determining proficiency, are often the sole standards for promotion. In consequence of this, backward children are not uncommonly held in a grade in which most of the pupils are far below these backward children as far as the development of instincts and interests is concerned. It is very rarely advisable to keep the child in a grade for more than two consecutive years. He either should be promoted, or if this seems impossible, he should be removed from the school and sent to some institution that can look out closely for his specific needs. It is obvious that markedly subnormal children, both for their own interests and for those of the normal children, should be segregated in special schools.

The development of instincts related to promotion in the grades.

The problem of allowing for the proper development and expression of instincts is closely related to the question of mental arrest. If the child, at an age when certain instincts develop, finds in the school no opportunity for the expression of these instincts, he may be permanently held at a low level of intellectual and moral attainment thereby. It is therefore one of the most important problems of experimental pedagogy to determine the approximate time when the instincts make their appearance. It is a problem of equal importance for practical pedagogy to devise means for the wholesome expression of these instincts. Unfortunately, these investigations have not been sufficiently extensive, nor the results so definite that a school program, or methods of instruction, can be determined in more than a general way. The previous discussion has, however, pointed out certain tendencies in the development and control of instincts that have obvious importance in the practice of the schools.

The suppression of instinctive tendencies may cause mental arrest.

Rules for the acquisition and modifications of habit have been long definitely formulated, and so often emphasized that the briefest mention of them at this point will suffice. James,[1] in his chapter on "Habit" has brought together these rules, as follows: "The first is that in the acquisition of a new habit, or the leaving off of an old one, we must take care to launch ourselves with as strong and decided an initiative as possible. Accumulate all the possible circumstances which shall reinforce the right motives . . . envelop your resolution with every aid you know. The second maxim is: Never suffer an exception to occur till the new habit is securely rooted in your life. . . . Continuity of training is the great means of making the nervous system act infallibly right. . . . A third maxim may be added to the preceding pair: Seize the very first possible opportunity to act on every resolution you make, and on every emotional prompting you may experience in the direction of the habits you aspire to gain. . . . No matter how full a reservoir of maxims one may possess, and no matter how good one's sentiments may be, if one have not taken advantage of every concrete opportunity to act, one's character may remain entirely unaffected for the better. . . . As a final practical maxim relative to these habits of the will, we may, then, offer something like this: Keep the faculty of effort alive in you by a little gratuitous exercise every day." It should further be added that habit formation may be negative as well as positive, and may consist in refraining from doing something for which there is a natural or acquired tendency. The direction of habit is largely determined by the direction of attention. This is particularly important in habit breaking, which is largely a matter of voluntary effort.

Rules for the modification of habits as laid down by James.

The most important law of habit formation has been formulated by Bagley[2] as the "focalization of conscious-

[1] "The Principles of Psychology," New York, 1890, Vol. I, Chapter IV.

[2] "Class Room Management," p. 16.

ness upon the process to be automatized, plus attentive repetition of this process, permitting no exceptions until automatism results." The great difficulty in habit building seems to lie first in securing the proper direction of the attention, and second, in the necessary drill which must occur if a permanent habit is to be formed. It is particularly essential in the beginning of all school activities that the teacher see to it that the pupil's attention is upon that part of the learning which is essential for the correct formation of the habit desired.

The law of "focalization" in habit building.

Book [1] and Swift,[2] as was stated in the last chapter, have both pointed out that in learning, variations in method appear as accidents, and that these variations build themselves up into habits, quite without the direction of consciousness, while Ruger [3] disputes this assertion as far as the latter part of the statement is concerned. He says that the results of his puzzle experiments "are in accord with this view so far as the coming of variations is concerned, but not as to subsequent relations, the employment of the variations. A large percentage of the fortunate variations came altogether unpremeditatedly." On the other hand, "The value of the variations . . . seems to have varied rather directly with the precision with which they were analyzed, and with the extent to which they were treated as hypotheses to be systematically tested with subsequent adoption or rejection. In other words, the drops in the curves, the time being variable, were coincident with consciously adopted variations rather than with the 'unconscious' ones." The conclusions of Ruger, then, are in agreement with Bagley's contention that habits to be learned must be focalized. This point of view has the advantage of offering a definite method of procedure in teaching habit, while the contentions of Book and Swift leave the whole process a matter of chance.

In the early years of elementary school instruction, particularly in the work of the first grade, the problem before the teacher is principally that of properly initiating right habits, such as habits of correct bodily posture, of speech, of attention, and the like. It is at this point in formal instruction

The problem of initiating habits properly.

[1] *Op. cit.*, p. 158. [2] *Op. cit.*, p. 213. [3] *Op. cit.*, p. 15.

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that the first maxim laid down by James is to be particularly regarded. The teacher must take every opportunity to impress upon the pupils the necessity of acquiring the habit, and to provide the proper incentives for drill in the formation of these habits.

When the child first enters the school, the habit that must be attended to, perhaps above all others, is that of correct carriage of the body, particularly when the child is seated at work at his desk. Almost invariably the beginning pupils assume incorrect attitudes. They do not sit erect in their seats, they squirm about, and in nearly every way place themselves in positions that are calculated to interfere with their physical well-being and their mental alertness. The skillful teacher may correct these tendencies and initiate desirable habits by certain simple devices of holding the attention on the necessity of sitting erect and of keeping an attitude of alertness. He may begin by reading them a story about soldiers; and when he has brought to the minds of his pupils the fact that these soldiers stand erect and keep strict attention to the commands of their officers, he may point out to the children one of the rows in the room that is giving the best attention, and say, "That is a soldier's row." By this means the teacher emphasizes at the very outset the importance of correct bodily attitudes, and initiates the habit with a strong impetus.

Again it may be the purpose of the teacher to emphasize the importance of clear and loud speech. To do this he may, for example, dramatize the story of Little Red Riding Hood. He asks various children to take the parts of the characters in the story. To a girl who speaks so low that she can scarcely be heard by the others, he assigns the part of reading the story at those places where the various characters do not speak; to a boy who has the like fault of not speaking out because of bashfulness he gives the rôle of the wolf. He does not, however, make the mistake of assigning all the parts in the drama to children who are bashful and weak of voice. Some of these parts he gives to the children that speak the most clearly, in order that they may serve as examples for the rest. This makes the indistinct speech of the others more striking by contrast; and when the little girl who is reading the story fails to make herself heard by the others, they spontaneously call out, "Louder, louder"; also, when the wolf does not growl in a wholehearted way, and when he mumbles his words, the children likewise express their disapproval. By such means as these, the skillful teacher can launch the essential school habits with an emphasis that with further drill will insure their continuance in most instances until perfected.

One of the most frequent difficulties in correct habit formation in the school lies in disregarding the second maxim quoted from James, namely, that an exception must never occur during the formation of the habit. If the child is to write well and speak well, he must write and speak well on all occasions. The pupil often gains the impression that correct language, whether written or spoken, is a matter that concerns his formal language work alone, and that he need not trouble himself about the use of correct English in general. This attitude may remain with the pupil throughout his entire career as a student. It not infrequently happens that members of university classes forget that they have obligation to write or speak well in the work connected with other courses than those offered by the department of English. The third maxim of James concerns more largely moral education than it does the education given in the common branches. However, since the school must consider the moral life of the pupil, the principle involved in this maxim should not be disregarded. It is not sufficient to urge the pupil to practice good manners, and then let the matter drop there. He should exhibit courtesy on all possible occasions in the schoolroom and about the school building. The school is well adapted to teach the social virtues in a concrete way, provided that the teachers insist on the pupil utilizing every opportunity for their expression.

The pupil must practice desirable habits.

In practically all of the experiments performed in the acquisition of skill, as has previously been pointed out, the investigators have shown that at certain stages in the progress of habit formation, plateaus, or periods of no, or slight, improvement in the learning have manifested themselves. If Book's theory in regard to the nature of plateaus is the correct point of view, we cannot regard them as useful in the incubation of higher habit formations. They should, then,

The avoidance of plateaus in habit formation.

be eliminated as soon as possible, and always reduced to a minimum. When the teacher discovers that the pupil has reached a long period of mental arrest, he should do all in his power to aid the pupil in overcoming the difficulties. If the arrest is due to bad and wasteful habits of work, as is sometimes the case, the effort should be made to correct these. For example, if the pupil, after making reasonable progress in number work, at length fails to advance in the rapidity and accuracy of performing the elementary processes, this may be due to the fact that he has not sufficiently mastered the arithmetical tables, and that he is spending time in "thinking them out," when he should have them at "his tongue's end," or perhaps his difficulty lies in care and neatness in the written operation. Whatever the cause may be, the teacher should strive to discover it, and then remedy the difficulty. Subjective attitudes have been shown to be of significance in these periods of arrest in learning. Therefore the teacher should give the pupil at these stages all the encouragement possible, should seek to secure for him some added success, because of its stimulating effect, and should urge him to persevere. Since at these times there is a falling off of spontaneous interest, artificial methods of stimulating interest may be employed. The mature student who is directing his own learning should recognize the necessity of these temporary crises, and be prepared to rise above them through consistent endeavor. He should at times put forth maximal effort, since in this way, sometimes at least, habits shoot together on a higher plane, and thus a permanent improvement is achieved. It is well, too, in the school to have special occasions at which unusual effort is demanded.

We have already commented on the fact that spontaneous interest is one of the prime essentials in correct habit formation. When the interest begins to wane, the skill falls off. For this reason Book recommends that the child should stop work when the interest is gone. There is a danger in too literally following this advice. Temporary loss of interest may, and often should, be overcome. Obviously it would be entirely undesirable to accustom the pupil to abandon work with the approach of *ennui*. He must be trained to disregard certain distractions, if he is to achieve worthy results. On the other hand, when it is quite evident that the child has lost all interest for the time, the teacher may wisely vary the nature of the work, or introduce a period of play or recreation, as may seem best. A task that is conducted on the dead level of monotony over a long period is scarcely worth the effort it costs; indeed, its results may be positively injurious in habit formation.

The necessity of interest in habit formation.

Both the teacher and the mature student are often not aware of the natural fluctuation in interest in learning; therefore they are prone to take too seriously the falling-off in accomplishment that is apt to occur from time to time. The teacher who thinks of the zest with which his pupils began the work of the new term or the new course, and who compares it with the painful lack of enthusiasm and interest that may appear when a few weeks have passed, need not attribute these discouraging conditions to poor teaching on his part nor to inferior intelligence on the part of the pupils. He must remember that as the pupils acquire greater knowledge and master more details, interest will surely return, and with it, successful accomplishment. The student, too, who finds his course of study less attractive after some time than he did at first, should not conclude that he should abandon it for that reason. If he thinks that the subject is worth while for him, he should stick to his task, with the confidence that when he has reached the expert stage he will have a genuine and direct interest in it for its own sake.

The fluctuation of interest in extended learning.

Habit, which, we have seen, is on the basis of unconscious adjustment, should be only a part of the aim of the learning process. We should never be satisfied with a training that merely mechanizes. Drill is essential at all stages of the learning process. In recent years there have been in certain quarters evidences of a tendency to minimize the value of drill. This is to be distinctly deplored. However, education can never end with drill. It must lead the child to interpret his environment, and find new elements in it to which he must adjust himself. The girl in number work who said that she could do the problem all right if she knew whether she should "times it" or "into it" had the drill, but not the point of view beyond the drill. Observational studies, such as geography and nature work, that suggest to the child that he has a field of knowledge to explore, are excellent correctives of the deadening influence of drill in the earlier stages of development. Most of the studies that have been introduced to "enrich the curriculum" have been of this character. When the individual has reached the higher stages of learning, philosophical interpretation and a genuine curiosity to know are incentives which lead him beyond the merely formal and mechanical aspects of the learning process. As the Herbartians have said, the aim of education is the creation of permanent interests. *It is not the facts and habits that have been acquired in the learning process that count as much as it is the disposition to learn new facts and acquire new habits.* It is important that the teacher should always have the attitude of a learner, and convey to the minds of the pupils the subtle sense that no knowledge is ever an absolutely completed and closed set of facts; that no activities, however comprehensive and satisfactory, are ever final.

Habit formation should be a means, but not the end, of learning.

CHAPTER V

SENSATION AND PERCEPTION

UP to the present point in this discussion, the nature of the learning process has been considered largely in terms of its objective features, namely, in terms of the adjustments made by the organism in adapting itself to its environment. Consciousness has been treated as arising only where there appears to be a necessity for it in terms of adjustment. These objective biological considerations, however, are entirely inadequate and incomplete unless we consider the conscious processes that accompany adjustment. Indeed, the learning process, as far as education is concerned, must be approached largely through the subjective elements correlated with the objective adjustments. We now turn to consider, briefly, the most simple of these various conscious processes, namely, sensation.

Consciousness must be considered as the chief factor in learning.

When we attempt to define or describe sensation, we find the same difficulty that confronted us at the outset of our discussion in attempting to define consciousness in general, namely, the difficulty of describing an elementary experience in terms of anything more fundamental and elementary. We can say, if we choose, that sensation is the primitive stuff of consciousness; the noetic or intellectual aspect of mentality, and that from it develop all higher intellectual processes; but this statement throws very little light upon the real nature of a sensory experience. Perhaps the only description that we can give of sensation, a description that is entirely inadequate, because it is in physiological terms, is that a sensory experience is the conscious cor-

The difficulty of defining sensation.

relate of the stimulation of an end organ and the transference of this stimulation to appropriate brain centers. We can further add that the experience aroused in this way is something new, and is not brought into relation with any previous experience. In other words, there has been no working over on the subjective side of the raw sense material, but the whole experience is entirely immediate and without reference to anything beyond itself. Such a state as this is what is described by James[1] under the term "pure experience."

A sensory experience both sensory and motor.

It is doubtful if such a pure experience ever actually exists. It certainly does not exist in any developed form of consciousness, and, therefore, is a hypothetical element to be inferred, but not to be demonstrated. As we have already seen, the sensory experience demands for its completion an adjustment to some object connected with this experience, and, therefore, sensation can never be taken as something complete in itself. Even in visual experience, there must be actual adjustments before a world of tri-dimensional space, filled with objects, can ever be known. The infant early in life has the possibility of seeing, — *i.e.* the retina is functional and responds to the appropriate light stimulus shortly after birth, and later the proper sensory connections with the higher brain centers are perfected. Although this is a fact, the child cannot in any genuine sense perceive visual objects for some time. In the act of vision, beyond the functioning of the retina and the development and connection of neural paths to the higher centers, is involved the adjustment of the eye through its internal and external muscles to the object to be seen. The lens must be focused, or accommodated, and the two eyes must be made to move in harmony, — they must be prop-

[1] See "Does consciousness exist?" *Jour. of Phil. Psychol. and Sci. Methods,* I, p. 485 (1904). "The instant field of the present is at all times what I call the 'pure,' experience," he writes.

erly converged upon the object of vision. It is often thought that the only thing the child has to do is to look out upon a world of objective reality and have it photographed in all its details in a purely passive way. Nothing could be farther from the truth. If the eye were purely a passive organ, no genuine visual experience could ever arise. There can be no visual sensation except in a visual experience requiring a reaction on the part of the organism. What is true of visual sensation is equally true of the pressure sensation. Mere passive touch could in no way acquaint us with the world as we know it in developed consciousness. There are also adjustments in hearing, and in taste and smell as well, which give to the auditory, gustatory, and olfactory sensations an objective meaning and significance. When we consider the so-called kinæsthetic sensations, — *i.e.* those sensations arising from the muscles, joints, and tendons, we find that the very existence of these sensations is conditioned by the adjustments which involve muscular contraction. No further elaboration is necessary to emphasize the fact that sensory experience without adjustment is an impossibility, and that a sensory experience is never merely sensory, but motor as well.

What we call sensation is in reality perception.

It must be kept in mind that what is often called a sensation is in reality a perception, *i.e.* it is an experience which is due not merely to the stimulation arising from an object present to the senses, but also to past experiences with that object or similar objects. In other words, a fully conscious experience never exists without an element of meaning. This meaning arises because of the experience previously acquired with the object through adjustments to it. For example, the visual experience of an orange, in so far as it is a mere visual sensation, is nothing more than color and form. However, the actual orange, which is not merely sensed, but perceived, means much more than the visual sensation as such can mean. Indeed, it is doubtful if any meaning could be attached to a visual experience that had not connected with it something of the past.[1]

In our earlier discussions, we have emphasized the fact that conscious processes follow in their groupings the law of end or purpose, and in this particular differentiate themselves completely from the processes of the material world. As will be brought out more definitely later, the entire psychology of learning has as its final principle of interpretation and explanation this same law of purpose. Sensation, however, as such, appears to arise entirely independent of any such purpose on the part of the organism, and, therefore, to fall outside of the learning process. The question may then naturally arise as to the justification of considering this topic here in a discussion of the psychology of learning. The reply to such an objection is easily made. Sensations are the materials which are to be organized through the experiences of the individual. *While sensations alone could never give us any knowledge of the world about us, they are absolutely indispensable for such knowledge.* It is safe to assume that there is nothing in our conscious life that cannot be reduced, in its most fundamental form, either to sensations, or to affection. It will be maintained in a later chapter that there is no pure thought as such that does not contain, as its basis, sensory material.

Sensation the raw material of knowledge.

It will further be seen that while the individual organism may in no way choose its sensory experiences consciously, still it is possible for the educator to determine, to a certain degree, the variety and number of sensory stimuli that the pupil shall experience. It has been found, for example, that the intelligence of the feeble-minded and the idiot has been improved by an education in sensation.

The nature and variety of sense stimuli to an extent under control.

We must also keep in mind the fact that developed sensations are, in reality, perceptions, and perceptions do not

[1] For a further discussion of this topic, see Chapter XVII.

arise entirely independent of the individual's conscious aims. This the following consideration will make more apparent. As we have already said, perception is due to experience added to the original sense material. This experience arises through the organism adjusting itself to the object of sensation, and thus gaining a practical familiarity with it. Now this adjustment is by no means entirely a matter of indifference, and generally the kind of adjustment that is made is in the higher learning processes a matter more or less of deliberate choice. *We determine, then, to a considerable degree consciously what our perceptions shall be. Further, if we extend the notion of purpose to unconscious choice, we can say that there is no perception that does not arise under the dominance of some end.*

We control to a degree the character of our perceptions.

In general the newborn child has less vivid and less active sensations than the older child or the adult. Before birth the child has doubtless experienced a few dim sensations. The fœtus is capable of movement during the last months before birth, and, therefore, has the possibility of vague kinæsthetic sensations. The possibility of pronounced dermal sensation is practically excluded on account of the medium in which the embryo develops. However, there may be certain sensations of pain and of the internal organs. At birth, and shortly after, there rushes in upon the child a flood of sensory stimuli. Immediately with birth the child breathes for the first time, and with breathing there comes the possibility of sensations arising from the respiratory tract. The child, too, has the possibilities, for the first time, of the dermal sensations of temperature, and pain is perhaps first sensed at the time of birth. The sensation of pressure, of course, exists as a possibility before and during birth. Light stimuli begin to affect the eye of the child in a few hours after birth, and within the first forty-eight hours the middle ear is generally freed

The child's sensory experience less rich than that of the adult.

from the mucus which prevents the possibility of hearing before this time. Early in the child's post-natal existence there are more or less definite reactions to taste stimuli, but olfactory stimuli seem to possess little effect for some time. In the main we can say that in the early months of the child's life he possesses all the possibilities of sensation that he will later have, but that most of his sensory experiences are more vague and less definite than they are with the adult.

Taste and touch in the child.

In two particulars, however, the infant, after a certain period of development, undoubtedly possesses greater possibilities of sensory experience than he will later on in his life. The dermal end organs are probably as numerous as they will ever be, while the total surface of the child's body is much less than it will be when he has reached maturity. For this reason the basis of sensory discrimination of the dermis may be much finer in the case of the child than of the adult. Also the little child is provided with a large number of taste buds in the cheeks. For this reason he gets pleasure in stuffing his mouth with food. With these two exceptions, however, it is safe to say that during the first year of a child's life his sensory experiences are inferior to those of the mature individual. Notwithstanding this fact, the relative importance of sensory experience is greater for the child than for the adult. Children are more concrete in their attitudes, the perceptive and interpretative elements are less. Their attention is largely of the sensory type, and is determined in a passive way.

Sensory defects may vary all the way from the absolute lack of one or more of the senses, as in the case of Helen Keller,[1] or Laura Bridgman, to slight defects in vision or in hearing. Children who are deprived of sight or hearing show, apparently, mental defects, but these are not due

[1] Miss Keller was only eighteen months old when she became deaf and blind. See "Story of my Life," New York, 1903.

necessarily to any lack in the nervous system itself, but rather to the fact that the sense stimuli are not received and reported to their appropriate brain centers. The congenital deaf-mute is handicapped in intellectual development. This is largely due to the fact that without special education such a child is unable to learn spoken language. And since the spoken word is important in the development of the higher intellectual processes, the deaf-mute's lack of ability to speak is a pronounced drawback to his mental progress. When deaf-mutism and congenital or early acquired blindness are found in the same person, the difficulty of education is, of course, much greater, since the only sense department of much value in the learning process that remains is the tactile sense, including the kinæsthetic. That education even under such circumstances is not altogether impossible, the high intellectual attainments of Helen Keller, and, at an earlier time, of Laura Bridgman, bear witness. There are other cases also on record where a similar education has been in part possible under similar conditions.[1] Other children it has been found impossible to raise above the stage of idiocy when apparently similarly afflicted. The remarkable fact remains, however, that in a few cases, at least, it has been possible to educate to a high standard of intellectual proficiency individuals whose effective sensory experience was limited to the kinæsthetic and tactile sensations. The learning process is evidently possible with a paucity of sensation, but this does not imply that learning can proceed with no sensory experience whatsoever.

The education of individuals with marked sensory defects.

[1] One of the most interesting of these cases is that of Emma Kubicek, who was present at the meeting of the Illinois State Teachers' Association at Springfield, Illinois, December, 1905. Miss Kubicek was presented to the Child Study section by her teacher, Helen R. Jordan. The unfortunate girl was blind, deaf, and dumb, but her other senses were remarkably acute, and her general intelligence high. Miss Kubicek has since died.

Only with infinite patience has the education of those with grave sensory defects been accomplished.

The problem of educating the blind and the deaf is a special one, but there are found in the common schools children with sensory defects which often are not prominent, but which, nevertheless, interfere with their learning, often to a considerable extent. Sometimes the teacher is not aware of these defects; even the parent may not know of their existence; and yet they may be, from the standpoint of the learning of the child, sufficient to greatly hinder his progress.[1]

Slight sensory defects sufficient to greatly hinder learning.

Defects in vision are extremely common. A considerable number of investigations have been made in regard to the eyesight of school children, which show that absolutely perfect vision is decidedly the exception rather than the rule. The most common of these visual defects are what are technically known as errors of refraction, which are of three kinds, namely, myopia, or near-sightedness, hypermetropia, or far-sightedness, and astigmatism. Myopia is due to the fact that the fundus of the eye is so far removed from the lens that the rays of light are brought to focus in front of the retina, and, diverging again, they cause a blurring of the vision. Hypermetropia is due to the opposite defect, and the rays of light are not brought to a focus soon enough to give clear vision. Astigmatism is due to irregular curvature, generally of the cornea, which is itself a refracting medium. If the curvature is greater, for example, in one meridian than in another, the lens cannot properly accommodate for both, and the result is that while part of the rays of light are brought to a focus,

Defects in vision extremely common.

[1] Sometimes the parent is aware of defects of vision or hearing in the child, but when spoken to about such defects by the principal or superintendent, replies, "Yes, I know he cannot see very well, but he was always so." This fatalistic attitude is a serious drawback to improvement in many cases.

others are not. Often a pupil advances through the grades and the preparatory school before it is discovered that his vision is impaired. One case in point called to the writer's attention was that of a young man with so marked a case of myopia that he had only one-twelfth visual acuity. When he first was fitted with glasses, he thought that they must be imperfect, because he noticed on looking at the floor certain lines, which he afterwards learned to be cracks in the floor. This young man had worked for many years with vision so poor that he had never known that the floor contained cracks. It is perfectly obvious that such grave defects as this must be remedied if suitable progress is made in learning.

Various physical troubles result from visual defects.

Visual defects do not always show themselves in marked decrease in acuity. Sometimes when the vision is not strikingly subnormal there result eyestrain, nervousness, headaches, stomach troubles, and perhaps more or less general ill health. It is a safe principle to proceed on that when there is any considerable visual abnormality, whether it is sufficient or not to interfere seriously with the ordinary school work, this defect should be remedied at once.[1]

Less common but more serious than defects in vision are

[1] Allen, in his book on "Civics and Health," Boston, 1909, says: "Wherever school children's eyes have been examined, from six to nine out of thirty are found to be nearsighted, farsighted, or otherwise in need of attention. A child is dismissed from school for obstinately declaring that the letter between *c* and *t* in "cat" is an *o*; a pupil in her fourth school year was recently brought to me by her teacher with the statement that she did unreasonably poor work in reading for an intelligent and willing child; a boy is punished for being backward. These three cases are typical. Examinations showed that the first child was astigmatic and not obstinate; the boy had run a pin into one eye ten years before and destroyed its sight; while the second girl was found to be afflicted with diplopia, and in a friendly chat told the following story: 'I very often see two words where there is only one. When I was a very little girl I used to write every word twice. Then I was scolded for being careless. So I learned that I must not say two words, even when I saw them.'"

those arising from hearing. In a series of investigations in the Washington schools, teachers reported defects in hearing among boys at sixty-seven hundredths per cent, and among girls at thirty-six hundredths per cent. Recent tests in New York City schools showed one and one tenth per cent of the children tested had defective hearing. Other tests have shown children defective in hearing in some cases as high as thirty per cent. The great difference in the various results is due in part to difference in methods of testing the children. In those tests where the percentage is very small the methods have been crude and inaccurate. Not infrequently a child who is defective in hearing is classed by his teachers as stupid.[1] His normal development is, therefore, seriously arrested, and perhaps permanently interfered with. Children differ not only in visual and auditory acuity, but also in the acuity of other senses; for example, the sensibility to pain and to pressure is not the same for all individuals, and may vary with the same individual from time to time. Fineness of dermal sensation is also a variable quality, as is also the sensitivity to taste and to smell. These variations, however, except in pathological cases, have relatively slight significance in the learning process.

Defects in hearing often serious.

Taussig [2] summarizes various investigations in regard to visual defects of public school children as follows : —

	Per cent.
Heidelberg, Germany (1870)	35.0
Edinburgh, Scotland (1904)	43.2
Dunfermline, Scotland (1907)	17.0
Cleveland, well-to-do district (1907)	32.4
Cleveland, congested district (1907)	71.7
Massachusetts, except Boston (1907)	19.9
Boston and environment (1907)	30.7
Boston (1908)	23.0

[1] Adenoids are often the cause of defects in hearing as well as of general dullness. Their removal is imperative in all pronounced cases.

[2] *The Psychological Clinic*, III., pp. 151–152 (1909).

	Per cent.
New York City (1906)	31.3
New York City, Borough of Manhattan (1908)	10.2
Chicago (1909)	19.4
Jefferson City, Mo., either eye (1908)	36.5
Jefferson City, Mo., both eyes (1908)	22.7
St. Louis County, Mo., either eye less than 20/20 (1909)	30.6
St. Louis County, Mo., both eyes less than 20/30 (1909)	14.3
St. Louis County, Mo., both eyes less than 20/40 (1909)	2.8

His table in regard to defective hearing in the public schools is: —

Edinburgh, Scotland (1904)	12.2
Dunfermline, Scotland (1907)	4.0
Cleveland, well-to-do district (1907)	5.2
Cleveland, congested district (1907)	1.8
Massachusetts, except Boston (1907)	5.8
Boston and environment (1907)	7.7
Boston (1908)	7.6
New York City (1906)	2.0
New York City, Borough of Manhattan (1908)	1.0
Chicago (1909)	2.7
Jefferson City, either ear defective (1908)	7.7
Jefferson City, both ears defective (1908)	1.3
St. Louis County, either ear defective (1909)	7.3
St. Louis County, both ears seriously defective (1909)	2.2

Sensitivity among defectives and delinquents.

It is generally believed that sensitivity among defectives and delinquents is less than among normal individuals. Italian investigators have found among criminals that general sensitivity is one sixth, and sensitivity to pain two fifths, less than in the average person. There is a general obtuseness in touch, except among swindlers and thieves. Color blindness, which is a defect more common among men than women, is found to be also greater among criminals than among normal persons. Bono reports sixty per cent of two hundred and twenty-one youthful criminals color-blind. Holmgren comes to similar conclusions, and Biliakow found fifty per cent of the hundred murderers investigated by him color-blind, as against four and six tenths per cent among normal Russians. Schmitz says that fifty-five per cent of those who are color-weak are subject to the more severe nervous diseases, such as epilepsy, chorea, and hysteria.

Moral obtuseness often accompanies physical insensitivity.

Moral obtuseness is often found with physical insensitivity. Lack of pity for the sufferings of others is sometimes accompanied by an inability to experience pain to any high degree and by a general insensitivity.[1]

Possibility of sensation alone not sufficient.

It should always be remembered, however, that while it is imperative to correct, as far as possible, sensory defects, and thus assure the possibility of sensation, the mere possibility of sensation does not necessarily mean that the child actually possesses the desired experience. A large number of stimuli are ignored because of a lack of interest in the objects which arouse them. This interest, as we shall point out later on, must be secured at all hazards, and is often best obtained by distinct pedagogic devices.

[1] The statistics quoted above are found in a more extended form in a monograph presented in connection with a Hearing on the Bill (H. R. 14798) to Establish a Laboratory for the Study of the Criminal, Pauper, and Defective Classes, by Arthur MacDonald. Government Printing Office, Washington, 1902.

CHAPTER VI

NATURE OF PERCEPTION IN THE CHILD

In the above discussion of sensation, a contrast has been drawn between sensation and perception. As has already been said, sensation is the crude stuff by means of which the world of external reality is brought to the individual experience. Before this raw material can be utilized, however, it must be interpreted. So it happens that at the basis of every developed experience there lies a perception, and it follows further that the more extended the experience of the individual is, both in particular and in general, the wider is his range of perception.

All perception dependent on previous experience.

The world of the little child is very narrow, and in many respects indefinite. Often the child of six or seven cannot discriminate colors with any degree of accuracy, though girls are more capable than boys in this respect. Temporal and spatial relations are not well understood, and are gradually comprehended only through practical necessities. The child's perceptions are often fantastic and emotional. A number of studies have been made to determine the range and nature of the perceptions of the child at the beginning of the school age. The first of these experiments was performed in Berlin, under the direction of the Pedagogical Verein, in 1870, and the principal results reported by Bartholomai. They indicated that the Berlin child possessed relatively meager perceptions at the time of entering school; but more definite facts can hardly be deduced with any degree of certainty.

Studies in range of perception. The Berlin experiments.

Nine years later Karl Lange carried on a similar experiment in Plauen. He asked the children fourteen different questions; for example, who had seen the sun, moon and stars? The principal result of Lange's experiment was that city children knew less of natural phenomena than country children. Other experiments of a like nature were carried on in various German cities, and the following year G. Stanley Hall "undertook, soon after the opening of the Boston Schools in September, 1880, the making out of a list of questions, suitable for an inventory of the contents of the minds of children of average intelligence on entering the primary schools of the city."[1]

Similar experiments by Lange at Plauen; Hall's experiments.

Hall, in discussing the results, says: "The high rate of ignorance indicated by the tables may surprise most persons. . . . Skeins and spools of thread were said to grow on the sheep's back or on bushes, stockings on trees, butter to come from buttercups, flour to be made of beans, oats to grow on oaks, bread to be swelled yeast, trees to be stuck in the ground by God and to be rootless, meat to be dug from the ground, and potatoes to be picked from trees. Cheese is squeezed butter, the cow says 'bow-wow,' the pig purrs or burrows, worms are not distinguished from snakes, moss from the 'toad's umbrella,' bricks from stone. . . . So that, while no one child has all these misconceptions, none are free from them and thus the liabilities are great that in this chaos of half-assimilated impressions,

Children manifest remarkable ignorance concerning most simple facts.

[1] In order to avoid the errors arising through suggestion and emulation of children questioned in large groups, "four trained and experienced kindergarten teachers were employed by the hour, to question the children in groups of three at a time. About sixty teachers, beside the four examiners, made returns from three or more children each. . . . From more than twice that number, two hundred of the Boston children were selected as a basis," for the tables drawn up. Shortly after the publication of these tables Superintendent J. M. Greenwood of Kansas City tested six hundred and seventy-eight children of the lowest primary class in that city; forty-seven of these were colored.

half right, half wrong, some lost link may make utter nonsense or mere verbal cram of the most careful instruction, as in the cases of children referred to above, who knew much by rote about a cow, its milk, horns, leather, meat, etc., but yet were sure from the picture book that it was no bigger than a small mouse."

Summary of Hall's conclusions.

Hall summarizes the result of the experiment as follows: "(1) That there is next to nothing of pedagogic value, the knowledge of which is safe to assume at the outset of school life. . . . (2) The best preparation parents can give their children for good school training is to make them acquainted with natural objects, especially with the sights and sounds of the country. . . . (3) Every teacher, in starting with a new class or in a new locality, to make sure that his efforts along some lines are not utterly lost, should undertake to explore carefully section by section children's minds. . . . (4) The concepts which are most common in the children of a given locality are the earliest to be acquired, while the rarer ones come later." To this summary should be added the fact that children form many of their ideas from the most absurd verbal analogies, and have behind them practically no concrete notion of the significance of these ideas. Further, that in their ideas of natural phenomena they are strangely anthropomorphic and mythopœic. God lights the stars so that he can see to go on the sidewalk or into church. When people die they are slung up into the sky, where God catches them. Thunder is perceived as God groaning, or kicking, or rolling barrels, or turning a big handle, or grinding snow, talking aloud, and so forth. Lightning is God striking many matches at once. He keeps rain in heaven in a big sink or a big tub or barrel. God lights the stars with matches, or blows them out.[1]

[1] The account of Hall's investigations were first published in the *Princeton Review*, Vol. II, pp. 249–272, May, 1883. It was later reprinted as a sep-

In 1880–1884 Dr. B. Hartmann[1] made similar tests in the Annaberg schools. The results obtained do not differ greatly from those reached by Hall. The great advantage of the Annaberg investigation over that of previous experiments lies in the fact that it was continued for five years. Hartmann found that the per cent of known concepts varied enormously in accordance with the field from which the questions are chosen; for example, only 128 children knew what a triangle was, while 564 were familiar with the circle and 1056 with the globe. Meumann,[2] commenting on this, says, "we see from this that the triangle is not psychologically the most simple and best known figure, as Herbart falsely assumed; the logically simple is not necessarily psychologically simple and elementary."

The Annaberg experiments.

Still other experiments have been carried on in later years by Superintendent Seyffert in Zwickau, who concludes that pictorially represented objects are not nearly as well known as objects of concrete perception, and that it is the tendency of children to hold their perceptions to the known and to distinguish the new and exceptional in terms of the old. Meumann concludes that this is both a pedagogical advantage and disadvantage. The advantage consists in the fact that the teacher can connect the new with the old in developing the child's perceptions. The disadvantage is to be found in the fact that the new is often conceived in terms of the old, and is not comprehended in its essential qualities. *Therefore, the pedagogical rule of always bringing the new into connection with the old has its dangers.*[3]

Children interpret the new in terms of the old.

arate monograph, and still later in a volume of essays by Dr. Hall, entitled "Aspects of Child Life and Education," Boston, 1907.

[1] "Die Analyse des Kindlichen Gedankenkreises als die naturgemässe Grundlage des ersten Schulunterrichtes."

[2] "Vorlesungen," Band I, p. 144.

[3] This danger is illustrated by a reply made by several pupils in a class in Greek history, when asked what advantage the possession of certain islands was

In 1898 J. Olsen made a study of 5600 pupils in Varde, Denmark. Hall, who reports this study in the article by him previously cited, says: "Some of the misconceptions of children were remarkable. Some know moving, but not stationary clouds. Very much that passed under the children's eyes every day was not noticed. School work must be built upon a very poor foundation of clear ideas. The fact that children see objects a hundred times without acquiring consciousness of them suggests that we need to converse with children about the commonest things."

Hall's comments on Olsen's experiment.

Under the direction of Meumann during the school year 1903–1904 Dr. Engelsperger and Dr. Ziegler, teachers in the Volksschule in Munich, carried on an extensive experiment similar to those above described. The results showed great differences in the perceptions of country and city children, and according to Meumann clearly prove that the city children as often as possible should be taken into the country and the country children into the city, and further that we should be careful in selecting the materials for our instruction to keep in mind the differences in the stock of ideas that these two different classes of children possess.[1]

Great differences in the perceptions of country and of city children.

Some of Meumann's most important conclusions from these various investigations are: The happenings in the home life of the child are those things which he knows the best. Those things which he learns of in his wanderings about are known much less exactly. *Those things which the child does not handle are less familiar to him than things which he does handle.* The tools with which his parents or the servants work are less familiar to him than the tools with which he

Meumann's summary of the results of various experiments.

to the Athenians in their naval operations. The statement was made that these islands served as coaling stations. The Spanish-American War was then in progress.

[1]Meumann, *op. cit.*, pp. 154–155.

works. Those things for which the child has interest are much better known than things for which he has no interest. *Things which arouse feelings of unpleasantness seem to be better known than things which arouse pleasurable feelings.* In general there is a great paucity of perception in the child of six years. It is uncertain, unsystematic, and lacks penetrating analysis. It is filled with an imaginary completion of the gaps of perception, and contains gross verbal inaccuracies. Meumann considers the dictum entirely wrong that Biblical history and fables are the proper materials for the first school years. The child lacks an understanding of the temporal relations which lie at the basis of all history, while his tendency to form analogies, to draw on his imagination whenever necessary and interpret his perceptions subjectively, make the myth and fable unsuitable material for the beginning school years. On the other hand, the emphasis of concrete instruction by the use of models and natural objects is a sane one. This last statement is doubtless too extreme. The value of myth and fable will be discussed later.

Sensations are neither true nor false: perceptions may be true or false.

Since perception is the interpretation of the present sensory stimulus in terms of past experience, the possibility arises that such an interpretation may be wrong. *Sensation could be neither true nor false. As mere sensation it would simply exist.* On the other hand, the perception goes beyond the present sensory experience, and is implicitly a construction in terms of a mental content that has been acquired. The mere sensation of redness would be a reality, whether it were due to an external stimulation or to some activity confined to the retina; the perception of an externally red object, however, may be valid or not in terms of the objective or subjective nature of the stimulus. It makes no difference to the mere sensory experience what the nature of the stimulus is ; it does make a difference, however, in the interpretation of this experience, that is, it makes a difference in conduct.

There are two varieties of false perceptions, namely, illusion and hallucination. The difference between these as ordinarily given is that the former is due to the inadequate interpretation of an objectively existing stimulus, while the latter is due to a false interpretation arising from purely subjective causes, no objective stimulus being present.

Distinction between illusion and hallucination.

For example, on a foggy day, objects seen through the mist often assume gigantic proportions, the reason for this being that under ordinary conditions an object casting the same sized retinal image and possessing the same indistinctness of outline would be much farther away than it is in reality under the unusual atmospheric conditions. Since it is judged as being farther away, it also is judged as being larger than it actually is. An external stimulus is present, but it is not accurately interpreted. The example of an hallucination is found most clearly in cases of mental disease where the patient, for example, hears voices that do not exist or sees forms not visible to other eyes.

The above distinction between illusion and hallucination is not, however, an entirely valid one. In the first place, the hallucination is not generally due to purely subjective conditions, and the difference between it and illusion seems to be a matter of degree, rather than of kind. The person who sees a mirage on the horizon and interprets it as a city near at hand, has, indeed, an objective stimulus which sets up the illusion; but the person who hears imaginary voices plotting his destruction finds also a stimulus for his hallucinatory experience in certain sounds objective to the ear. Even the unfortunate victim of alcoholic mania, who construes his heightened retinal circulation into horrible objects in the external world, has as a basis for his hallucination, not a stimulus outside his body, but, nevertheless, one that is objective to the centrally aroused nervous processes.

The common distinction not valid.

The distinction between illusion and hallucination is pragmatic or practical, and in the last analysis is to be found in the interpretation of these false perceptions in terms of a wider experience. An illusion may be defined as a normal false perception (that is, a false perception which ordinary persons would experience under similar conditions), which does not agree with the more extended experience of the individual or individuals experiencing the illusion. An hallucination, on the other hand, may be defined as an abnormal false perception (that is, a perception which the mentally sound individual would not experience under similar conditions), which does not agree with the experiences of healthy minded individuals in general. The individual who experiences an illusion discovers the fact by trying out his perception, and finding that it does not work in his wider experience. For example, a system of mirrors may make a bouquet of flowers appear to be resting in a vase, when in reality it is in an entirely different position. To all normal people this illusion would be present. If the person who experiences it, however, puts forth his hand to grasp the flowers, he finds nothing that answers his touch. His visual experience is not consistent with his tactile experience. The two parts do not fit together, and he, therefore, judges, since the tactile experience is less often deceptive than is the visual, that he is subject to an illusion of vision.[1] *The test for an illusion, then, is within the circle of individual experience; the test for an hallucination, under ordinary circumstances, is to be found not primarily within the individual's experience, but within the experience of the group. The test for both is in terms of wider experience, but the wider experience of the individual is not sufficient if the individual does not conform to the social group.*

The true distinction is practical.

[1] Macbeth saw the "air-drawn" dagger with the drops of blood, and was clearly the victim of an hallucination. He might have put forth his hand and touched the dagger, for it is quite possible for the abnormal person to experience an hallucination that appeals to several senses at the same time. The test of the reality of Macbeth's experience would be found in the fact that others would not have seen the dagger if they had been in the room with him.

In the last analysis, then, we find our criterion of a false perception one of adequate adjustment..

The relation of false perceptions to the learning process is an important one. The significance of hallucinations, however, belongs to abnormal psychology, and, therefore, does not concern us here to any extent. With illusions, it is a different matter.

Two types of illusions.

Illusions, generally speaking, may arise from one of two causes, or from both together. An illusion may be due to an unusual set of conditions in connection with the object of the illusion, or to a strong subjective tendency, which leads to the interpretation of external conditions in terms of the subjective bias. As an illustration of an illusion of the first class may be cited the common laboratory experiment which consists in crossing the two middle fingers of the hand and then testing on the surface of these fingers, so crossed, the discrimination of distance between two compass points, one touching the first of the crossed fingers, and the other the second. If the subject of this experiment is blindfolded, or is in any way prevented from having a visual experience of the test, and an assistant manipulates the compass points, it will be found, almost invariably, that the shorter distances between the points are judged greater than the longer distances. This illusion is caused, as can readily be seen, by the fact that the crossing of the fingers has exactly reversed the ordinary conditions on which the discrimination of the compass points is based. An example of an illusion of the second type is to be found when a person is expecting a visit from a friend. Under such conditions persons, perhaps but slightly resembling in voice or appearance the friend expected, are perceived as that friend. It is obvious that in this second class of illusions we more nearly approach the hallucinatory perceptions discussed above. When this subjective tendency of interpretation reaches a sufficient degree of intensity, we may easily pass from the illusion to the hallucination. In the pathological "fixed idea" we have a case in point.

Necessity of cultivating the right attitude of expectancy.

It is with this second case of illusion that the learning process is most concerned. It may readily be seen that here we have an example of the aim of the conscious process entering in very largely to determine the nature of the illusory experience. It is what we are strongly desiring or fearing that we are apt, other things being equal, to experience, and it becomes the business of the person who is directing his own learning processes or those of others to see to it that there exists the proper sort of expectancy; in other words, that the ideas and aims of the thought processes are such as can be actually realized in a world of concrete reality. It is at this point that illusion and imagination have much in common, though, as it will be insisted on in the following chapter, an imaginary experience is to be kept distinct from an illusory one.[1]

Methods of instruction must call forth activities. The most obvious pedagogical applications to be deduced from the facts that have been discussed in the last two chapters may be summarized as follows: —

1. Since adjustment to the object of sensation is necessary to assure real experience and genuine learning, it follows that school methods must be more than merely passive in their character. They must call forth some activity on the part of the child. For this reason there is great danger, particularly in college and university work, of overemphasizing the lecture method. To remedy this defect the quiz, the written recitation, free discussion, and laboratory methods should be introduced whenever possible. In the elementary school, where these methods cannot be used to so great an extent as in higher education, the pupil should be called upon to react in definite ways to the materials of instruction. If, for example, the teacher desires to acquaint the child with the distinction between various colors, it is not sufficient that he should simply present these and call the pupil's attention to them. The pupil should be asked to match and compare them, to arrange them in the order of his preference, and so on. There are countless ways in which the child may actively express himself in his school work,

[1] Illusions are particularly likely to arise with school children, their strength decreasing with the age of the pupil. It is also true that imagination of a certain type, as will be pointed out later, loses its importance in the child's life as he grows older.

and the skilled teacher will be able to make the proper application of this principle of adjustment in all the subjects of the curriculum.

2. The sensory experience which the child should obtain in his elementary school instruction must be integrated and finally fitted into a system of meanings. The teacher should never rest with furnishing his pupils with mere concrete instances. From the very beginning, the facts that the pupils acquire should be grouped together in terms of their significance in relation to the subject matter as a whole.

The experience of the child must be meaningful.

3. Since all learning is based on sensory experience, it follows that the learner must have the possibility of receiving this crude material knowledge, if he is to develop properly. Sensory defects in children must be systematically discovered, and remedied as far as possible.

Children should be systematically tested to discover sensory defects.

While skilled specialists must be employed for an accurate diagnosis of eye and ear defects, rough tests of a preliminary nature can be made by the teacher or the school nurse. Tests for eye defects due to errors of refraction can be made with the ordinary Snellen cards. These cards should be placed in a good light, and the children should be tested singly, standing or sitting at some accurately measured distance (for example, twenty feet or six meters), from the test card. Each eye must be tested separately, as there is often a marked difference in the acuity of the two eyes. If the child can read the line marked twenty at the distance of twenty feet, his acuity is expressed by the fraction $\frac{20}{20}$ or 1; if, however, he can read no line above the one marked thirty, his acuity is $\frac{20}{30}$, or two thirds normal. If there is but slight difference in his two eyes, and if they are not markedly subnormal, the errors of refraction are probably of slight consequence. However, a child who has but one half or one third vision in one or both of his eyes is under considerable strain when he is reading small print or copying from the blackboard at a distance. This strain may eventually work disaster, not merely to his eyes, but to his whole body as well. Allen says: "Thousands of upper grade children and college students are dieting for stomach trouble that will last until the eyes are relieved of the undue and unrecognized strain." In testing for astigmatism, Verhoeff's astigmatic chart or some similar device is to be used.[1] Visual tests may also be made for muscular insufficiency (heterophoria), color blindness, discrimination of brightness, color discrimination, and the like. A simple test to determine auditory acuity may be made with the watch. Each ear is to be tested separately, and the watch is to be removed until the threshold of audibility is reached. The room in which the test is made must, of course, be quiet, and the child must further be tested to determine that he is not imagining that he hears the watch tick. This can be accomplished by covering the watch with the hand in such a way that the sound is deadened. If the child then asserts that he hears the ticking, it is evident that he is supplying the lack of sensation with his imagination. Auditory acuity may also be determined by the whisper test, by tuning forks, or with elaborate instruments such as Seashore's audiometer or Lehmann's acoumeter.[2] If marked visual or auditory defects are discovered by any of the tests employed, the child should be examined by an oculist or aurist. Whenever a child is found that is particularly dull or stupid, the simple sensory tests for vision and hearing should at once be resorted to, as it is possible that the entire defect lies in these organs of sensation and is not more deeply seated.

The danger of dwelling too long on the concrete.

4. It must be remembered that while in the elementary school the adjustment that is required of the pupil is generally to some immediate and concrete situation, it does not follow that all adjustment needs to be of this character. In the higher forms of the learning process the adjustment

[1] The most elaborate and careful description of these tests for sensory defects as applicable to school conditions is found in Whipple's "Manual of Mental and Physical Tests," pp. 128–187.

[2] All of the above tests are outlined by Whipple. Kirkpatrick, in the *Psychological Clinic*, III, pp. 96–97 (1909), gives a description of a simple whisper test for auditory acuity that may easily be applied by the teacher under ordinary school conditions. As many as fifteen children may be tested at once, by placing five each in the two outside rows and the middle row of seats. The pupils are supplied with pencil and paper. The teacher, standing on the right opposite the middle pupil, pronounces in a low, distinct tone, and also in a low, distinct whisper, a series of numbers that they are required to write. After four or five numbers have been given in a low tone, and also a similar number in a whisper, the children change seats, and the test is continued. Standing at the left, opposite the middle pupil, the teacher repeats the test for the left ear. The record obtained shows the auditory acuity of each child as compared with that of his mates.

must take place on the plane of ideas. There are dangers of dwelling too long on concrete material. More and more the individual who is to be educated must acquire the capacity of passing from object to symbol; from the habitual adjustment to the interpretation of the environment in terms of meaning.[1]

There has been manifest recently, in certain quarters, a tendency to insist that all the instruction in the primary and grammar grades should be based on material of a concrete sensory character. With the younger children this insistence is, doubtless, wise. The child in the first grade may be taught to add and subtract by performing these operations with splints or blocks; he may be made to comprehend the relative values of weights and measures by actually employing these; for example, he may learn that two pints equal one quart by pouring water into a quart vessel from a pint receptacle. It is, however, nothing more than ridiculous to insist that this kind of instruction should be continued indefinitely. It is true that primitive man first learned to count by using his fingers, but he never could have arrived at any general notion of number relationships if he had remained in this first stage of concrete learning. When we are told that algebra should not be taught in the higher grammar grades, because the pupil is thereby kept away from the concrete material that arithmetic affords, we must dissent. Whether the introduction of algebra into the grades is wise or not, its retention or elimination is not to be determined on the superficial basis of the opinion that the child is not ready to grasp the abstract and symbolic in the eighth grade.

The child should be given materials of instruction not found in his home environment.

5. The meager, vague, and inaccurate perceptions possessed by the child suggest the necessity of determining, as far as possible, systematically the range of experience that each pupil has on entering the school. Tests of this sort for older pupils have been used by Whipple and Kirkpatrick. Similar methods adapted to younger children could advantageously be employed in testing the children in the primary grades. The investigations recorded in the earlier pages of the present chapter indicate that city children should be, in part, educated by

[1] Hall ("Adolescence," II, pp. 462–465) emphasizes the value of abstraction and the dangers of dwelling on concrete material.

means of those materials that are familiar to country children. The attempt that is now being made to link the elementary nature study with the rudiments of agriculture has its chief economic value in the country school; on the other hand, the educational significance of this material is perhaps greater for the city child than for the country child, since through this material the former is given a new perceptive basis. It should further be remembered that a knowledge of natural objects and phenomena is not sufficient material for education in the modern complex social environment. The country child in particular should know something about industrial and social facts; have an acquaintance with machinery, and gain some knowledge of those activities with which the city child is familiar, but which are relatively uncommon in the rural life.

The desirability of teaching fable and myth in the grades.

6. Since the child is more suggestible than is the adult, since he interprets the world in a more subjective and personal manner, and is thus open to illusion and misconception in a marked degree, the problem of the place of the fable and the myth in the grades becomes an important one. This question naturally belongs to the chapters immediately following, and will be discussed in its appropriate place.

CHAPTER VII

GENERAL CHARACTERISTICS OF IMAGINATION

THE term "imagination" in its popular sense often conveys a different significance from that which it has when employed in psychology.[1] In everyday language it is not uncommonly used to describe an impractical state of mind given over to illusion and the contemplation of uncertainty. From this point of view the world of imagination is a realm of shadows divorced from contact with vital living and fruitful thinking. Such a conception as this is unfortunate, because it is not true, and has caused no little confusion in the discussion of the desirability of imagination in the mental life of the child and the use of imagination as a means of education. A very little reflection, however, should convince us that imagination (if we mean by it anything more than the wildest phantasies of the abnormal mind) has, even in its form of free productive creation, a very firm grasp on the real universe.

Imagination not a capricious act of fancy.

What psychology means by imagination is quite simple. To illustrate, before me as I write is this manuscript. My knowledge of its presence is due in part to rays of light existing in the physical world as vibrations in the ether and conveyed to my eye, where they are focused on the retina and thereupon affect the cortex of my brain through the excitation of the optic nerve. This nervous discharge is correlated with a state of consciousness that may be described as seeing the paper which I have before me.

Imagination refers to sensory objects not immediately present to the senses.

[1] A considerable amount of the material appearing in this chapter has already been published by the writer in various articles in the *Psychological Review.*

Through other senses, also, there come other reports of the presence of the manuscript. I touch it; I hear the rustle of its pages; I recognize that it has weight when I lift it, and so on. The knowledge that comes in this way through the direct presentation of an object to the senses, and the interpretation of that object in terms of past experience, is, as we have already seen, perception. Now, if I lay the manuscript on the table and shut my eyes, it is no longer present to the senses as an object, but it still may exist for me as a memory image. My mental state of perception is then changed to one of imagination. In this change there is no question of reality or unreality, of truth or delusion, but of immediate sensory presence, or the lack of such sensory presence. The object of my imagination has an external reality, and is not merely subjective and individual. When I imagine the manuscript I have not set into operation a capricious, individual fancy. I refer the imagined manuscript to a world external to my passing, momentary thought, just as truly as I refer the perceived manuscript to this same external world.

Imagination and perception not to be distinguished in physiological terms.

Various attempts have been made to define the mental image, and to distinguish it from sensation and perception. The attempt to arrive at such a distinction by classing the mental image as unreal and the percept as real has invariably resulted in failure, and has no justification, as has been shown above, in experience. A number of writers have attempted to distinguish between image and percept in terms of the functioning of the end organs and the nervous system.

This is a favorite distinction, employed by many reputable authors. Miss Calkins,[1] for example, says: "The physiological basis of imagination differs from the physiological basis of perception, in the first place, by the lack of excitation of the peripheral end-organs, retina, taste-bulbs, and the rest." Miss Calkins further states that "all elements of

[1] "Introduction to Psychology," p. 187.

the sensory image are centrally stimulated." Stetson [1] likewise defines the memory image as the appearance in consciousness under voluntary control of images without any sensory stimulus. James [2] says in a similar vein, "In common cases of imagination it would seem more natural to suppose that the seat of the process is purely cerebral and that the sense organ is left out."

The impossibility of determining the physiological process involved in imagination.

Granted for the moment that these and similar distinctions between imagination and perception, based on the activity of the end organs and cerebral centers, are valid, these distinctions are primarily of no value to the psychologist. *The presence or absence of excitation in the end organs and in the central nervous system is not something to be directly observed, but rather to be inferred from the nature of the conscious process itself.* There is no possibility of determining directly just what physiological processes are occurring under such conditions. It is a distinction in hypothetical physiological terms, and not in psychological terms.

The attempt to describe the mental image through introspective analysis.

A more satisfactory attempt to define the mental image is from the standpoint of the experience as such. Fechner,[3] more than half a century ago, in drawing a distinction between a mental image and a visual after image, described the former as indefinite, washed out, and lacking corporeality. It possesses no sharp boundaries, and is not easily held in attention. The distinction in general has been held by many psychologists, who seem to regard the mental image as a weak and indefinite sensation, differing from the actual sensation in degree rather than in quality.

This, indeed, is the view of Wundt, who finds no absolute ground of distinction between image and sensation, and classes them both as the same kind of mental phenomena. Baldwin [4] says: "We are

[1] "Types of Imagination," *Psychol. Rev.*, III, pp. 398–411 (1896).

[2] "Psychology," Vol. II, p. 10.

[3] "Elemente der Psychophysik," II, p. 469.

[4] "Handbook, Senses and Intellect," p. 147.

aware in consciousness of no peculiar mark of revived states by which to distinguish them from percepts, except that they are prevailingly of less intensity. . . . If we try to recall the taste of an orange, we seem to have a kind of after taste of the orange."

Other writers, however, like Ziehen,[1] hold that there is a qualitative difference between image and sensation.

"The idea of the sun is therefore by no means merely a faded sun. . . . It is not a difference of intensity between the idea and the sensation, but above all a qualitative difference. The sensual vivacity characteristic of every sensation, does not belong *at all* to the idea, not even in a diminished intensity."

Both of these views possess, doubtless, a certain psychological justification; yet both cannot be a correct introspective description of the nature of the mental image as distinguished from a sensation. It is true, as Wundt points out, that there are border line phenomena in which the distinction between the image and the sensation is at a vanishing point. Such states occur when the sensation is very weak or the image unusually vivid. On the other hand, it seems evident that ordinarily, in most sense departments, there is an actual qualitative difference between the mental image of an object and a sensation of the same.

For example, I cannot persuade myself that my mental image of middle C or of the taste of an orange is merely a weakened sensation of the musical sound or the taste of the fruit. In my ordinary experience, my mental image of these objects has so little likeness to the actual sensation that I can find no qualitative resemblance. On the other hand, my memory of the color violet is quite like my actual sensation of it. It seems probable, then, that we have certain mental images, especially in the field of vision, that quite closely resemble the actual sensation in the same sense department; it also is apparently true that there are other experiences which pass for mental images that have little qualitative resemblance with their corresponding sensations. It would then seem impossible to define a mental image either as a weak sensation or as something *sui generis*.

[1] "Introduction to Physiological Psychology" (tr. by Van Liew and Beyer), p. 152, London, 1892.

Imagination defined.

The most serviceable description of the mental image is not to be found in defining it as a weak, hazy, and indefinitely localized sensation, although often it may take on this character, neither in defining it as an absolutely unique experience, although at times (indeed, perhaps, generally) it appears qualitatively different from the corresponding sensation. The definition which seems the most valuable, and which offers the least logical objections, while at the same time agreeing most closely with the verifiable facts of introspection, can best be stated in a functional way by defining *imagination as that activity of consciousness in which an object of sensation is experienced as not being immediately present to the senses.* In other words, in order to have a genuine state of imagination there must be the direct experience of the object not being actually before the senses. If this experience is lacking, there is no true imagination nor true mental image.

This definition distinguishes between the mental image and the false perception.

This definition at once gives a clear distinction between imagination on the one hand, and perception, illusion, and hallucination on the other, a distinction which psychology has often failed to emphasize, which failure has led to confusion and contradiction. The subjective test can always be made. If the experience comes stamped with that quality which functions for the immediate sensory presence of the object, then the experience is a perception, true or false; if it is false, it must be classed as an illusion or hallucination, and never as an image. *Whenever there is an immediate revelation of consciousness that an object is before the senses when it is not there, then there exists a false perception.*

It does not matter if the individual recognizes the fact that he is deceived. He may know, for example, that the lake which he senses as on the horizon is not actually there; this knowledge does not do away with the illusory experience. Likewise the victim of an insane delusion may recognize the fact that his experience is false, but this again does not remove the delusion. The mental image, on the other hand, has in the moment of consciousness that quality by which it is at once recognized that its object is not directly present to the senses. It makes no difference what is the physiological correlate of this mental image; the origin of the experience is not the vital thing. The significance of the experience as a conscious phenomenon is that which is important. Its value is determined by its meaning, not by its origin.

The difference between image and percept interpreted in terms of reaction.

If we inquire more definitely what is the meaning of the mental image as distinguished from the meaning of the percept, we are obliged to state this distinction in the difference of the type of reaction aroused by the image from that aroused by the object of immediate sensory experience. On the whole, the reaction to the object of immediate sensory experience is more direct, definite, and sustained. This is evident when we compare the difficulty of holding in attention the object of imagination and the object of perception. But, on the other hand, while the reaction to the object of imagination is indefinite and incomplete, the meaning which the image has is more complete and satisfactory than the meaning possessed by the percept. The image fits into my total purposes better; it has greater significance in my thinking; it is more amenable to the law of purpose, since it is farther removed from sensation; it is less fixed and does not come to me so clearly from without, and it finds its place more readily in the total flow of consciousness. Still, since its origin is in a sensory experience, the choice which I exercise in its selection is restricted. It cannot transcend all experience, and must ultimately conform to the sensations which give it birth. No mental image is a mere creation of the individual mind. As has already been said, it is not entirely capricious and arbitrary. It has relations to a world of fixed realities, and, although its object can be manipulated with greater ease than the object of perception, yet, in so far as it has significance, it must ultimately accord with the facts of an objective world. On the other hand, the object of perception must possess to a certain degree the characteristics of the image; it, too, must, in general, find a place in the total flow of consciousness and be determined by the purposes of thought. At the two poles of experience we have the object of sense and the image. The mere object of sense, as we have already seen, may be considered as entirely without meaning, arbitrary, insistent, and present, whether we will it or not. It may come in at the most inopportune moment, as, for example, when a loud noise distracts our thought processes. But we never have in normal consciousness a mere sensation; we have a perception, already partly tinged with meaning through previous experience; neither do we have a pure image completely separated from a world of sensory experience. *The image is not absolutely spontaneous, but must conform to an environment of hard facts in which it finds its validity and justification.* The image does not need to relate itself so directly and immediately to this objective world as does the percept; but the ultimate adjustment to such a world is necessary, if the image is to be justified. *Flights of imagination have value only in so far as they can somehow square with facts.* Like perception, their truth or falsity is to be tested out in the way in which they work. The great difference is that in the instance of perception the adjustment is immediate; in imagination relatively remote.

Both image and percept must fit into a world of concrete reality.

However, eventually both image and percept must justify their existence in a realm of actual, concrete living. To the object of perception I must react *now* in a distinct and definite way. I cannot postpone the action; I cannot make the perceived object conform more completely to the aims of my thinking. The object of imagination demands no such complete and decisive action. I may suspend action; I may reform the image in more ideal terms to suit a more ideal reaction; but the postponement of my reaction is merely a postponement. *The two worlds, the imagined and the real, are not finally two worlds.* Eventually the imagined must be realized and the ideal must be made a part of my concrete achievement.[1]

Two reasons that have led to imagination being considered unreal.

If imagination, then, is so fundamental a constituent of reality, how happens it that the widespread notion of its unreal character should have arisen? The answer is not far to seek. In the first place, imagination has been confused with illusion and hallucination. These, as has been said, are false in so far as they assume an object present to the senses that does not exist. If imagination is made identical with false perception, why, then, it naturally follows that it is unreal. In the second place, simple imaginary elements, in themselves representatives of concrete realities, are capable of combinations that do not correspond to any actual or possible experience. This complex of imaginative elements owes its existence to the so-called productive imagination, while to the recalling of single sensory experiences, not immediately present to the senses is given the name of reproductive imagination. Productive imagination may combine elements of past sensory experience into products utterly fantastic and absurd. Our images of a horse and a man are results of a reproductive imagination essentially real; but when they combine into the picture of a centaur, they constitute a productive image to which our experience denies reality. It does not, however, follow that because these constituents of the productive or creative imagination are unreal, all such images are. It would be a great mistake to assume that productive imagination as such were more unreal than perception. *The test of the reality of any object, whether perceived or imagined, is its agreement with the wider experience of the individual and of society.* This is

[1] See Colvin, "The Nature of the Mental Image," *Psychol. Rev.*, XV, pp. 158–168 (1908).

essentially the criterion of adjustment referred to above. Why do I say, for example, that the centaur is unreal? Because I have never experienced such an animal, and because I believe no other being ever has or ever will. Surely the centaur is inherently no more fantastic than certain products of the imagination in whose reality I have the most firm belief. Let us take some of the almost contradictory animal forms of prehistoric times which the scientific imagination has constructed. Do we believe they really existed? We do, because they fit in with the extended experience of those scholars who from a few scattered remains, here and there, by a rare feat of productive imagination have reconstructed these animals. Without productive imagination the greatest literary works of the past, the constructions of inventors, and the hypotheses of men of science would never have come to pass.

The ordinary doctrine of mental types inadequate.

According to the common doctrine, there are as many kinds of mental imagery as there are various sense departments. Thus there are visual images, auditory images, tactile, temperature, and pain images, images of taste and of smell, as well as images of organic movements and of movements of joint, tendon, and muscle (kinæsthetic imagery). It is, however, doubtful whether there are actual images without sensory accompaniments in any of the sense departments except vision and hearing, and even here, in many instances, what are termed visual and auditory images may have with them incipient sensations. When we turn to consider the images belonging to other departments of sensation than vision or hearing, we find that their existence, apart from a direct sensory experience, is very doubtful. The recall of an olfactory or gustatory experience without the aid of a present sensation is by no means established. In taste especially there are often present in the mouth actual gustatory stimuli that set up weak sensations and that may readily be taken for images.

Distilled water almost invariably gives the writer a bitter or a sour sensation, and in taste experiments with barely perceptible solutions, he finds it extremely difficult to judge whether these elements (bitter and sour) are actually present in the liquid tasted, or whether the taste is merely "in the mouth." Generally olfactory images are quite wanting, unless there are some actual odors present that serve as a basis for the recall. Titchener[1] has found that it is quite possible for him to recall various olfactory sensations while smoking a cigar, the odor of the tobacco furnishing a sensory basis for the revival. Slaughter[2] found that subjects who recalled certain tastes gave evidence of experiencing accompanying sensations in which movements of the tongue played an important part. With the attempt to recall salt there was a flow of saliva; with bitter, a puckering movement of the mouth and setting of the muscles, with the movement of the tongue and an organic reaction. Sweet and sour likewise caused tongue movements. In the attempt to recall ammonia, Slaughter's subjects gave evidence of tension and feeling of irritation of the nostrils; while with alcohol, the breathing was a little irregular. In the case of dermal imagery it seems highly probable that the suggestion of the experience is sufficient to initiate actual sensations arising from the skin; Slaughter concludes "that the existence of dermal images in normal persons is extremely doubtful, and that the non-existence of the taste and smell images is practically certain." There is no way of determining whether the so-called organic images (experiences arising from the internal organs) are not organic sensations. Indeed, it seems extremely probable that in most instances the sensory element is the chief part of the experience. It is likewise probable that kinæsthetic images are kinæsthetic sensations.

Mental images often involve peripheral factors.

There is ground for believing, therefore, that the mental image must be regarded in many sense departments as arising in connection with peripheral factors, and that the mental image without these peripheral accompaniments perhaps exists only in vision and hearing. However, it makes little difference if we hold strictly to our definition, namely, that a mental image is a state of consciousness in which an object of sensory experience is revived with the immediate knowledge that it is not present to the senses,

[1] "Taste Dreams," *Amer. Jour. of Psychol.*, VI, pp. 505–509 (1895).

[2] "A Preliminary Study of the Behavior of Mental Images." Same journal, XIII, pp. 526–549 (1902).

whether the so-called images are accompanied by totally or partly weak sensations.

If an image of bitter is suggested by a taste in the mouth, but is not experienced as a bitter object actually present to the senses, it is according to the above definition still an image, whatever its origin. If an image of a spoken word arises because of incipient sensations of movement in the vocal chords without the word being perceived as actually spoken, we have in terms of the above definition an image ; if an image of the color red is due in part or entirely to the physiological activity of the retina and is not accompanied by the impression that the red object is actually before the senses, there is no perception of the object, but rather an image of red. If we hold to this point of view throughout, then, we can maintain that there are images in connection with all sense departments. If, on the other hand, we define the image as an experience invariably arising without sensory accompaniments, it is probable that our imaginal experiences are extremely limited.

Object-types and word-types of mental imagery.

A more important classification of images divides them into two main classes, namely, object-types and word-types.[1] To the object-types belong all concrete images of all sense departments, including motor images in which the ideational processes are in terms of imitative movements. Under the word-types are to be found verbal-visual, verbal-acoustic, and verbal tactile-kinæsthetic types.

Examples of the various object-types are simple. The reinstatement of any concrete experience is in terms of the object-type. If I revive in imagination the appearance of a rose, I have a concrete visual image; if I recall its odor, I have a concrete olfactory image; if I recall the sensation of touching its petals, I have a concrete tactile image ; if I recall the prick of its thorns, I have a concrete pain image; if I recall the movement that I make in drawing my hands away from the thorns, I have a concrete motor or kinæsthetic image. If, however, I do not recall the appearance of the rose, but merely its name, I have a verbal image ; if I recall the name as written or printed on a page, I have a verbal-visual image; if I recall the name as spoken by some one, I have a verbal-acoustic image; if I recall the name in terms of the movements of my throat in speaking it, I have a verbal-motor image. Verbal-

[1] See Meumann, *op. cit.*, Vol. I, p. 449.

motor images may be of two kinds, namely, the verbal-motor images in connection with the organs of speech and the verbal-motor images in connection with the movements of the arms, hands, and fingers in writing. The person who thinks of a word as he would write it has a verbal-motor image of the latter kind. Such images, however, do not normally arise without being accompanied by verbal speech-motor images. A simple test is sufficient to convince most persons of this fact. Attempt to spell a word merely by forming the letters with a pen or pencil, and you will find yourself, probably, either actually pronouncing the letters or reviving images involved in pronouncing them.

The word-types of images, as can be readily seen, are symbolic; they stand for concrete realities, which, however, generally are not revived in connection with the symbol. I may, it is true, when I image the word "rose," also think of the object for which it stands, but in most instances the revival of the concrete image with adults is not likely.

Symbolic imagery essential to higher thought.

Verbal or symbolic imagery is of the greatest importance in the more developed thought processes. It would be impossible to carry on the higher thought processes without this symbolic imagery, and in the education of the child there must be a gradually increasing emphasis on the symbolic aspects of thought. Nevertheless, these symbols, if they have any ultimate validity, must in some way refer to the concrete image for which they stand. When we say that a discussion contains mere words, we often mean that the symbols that it uses refer to no concrete objects in a real world of experience. For many, doubtless, the only image connected with "infinity" is the mathematical symbol which represents it. Whole treatises have sometimes been written that seem to contain nothing but meaningless symbols. It is evident that *while verbal imagery is absolutely necessary in the learning process, still its abuse may be accompanied by very grave dangers.*

Besides speech-motor and hand-motor thinking, there is another type of verbal motor imagery that has been given but slight attention in psychological literature, but which, nevertheless, is probably of a great deal of importance in the more abstract forms of thinking. This type of verbal-motor imagery may be called dramatic or mimetic. In thinking in this type of imagery the person does not employ "inner-speech" (thought in speech-motor terms), but rather an inner sign language that carries the meaning often of abstract and colorless modes of thought. A few illustrations may make clear what the general nature of this symbolic mimetic imagery is.

Dramatic or mimetic imagery.

When the writer attempts to call to mind a series of words, a phrase, or a paragraph, or even a collection of nonsense syllables, his first experience in the recall is not generally the revival of the words as such, but rather the emergence in consciousness of the background or setting of these words in terms of their general "drift," or meaning. There seems to be a certain rhythmical sequence in which these words appear; an arrangement which is not spatial in its character in the sense that it represents the arrangements of the words on a printed page. It is rather a spatial arrangement in terms of the meaning of the thought processes. These meanings are represented by images of curves or zigzag movements, in which, often, there appears a sort of a plot, with a distinct rise to a climax, and perhaps a falling off at the end. This way of thinking comes out with great clearness for the writer when he is attempting to learn a series of nonsense syllables. If left to his own devices, he finds himself invariably attempting to arrange these, even when he studies them in successive presentation, in a sort of a sequence of movements which seem essential to their subsequent recall. The actual "mind-stuff" of these thought processes he finds in images which represent gestures, such as pointing, raising the index finger, curving the hand, or in more general symbols of bodily movements which may involve a large variety of muscular adjustments. Such a sentence as this comes to the mind : "Infinity broods over all things." Immediately with the words themselves, arises in consciousness a general motor symbolism. The symbolism for the word for INFINITY is found in the tendency to prolong the word in imagination, this prolongation being accompanied by the distinct impression of projecting the word from the mouth, and then following this projected word, as it seems to float on out into space, with the body. There is an image of a forcible and continued ejection by the speech-motor apparatus and a bending forward of the entire body, setting itself as if for flight. There is no visual symbol here, as, for example, of extended space or the limitless vault of the heavens on a starlit night. The whole suggestion of unending space comes as an image of motor adjustment. The word BROODS brings an entirely different suggestion. Here the ideation centers in a distinct picture (motor, not visual) of outstretched hands, with the body bending forward and downward. ALL is symbolized by a sensation or image of roundness in the oral cavity, and by an extensive gesture (not actually executed, but merely represented) of an inclusive movement with both hands sweeping around and joining in front of the body. The symbol for THINGS is the mental representation of a direct and sudden gesture, with hand extended and index finger pointing out and downward.

It may be noticed from this description that much of this mimetic thinking is in the stage of what would correspond in the development of word language to the period of ideographs, in which the word-symbol suggests the concrete situation for which it stands. This is particularly true of the imagery in connection with the word BROODS. On the other hand, INFINITY and THINGS are represented by imaginal elements in which the concrete has been almost entirely replaced by the symbolic.

General kinæsthetic imagery symbolizes actual situations.

The fact is to be kept in mind, then, that besides speech-motor and hand-motor symbols, there are a large number of more general bodily movements that may be imaged and which may symbolize concrete objects and situations, just as truly as the images of written and spoken words may represent the concrete realities which they symbolize. This general kinæsthetic or mimetic imagery stands for actual adjustments to concrete situations. This type of ideation is what we might naturally expect. It must be more primitive than that type which employs the images of words spoken or written as symbols. In an earlier part of our discussion, it was maintained that a completed experience arose first through a sensation to which there was some kind of reaction or adjustment; that a perception was more than a sensation or a group of revived sensations, and that it was fully set up only when completed by a reaction to the stimulus evoking the sensation. *It would, therefore, be entirely natural to suppose that these general* *motor images are the symbols of actual concrete adjustment.* They are, indeed, the images of a gesture language, a language earlier to appear and more simple than the word language. *Thus mimetic images are the deepest and most subtle things in our thinking.* This view falls in with the current biological theories in regard to consciousness, particularly with the Pragmatism of James and the Instrumentalism of Dewey. These theories have made us familiar with the thought that *the meaning of a situation is after all an attitude, and that an attitude must in the last analysis be a motor affair. Thus it is but a step to the conclusion that this general dependence of experience for its significance on motor adjustments has left a deposit or "mind-stuff" that symbolically represents concrete situations, not actually present, but ideally represented.* This mind-stuff may in many instances have lost entirely its original significance. In other words, the situation is no longer reinstated in terms of an actual concrete adjustment, but rather in the terms of the motor symbol of that adjustment.[1]

General kinæsthetic imagery and imageless thought.

The above point of view has an important bearing on the question of imageless thinking that has recently been raised. A number of American and German investigators have maintained that the higher thought processes proceed without any imaginal content whatsoever. On analyzing their experiences, when reasoning or judging, they do not find any trace of an imaginal background. If this is true, we have a separation between the higher and lower processes of intelligence; a chasm which it seems difficult to bridge over. In the chapter on sensation it was maintained that our sensory experiences form the crude stuff from which all higher intellectual processes are constructed, and that sensation plus adjustment gives to the growing conscious-

[1] See Colvin, "A Marked Case of Mimetic Ideation," *Psychol. Rev.*, XVII., pp. 260–268 (1910).

ness of the child his first knowledge of a world of concrete objects. We have seen further how this primitive knowledge has developed into perception and has been revived through images coming from the various sense departments, including those arising from the sensations of movement. *It seems probable that the writers who have maintained that our higher thought processes are divorced from all imaginal elements, and thus in the last analysis cut away from their sensory basis, have ignored to a large extent motor imagery, and particularly that type of motor imagery which has been termed in this discussion mimetic symbolism.* If it is true that a considerable part of our thinking is carried on with this motor background, the importance of this type of imagery in the learning process becomes apparent. Its significance in connection with rational thought will be discussed in a later section.[1]

Miss Washburn [2] has arrived at a similar conclusion. She says, in discussing the "relational elements" of consciousness: "The significance of these, it appears to me, is the following. They are the remnants of remote ancestral motor attitudes, and they resist analysis now because of their vestigial nature. Take the feeling of 'but,' for example; the sense of contradiction between two ideas present when we say, 'I should like to do so, *but* — here is an objection.' If we trace this back, what can it have been originally but the experience of primitive organisms called upon by simultaneous stimuli to make two incompatible reactions at once, and what can that experience have been but a certain suspended, baffled motor attitude. Similarly with the feeling of 'if,' — 'I would like to do so and so, *if* a certain condition favors.' The primitive representative of this must have been the experience of an animal called upon to suspend all reaction until a definite added stimulus was given."

A number of investigations have been made during recent years concerning the development of imagination from childhood to maturity and the various types of imagination employed by different individuals in their think-

[1] See Chapter XX.

[2] "The Term Feeling," *Jour. of Philos., Psychol., and Sci. Methods*, III, pp. 62–63 (1906).

ing processes. It was held at one time that individuals were of pronounced types in their ways of thinking. Studies of mental diseases seemed to emphasize the fact that certain persons thought in visual images almost exclusively, others in acoustic, and still others in motor images. The doctrine of types, however, has more recently been, to a considerable extent, abandoned. One of the most important discussions concerning the various types of imagery is that of Segal,[1] who maintains that the conclusions reached by Charcot and others as to the existence of sharply distinguished types of imagery are not altogether correct.

The doctrine of imaginal types not as strictly held to as formerly.

Segal observes that not all those who possess intense visual imagery see all the words that they employ in thinking. Indeed, such a type of thinking is exceptional, and a person may, as Meumann has pointed out, for one purpose think in concrete visual imagery, while for another purpose he may think equally well in acoustic or motor imagery. Individuals apparently think visually concerning concrete objects, and in acoustic-motor terms when they employ words. For such reasons as these Segal concludes that the whole doctrine of distinct types is untenable and that the qualitative conception of types of imagery must be abandoned for a quantitative distinction. Most persons belong to a mixed type, and although they may possess greater vividness of imagery in one sense department than in others, they are not for this reason confined to one type of thinking. Further, it is not to be concluded because a person generally thinks in one kind of imagery that this is due to the fact that his imagery in that sense department is particularly vivid. It is evident that the majority of the perceptions which arouse our attention and are significant for us will be revived in that sense department to which they originally appealed. Segal further urges that a person may be visual for one kind of material and perhaps motor or acoustic for another, and, therefore, the type must be considered as relative to the material employed. Baldwin[2] remarks that for him "German is speech-motor and auditory, having been learned conversationally in Germany, while the French which was acquired in school by reading and exercise writing is visual and hand-motor." Similarly

[1] "Ueber den Reproduktionstypus und das Reproduzieren von Vorstellungen," *Archiv f. d. gesamte Psychologie*, XII, 124–235 (1908).

[2] "Internal Speech and Song," *Philos. Rev.*, II, p. 385 (1893).

Dodge[1] reported that though he generally thought in words and pronounced these to himself, he at times thought in concrete visual imagery, as, for example, when he was planning a piece of apparatus. In this connection it may be said that in a series of experiments recently conducted in the psychological laboratory at the University of Illinois, it was discovered that the method of learning a list of words by one of the subjects observing varied according to whether the words were presented in a regular or in a mixed order, in one instance the learner using visual images, in the other motor.[2] Considerations like the above lead clearly to the conclusion that *in most cases there are no absolutely fixed types of imagery, but merely predominating types for certain classes of sensory or verbal material.*

Young children think largely in concrete visual imagery.

Investigations that have been conducted concerning the development of types of imagery seem to have established the fact that young children think largely in concrete visual images, and that while auditory and motor imagery are present to some degree, they play a relatively unimportant rôle in the lower school grades. The child up to ten, at least, is predominantly a visualizer. Concrete visual, and probably all concrete imagery, tends to fall off in the more advanced grades, its place being taken by verbal imagery. There is a great loss in vividness in concrete imagery in the higher grades of the common schools. The importance of motor imagery, both of the hand and of the vocal organs, appears to be less than has generally been supposed, although children think in speech-motor terms much earlier than they do in hand-motor terms. The apparent growth in auditory imagery as the child advances in the school grades probably is indicative of the increase of the verbal type of imagery, and its development may show the growing tendency to thinking in terms of inner-speech.[3]

[1] "Die motorischen Wortvorstellungen" (Halle, 1890).

[2] Edwina E. Abbott. "On the Analysis of the Factor of Recall in the Learning Process," *Monograph Supplement Psychol. Rev.*, XI, No. 1 (1909).

[3] See Colvin and Myers. "Development of Imagination of School Children," etc., *Monograph Supplement Psychol. Rev.*, Vol. XI, No. 1, pp. 85–124. Also for an extended discussion of the whole problem, see Meumann, *op. cit.*, Vol. I, pp. 435–497.

The education of the child has much to do in determining the particular type of imagery which he generally uses, and it is no evidence that the child is devoid of a certain type of imagery, because he does not think in such terms. Nevertheless, constant disuse of a certain type may completely destroy the effective use of that type.

The education of the child has much to do with his type of imagery.

Francis Galton,[1] in his celebrated investigation concerning mental imagery, found that men of science are singularly lacking in all concrete imagery. On extending his inquiries more generally to persons of both sexes and various ages he found some possessed of extremely vivid visual images, brightly illuminated, clearly outlined, and distinct and rich in coloring. That the men of science investigated by Galton did not possess such imagery was not due, probably, to any general difference in inherited ability, but merely to a difference in environment. However, while the average person is not strongly predisposed by heredity to any one particular type of imagery, there are cases in which heredity has played an important part. Men of genius have often possessed a very rich imagery of the concrete type. Great artists have been reported with remarkable visual powers; musicians, with unusual ability to recall melodies, and so on.

[1] "Inquiries into the Human Faculty" (1883).

CHAPTER VIII

THE PEDAGOGICAL SIGNIFICANCE OF IMAGINATION

As has already been pointed out, imagination is often confused with illusion and hallucination. Further, it must be remembered that in its creative forms, imagination often produces combinations that do not accord with actual or possible experience. For these reasons the question of the value of imaginative materials in the life of the child has been seriously raised. The child early in his life begins to combine past experiences into original mental products, and starts to weave a world of fancy that differs from the world of his ordinary experiences, sometimes in an astonishing degree. The study of the imaginary companions of children has revealed the fact that these companions sometimes make their appearance as early as the third year. They are often the most vivid of realities; they are distinctly visualized, have definite peculiarities, such as manner of dress and speech, and have well-marked moods and characteristics. They even converse with and aid those who have created them. Nevertheless, if these companions are not actually confused with objectively existing personalities, they are still, according to the definition laid down in the preceding chapter, imaginary and not hallucinatory experiences. Imagination with the little child, however, may readily pass over into actual illusion or hallucination. Hall writes in this connection: —

The imagination of the child extremely vivid.

"In childhood credulity amounts almost to hypnotic suggestibility. Not only is everything believed, but the faintest hint starts the exuberant imagination to a vividness almost hallucinatory. This power to believe the false and even the absurd in infancy is not a defect, but excess of psychic vitality. The narrow horizon of reality within the juvenile ken is not enough, and the world of fancy and myth is needed to supplement it. Never is receptivity so near to creative energy; and this is why genius is defined as the preservation into mature years of the fecund mental spontaneity of childhood."

Children have difficulty in distinguishing between the fanciful and the real.

Much of the mental imagery of the child resembles the fancies of our myth-making forbears. The clouds and the stars, the sun and the moon, the raindrops and the snowflakes, and other elemental phenomena are often explained by children in a way that suggests the poetic conceptions of nature common to primitive peoples. For the child, the forest and stream, the field and fountain, are filled with conscious beings. Elves, pixes, goblins, fairies, and gnomes often seem as real to the child as parents, brothers and playmates. They form an essential part of his wider world. Since the knowledge of truth and falsehood, of reality and delusion, depends on experience in which the present is found to agree with the past or to contradict it, it clearly follows that in his early years the child has no definite criterion by which he can test his world of images and distinguish those which refer to the actual or possible from those which represent the fanciful and contradictory. Thus it happens that the child is incapable of distinguishing between the possible objective reality of the most fantastic experiences and of those which can readily be realized in his daily life. Further, since the child is open to suggestion to a marked degree, his images may result in manifold illusions, such as come to grown-ups only in dreams, hypnosis, or pathological conditions.

The hallucinatory character of the child's experience often results in apparently intentional falsification on his part. Children's lies not infrequently arise from the fact that the child is incapable of separating the world of fancy and of fact. The tendency to fable-making causes him to make statements that are completely at variance with the truth as judged from the adult's standpoint. Some years ago a teacher in the city of Boston asked the pupils under her charge to describe what they saw on their way to and from school. The result was, indeed, remarkable. The streets of Boston, from the reports of the children, resembled an African jungle or the country explored by Alice in Wonderland. It would be unfair to the children to describe their reports as lies, since these children had never had the issue of truth or falsehood presented in this connection. With young children intentional and deliberate falsehood is comparatively rare. However, at an early age habits of untruth may be formed in a perfectly innocent manner that in later life may rise to a plane of ethical import. The question of the extent to which an exuberant childish fancy may be allowed to go, therefore, becomes one of moral as well as intellectual significance.

Intellectual and ethical importance of the imagination of children.

The fact, then, that children possess more than adults the creative imaginative faculty; that they distinguish only slowly and by degrees between the world of imagination and perception, and that they are so easily suggestible that an image may pass over into a false perception, raises the question as to the value of the imaginary world for the child and the proper attitude of education toward it. Should imagination be cultivated in children? And if so, in what direction should it be cultivated; or should it be eliminated as soon as possible from the lives of the little ones, in order that they may better be prepared for the serious life which some day must come to them, if they survive the days of childhood and arrive at the development of adults? There are not a few who would be inclined toward this second alternative. Fact is fact, and there can be no compromise between it and falsity. So the teacher of history hastens to banish all such delusions as the existence of William Tell, and the instructor in science urges the unreality of the nature myth and the fairy tale as explanations of events in a world of ordered phenomena. Likewise, too, the professor of ethics may insist that truth is to be secured at all hazards, and that there can be no compromise with falsehood. Hence Cinderella and Jack and the Beanstalk and even Santa Claus must go, for the child is to be made a moral being at all costs. Doubtless people of this turn of mind are not in the majority, and their numbers are yearly growing less; however, they are still heard protesting against the mass of myth and fairy tales that of late years have been especially prepared for the instruction and entertainment of the child. Their point of view deserves consideration and an intelligent answer.

The nature of truth.

What reply can we frame to the objection that myth is intellectually and morally wrong because it is not true? Our answer to this view of the case will be aided if we consider again the position which we have previously set forth, namely, that reality and truth depend on the agreement of our present experience with our total experience and the experience of others. *That which best fits into experience, which most uniformly satisfies the intelligence, is the truth; and since experience must ever change, there is no truth that is absolute and that will stand the test of the ages.*

For later antiquity and the middle ages the system of the universe evolved by the Greek-Egyptian astronomer, Claudius Ptolemy, was true because it fitted the then known facts; yet the wider experience of a later age made this view unsatisfactory, and the Ptolemaic system gave way to the Copernican; but who will be so rash as to affirm that the latter gives a final point of view? The individualism of the eighteenth century proved a sufficient philosophy for Rousseau and the doctrinaires of the French Revolution; it satisfied the framers of our own Declaration of Independence, but to-day it is giving way to a theory of social dependence that cannot find truth and satisfaction in what was once accepted as an ultimate statement of the nature of man. So, too, the mechanical atomism of the science of yesterday is no longer able to hold its place in the newer conception of the physics of to-day. We need not multiply examples. On all sides we see a significance in the statement now so often heard that a thing is true as long as it proves satisfactory and no longer, and that the quest for ultimate truth is an unending quest; the search for a goal that always recedes; a journey toward the rim of the horizon whose mystic borders we can never attain. So myth which satisfies the intellectual and moral needs of the savage is true for him, but false for us; just as our science will be false for some future generation; so the fairy tale of the child, which for him offers the most reasonable explanation of the world, is far more true *for him* than our adult conception could possibly be. Some day he will be an adult and will have put away childish things, but as long as he remains a child, he must think as a child, if he thinks at all. As his experiences extend, he will slowly cast aside the fancies of an earlier day, now grown inadequate, but not so suddenly that there will be a jar or a break in the continuity of his reality. Think as I may, I cannot tell when Santa Claus became for me a reality of another order than that which my earlier imaginings had made the venerable saint. When I first learned that he had no place in this dull, prosaic world, I cannot remember. I am sure, however, that the change was not in the twinkling of an eye. New truths come like the dawn, — first the pale auroral tints that brighten and broaden, and before which the stars and moon gradually grow dim and finally pass from view. But the stars and the moon lit the night and made the path clear.

The myth-making period of childish imagination is necessary because it satisfies the childish conception of the world, and is, therefore, the true conception for him. This is the only measure of its value. If the fancies of the child become so unreal and extravagant as to place him out of harmony with his childish environment, then they are dangerous and valueless for him.

The value of fancy in the life of the adult.

It must not, however, be supposed that the creative fancy of children has no value beyond the early years of development. Child study teaches us one fact at least with sufficient certainty, and that is that each stage of development is necessary for that which follows. Just as the gill slits in the human embryo, those worse than useless appendages for the child in his post-natal existence, serve a very necessary purpose in contributing to organs yet to be formed, so the mythopœic fancy of childhood enters into the adult experience in many subtle ways and enriches the life of the man. The fairy story of childhood still counts in the healthful fancy of grown-ups. Can we enter into sympathy with the greatest imaginative writers of the ages, if our early training has found no place for Grimm and Andersen, and others of the noble company of myth-makers? The language that Homer and Virgil and Spenser and Shakespeare and Dante and scores of others of the past have spoken is jargon to him who has no understanding of the simpler obscure and forgotten masters, who in the folklore of the people of all times have left a world of rarest story for the children of ages yet unborn. In this humdrum world of ours, how the heart yearns for these oases of fancy in the desert of the real! But to drink from the sparkling waters is a privilege given only to those who have discovered the hidden fountains in the days of childish simplicity. A boy of nine who has outgrown his implicit faith in fairy tales, but who still finds in them a satisfaction for his emotional life, often says, "I wish they were true; I wish that when you opened your mouth, gold would fall out of it. Wouldn't it be fine if just by thinking you could make castles rise in the air? How nice it would be if there were real giants that brave boys could kill and beautiful princesses who could be rescued from wicked witches and watchful dragons!" I must confess that I sympathize with the youngster, and I am not ashamed that I still have a love for the fairy tale and the supernatural; but this sympathy and love could not exist if at one time these tales had not been for me a genuine *Weltanschauung;* if they had not constituted for me a realm of reality more satisfactory, and as sufficient as my present view of the universe. So when some child on hearing a story of wonder asks, half believing, half doubting, "Is it true?" I cannot with a clear conscience reply "no"; for it is true in a sense which the little questioner does not comprehend. Indeed, as a mere intellectual proposition I am not at all convinced but that the myth world of the child and primitive man does not more exactly correspond to ultimate realities, than the mechanical universe of the materialist filled with whirling atoms, but without purpose or design.[1]

As a corollary to the proposition that the creative fancy of the child is valuable as long as it adequately satisfies

[1] See Colvin "The Child's World of Imagination," *Proceedings of the Illinois State Teachers' Association*, December, 1905.

the child's needs comes the equally true statement that when these fancies have become inadequate they should no longer be insisted on. When the child has outgrown his primitive ideas, he must be given something that better suits his needs. In the work of the common schools there is perhaps little danger of violating this important principle; however, *in the religious education of the child the mistake is often made of keeping him in a world of the mysterious and impossible when his intellect cannot give assent to the miraculous and the supernatural.* The result is that when the older child is instructed in those materials of religious education which were quite adequate for his simpler comprehension, he rebels against them, and, doubting the validity of these, questions the value of religion as a whole. Many tragedies in the religious life of children have arisen in this manner.

Mythopoeic fancies should not always be cultivated.

It should further be kept in mind, as has already been said, that while a part of the child's early life is properly given over to myth and fancy, a considerable part of it must be within a circle of exactness and definiteness that cannot be departed from without serious danger. Primitive man, like the child, was a myth-maker. He dwelt in a world filled with supernatural beings; nevertheless, there were certain things that he was compelled to know exactly and accurately, if he were to survive in his desperate struggle for existence. He might believe that a mysterious god moved in the frightful tempest, spoke in its thunders, and revealed himself in his wrath in the flashes of lightning. But this same savage must know definitely how to make his spear and hurl it with accuracy against the savage beast or his more savage human enemy, if he were to survive. There could be no fancy, no myth-making here. So it is with the child. A large number of things he must know definitely and certainly, particularly those that relate to

Certain facts that the child must know exactly.

the ordinary subjects of instruction in the schools. *There can be no supernaturalism about the multiplication table; myth should not enter into his spelling exercises. Fancy will not help in geography and nature study.* For this reason it is to be doubted if those delightful animal books which have appeared in recent years and which give all sorts of charming but absurd attributes to real and mythical animals are not a positive danger in accurate knowledge. It is a fortunate thing, perhaps, that even with the child, the mind is, to a certain extent, built on the compartment plan. *So it is possible to instruct the child accurately in one branch of knowledge and still to leave him a considerable play of fancy in others.* It is the business of the educator to draw the line between those fields of instruction which permit flights of imagination and those that do not. No absolute rule can be laid down, and it must be left largely to the common sense of the individual teacher to make the division. It must always be kept in mind, however, that while it is absolutely necessary for the highest enjoyment of the child and for his future development to have a vivid creative imagination, on the other hand, it is equally as necessary that he should conform also to a world of solid and definite facts, with which he must count, if he is to succeed either in the mimic world of his school environment or in the broader activities of later life.

The relative importance of concrete and of verbal imagery.

In discussing the various types of imagination as they appear from childhood to maturity, the fact was pointed out that young children think particularly in concrete imagery, in most cases largely visual, while later on they develop verbal imagery largely of the speech-motor type, in which they do their thinking. In connection with this fact there arises the important educational problem of the relative value of these two types and the proper emphasis that should be given them at various stages of development.

Concrete visual imagery gives a vividness and objectivity to the thought processes of the little child which are entirely wanting in the life of the adult. At the same time this concreteness is, to an extent, incompatible with the more developed forms of thinking. It, therefore, is necessary to accustom the child to the use of verbal imagery. This the school does to such an extent that there is a gradual devitalization of the imaginal elements in the consciousness of the child. The gain in abstract thinking is of course incalculable, but the loss in vividness is a real one. It is specially important, if the child is to understand and enter into sympathy with various forms of artistic expression, that he should be able to revive his concrete imagery whenever necessary. Some of the finest passages in English literature in narrative and descriptive prose and poetry have lost their real significance for the pupil of high school age, simply because they call up, not the living images of the scenes and events which they describe, but mere symbols that have no genuine significance in the interpretation of the piece of literature that is being studied. As has already been said, the type of imagery which a person possesses is perhaps not so much a matter of inheritance as of training, and there seems to be no good reason why both types of imagery, the concrete and the verbal, should not be cultivated at the same time. There are certain studies in the school curriculum that are particularly well suited to cultivate concrete imagery, and others to stimulate the symbolic types. Among the former may be mentioned literature, when taught in the proper manner, nature study, geography, and, to an extent, history. Mathematical studies, grammar, and the like, encourage the development of the latter type. It is the business of the teacher to insist in the proper place that the various school subjects shall be so studied that they shall stimulate the growth of both of these types. The fact that the concrete visual imagination predominates over both auditory and motor imagination may be in part due to the native superiority of the first-named type, but is very likely to a considerable extent to be explained by the fact that the course of instruction in the school tends from the very outset to emphasize the printed page.

Literary appreciation demands concrete imagery.

Here again in instruction in literature it should be remembered that the proper interpretation of the greatest classics depends as much upon auditory and motor elements as it does on visual. *Children are not required to read aloud enough, and if they are requested to read before the class, this is often done in a slipshod manner.* The teacher of literature, too, is often unskilled in interpretation, and so it happens that many of the finest pieces of prose and poetry make appeal to the eye alone. This is all the more unfortunate when we remember that the earliest forms of the communication of literary masterpieces were oral and dramatic. The superintendent, in choosing a teacher of English for the high school, ought to insist, not merely on a knowledge of philology and on critical ability, but also on power to interpret and express the thought. Teachers of literature often emphasize a mere word-cram and mechanical memorization. Through this they aim to get definiteness and concreteness in the work of the pupil; they, however, lack definiteness as to their own aims in teaching literature, and in the end they succeed only in creating a disgust on the part of the pupils for the literature that they study.

Recently in school instruction story-telling has found a prominent place in the earlier grades, and there is an increasing tendency to give value to the dramatization of literary masterpieces. This tendency is certainly in the right direction, if it is not overemphasized. It is, however, necessary to remember that there are certain fundamental elements in the school work that cannot be ignored, and the attempt to enrich the course of study and to develop the various aspects of imagination should never be at the expense of minimizing the value of those elements which make up the rudiments of education.

The importance of kinæsthetic or motor imagery in the thought processes suggests that it may be cultivated to advantage. Education has recognized in manual training, sewing, and studies of a similar nature the desirability of developing concrete kinæsthetic imagery of a certain type. Such studies, however, cultivate kinæsthetic imagery only in one direction. A person may be skillful with his hands to an extraordinary degree, and yet have no power of expression in the use of words and be entirely lacking in general dramatic ability. The symbolic mimetic imagery which we have discussed earlier seems to be much more closely connected with dramatic interpretation than it does with mechanical skill. To cultivate this latter form of imagination we cannot rely upon manual training and studies of a like nature, but we must appeal to the dramatic instinct more directly and seek to interpret pieces of literature and the like through drawing the pupil's attention to the meaning of this literature in terms of action.

The importance of kinæsthetic imagery.

In conclusion it may safely be said that the greater the amount and variety of imagery at the disposal of a person, the richer and more valuable his thought processes. Nevertheless, a high degree of specialization may demand the limiting of the effective imagery used by the individual to one particular type. As previously stated, Galton found men of science to be practically without concrete imagery of any sort. *In the common schools, however, there should be no such thing as specialization, and a broad basis should be laid so that to the pupil shall be opened up that avenue of life along which he may journey with the greatest profit to himself and value to the community.* No child should graduate from the common schools with his ability to imagine in concrete forms devitalized. He should have it in his power to revive visual experiences in as intense a manner as when he entered the primary grade. If he possesses a natural

All types of imagery should be cultivated.

disposition, his auditory imagery should still be vivid, and the dramatic instinct which he showed normally in his childish plays should not have vanished. At the same time he should have acquired the power to think symbolically, and should have at his command hand-motor, speech-motor, and general kinæsthetic imagery. It is doubtful if specialization should come even during the high school course to any great extent; but there should be development in the pupil's ability to use symbolic imagery, and at the same time a growth in the keenness of his powers to bring into existence through imagination the concrete experiences of daily life.

CHAPTER IX

MEMORY

Memory as a fundamental biological phenomenon.

MEMORY in the widest use of the term is not only an essential feature of conscious life, but of all life as well, and even to a certain extent of inorganic nature. Matter is affected by the forces which play upon it in such a way that it is permanently modified. In a certain sense such modification may be looked on as memory. *As a fundamental biological phenomenon, memory signifies the modification of an organism by contact with its environment.* In this way it lies at the very basis of the learning process, which has been described in its most general terms as the modification of the reactions of an organism through experience.

This view that memory is a general characteristic of all organic material has been emphasized by various writers from time to time. It has been pointed out that those causes which act upon matter leave behind them dispositions or tendencies because of which a recurrence of the phenomena aroused by these causes is more probable with each succeeding repetition. The latest and most systematic attempt to describe memory as an underlying principle of organic life has been made by Semon.[1] Such a general point of view as this is, however, not particularly serviceable in the discussion of memory as an essential element in the learning process.

Memory as a conscious phenomenon.

In a narrower sense of the word, *memory as a conscious phenomenon signifies the modification of present experiences in terms of past experiences.* An example of this modification is found in perception. The object which I recognize is something more than the mere sensation of it, because of the experiences that I have already had with it.

[1] "Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens," second edition, (Leipzig, 1908). Also "Die mnemischen Empfindungen," Leipzig, 1909.

For example, I see before me a round object of a certain size and color. This visual stimulus I interpret, and I recognize a ball. In connection with this experience of the ball there are involved many past experiences, such as lifting it and throwing it and catching it. In a sense, then, my present experience is in part due to memories of past experiences; yet these memories may not be revived in any distinct sense. I may not even have images of these past experiences clearly in my mind. Still the object which I see before me is an object constituted by past experience that has left its traces somewhere, and these function in my interpretation of the visual stimulus before me.

Memory as reproductive imagination.

We can restrict our definition of memory still more, and identify it with reproductive imagination. This is Miss Calkins's[1] point of view in her most recent work. She says, "*Relatively accurate and complete reproductive imagination is called memory.*" This definition would seem to imply that if, for example, I see an orange, and there arises in connection with the visual sensation an image of the taste of the fruit, I have a memory of the taste. Reproductive imagination then functions for the modification of the present experience in terms of the past, while productive imagination, as Miss Calkins points out, functions for the extension of experience into the future.

She says, "By reproductive imagination or memory I hold the past; and in creative imagination I reach out also beyond the limits of past and present. As a merely perceiving self I am bound to this desk, this room, this plot of ground; but as a remembering self I live through once more, the exhilarating adventures and the beautiful scenes of my past experience, and as a creatively imagining self I am hampered neither by 'now' nor by 'then.' I go beyond my own actual experience. I see visions, I dream dreams, I create new forms." Miss Calkins goes as far as to say "that all thoughts are based on memory." She adds, "I could not be conscious of chairs as a class, if I could not remember different sorts of chairs which I have seen; and I could not reason . . . if I could not remember the values, once learned, of the different terms." It will be seen from the above discussion that Miss Calkins considers all images and ideas that arise through past experience as memories.

[1] "A First Book in Psychology" (New York, 1910).

Memory may be defined in a still narrower sense. James says that it is "the knowledge of an event or fact, of which meantime we have not been thinking with additional consciousness that we have experienced it before." In this restricted sense of the term the mere revival of memory images does not necessarily constitute a personal memory. When I see an orange, and at the same time recall its taste, I may, or I may not, recollect definitely that I have experienced that taste before.

Memory in the most restricted sense of the term.

If I do not have the definite recollection of a previous experience, then, according to James, I have no memory of the taste. If, however, we accept Miss Calkins's point of view and make memory identical with reproductive imagination, then, even some of the earliest experiences of our childhood that we cannot recall as individual experiences may appear as memory images. *Ordinarily, however, we understand by memory what James implies in his definition; namely, the revival of a past experience with the definite knowledge that this experience belongs to the past.* This restricted definition of memory is perhaps too narrow for us to consider exclusively in discussing the learning process, since a large number of experiences which function in the present moment are never recalled definitely as past experiences; nevertheless, they are most important in learning.

The views of James and Calkins contrasted.

When we speak of the revival of a past experience as the essential characteristic of memory, we must remember that an experience can never be revived in all its details, and that the memory of it is not the mere reinstatement of the past. There is always something lacking in the memory, and there is always a difference in quality as well as in quantity. We must forever dispense with the naïve notion that the mind contains somewhere a storehouse in which the past is deposited and from which the past can be brought up

An experience never revived in all its details.

unaltered. Images and ideas cannot be thought of as floating in and out of consciousness and maintaining an existence as conscious elements during the intervals in which they are forgotten. *Memory must be rather considered as the functioning of present experience in such a way that it revives the past without actually reinstating that which in one sense has departed forever.*

Various degrees of memory.

It must further be borne in mind that to have an actual memory, time must have elapsed between the original experience and the revival, and that during this interval the past experience has dropped out of consciousness. If, further, we accept James's definition of memory, we must recognize that the accompanying consciousness of an experience as past may range from a mere sense of familiarity to a detailed recollection in which events are put in their temporal setting and related definitely. It is doubtful if animals or young children ever have this latter sort of memory.

Hall describes, in his charming style, his experiences on revisiting the home of his childhood and the various familiar scenes of his early environment.[1] His earliest memories of the objects which he saw about him are of the vague reminiscent type, characteristic of childhood. In one place he says, "Often, as, *e.g.* while gazing eastward toward a dense swampy forest, where even yet an occasional bear or deer is killed in winter, or when coming upon cherry trees near a ledge, or visiting rocks beside which were two old maples, a feeling that I thought to be a glint of vague familiarity was experienced. On coming to a knoll upon a vast heap of stones near trees, I found myself articulating 'Why! yes, of course, there was something like that.' . . . 'The sudden smell of catnip, the gloominess of an old wall of black stones, a deep well beneath the kitchen, the abundant and peculiar moss on the ledges, were other things that brought a distinct sense of familiarity, but no trace of anything like memory. A deep wild gorge to the west of the level road, although quite hidden from it; the stumps of three old maples on the east some distance from the house; the slight slope of the front yard and that of a neighbor's, with a wellhouse,

[1] "Note on Early Memories," *Pedagogical Seminary*, VI, pp. 485–512 (1899).

vaguely suggest reminiscence, but it is more a feeling of a strong and peculiar interest than any identification with past experience."

In the discussion it is clear that Hall means by memory reminiscence in the sense in which James uses the term. In another place he says, "So with the rocky end of a knoll comes an almost imperative association of cows being milked by a woman." This, however, was not a distinct memory in the sense in which Hall uses the term, but rather an aroused image which might refer or not to some particular past experience. In the sense in which Miss Calkins uses the term, this latter revived experience should be given the name of memory, although no definite recollections are connected with the image. Examples of more definite memories are found in Hall's account in such descriptions as the following: "Yes, there was a tree here, a nutting place, a cow path, blackberries, a curious stone there, this was the old door hook which it is a certain pleasure to rescue from entire forgetfulness, the same old stone wall half torn away remains." Dr. Hall also cites memories of vague, shadowy fears that were revived through the sight of the objects which originally excited them. He says, "Several times, first on a dark, stormy, windy night, and last on a bright moonlit one, I undertook to wander through the village graveyard. . . . As I approached it, there was a depressing sense of loneliness, which darkened down to a strange kind of fear. I found myself tense, anxious, expectant of something painful before these apprehensions took any form or had any object. Then I thought of ghosts and kindred wild scenery, that made me always, as a boy, run by this place after dark. As I forced myself to climb over the black fence under the pines and to touch a few of the nearest gravestones, the nervous awfulness of it all increased." Hall concludes that memories before the dawn of adolescence are vague and incoherent. "Coherent and sequent memory does not begin until the child has reached the age of puberty."

Recognition and recollection distinguished.

In discussing the nature of memory we should make a careful distinction between recognition and recollection. To recognize an object merely implies that we react to it with a degree of familiarity, but it does not imply that we recall definitely where we have previously had experience with this object. Recollection, on the other hand, involves, to a greater or less degree, recalling the experience or event in its original setting. We may, for example, recognize the clang of the trolley bell, but this does not necessarily imply that we recollect any previous occasion on which we have heard it. It further should be borne in mind that recognition does not necessarily involve imagination. On purely *a priori* grounds it has been held by many writers that recognition involves a memory image in connection with the object recognized. An examination of one's consciousness during recognition does not by any means substantiate such a belief. I may, it is true, recognize the face of a friend, recalling in imagination previous occasions on which I have seen my friend. On the other hand, I may hear the clang of the trolley bell, and identify it accurately, yet I may be incapable of experiencing an auditory image, and may never be able in the slightest degree to recall the sound as an element in my past experience. Most of us have not the slightest difficulty in recognizing our acquaintances by their voices; yet it is probable that a large number, perhaps the majority of individuals, do not possess the ability to revive in imagination the distinctive quality of these voices. *Recognition merely implies that we react toward an object of past experience in an habitual manner. Many animals are capable of recognition in this sense of the word; it is to be doubted, however, if any but the very highest have the ability to recollect.*

The story is told that Odysseus, on his return from his wanderings after leaving Troy, was recognized at his home-coming by his faithful dog alone. It is not to be supposed, however, that the animal actually identified his master; the action was merely spontaneous and habitual, and the accompanying mental state could have been nothing more than a vague feeling of familiarity.

Conscious comparison does not take place on habitual levels.

Memory easily lapses into mere habitual responses to familiar objects or events without any conscious recognition. *It is only when some doubt arises; when the habitual attitude is in some way interfered with, that there occurs the necessity of recognition on the level of conscious comparison.*

For example, as I am walking along the roadside, I see a wild rose, stoop, pluck it, and smell its odor. This I do with a very slight degree of consciousness. The recognition involved in my reaction is on the level of the subconscious, but, nevertheless, whatever mental accompaniment there is of my action is to be characterized as the recognition of the rose. I may, however, in my walk come upon a flower which I do not readily and subconsciously recognize, and to which, therefore, I do not react in the same habitual way as I did in the case of the rose. I may hesitate to pick the flower until I have identified it. In this event there will probably arise in my mind memory images of flowers of a similar nature, and the process may continue until I have identified this particular flower in terms of previous experience and through the aid of a memory image. We will see in a later discussion that such a mental process issues in what is termed a judgment on the subjective side and in a definite reaction on the objective side.

Impression and association.

The two basal elements in memory are impression and association. Impression can perhaps be treated best on the physiological side, and is to be thought of as that capacity in the nervous system for receiving and retaining experiences. Association, on the other hand, is best explained in terms of consciousness, and relates to the manner in which the elements in memory are linked together so that they may be subsequently recalled. Manifestly, the first factor in memory is not to any large degree amenable to the learning process; while the second element is modified and controlled by learning. James in his chapter on "Memory" distinguishes between desultory and systematic memory, making the former depend almost entirely upon the ability of the nervous system to receive and retain impressions, and the latter upon the ability of consciousness to join together in helpful ways the materials already deposited through past experience. James considers impressionability a matter predetermined through the inherited nature of the nervous system; therefore, according to his point of view, desultory memory cannot be improved. It is only systematic memory that can be educated. Some writers have identified memory on the side of impression with a purely physiological activity, and have termed the product of such memory, a memory after-image. In using this term they have had in mind the analogy of the purely physiological after-image, which appears as a continuance of the stimulation of an end organ after the stimulus has been removed.

For example, if we look for some time at a yellow disc of paper, and then turn our gaze away to a neutral gray background, we will see appearing on that background the form of the disc that we have been looking at, but colored blue, the complement of the yellow of the stimulus. This effect is to be explained by the fact that after the stimulus of the yellow disc has ceased to affect the eye, still there is a continuation of the chemical processes set up in the retina by the original stimulus. In somewhat the same way, the impression of the object of memory is thought to continue and be revived without any other reason than the purely physiological activity due to a modification of the nervous substance through the experience recalled in memory.

Can recall take place without association?

There seems to be some doubt, however, as to whether we can have any recall whatsoever, without a certain amount of association. There have been discussions pro and con concerning this question. Those who hold to the possibility of such recall point to the fact that things and events of past experience often come into the mind with apparently no reason in the flow of consciousness and the associations present in consciousness for their appearance. Certain bits of experience have the tendency to persist or persevere [1] and to come up from time to time in a haphazard sort of a way. Indeed, they sometimes come up in spite of our conscious associations, in a most provoking manner. Most of us are, doubtless, familiar with Mark Twain's story of the senseless jingle, "A blue trip slip for a ten cent fare," etc., which persisted in the most provoking way and with the most disastrous consequences in the conscious-

[1] "The tendency of past experiences to reproduce themselves spontaneously, constitutes their tendency to 'perseverance.' The running of a tune in the head, the persistent revival of a painful scene, the reappearance of striking events of the day just before the onset of sleep — each is an instance of perseverance." Myers. "Text Book of Psychology," p. 144 (London, 1909).

ness of those who had once learned it. Those who do not believe that it is possible for the bare memory image without associative links to intrude itself upon consciousness, maintain that these seemingly irrelevant and disjointed memory fragments do not occur without some reason. This reason is probably to be found in subconscious associations, which have worked themselves out in a perfectly definite way, though unknown to the person in whose mind they have been forming. That such subconscious associations seem probable is indicated in the investigations and theories of many workers in mental diseases and in abnormal states of consciousness. Whatever the facts may be, *it is entirely certain that a very large part of our effective memory is based upon association, and education must find its problem in forming the most helpful associations, so that the memories involved may be utilized in the most serviceable manner.* It, therefore, is necessary if we wish to insure the recall of some fact or event to see to it that it is linked up with as many associations as possible.

Children depend more on impression than association.

It seems probable that young children, and older ones of defective mental development, depend much more on impression than on association for recall. As the child grows older, the associative factor becomes of greater and greater importance. This, of course, means that the memory material is interpreted more and more in terms of meaning, and that the mere "brute fact" as such has less and less significance.

Total and partial recall.

Writers on memory, particularly James, have emphasized the distinction between total and partial recall. Some events are recalled with their entire setting, while others are recalled only in skeleton outlines. Of course, it is absolutely impossible to recall every minute detail of a previous experience, so that total recall, in the strictest sense of the word, does not exist. Nevertheless, for practical purposes we may speak of those experiences which are revived in all their minutiæ as examples of total recall. Obviously, it is not desirable to recall many experiences in this way. Such recall is asked for generally only from witnesses on the stand, or persons attempting to give an account of happenings where the smallest details may be extremely significant. Generally speaking, it is the mark of a well-ordered mind to omit the unessential details. Often the difference between the effective and the poor story-teller lies in the fact that the former knows what elements to select to bring out the point that he has in mind. The latter, however, lured by the multiplicity of details, wanders about and arrives nowhere. *As the individual grows more mature and as his thought processes become more controlled by an intent or purpose of his own, he passes from total recall, or attempted total recall, to systematically planned partial recall.* The earliest form of memorization demanded of school children is learning by heart, where every detail is supposed to be reproduced. As the child grows older he is not required to learn in this mechanical way, but is supposed to select those materials for memory which are the most valuable in terms of the ends for which he is memorizing. For effective memory we should not burden ourselves with the unessential. We should learn the art of forgetting judiciously.

Four kinds of memory as distinguished by Meumann.

Meumann[1] distinguishes four different kinds of memory, namely, memory of sense perception, including visual, auditory, taste, smell, touch, temperature, and motor memory — also memory for spatial and temporal relations, likewise memory for totalities of objects and occurrences in the external world; second, memory for symbols, names, numbers, and abstract word meanings; third, memory for the products of our ideational processes; and fourth, memory of feeling and emotional states. Experiments seem to show that

[1] *Op. cit.*, Vol. I, p. 174.

there is a good deal of difference in the vividness of these various memories and the ease with which they arise; and further that there are periods in the development of the individual when certain types of memory are more important than others. In general with children memory for objects of sensation is stronger than are memories of relation, such as time and space and cause and effect. Memories for things in movement are, on the whole, better than for things at rest. Visual memory, as far as form and light and shade are concerned, is good, but memory for colors is weak. Only by special training and careful observation can adults be brought to a point where they can accurately distinguish colors. Memory for abstract relationships and for emotional states does not seem to be at all well developed until the high school age. Further, the various kinds of memory show marked fluctuation from time to time, with periods of rapid development, and others where there is no progress at all, and even perhaps a retrogression. Experiments conducted by the Department of Psychology at the University of Illinois[1] in connection with the written work of the school seem to show that there is a general falling off in the various kinds of memory, with the exception of the verbal-visual, at the onset of puberty. Similar experiments by other investigators[2] have led to conclusions in the same direction. Meumann says that the fourteenth and fifteenth years of the child's life seem to be particularly unfavorable for all kinds of memory.

A number of studies have been made in regard to the growth of memory among school children, and it has been found, with the exception of those periods indicated in the preceding paragraph, that the memory of children in-

[1] Colvin and Meyer. "Imaginative Elements in the Written Work of School Children," *Ped. Sem*, XIII, pp. 84–93 (1906).

[2] Lobsien. "Experimentelle Untersuchungen über die Gedächtnissentwickelung bei Schulkindern," *Zeitschr. f. Psychol. u. Physiol. d. Sinnesorgane*, XXVII, pp. 34–76 (1901). Al. Netschajeff. Same title and journal, XXIV, pp. 321–352 (1900).

creases constantly. Meumann says that the adult learns various kinds of material in a much shorter time and with less repetition and with less fatigue than do children. Young children, however, retain what they learn more exactly. If this latter statement is true, it is probably because of the fact that their imagery is more vivid, and the greater amount of time which they require in the learning produces a greater impression. *The point, however, is to be kept in mind that effective memorization seems to increase up to maturity, and that decrease in ability to memorize probably does not set in much before there is an actual decline in mental powers in general.*

Ability to memorize increases throughout the school years.

Meumann[1] holds that the assertion often made that the memory of children, particularly for mechanical learning, is far better than that of adults, is not borne out by experimental evidence. The ability of children to learn is much less than that of adults. Adults, even in middle life, have greater ability to learn than school children in the best years of their development. Adults, however, are accustomed to logical learning, and children learning with much more difficulty, largely by mechanical methods, show somewhat more retentivity.

It is often asserted that the time to begin the study of a foreign language is in childhood, and that mature students are less capable of memorizing the rudiments of a foreign language. This is probably not true. However, adults approach the mechanical processes involved in learning vocabularies, rules for construction, declensions, conjugations, etc., often with a positive reluctance. For this reason they are less capable of acquiring the elements of a foreign language than are children. If they entered upon the task with determination and zest, their success would be far greater than that of the immature pupil.

The rate of forgetting of various materials is a question of no little pedagogical significance. The first experiments to determine the rapidity of forgetting were made by Ebbinghaus,[2] thirty years ago, and for a long time served as the final authority on the manner in which certain kinds of material fade from the mind. Ebbinghaus

[1] *Op. cit.*, Vol. I, pp. 192–193.
[2] "Ueber das Gedächtnis" (Leipzig, 1885).

used himself as the subject of his experiments, and memorized meaningless material (nonsense syllables). The results of the investigation of Ebbinghaus showed that for the materials and methods employed by him there was a rapid loss in memory, especially during the first few hours after learning, and that the loss after a few days was relatively slight. During the first hour over half of what was learned had been forgotten; at the end of the first day two thirds, but at the end of a month only about four fifths. Since Ebbinghaus attempted to exclude all associative factors in his learning, he really tested not the loss of memory as such, but merely the fading of the memory after-image. Attempts have been made to study the fading of various materials other than those employed by Ebbinghaus, such as color, brightness, linear extent, tones of definite pitches, and even tactile stimuli. More recent experiments have shown indirectly that the rate of forgetting when association is joined with impression is very much less rapid than the results of Ebbinghaus and of others who have worked in similar fields would lead us to suppose. *Indeed, it often happens that reproduction of material learned is best after an interval has elapsed between the learning and the recall.* This improvement in memory seems to be due to the fact that the original impressions have had an opportunity to become associated with permanent elements in consciousness, and, therefore, are capable of revival more readily after a certain lapse of time. This fact, which is of great educational significance, will be discussed more fully in a later part of this chapter.

The fading of memory rapid when the associative factor is weak.

The question whether a person has forgotten something that he has previously learned is not as simple as might at first seem. The common method of ascertaining what is remembered is to determine how much of the original material learned can be reproduced immediately, or after any definite interval.

The Method of Retained Members in testing memory.

This method of testing is commonly known as the Method of Retained Members, and the accuracy of memory is measured by the total amount of material kept in mind. If, for example, a person has learned a series of words by heart and an hour later can reproduce two thirds of them, this fraction represents the accuracy of his memory for the material at that time. It is, however, perfectly clear, although he may be unable to reproduce a single one of the words or syllables learned, that his consciousness has been modified and in a sense his entire memory for the series has not been destroyed. *Theoretically there is nothing once learned that may not, under certain conditions, be revived in memory.* There are examples in psychological literature which show that under abnormal mental conditions facts and events which seem to have been completely forgotten most unexpectedly reappear above the threshold of consciousness. Obviously, then, there should be some other way of testing the memory than that by the Method of Retained Members, if we wish to make sure that no traces of a previous experience have been left behind.

The Saving Method of testing memory.

To do this a second method of testing memory has been devised. It is the one used by Ebbinghaus in the experiment previously mentioned. It is technically known as the Saving Method, and consists essentially in learning the material at a prescribed uniform rate of speed, the readings necessary for learning being repeated until the first correct repetition is obtained. The number of repetitions necessary for this original learning is then recorded. After the material has been learned and a certain interval has elapsed (*e.g.* twenty-four hours) the series is relearned and the time saved in the relearning is noted.

The following, taken from Myers[1], gives a record of such a memory test for periods of relearning, varying from one third of an hour to a month :—

[1] Myers, *op. cit.*, p. 162.

Relearning after x Hours x =	Percentage of Time Saved	Percentage of Time Lost
0.3	58.2	41.8
1.0	44.2	55.8
8.8	35.8	64.2
24.0	33.7	66.3
2x24	27.8	72.2
6x24	25.4	74.6
31x24	21.1	78.9

The above is a record of one hundred and sixty-three experiments, nearly all of which consisted in learning eight thirteen-syllable series and in relearning them at a prescribed rate of reading after a varying interval, the economy of time spent in relearning being in each instance noted.

The Method of Right Associates.

Another important method of testing memory is technically known as the Method of Right Associates. According to this method, as employed in the psychological laboratory, a series of syllables is read a number of times rhythmically. Generally the first syllable is accented and the second syllable is without stress, as, for example, *beb′–sev; roz′–lut; cac′–ron; dyt′–hif.* After an interval, the accuracy of memory is tested by presenting the accented syllable of the trochaic pair, and recording the number of right associates that are called up with the accented syllables. In this connection the amount of time between the presenting of the accented syllable and the recall of the unaccented syllable is accurately measured, and it has been found that *those associations which are the most lasting generally take the shortest time for recall.* Some important facts in regard to the way in which associated groups are formed have been discovered by this method of testing memory. These will be discussed in a later section and their significance in the psychology of learning pointed out.

Some other and less important methods of testing the memory may be summarized as follows: (*a*) The Prompting Method. In this method the material is imperfectly learned and the accuracy of the memory measured by the amount of prompting required. It is difficult to bring this method under exact experimental determination, but it is one that is, of course, familiar in the schoolroom and has a certain value; (*b*) The Recognition Method. In this method the material for memorization is presented and learned, and later the same material, together with other material of a similar nature, is shown. The test of memory consists in picking out from the total mass of material that which was previously presented. It is clear that in certain phases of school work this is the test of memory that is ordinarily employed; (*c*) The Reconstruction Method. In this method the memory material is given in some sort of order, and later it is presented in a different order. The memory test consists in restoring it to its original arrangement.

The relative value of various methods of testing memory.

The value of the various above described methods of testing the memory depends very largely on the purposes for which the material was originally memorized. Undoubtedly the most common method practiced in the schools is that of Retained Members. The child is asked to reproduce verbatim what he has learned, and his school grade is determined by the fidelity with which he succeeds in doing this. For some varieties of material absolute reproduction is the only kind desirable. For example, the child must know how each word in his spelling lesson is written if he has learned the lesson; a test of his knowledge of the multiplication table is the number of parts of it that he can exactly reproduce. On the other hand, especially with older children and adults, there are certain kinds of materials that need not be carried always in the mind. It is desirable to reproduce them only as they are needed. It is quite certain that in most instances the graduate of a high school could not pass an examination which he took with ease at the end of his course in the elementary school. This does not, however, imply that what he has previously learned is of no value. If it were necessary, he could, with a relatively slight expenditure of energy, relearn all that he has in the meantime forgotten. It is likewise true that there are certain memory materials which need to be reproduced only in connection with others which have been definitely associated with them, as, for example, certain dates in history in connection with certain events. For many kinds of material the only memory that is necessary or desirable is that of simple recognition on the presentation of this material. This would apply to the pupil's knowledge of various tools and instruments used in his school work. It is not supposed that he will carry the memory image of these tools with him, but that merely on seeing them he shall be able to recognize them and know how to use them. Reconstruction is also an important factor in certain parts of the school work. To be able to put together in the right order various features of an outline map, such as cities, bodies of water, and mountain ranges, is a more valuable test of geographical knowledge than the ability to reproduce the names of capitals, counties, boundary lines, and so forth. In general the schools have relied too much in their estimation of the acquisitions of children on the memory test of Retained Members.

CHAPTER X

ASSOCIATION

The importance of association in memory has for a long time been recognized. Aristotle, in his treatise on "Memory and Reminiscence," laid down certain fundamental laws of association, distinguishing association by similarity, by contrast, and by contiguity. These principles were worked over to an extent during the Middle Ages, and have been amplified in modern times, especially by Locke, Hume, Berkeley, Hartley, and more recent Associationists in British philosophy. The two fundamental laws, as finally formulated, are known as the principles of Association by Contiguity in Space and Time, and Association by Similarity and Contrast.

The laws of Association by Contiguity and Similarity.

Illustrations of these laws are easy to find. For example, if in learning nonsense syllables, the syllables *mej* and *vot* come side by side or one after the other, on the presentation of the first, the second tends to come into mind rather than some subsequent or preceding syllable. Again, if on crossing the railroad track I am accustomed each time to see the flagman, I associate the track and the flagman in such a way that when I see or think of the former I am likely to recall the latter, and *vice versa*. Two events happening at the same time are more likely to be recalled than two between which there is an interval. Attempts have been made to explain this general fact of association in terms of purely physiological laws. Those brain cells which are stimulated at approximately the same time are supposed to be more likely to form associative bonds than those which are stimulated with a time interval between them; those which lie more closely together are more apt to be connected than those that are separated by some distance. The principle of Association by Resemblance finds illustration in the recall of a friend not present, on seeing some one who resembles him. The full moon may bring to mind a balloon, because of the roundness of each. A red flag may, on the same principle, suggest bloodshed. The principle of contrast is the exact reverse of that of resemblance. Darkness brings to mind light; beauty suggests ugliness, and the wintry landscape the luxurious foliage of summer.

It is to be remembered, however, that there is no fundamental difference in the association by similarity and by contrast. The difference is in the attitude or the purpose of the person making the comparison. From one point of view the night may suggest solitude, and from another its opposite, — the brightness of the morning. Neither resemblance nor difference resides entirely in the object as such, but only in the object as it exists for the person who perceives it. Therefore, the principle of resemblance, if it is to be made serviceable in any genuine way, must be interpreted in terms of the purpose which exists as the end of the thought process.

Both the above laws explained in terms of purpose.

It is also to be noticed that what seems to be the purely physiological law of contiguity is likewise to be interpreted under this same principle of purpose. I recall two events in history that may be separated by many years, as, for example, the battle of Salamis and the battle of Santiago Bay, because of some relation between them that is constructed by the purpose or point of view which I have in mind. The illustration has already been given of the association between the railway crossing and the flagman on the principle of spatial contiguity. It might happen, however, that this association would be entirely destroyed if the railway crossing were connected with some other circumstance more important in the mind of the person making the association. For example, if at the time when the pedestrian was crossing the track, he narrowly escaped being run over by an approaching train, on thinking of the track subsequently, he would recall, not the flagman, but the narrow escape from death. It should then be borne in mind that *except for associations of the most superficial character, these two laws of similarity and contiguity can be made effective in* *the learning process only by subjecting them to the higher law of purpose or aim.*

These laws have been experimentally worked out by two principal methods. According to one method, the subject tested is given a word to which he is to react with the one which is immediately suggested. This he writes down, as he does also the word that is suggested by this second word, and so on till the test is finished. According to the second method, the person reacts immediately to a presented word with the first association that comes into his mind, after which a second word is presented to him, to which he also reacts, and so on. These various kinds of reactions have been classified. Myers[1] gives an example of such a classification as follows: —

Similarity	in meaning	coördination	*e.g.* baby — infant
		superordination	*e.g.* soldier — man
		subordination	*e.g.* man — soldier
		contrast	*e.g.* peace — war
	in sound	in letters or syllables	*e.g.* port — porter
		in rhyme	*e.g.* fight — kite
Contiguity	in time	causal	*e.g.* lightning — thunder
		verbal	*e.g.* one — two snow — snowball
	in space		*e.g.* handle — lock

Several interesting facts are to be noted about these various classes of association. In the first place, those that are the most superficial are the associations by similarity in rhyme; they can hardly be explained in terms of conscious association. It is often the mark of a disintegrating mind to form superficial associations, characterized by similarity of sound. The only explanation that seems to be at all adequate for such kinds of mental relationship is a physiological explanation. The varieties of association in order of decreasing superficiality are, first, those of contiguity in space and time, then of verbal and causal contiguity; while associations through similarity in meaning are dominated to a very large extent by the aim or purpose which the person has either clearly or subconsciously in his mind when he forms such associations. It has been found, that the whole direction of associations of this character is changed when the subject is told to change his attitude toward the stimulus word with which the reaction word is associated. For ex-

[1] *Op. cit.*, p. 152.

ample, the subject is told by the experimenter that when he sees the stimulus word he is to react with a coördinate, superordinate, subordinate, or contrast word, as the case may be, or, perhaps, he is told to react with a word which is causally connected with the first. It may be seen from such examples as these that the attitude of the subject is a very important factor in determining the direction in which the associative links are formed.

The teacher must not rely on purely mechanical associations.

The significance for education in this connection is obvious. *The teacher is not to rely on these purely objective and mechanical laws of association, but he is to guide his pupils through direct instruction or through suggestion to form those associations which shall have the most practical significance in terms of the purposes of the lesson in hand.* If these laws are treated in a purely objective manner, they will have extremely little value in the learning process. This does not imply that some of the more mechanical aspects of association should not be given attention. But it does mean that these *mechanical elements in themselves have no ultimate value in the learning process, unless they are linked up with higher and purposive associations.* When other means fail, the teacher may be justified in availing himself of mechanical devices for memorization, even the reliance on senseless jingles, if these associations are to be worked over ultimately in terms of a significant purpose.

The old device of learning the succession of the sovereigns of England or of the presidents of the United States in verse is justifiable, if later these same personages are to be woven into a connected and meaningful set of associations in the development of the history of England or of America. The principal criticism that is to be brought against such methods as these is that they too often end in themselves, and lead to no useful result. If this be true, they are worthless and indefensible; but on the other hand, if these mechanical associations are used as the basis of higher and more purposive associations, they may be valuable.[1]

[1] For a further discussion of mnemonic devices, see Chapter XI, p. 172.

Beside the primary laws of association already discussed, there are certain secondary laws that are of equal importance. These are generally termed the Laws of Primacy, Recency, Frequency and Vividness. The Law of Primacy asserts that, other things being equal, the first word in a series, the first new experience, and so forth, are better remembered than those that follow. The Jesuits, in planning their scheme of religious education, have emphasized the beginnings of instruction as the most important, because these make the most definite impression on the mind and are the most lasting. It is the first day of school, the first pair of long trousers, the first visit to the theater, that are recalled among early memories; the many days succeeding and the many experiences of a similar sort coming in these succeeding days tend to drop out of memory. The Law of Recency asserts that, other things being equal, the last things are those best remembered. So it is that the last word in the series, the last day of the school, my most recent visit to the theater, my newest suit of clothes, are more readily recalled than the events and things that have preceded. The Law of Vividness asserts that the things that make the most definite impression at the time of their presentation, other things being equal, are best retained. So for this reason the child remembers those days in school best in which something novel happened, as, for example, the visit of his mother, an unusually successful or unsuccessful examination, or the coming of a new teacher. Finally, the Law of Frequency asserts that those things that are the most often repeated are the best remembered. This law has been the one which has been recognized by schoolmasters of all times, and is the one most readily utilizable in the learning process. It lies at the foundation of all drill, and has been carried to such an extreme that it has been severely criticized; to an extent with no small degree of justice. Yet it is a law which

The secondary laws of association.

must be appealed to in a great many instances, and is the chief method of memorization in the earlier years of learning.

These laws have been worked out experimentally in various directions. One of the principal attempts at demonstrating them was made by Miss Calkins [1] and published in 1896. In general the validity of these four laws was clearly established. Seashore [2] gives the following instructive introspections of a subject's associations, in response to the key-word "fig": —

"Fig suggested apple, because apple is the most common (freq.) specimen of the kind of a thing a fig is, a fruit. Apple suggested tree, because they had been experienced together most frequently (freq.). Tree suggested blossoms, because I had been looking for blossoms on the cherry tree this morning (rec.). Blossoms suggested bee, because bees are frequently seen with blossoms, and their presence has an exciting interest (freq. and int.). Bee suggested honey, because bee and honey are thought of as cause and effect (freq.). Honey suggested juice of a flower, because the image of honey has followed the image of flowers (rec.). Flower-juice suggested sweetness, because sweetness is the principal characteristic of flower-juice or honey (int. and freq.)."

The most recent experimentation in the psychology of learning has shown in a rather striking way the greater ease of retention of the beginning and the end of a series learned than of the middle portion. The following table given by Myers in his "Experimental Psychology" (p. 159) sums up the results of the learning of a series of words of twelve and of ten members respectively, by the prompting method. It can be readily seen that the position of the different members in the series is an important element in the recall; that the first member of the series is remembered best of all; that there is an increasing inability to remember, which reaches its maximum a little beyond the middle of the series, and falls off pronouncedly at the end. The table is as follows: —

Order of words in series		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Number of Prompts	in 12-wd. series	0.	11.	21.	13½.	35.	36.	36.	29½.	43.	37½.	34.	11.
	in 10-wd. series	0.	3.	6.	9.	23.	24.	31½.	25.	23.	5½.	—.	—.

In another experiment, by the Method of Right Associates with twelve and eighteen-syllable word-series, it was found that in the case of the twelve-syllable series there were sixty per cent of right associates as against seventy-one per cent with many repetitions; further that there

[1] "Association," *Psychol. Rev.*, Monograph Supplement No. 2 (1896).

[2] "Elementary Experiments in Psychology," pp. 124–125 (New York 1908).

were thirty-three instances of right associates that took less than two seconds with few repetitions, as against forty with many repetitions. For the eighteen-syllable series there were forty-seven per cent of right associates with few repetitions, as against sixty-nine per cent with many repetitions. Further, there were twenty-one right associates that took less than two seconds with few repetitions, as compared with twenty-seven with many repetitions. This experiment shows the value of frequency of repetition in learning. It also shows that "the number of associations which after a few repetitions are almost ready to rise above the threshold (of memory) and become effective is considerably greater in longer than in shorter series." This would indicate the greater value of many repetitions the larger the amount of material to be memorized.

The principle of purpose in determining the secondary laws of association.

In discussing the primary laws of association (contiguity in space and time and similarity) it was pointed out that in order for these to be highly effective they should be reinterpreted in terms of purpose or end. What is true of these primary laws is also true to a considerable degree of these secondary laws. The principle of vividness in particular is to be interpreted very largely in terms of meaning. By vividness is not meant, at least in the higher intellectual processes, mere sensory vividness, but a vividness of meaning. Those things attract attention which have significance.

The mother tired out with caring for her sick child will fall asleep while the child rests. Her slumbers may not be disturbed by the loudest noises, and yet she will awaken at the first restless movements of the child. In Whittier's poem, "The Pipes at Lucknow," the Highland woman hears above the roar of the Sepoy guns and the cries of the besieged and besiegers, faintly in the distance, the piping of the MacGregor clan coming to the rescue of the British defenders.[1] The

[1] Hushed the wounded man his groaning ;
Hushed the wife her little ones ;
Alone they heard the drum-roll
And the roar of Sepoy guns.
But to sounds of home and childhood
The Highland ear was true ; —
As her mother's cradle-crooning
The mountain pipes she knew.

sound of the piping which attracted her attention could not be called in any objective sense intense or vivid. It was the vividness due to its meaning or significance that gave it an important place in consciousness.

In the lowest stages of the learning process the vividness is more objective. It is the bright light, the loud noise, the rapidly moving object, that attracts the attention. In the training of defectives it is this objective vividness that must be largely relied on; but for all higher mental processes the chief importance of vividness is found in its significance in the train of thought of the learner. Of the other three principles referred to, — primacy, recency, and frequency, — the two latter depend largely upon physiological conditions for their explanation. However, the first experience is apt to be remembered largely because of the inherent interest that is called forth by novelty. On the other hand, the most recent event is better remembered, partly because the memory image has had less chance to fade from the mind than have those of preceding events. Constant repetition may be thought of as impressing the nervous system more and more, and thus causing the object concerned in the impression to be better retained. However, it must be remembered that recency, as well as primacy, possesses novelty because of its position in a series of events. Even constant repetition will have little effect unless that which is repeated is attended to and enters into the associations formed in a significant way. Repeating a grade, or taking a subject in the high school a second time, often proves of little benefit to the pupil. The lack of positive results in this instance is probably to be explained because through the repetition the interest in the subject matter becomes deadened, and, therefore, no permanent impression is made in consciousness. Indeed, to repeat once more the thought that is so important educationally that perhaps it cannot be overemphasized, no learning has ultimate value unless it enter into the conscious complex in such a way that it fits meaningfully into this complex. The mechanical laws of association possess value only in so far as they furnish the materials for associations of the higher type.

The four principles of primacy, recency, frequency, and vividness find ample illustrations in school practice. The Law of Vividness is well illustrated in what Bagley has termed the principle of vivid portrayal, which he considers one of the most effective ways of focalizing a habit. The use of stereoscopic slides in the study of geography, history, and the natural sciences is an admirable case in point. It gives a concreteness and reality which cannot be obtained in any other way. Every school should possess ample illustrative material of this sort, and likewise a good projection lantern with plenty of slides. Charts, models, maps, and concrete materials of all sorts should be utilized. It should, however, be remembered that such materials are to be used to illustrate the thought and not as ends in themselves. It is possible here, as in every department of education, to go to extremes, and to obscure the significance of the subject matter by injudicious emphasis on incidentals rather than on essentials. Certain subjects in the curriculum cannot, with ease, be illustrated in the concrete manner above indicated. There are, however, certain devices that readily accomplish the purpose of making more vivid the essence of the subject matter that is being taught. Perry [1] enumerates in his chapter on "The Use of the Blackboard" some of these. He advocates the liberal use of various colored chalks [2] to bring out important facts and relations. For example, "Emphasis that is made in speech by accent may be made in board writing by colored words or underlining." In the word "separate" the first *a* may be written in red chalk. A formula may be written in colors, and its application in the white chalk. In studying the structure of a sentence, the various parts of speech may be written in different colors. "Unseen lines in an illustration may best be indicated in color."

The principle of primacy, which demands that those things to be remembered be given an initial position, comes into conflict with the educational practice of developing a subject. It is a debatable question whether it is not advisable to place the important things first, rather than to lead up to them through an extended discussion and explana-

[1] "Problems of the Elementary School" (New York, 1910).

[2] Taylor (*Jour. of Pedagogy*, XVI, 1903) reports an experiment that tends to show that the use of colored chalk to emphasize silent and obscure letters has little value unless the pupil's attention is further called to the fact of the colored letters and the reasons for so coloring them.

tion. The principle of plunging *in medias res*, which has been recognized as valid in literature, is not to be ignored in pedagogy. Some of the older textbooks, as, for example, J. E. Worcester's "Epitome of Modern Geography," published in 1820, start with definitions and important principles.

In following the principle of recency, emphasis must be placed on the impressions made at the end of a course of study or a school exercise. The last must be, if possible, the best. Here should come summaries and final explanations. It is well to have the climax at the end.

Congruity of emotional tone.

To the four secondary laws of association another has been added, which is termed by James "congruity of emotional tone." By this he intends to signify the fact that the direction and nature of the associations is to a considerable extent determined by the feeling or emotional state in which the individual is. If a person is depressed and gloomy, he is apt, for example, on seeing a winter's landscape to associate with it ideas of barrenness and solitude; while, on the other hand, if he is in a cheerful mood, the sparkle of the ice, the bracing nature of the atmosphere, and the holiday appearance of the landscape are the things that predominate in his mind. This is, again, an illustration of the fact that *the interests, aims, and values that a person brings to his facts determine, in a very large manner, the selection of the elements to be associated and the direction of such associations.*

The influence of retroactive inhibition.

One of the most important facts from the standpoint of educational procedure that has recently been brought out in laboratory experiments on memory is that an association or set of associations just formed tends to weaken associations formed earlier.

For example, let *A–B* represent a series of associations formed during a certain learning period, and *C–D* represent another series of associations formed immediately after *A–B*, or with only a short interval between. It has been clearly demonstrated that there is a marked tendency for the *C–D* associations to break up the associated bonds in the *A–B* group. This is technically known as retroactive inhibition, and it has been found to occur, not only when the second associations were similar to the first, but even when they were quite dissimilar. As an illustration of this may be cited the fact that the examining of pictures immediately after learning a series of nonsense syllables has been found to weaken the memory for the nonsense syllables. However, it is probably true that the greater the similarity between the material learned during the second period and that learned during the first period, the greater is also the strength of the retroactive inhibition.

The explanation of this phenomenon is probably to be found in a large measure in the fact that it takes a certain amount of time for associations to fix themselves; and if a period of learning is immediately followed by another, the first associations do not have the chance of becoming as permanently established as if there were an interval of rest between. The importance of this fact in practical pedagogy, especially in arranging a program of studies, needs hardly to be commented on.

The formation of principal associations.

It has further been discovered that associations are more apt to be formed between immediately consecutive members of a series than between members more widely separated, and that the association is further in a forward direction. In other words, it is much more easy to recall the association *a–b–c–d* than the reverse, *d–c–b–a*. With sense material it is even more difficult to recall associations in the reverse direction than it is with nonsense material. This is, of course, to be explained by the general "drift" of consciousness in terms of meaning. In significant material associations are formed not merely between the various parts of the group, but the associations also connect themselves up with the meaning of the group as a whole. The associations formed between consecutive members are technically known as "principal associations." It is, however, quite obvious that in anything but mechanical learning with nonsense material the consecutive members of a series or group may not be the elements that stand side by side in the thought process, but the elements which are related more closely in terms of the meaning of that which is to be learned. For this reason, in meaningful material, we may assign the name "principal associations" to those which most naturally belong together in terms of the general thought or meaning.

The formation of remote associations.

Beside the formation of associative bonds between the parts of a given piece of memory material that stand closest together, either in order or in significance, there is a tendency to form in a lesser degree subsidiary and remote associations. The strength of the remote associations grows less, directly according to their distance from each other or according to their remoteness in meaning. Subsidiary and remote associations fade more rapidly from memory than do principal associations. For this reason, care must be taken in the learning process, when dealing with meaningful materials, to select and emphasize the principal associations.

Retroactive reinforcement.

While the general tendency to form one set of associations is to inhibit the formation of others through retroactive inhibition, it is possible that the formation of one set of associations which is closely related to another that has preceded it may strengthen the associative bonds in this first set of associations. Myers states the principle as follows: "When a syllable *a*, which has been already firmly associated with *b*, is presented with *c*, the association *a–b* is strengthened." This seems to hold good only when the first association has been strongly formed. If it has not, the second association tends to break up and destroy the first.

The reason for this may be made clear from the following consideration. If *a* and *b* are strongly joined together in associative bonds, then the association *a–c* will tend to call up the association *a–b*, because of the inherent tendency of *a* to associate itself with *b*. Therefore, every time that the association *a – c* is presented, the association *a – b* will tend to appear. On the other hand, if they are not joined in strong associative bonds, the tendency will be to establish the association $a-c$ to the exclusion and complete destruction of $a-b$. The significance of this fact in relation to the learning process is clearly that the first associations are to be impressed with sufficient strength, so that the formation of subsequent similar associations will tend to strengthen the first, rather than to destroy them. In the distribution of time, then, in learning, we should take care to see that a due amount is given to the associations first formed.

Tendency toward initial reproduction.

Experiments have shown that when the important word in a series of nonsense syllables, or in a phrase or sentence of meaningful material is given, there is a tendency to reproduce the first word; for example, the word "liberty" tends to recall the beginning of the verse "My Country 'tis of thee," etc. The underlying reason for this tendency is doubtless to be found in the fact that we associate the parts of a series or a sentence in terms of meaning, and the meaning is carried necessarily in one direction only, namely, from the initial word toward the completion of the thought. This is true to an extent with nonsense material, because of the fact that in most cases such material is in part learned through some sort of meaningful associations.

The age of the association.

Experiments have also demonstrated the fact that the age of an association is an important element in its retention. By the age of the association is meant the length of time since it was first set up. For example, a poem learned a week ago has a greater age in this sense than one learned yesterday. Jost,[1] who experimentally investigated the relation between the strength of associations and recall, has formulated the following, which is known as Jost's law: "When two associations are of like strength, but of unlike age, repetition increases the strength of the older more than of

[1] "Die Assoziationsfestigkeit in ihrer Abhängigkeit von d. Verteilung d. Wiederholungen," *Zeitsch. f. Psychol. u. Physiol. d. Sinnesorgane*, XIV, pp. 436–472 (1897).

the younger associations. When two associations are of equal strength, but unlike age, the younger fades more rapidly than does the older." Stated concretely, the first part of this law means that if I know two poems of like length and similar character equally well at the present time, a given number of repetitions will more firmly fix the poem first learned than the one learned later. The second part of the law signifies that if I know, for example, these same two poems equally well at the present time, a month from to-day I can recall better the one learned first. This fact has, of course, considerable practical significance. It can be readily seen that I accomplish more in studying over something that I have had in my mind a considerable length of time than I can accomplish by giving an equal amount of study to fresh material. This has a bearing upon the value of short courses and subjects continued but a relatively small time in the school work. The underlying significance of Jost's law is to be explained by the principle already referred to in another connection, that it takes some time for associations to form permanently. *The fact that the pupil has learned a certain amount of memory material so that he can reproduce it with facility, is no warrant that what he has learned will be of any permanent value to him. There must further be added the fact that this learning has been extended over a considerable interval of time, so that the associations have a chance to fix themselves permanently.* This fixing further is not to be understood in a merely mechanical way, for it is undoubtedly true that the longer associations are carried in consciousness, the greater is the extent to which they join themselves with other elements, and the greater is their meaning and significance.

CHAPTER XI

ECONOMY IN MEMORY AND ASSOCIATION

THERE are undoubtedly tremendous wastes in the technique of learning. Some of these escape observation, and indeed are very difficult to discover by ordinary experimental methods. However, when we come to consider memory and association, at least in their more simple forms, we find a considerable amount of fairly definite knowledge in regard to the most economical methods of learning. These economies, although they may not seem of the greatest importance in education, are not to be ignored. In the industrial world the attempt has been more and more to eliminate wasteful and extravagant methods, the smallest detail in saving being emphasized. A little thought should make it apparent to us that *if we can economize in the smallest matters of learning, we shall save in the aggregate a large amount of time and much useless expenditure of energy.*

Economy in small matters of learning.

A number of experiments, beginning about a decade ago, have been made in regard to the so-called "whole" and "part" methods of learning. The first of these was undertaken by Lottie Steffens.[1] By the whole method is meant the memorizing of a piece of material by beginning at the commencement and continuing straight through to the end, following this method during the entire learning period. By the part method is meant learning the memory material in sections. For example, the pupil may learn Longfellow's "Psalm of Life" in various ways. He can commit it line

The whole and the part methods of learning.

[1] "Experimentelle Beiträge zur Lehre vom ökonomischen Lernen," *Zeitsch. f. Psychol. u. Physiol. d. Sinnesorgane*, XXII, pp. 321–382 (1900).

by line, or stanza by stanza; or he may proceed from the first line directly to the last, and then, beginning the process over again, so continue until the whole poem is mastered. Probably most persons, if left to their own devices in learning, would pursue the second course, namely of committing the poem stanza by stanza. Perhaps a few would attempt the learning line by line, and still fewer the learning of it as a whole. Both the first two methods are forms of the part method of learning.

Advantages and disadvantages of the two methods.

Notwithstanding the almost universal belief and practice, the part method of learning seems to be less economical than the whole method, especially when meaningful material is concerned. Indeed, some investigators go so far as to assert that even with nonsense material the whole method has a slight advantage over the part method. This, however, is to be doubted.

The reason for the superiority of the whole method as compared with the part method in learning meaningful material is usually explained by the fact that in learning the material as a whole, the proper associations are formed. If a poem is learned stanza by stanza, then the associations set up are, for example, between the last words in a stanza and the first words in the same stanza, whereas the proper associations would be between the last words in the stanza and the first words in the stanza next following. Hence, when the poem is learned by the part method, a large number of incorrect associations are formed, and this necessitates not only the learning of the new and proper associations, but the breaking up of the old associations as well.

While undoubtedly with laboratory subjects under strict experimental conditions, the whole method of memorization is much to be preferred to the part method, it has certain disadvantages in the ordinary learning of the schoolroom. Among these disadvantages may be mentioned first that arising from fatigue in attempting to master a large amount of material by the whole method. The fatigue, however, is probably more apparent than real, and arises largely because of the discouragement which comes to the pupil in failing to notice progress in his memorization.

It can readily be seen that if ten minutes were spent in learning the "Psalm of Life," there would be little evidence of progress during the period, if the learning were by the whole method, while if the poem were learned stanza by stanza, the progress would be clearly evident. According to the first method of procedure a considerable number of words would have been raised up close to the memory threshold (*i.e.* the point just below which they are to appear in memory), but none would have passed over it, and, therefore, there would be no indication of progress. In the second method, however, perhaps a whole stanza would have been committed during the ten-minute period, and clear progress would be evident. For the child this lack of evident progress is a great discouragement; and the result is that he loses interest in learning; and this loss is fatal to the accomplishment of his task. Another reason why the whole method is not in every instance superior to the part method is to be found in the circumstance that a part of the memory material is much more difficult to bring above the threshold of memory than are other parts; so it not infrequently happens that a large number of repetitions of the entire memory material are necessary in order to learn that small portion of the whole which refuses readily to be memorized. A third, and perhaps the principal disadvantage of the whole method, lies in the fact that it is much less easy during the learning to practice recall than it is in the case of the part method. As will be seen later, recall is a most important factor. However, these various difficulties may be partly or entirely obviated if certain precautions are taken.

Advantageous modifications of the whole method.

In the first place, the pupil should be informed of the advantages of the whole method and his interest stimulated in learning by this means. Thus he will tend to overcome his inherent prejudices against the method, and will not so easily be discouraged, if results are not immediately apparent. Further, he should be told to study the whole piece to be memorized up to the point where the difficult parts become particularly prominent; then to confine his attention for a while to the difficult portions, and after that, again to continue learning by the whole method. He should also be instructed that after a certain time he should attempt to recall, as far as possible, what he has been studying. It will probably be found, especially for older pupils and adults, that if this method, with the modifications indicated is followed until it becomes habitual, a considerable amount of time will be saved in the learning of ordinary material.

Learning by the whole or part method should be carefully distinguished from the learning of memory material entirely at one sitting or at various sittings. To refer to the "Psalm of Life" again, it is possible to spend an hour on it without pausing, or to spend two thirty-minute intervals, or perhaps to spend four fifteen-minute intervals on the learning. As to the value of these various ways of learning material, there seems to be some doubt, although again laboratory experiments show that the distribution of learning over a considerable period is economical.

Distributed and concentrated learning.

Among the reasons why distributed learnings are better than concentrated learnings may be mentioned first the fatigue of long periods of learning, with accompanying loss of interest and the falling off of attention. The principal reason for the superiority of learning in several sittings over learning in a few seems to lie in the fact already referred to, that the age of the associations is an important factor in retention. So it happens that if the learning of the memory material has covered, for example, a week, at the end of the period of learning the age of the associations first established is clearly greater than if the learning had occupied one or two days. The associations, being extended over a greater period when the material is distributed, have greater opportunity to become permanent and to acquire significance.

It is a fact well known that cramming is a bad method of learning. It is quite possible for a clever student to prepare for an examination in a few days and to pass the test with a high grade. The more systematic worker, however, who has been preparing his material for weeks and months, although he may not obtain any better results on the immediate test, will carry the substance of his studies much farther than will the person who learns in haste, and the significance will be far greater. There is a prevailing opinion that a great deal can be accomplished by spurts; and while it is undoubtedly true that there is a certain value arising from a great expenditure of energy at particular periods, the final results accomplished by the person who works in spurts cannot be compared with the results obtained by the systematic worker, who can keep his learning distributed over long periods with a fixed degree of regularity and with a permanent interest.

There is, however, another aspect to the matter. Some of the reasons why the method of learning material by distributing it over various periods is unsatisfactory are the following: First, it requires a certain amount of time to adjust the attention to the subject at hand. In all learning there is this period of "warming up," which is particularly long with those individuals whose ability to adapt their attention readily is slow. It is clear, then, that during this warming up process the learning is not proceeding under the very best conditions. Suppose it takes five minutes for the person to adapt himself to the learning of his material. If he spends only fifteen minutes in the learning one third of the time will be under conditions not at all advantageous; if he spends thirty minutes, only one sixth of the time will be given to the warming up; while if he spends an hour, only one twelfth of the time will be so consumed. Another reason why breaking the periods of learning up into small sections may be disadvantageous lies in the fact that with material of considerable length brief periods do not give the opportunity for thoroughly comprehending the nature of what is being learned. In other words, sufficient time is not allowed for "orientation."

Distributed learning better than concentrated.

While, then, no absolute rule can be laid down as to the desirability of splitting the work up into many or few periods, it may be a safe principle to follow that for material of considerable length a number of divisions is desirable. With persons whose attention is readily adaptable and who lose little in the warming up process, the number of periods of learning a given amount of material should be greater than with those whose attention adapts itself but slowly. Further, with young children the number of sittings should be greater than with older pupils and adults.

In an experiment recently conducted in two of the grade schools of Champaign, Illinois, with pupils ranging from about eight to thirteen years, it was found that in learning a series of twelve nonsense syllables, it made absolutely no difference whether they were all learned at once or divided into two or four periods of learning, with considerable intervals of time between the periods. Probably, if the length of the material had been greatly increased, the results would have shown the learning at several sittings rather than at one more advantageous, while, on the other hand, if the memory material had been less in length, the opposite results would have been secured.

Short periods of learning advantageous for children.

There is, doubtless, for every subject in the school curriculum an optimal distribution of periods of learning, depending upon the amount to be learned, the nature of the material, and the age of the pupil. This optimal period can be exactly determined in any individual instant only by observation and experiment, yet there are certain general methods of procedure in regard to distribution which can be safely laid down in the light of experiments already conducted. For the youngest children it is probably better to have any subject given two periods a day, one in the morning and the other in the afternoon, than to have it grouped under one period. For older pupils very brief periods are not so advantageous, since these pupils are more capable of sustained attention and interest, and since by longer periods of study they get a better grasp of the subject as a whole. Obviously, it would be unwise for the mature student to break his intellectual work up into brief periods, for example, of fifteen or even thirty minutes each, particularly if it took him some time to get his attention fully centered on his subject. On the other hand, the average adult would accomplish more by spending two two-hour periods on a subject with an interval of twenty-four hours between, than he would in spending four hours consecutively.

Recall of value in learning.

From experiments recently conducted in the psychological laboratory of the University of Illinois [1] it seems certain that recall during the process of learning, or immediately afterwards, is a great economy in memorizing.[2] These experiments indicate that

[1] By Edwina E. Abbott, "On the Analysis of the Factor of Recall in the Learning Process," *Psychol Rev., Monograph Supplement*, XI, No. 1, (1909).

[2] Somewhat similar results have been found by Katzaroff, "Le rôle de la récitation comme facteur de la mémorisation," *Arch. de Psychol.*, VII, pp. 225–

recall is always an aid in the learning process, and that the recall should be interspersed in the learning; in other words, that during the study of the material the student should, from time to time, turn away from the work and attempt in visual or other imagery to recall it to his mind. This recall should not only be the reimaging of the material, but it should also be the reinstatement of the material in terms of its general meaning. Probably for significant material more than half the time should be spent on the recall. Recall is particularly valuable because it enables the pupil to discover his errors and correct indefinite and hazy impressions. He holds himself to a more strict account in recall than he does in memorization with the material directly before him.

The value of the recitation.

The fact that recall is of such great importance in learning has a significant bearing on the nature of the recitation. The recitation is one of the most valuable methods of instruction. It is only in a small degree, however, to be regarded as a means of determining what the pupil knows, in order to assign to him proper grades in his work. Its principal function, when skillfully conducted, is that it serves to recall to him the places where his knowledge is inexact, hazy, and uncertain, and it should always be followed on the part of the pupil by a relearning in the light of his previous errors. If the teacher regards the recitation from this point of view, it becomes the central factor in the whole scheme of primary and secondary education. The fact that the recitation as such is largely ignored in higher grades of instruction is, doubtless, a serious pedagogical defect, which can be remedied only by accustoming the student to practice on his own initiative recall in his learning. This is

258 (1908); by Witasek, "Über Lesen und Rezitieren u. s. w.," *Zeitsch. f. Psychol. u. Physiol. (d.) Sinnesorgane*, XLIV, pp. 161–185 (1907); and by Knors, "Experimentelle Untersuchungen über den Lernprozess," *Archiv. f. d. gesamte Psychol.*, XVII, pp. 297–361 (1910).

all the more important because of the fact that in the higher branches of learning so much less depends upon verbal memorization than it does in the lower branches. *Significant material can be comprehended only by working it over through recall and by reconstructing the printed page in terms of the student's own thought processes.*

The rate of learning varies under different conditions.

The rapidity with which an individual reads over or studies the memory material which he is trying to master is termed the rate or tempo of learning. This varies not only with different individuals, but with the same individual at different stages of the learning process, and also with different kinds of material. It also varies with age and other conditions, physical and mental. It, however, holds generally true that for the preliminary orientation of the material to be learned the rate should be not as rapid as for later learning. It is obvious that when the nature of the material is more or less unknown, it is desirable to first proceed slowly, so that no mistakes shall be made in apprehending it, either in its detailed parts or its general meaning. When, however, it has become more or less familiar, the rate of learning should be increased. It is further true that for children the tempo should not be as rapid as for adults. The character of the material and the aim of the learning will also determine in a measure, the rate, as has been said above. If a poem is to be learned by heart for exact reproduction, then the tempo should be much slower than if material is to be mastered which requires not accurate reproduction, but rather reproduction in terms of its general significance. It is also important to learn for permanent retention in a less hasty manner than for immediate reproduction without permanent retention.

Meumann is the authority for the statement that in general the individual who learns at a slow rate is apt to retain what he learns better than the individual who learns at a rapid rate. This, however, holds good only for individuals of average intelligence. The person of extremely acute intelligence probably as a rule learns more rapidly, and at the same time has greater retentivity, while the subnormal individual learns with extreme slowness, and at the same time his memory is poor. It is, without doubt, desirable to accustom the unusually rapid learner, who is at the same time not likely to retain well what he has learned, to a slower tempo. It is also well to accustom the pupil to read certain materials rapidly. This applies to those facts of which he needs to get only a general idea, and the details of which he need not carry in his memory even for the shortest time. A person who reads widely must learn the art of varying his tempo to suit the material in hand, skipping rapidly over the unessentials, and proceeding slowly when he comes to those parts which require special attention and which are for him significant.

Learning beyond the threshold of reproduction.

If material is to be retained for any length of time, a simple mastery of it for immediate recall is not sufficient. It should be learned far beyond the point of immediate reproduction, if time and energy are to be saved. For this reason it is often better to concentrate study upon a single phase or aspect of a lesson rather than to spread it over too wide a field. If this is done, then that which is learned can be kept in mind for subsequent recall after the learning period is ended. On the other hand, if the subject is learned only so that it can be just recalled at the end of the learning period, it will rapidly fade from the memory, and cannot be worked over again during the intervals between study. The advantage of learning in the way advocated above, however, depends largely upon the ability and willingness of the learner to practice recall between the periods of learning. If the pupil in the common schools and the student in the higher institutions of learning would make it a practice to recall immediately after study, and at intervals until the next period of study, the materials which they are to master, they would find it surprisingly economical.

In discussing the question of economical learning, the problem arises whether it is better to learn material through one of the avenues of the senses alone or by aid of the several senses. For example, if the pupil is learning to spell a list of words, should he, while studying them, pronounce them (aloud or in a whisper), and write them? A considerable amount of experimental evidence has been obtained on this point. Investigations made by various German experimentalists[1] seem to indicate that vocalization is a decided aid in the learning.

Aids in learning.

Lay found that words seen and copied simultaneously by pupils were learned the most readily, and that words seen and pronounced aloud stood second, while at the bottom of the list in ease of learning were those words which were simply heard. Fuchs and Haggenmüller ("Studien und Versuche über die Erlernung der Orthographie," *Schiller's Sammlung* u. s. w., II. Bd., 4H.) also, found that words seen and copied simultaneously by pupils were the most readily learned, and that, in general, vocalization was a decided aid. Itschner[2] found that words seen and pronounced aloud were the best learned, and that those seen and copied simultaneously stood second.

A series of experiments recently concluded by the Department of Psychology at the University of Illinois, in which about eighty school children were tested, seems definitely to show that learning for all grades is considerably facilitated by allowing the pupils to study in a whisper. On the other hand, learning by writing the word seen is a marked hindrance. This latter fact has been confirmed by other and more extensive experiments carried on with pupils in the cities of Urbana, Bloomington, and Danville. Writing seems to be a hindrance to learning up to the sixth grade. The reason for this is to be found in the fact that the process of forming the letters involved in writing has not become mechanized sufficiently in the earlier grades to allow the pupils to use it without concentrating their attention upon the effort expended in forming the letters.

Writing, therefore, should never be used with younger children as an aid in memorization. It seems positively to be a distraction. In general the rule should be laid down that in learning, all those aids that do not mutually inhibit each other or distract the attention from the main purpose of learning can be employed to advantage. There seems

[1] Lay, "Führer durch den Rechtschreib-Unterricht" (Wiesbaden, 1899).

[2] Lay's "Rechtschreibreform," *Jahrbuch d. Vereins für wissens. Päd.*, XXXII, 206–234 (1900).

to be no doubt that rhythm is a decided aid in learning, and it may be used legitimately in school practice when the memory material is to be mastered in a mechanical way. For certain kinds of memory material it is probably advantageous to have the children recite in concert in rhythmical form. Experiments at the University of Illinois have shown that one of the greatest distractions in learning is requiring children, especially those in the lower grades, to keep perfectly quiet. It was found that when the pupils were asked to sit in their seats with hands folded, their memorization of nonsense syllables was much inferior to their memorization when they were allowed to move about in their seats and to gesticulate.

Visual and auditory presentation.

In the presentation of material for learning, the question arises as to whether the visual or auditory method is better. Perhaps no final answer can be given to this question. It is true, however, that in general visually presented material possesses the advantage of greater clearness (especially with unfamiliar words or words difficult to spell), than does orally presented material. On the other hand, orally presented material is better suited to securing attention of young children. It is the more natural and primitive mode of presentation. In teaching the child to read it is a great mistake to rely entirely on the visual symbols. The words should not merely be seen by the pupil; they should in addition be carefully pronounced both by pupil and teacher, and broken up into their syllables. *It is clearly unpsychological to teach the children to read by having them grasp whole sentences or even phrases and long words in purely visual terms.* While there seem to be great individual differences among pupils in this matter, and while for some the visual method alone may be fairly satisfactory, for children in groups it will be found that many are seriously handicapped if their instruction in reading is without auditory presentation and is unaccompanied by a careful indication of how the words are to be pronounced. In learning to spell the conditions are somewhat similar.

In an investigation in the psychological laboratory of the University of Illinois concerning the factors involved in spelling[1] it was found for the adults tested that it was important to present the words to be learned in such a way as to facilitate the visual perception as much as possible, but that also for certain of the subjects the indication of the pronunciation was an aid in learning. It was further found "that the observers combining the letters at once into syllables as they are presented is of prime significance." For one of the observers it was found that vocalization was absolutely necessary for the recognition of words. The vocalization of syllables appeared to be an aid in all cases. Vocalization of letters, however, was sometimes a hindrance.

It seems evident that in learning to spell and to read, neither visual nor auditory methods of learning and recall should be exclusively relied on, but there should be an appear to both these channels of memorization.

Oral and written work.

When we consider the matter of children's compositions in the grades, we find, especially with younger children, a considerable superiority in the oral as compared with the written work. In the oral work the child has greater freedom and spontaneity, while in the written work he is held down more to the form of presentation, and gives less attention, consequently, to the substance. While written work is to be insisted on to cultivate accuracy and formal correctness, it is not likely to stimulate inventive ability. School instruction in composition has confined itself very largely to considerations of grammatical and rhetorical accuracy. While accuracy must be insisted on, it must be remembered that the form of the expression has but little value unless the thought in which the form is expressed is worth while. Children should be encouraged to create, as well as to present accurately what they have created. In the grades written composition should not be employed to any great

[1] Edwina E. Abbott. "Memory Consciousness in Orthography," *Psychol. Rev., Monograph Supplement*, Vol. XI., No. 1 (1909).

extent when the purpose is to encourage the child in invention. It is much better to have him first tell before the class the story that he is composing, and then perhaps later to reduce it to written form.

When the learning progresses economically, it passes through certain definite stages to a conclusion. Meumann has pointed out four such stages, namely, (1) adaptation and orientation; (2) passive learning; (3) active control of the learning through direction of the associations; (4) general review and final synthesis.

Stages in the learning process.

In the first stage, the attention is adjusted to the material, and its general nature is discovered; in the second stage the learning proceeds objectively, the various parts being impressed upon the mind with the learner in the attitude of receptivity; in the third stage the learner actively directs his manner of learning and seeks to form helpful associations. In this stage, if he is not learning for reproduction of the material verbatim, but for general meaning and significance, he determines what part of the material is to be particularly emphasized, and what part is to be passed over with relatively slight attention. In this phase of the learning, it is the business of the teacher to direct the immature pupils to select and properly arrange the important elements to be learned. Older pupils and adults must learn to make this selection themselves, if they are to succeed in any real way in mastering the more complex and difficult memory material. In the fourth stage, the entire material to be memorized is to be carefully gone over, the salient points are to be emphasized, and the whole is finally to be worked over and associated in meaningful ways. In slipshod learning the pupil too often relies chiefly on the methods of the second stage, namely, those of passive learning. He does not take the trouble to ascertain exactly the nature of the material to be learned, and he never rises to the plane of actively directing his associations, nor of reviewing and unifying his work.

It is extremely important that the teacher should insist that the pupil observe all these stages in the learning of the various subjects of the school curriculum. The method of approaching the material to be learned and the way of mastering it cannot be left to chance, if economy in time and energy is to be considered an important factor in the learning process.

The numerous investigations concerning the psychology of memory all emphasize the fact that meaningful material is immensely superior to meaningless material in the ease with which it is learned. Sense material can be learned from ten to fifteen times more rapidly, and also can be retained much better, than nonsense material. The practical significance of this fact is, that the material to be learned should be made as meaningful as possible. Some hold it desirable for this reason that when material has but little significance for the pupil he should memorize it with certain mnemonic aids. This would apply to learning of rules, lists of words, and the like. However, as has already been said, there is no excuse for learning anything which cannot be used in meaningful ways; therefore, that which is at first mastered by tricks of memory must be later comprehended, else the learning is worse than useless. It also is to be remembered that great care should be taken, when mnemonic aids are used, that they are employed only where the material cannot be learned through meaningful associations that inhere in the nature of the material. Any mnemonic system which attempts to facilitate memory has decided disadvantages when this material is to be recast in meaningful relations. The bonds of association formed by these artificial methods must ultimately be destroyed and new bonds of association substituted.

Material learned must be meaningful.

An example may make this fact more definite. It is possible for the child who is learning about some American or English author to commit to memory his works by ingeniously arranging them so that the initial letters shall spell a word or phrase. Doubtless, in the first instance, the mnemonic device greatly facilitates the memorization. However, later on, the pupil, if he is to understand the real significance of what the author has written, must arrange his works, not in terms of this mnemonic system by which he has originally learned them, but in terms of the significance which they have in the literary development of the writer. Obviously, the first series of associations that he has formed under the artificial arrangement of his mnemonic device must be broken down and a new system substituted. If the old arrangement, however, has been one of long standing, it is difficult to destroy it and set up the newer and more rational one. It is for this reason a safe rule to follow that mnemonic devices should never be used except in cases of absolute necessity, and that the pupil should never be encouraged to rely, to any considerable extent, upon memory tricks of this kind.

The following rules of pedagogical procedure may be deduced from the preceding discussion: —

Value of verbatim memory.

(1) In considering memory in the school work the teacher must recognize that it is broader than definite recollections of previous experiences. He is to keep in mind the fact that not only that which can be clearly reproduced, but also much of that which, as distinct recollection, has entirely faded from the mind, is of the greatest importance in the progress of the pupil. He is also to remember that there is not one way, but there are many ways of testing memory, and that different tests should be employed for different school subjects, for different materials, and for different purposes. The test so often used of merely reproducing verbatim what has been mechanically learned is perhaps on the whole the most unsatisfactory test. This is the test that is too often solely employed in written and oral examinations. While it has a place in the school work of all grades, it should not, especially in the higher grades, occupy a position of exclusive or chief importance.

Mechanical memorization belongs in the preadolescent years.

(2) Since the factor of impression seems to be relatively more important in the lower grades than in the higher, and since this factor is more important in mechanical than in significant learning, and since further the stability of memory seems to suffer a temporary upheaval about the time of the pupil's entrance into the high school, *the grades should be the place for mechanical memorization and drill in the fundamentals that form the basis of broader education.* It

is a mistake, however, to suppose that mere retentivity is greater among children than among more advanced pupils. The fact is that mechanical memory occupies a more important place than does systematic memory in the earlier grades, simply because of its relative, not its absolute value. However, since the older pupils are less willing to submit to the drudgery of drill than are the younger, it is a pedagogical maxim, safe to follow, that drill and mechanical memorization belong chiefly to the preadolescent years.[1]

A general rule for economical learning.

(3) It has already been pointed out that it is advantageous to learn material by the whole rather than by the part method, within certain limits. Further, it seems desirable to distribute the learning of a lengthy piece of memory material over several sittings. It also seems to be desirable to learn material sufficiently well so that later learning of other material shall not break up the associations first formed through retroactive inhibition. These various rules for economical learning, however, seem to conflict with each other at certain points. If the pupil learns by the whole method, spending a certain amount of time at each learning, he will raise fewer associations above the threshold of memory than if he learns by the part method; therefore, there is greater danger of retroactive inhibition than if he should learn a part of the material sufficiently well to establish firm bonds of association. The further fact that the material should be memorized, not at one, but at various sittings, seems to enter into conflict with the principle of learning the material sufficiently well to avoid the effect of retroactive inhibition. These difficulties may, however, in part be overcome by following a compromise method. This may be stated as follows: Select material of reasonable

[1] Hall writes ("Adolescence," II, p. 451): "Just as about the only duty of the young child is implicit obedience, so the chief mental training from about eight to twelve is arbitrary memorization, drill, habituation, with only limited appeal to the understanding."

length for one period of study; go over it carefully and slowly for purposes of orientation; repeat this until the general nature of the material is clearly understood, then increase the tempo. Continue to learn by the whole method until the majority of the material is raised above the threshold of memory. Next, strengthen the weak associations (*i.e.* those not raised above the threshold of memory); then go over the whole again until it is fixed. It is desirable to raise all the elements considerably beyond the threshold of memory. During the learning period practice recall; also, allow several minutes after the actual learning is finished for recalling and fixing the associations already formed. This will be found to be one of the most important methods of firmly establishing the material in memory. Relearn the material on several succeeding days until it is thoroughly mastered.

The school program should not be "bunched."

(4) The school program should be so arranged that subjects should be continued over a considerable period. It is probably better, for example, to have the course in algebra in the high school extend over two years with thirty-minute periods each day than to extend over a year and a half, as is at present the custom, with forty-five-minute daily periods. What is true of algebra is, doubtless, true of a considerable number of other subjects in the secondary school curriculum. *In general, the work on a school subject should not be "bunched," but should be spread over a sufficient period to allow the materials to be properly worked over and comprehended by the pupils.* In the work of college and university grade the student, in electing subjects, should, for the most part, select those that continue for some years in his course. It is better to select a subject reciting three times a week for two years, than one reciting six times a week for one year.

(5) Too many short courses are undesirable. Those subjects that have been put into the grades and the secondary schools to "enrich" the curriculum are oftentimes to be

objected to from this point of view. They are not taken often enough or continued long enough to secure the serious attention of either the pupil or of the teacher, and never become a permanent part of the mental equipment. *No school or college should offer so free an elective system as to permit its students to take a large number of short and unrelated courses.*

The pupil should not elect too many short and unrelated courses.

(6) Much has been said in recent years against the desirability of examinations at the end of courses of study. The value of the examination does not consist primarily in its worth as a test for determining the pupil's knowledge. Its chief service lies in the fact that it compels the person who is to be examined to carry over a considerable period the details of the subject which he is pursuing. The tendency too often is to let a subject drop out of mind as soon as it is no longer required in the school course. If the test of the work done by the pupil were made by determining his knowledge only at the end of each day's study, in many subjects he could make little advance. Only in those subjects like foreign language and mathematics, in which each day's work presupposes practically all that has preceded, would such a course be at all safe. In the higher work particularly, the English system of determining the knowledge of the student by examinations covering the study of several years has decided advantages over that employed in American colleges and universities. *In the elementary and secondary schools, examinations, not as tests, but as incentives for keeping in mind the work that has been pursued over an extended period, should be emphasized more than they are at present.*

The value of examinations.

In the eighties in various New England colleges, it was the practice to hold examinations at the end of the sophomore and the senior years, covering in each instance the work of the two preceding years. The introduction of the elective system, together with other causes, resulted in the abandonment of this excellent practice.

It may be seriously questioned whether the almost universal tendency to give up the college entrance examination is altogether an advantage. In the East the student is generally admitted to college by certificate; while in the Middle West the method of inspection and approval of secondary schools allows the student to enter a higher institution without being called to account at all for the work he has previously done. Under such conditions as these he has no incentive to carry a study in mind after he has finished it. The partial introduction of the elective system into the secondary school, with the increased opportunity of taking short and often unrelated courses, adds to the danger in this direction.

The pupil should rely upon many aids.

(7) In learning, rely upon as many aids as possible, if such aids do not mutually inhibit each other and distract the attention. In learning to spell and to read, it is not safe to rely on visual presentation alone. Probably separate letters should not be vocalized by the pupil or by the teacher, but syllables should invariably be vocalized. This has been found a considerable aid in experimental tests so far employed. *In learning to spell or to read, or in learning memory material in general, it should be remembered that writing is not an aid to the learning until the sixth or seventh grade in the schools.*

Visual presentation supplemented by oral presentation.

(8) Material to be studied should be presented, as far as possible, both visually and orally. The advantage of oral presentation is that it more readily holds the attention, while, on the other hand, visual presentation gives the opportunity for greater exactness. Further, visual presentation can be both successive and simultaneous (*i.e.* several words or many can be presented at the same time), while auditory presentation is of necessity successive. It is a safe rule to follow in instructing the pupil in material presented visually that this visual presentation should be supplemented whenever possible by the teacher or pupil reading aloud the material for study. For example, the geography or the history lesson that is to be prepared for the following day should

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be read over to the pupils when it is assigned, or perhaps, better still, various pupils should be called upon to read the advanced lesson.

(9) The teacher should aid the immature pupil to form the important associations in meaningful material properly.

Principal associations must be formed properly.

By means of outlines and the like, the pupil should be led to single out from the total mass of material those parts which are chiefly important for him to retain. The teacher, however, should rather instruct the pupil as to the method of discriminating between the principal and subsidiary associations, than to outline the material itself for him. At least, if it is necessary for the teacher to do this work at the outset, he should not continue it any longer than is absolutely necessary, for the chief value in forming purposive associations lies in the fact that they are purposive for the one who so forms them, and are not imposed from the outside. Gradually, at least, as the pupil becomes more mature, he should be more and more capable of forming the proper associations through his own initiative.[1]

(10) In conclusion, it should be remembered that instruction in the technique of learning is perhaps as important as

Instruction in the technique of learning important.

instruction in the content of the subjects of the school curriculum. Too often the teacher emphasizes only the latter phase of the learning process. The pupils are allowed to devise their own methods of study, that are often tremendously wasteful, and that persist throughout their entire lives. One of the most serious results of the attack on the possibilities of "formal discipline" has been the spreading of the belief that it is impossible to instruct the pupil in anything but the content of his school subjects.

[1] For further discussion see Chapter XXII, p. 322.

CHAPTER XII

THE APPLIED PSYCHOLOGY OF MEMORY AND ASSOCIATION

The chief fields of applied psychology.

The purpose of applied psychology, which is now rapidly developing, particularly in Germany and France, is to gather such psychological information as will serve various sciences in their practical application. The chief scope of applied psychology to-day is found in medicine, law, and education. In education, in particular, applied psychology shows many interesting facts that are of no small importance in throwing light upon the fundamental processes of memory and association. Applied psychology attempts to discover an exact method for evaluating the workings of human consciousness in the practical affairs of these three professions; it further seeks to devise methods of control in directing human conduct, in so far as it expresses itself in these three fields.

For a long time French psychologists have used their knowledge of the facts of mind in their treatment of mental disease; in the cure of alcoholism and the like. Indeed, under Janet and others, French psychology has interpreted normal mind largely from the standpoint of the psychological clinic. This has also been true, to some extent, of German, English, and American psychologists. Criminal psychology has received a considerable impetus of late years through the elaboration of the methods of Kraepelin, Jung, Riklin, and others, and has become known in America, to the general public principally through the books and magazine articles of Münsterberg.[1]

Less striking, but not less important, than the work in mental pathology and criminology have been the investi-

[1] Münsterberg's chief work in this field is entitled "On the Witness Stand" (New York, 1908).

gations of educational problems and practice. America, under the leadership of G. Stanley Hall, has for thirty years been in the van of progress in educational psychology.

We have but to recall the rapid growth of the Child Study Movement during this period as it has developed under the impetus given it at Clark University,[1] to recognize how much America has done to advance our knowledge of the mind of the child, particularly the child in the school. More recently German investigators have seriously taken up work in this field of applied psychology with the determination and patience characteristic of them. Meumann, whose investigations and conclusions have often been cited in the preceding pages, is one of the chief experimentalists who has given his attention to this phase of applied psychology.

The psychology of testimony.

William Stern, professor at the University of Breslau, has in the last few years, been a leader in the movement of applied psychology, particularly in its educational aspects. Stern's chief work has been in the psychology of testimony, and his investigations have brought out facts important to law and education alike. The purpose of Stern's experimentation has been to find out the extent and accuracy of testimony in children and adults.

The materials that he has used for his investigations are of two kinds. His principal material has consisted of colored pictures of homely scenes, familiar in their nature to German children and adults. Stern's most commonly used picture is the so-called "Peasant's Room" (*Bauerstube*).[2] It represents a room containing a bed, chairs, stools, a table, a cradle, and various articles on the walls. At the table a man and a boy are seated, eating, and by the table is standing a woman, who seems to be serving the man. There are dishes on the table, and a vacant chair at the side of the table for the woman. In the cradle there is a baby, with a doll on the floor and a dog near by. On the walls are a clock and three pictures. At the single window is a curtain and a shade; on the window sill is a plant. Through the window may be seen the foliage of a tree. The various objects in the picture are colored. Beside

[1] The articles that have appeared in the *Pedagogical Seminary* record the principal work of Hall and his pupils.

[2] This picture is found in the first volume of Stern's *Beiträge zur Psychologie der Aussage*, p. 418. (Leipzig, 1903-1904.)

the picture experiment, Stern also used later a so-called event experiment, which had been arranged beforehand. The event experiment consists essentially in a person doing a certain number of definitely prearranged things before witnesses, who afterwards are to report as to the exact nature of what was done. The value of these two experiments is not the same. The picture is better for the comparison of the testimony with facts; the event comes nearer to fulfilling the actual conditions of life. The value of both could be combined in the use of the moving picture. Beside the picture test and the event test a rumor test has also been arranged, for the purpose of comparing hearsay evidence with the report of an eye witness. In the rumor test a statement is made which is repeated by various individuals, and the final statement is compared with the original.[1]

The results of these various tests are brought together under two forms, termed by Whipple the narrative and the interrogatory. The person tested is required in the picture experiment to carefully study the picture, generally about a minute, and then he is asked immediately to give an account, either orally or in writing, of what the picture contains. This narrative is supplemented by a series of questions (the interrogatory). These have been for the most part carefully prearranged. The replies to the interrogatory are technically known as the deposition.

The manner of questioning a witness important.

The forms in which the questions are asked the witness are extremely important in arriving at the truth of his report. If the questions are put in such a way as to presuppose a certain answer, this answer is likely to be given, although it may be quite contrary to the truth. The obtaining of false testimony, especially from young children, through suggestive questions, constitutes one of the chief dangers of the reports of children. A skilled questioner may by the mere form of his interroga-

[1] Among important workers in this field, besides Stern, may be mentioned Binet, Borst, Claparède, Lipmann, Lobsien, and Wreschner. A description of the tests employed, together with a careful bibliography, is to be found in Whipple's "Manual of Mental and Physical Tests" and also in an article by the same writer in the *Psychological Bulletin*, VI, pp. 153–170, May, 1909, under the title of the "Observer as Reporter: A Survey of the Psychology of Testimony."

tories entirely obscure the truth of a deposition. It has been found by experiment that questions that presuppose yes or no are more strongly suggestive than questions that contain no such presupposition. For example, the question, "Has the man a spoon in his hand," is much more strongly suggestive than the inquiry, "What has he in his hand?" The most dangerous questions in the falsification of testimony are those in which an answer is assumed in the question itself, particularly when the implied answer contains a presumption contrary to fact. For example, the witness is asked, "How many drawers has the cupboard?" (there is no cupboard in the picture). It has been found that questions suggesting false replies are more likely to deceive the witness when they are preceded by questions containing suggestions that are true. The skillful questioner who wishes to falsify testimony will, therefore, only occasionally introduce a falsely suggestive question. A large amount of questioning will be suggestive of correct answers. It is further to be remembered that the personality of the questioner is a very important element in the suggestion. The suggestibility is greatly increased when the witness has a feeling of respect for the questioner, or a desire to please and to appear at an advantage. This is particularly true in the case of children.[1]

Degrees of certainty in the replies of a witness.

There are various degrees of certainty in the replies which the witness makes in response to the interrogatory. The least degree is that in which the witness risks neither affirmation nor denial. He replies that the details about which questions are asked may be true or they may not. The next grade of certainty is that in which the witness merely admits that a certain statement of facts may be true. He thinks it is possible. In the third stage of certainty the witness

[1] The various kinds of suggestive questions have been carefully worked out by Lipmann, in the *Zeitschrift für angewandte Psychologie*, Vol. I, 1907–1908, pp. 44–92, 382–415, 504–546.

believes that the statement is true; he says that it is probably correct. In the fourth grade of certainty the witness is sure that the statement is true, while in the final and highest grade he is willing to swear that the statement is true.

Errors in the direct report.

Error in a report of a witness may arise either in the direct report or in his replies to the questions of the examiner. Stern[1] has classified these errors as follows: —

(1) Errors of apprehension, due to overlooking some of the elements presented; misapprehensions that arise in consequence of expectation or habituation. These include the two sources of illusion outlined by James and discussed on p. 91. (2) Errors of memory as such that arise through the filling up of gaps in accordance with habit. In this form of error only a part of the event was actually experienced, and the rest is supplied in accordance with previous experiences. Errors of memory also arise from the using of verbal expressions in an altered sense when different accounts of the same event are given at various times after the happening (for example, the statement "The man's shoes were polished," made in an early report, might be changed in a later report to the statement that the man had a polished manner). Errors in memory are also due to the growth of the idea in various succeeding reports (for example, in the first report the witness stated, "There were two trees"; a week later, "a grove"; still later, "a forest"). (3) Errors of phantasy. These include the retouching of the recollections, the unintentional blending of the imagined with the experienced, and the confusion of experiences of different times. In this class of errors are to be found the mythopœic fancies of children and the "fish stories" of adults. (4) Lack of will. The witness has too great credulity. He subjects his knowledge to too little criticism, particularly in dealing with uncertain recollections. He will not attend sufficiently to get a clear apprehension of the facts.

Errors in the interrogatory greater than in the narrative.

The sources of error in the interrogatory are much greater than in the direct narrative. While questioning may be an excellent means of filling in the gaps of the spontaneous report, it is a constant source of error and falsification. For

[1] See "Lectures and Addresses delivered before the Departments of Psychology and Pedagogy, Clark University," pp. 90–102 (September, 1909).

the child, the uneducated, and the subnormal person, the questions put by a skilled examiner act as an imperative, that is, they demand the answer which they suggest. The witness has generally exhausted in his narrative his stock of clear ideas and is compelled to hunt among the remaining indistinct and fragmentary recollections for materials with which to meet the questions asked him.[1]

Among other sources of error in the report of a witness are hearsay statements, reading about the occurrence and discussing it with others who have also witnessed it. Although hearsay testimony is excluded from the courts, it plays a very large part in the statements of everyday life. Further, much which the witness believes that he is telling from his own actual experience is due to reading unverified reports and to conversations with others. It is often impossible for him, especially if the event is remote in time, to be sure of the part that has been actually experienced by him and that which has come to him by some indirect means.

An errorless report the exception.

The best summary in English of the results of the work of Stern and others in the field of the psychology of testimony is given by Whipple.[2] This is in substance as follows:—

The chief single result of the psychology of testimony is that an errorless report is not the rule, but the exception, even when the report is made by a competent observer under favorable conditions. Errorless reports are commonly characterized by a very small range, *i.e.* they are the reports of individuals who are extremely cautious and who state only what they are certain of.

There is no general relation between the extent of a report and its accuracy, though for a given reporter it is doubtless true that they stand in an inverse relation. In other words, while we cannot conclude that the person who

[1] The above statement of these chief sources of error is taken with slight change from the outline of Stern's lectures. *Op. cit.*, pp. 92–93.

[2] "Manual," pp. 304–310.

gives the most extended account is for that reason the most inaccurate, it is generally true, that if the witness greatly extend his report, he is likely thereby to increase the inaccuracy. There are two kinds of good witnesses: the one possesses pronounced capacity for observation, recall, and report, and hence covers a large number of details in his narrative with a high degree of accuracy; the other is cautious, and therefore restricts his range, which may not, under any circumstances, be extensive.

Relation between the extent of a report and its accuracy.

It is generally true that sworn testimony is more accurate than unsworn, although absolute certainty is no sure evidence of accuracy. A number of tests at the University of Illinois showed that witnesses were willing to swear to statements which were absolutely untrue, although in general they were more cautious when asked whether they would be willing to swear to the statement that they had made.

Sworn testimony more accurate than unsworn.

Stern is of the opinion that in general men are more accurate than women; boys than girls. Some other investigators have denied that there are such sex differences. The reports of children are uniformly inferior to those of adults. The extent covered is not great, the errors are numerous, but at the same time the certainty is marked. Between the ages of seven and eighteen the extent of the report increases rapidly. Although the accuracy increases at the same time, it does not grow with such rapidity as does the range. The one factor that is particularly responsible for the inferior reports of children is their excessive suggestibility, particularly in the preadolescent years. A considerable number of investigators have tested the suggestibility of school children, with rather surprising results. They all point to the fact that children up to the age of twelve or thirteen years can easily be made, through suggestion, to give reports and make judgments that are quite at variance

Reports of children inferior to those of adults.

with facts. Stern has found four different stages in the development of the child's capacity to report what he has experienced. Very young children enumerate only isolated objects or persons. A little later, about the eighth year, they report actions more carefully; but they first pay attention to relationships, spatial, temporal, and causal, at about the tenth year. Later still, there appears the capacity to describe the qualities of the objects concerning which they make their report.

Relation between the general intelligence and accuracy.

No satisfactory conclusions have yet been reached as to the relation between the general intelligence of the individual and the accuracy of the report. Persons who are of a high degree of general intelligence, but who possess a vivid imagination, and are not accurate in their observations, are likely to give very unreliable reports, while, on the other hand, it is possible to find dull but careful observers whose range of testimony is slight, but whose correctness is great. Defectives of all sorts show a high degree of inaccuracy, and are highly suggestible.

Accuracy decreases with the lapse of time.

The length of time elapsing between the experience and the report determines, to a considerable degree, its accuracy, the greater the length of time that intervenes between the occurrence and the report, the less accurate being the report. It is to be noted, however, that some reporters show improvement during the first days following the occurrence.

Not all details of an event reported with equal accuracy.

Not all features of the original experience are reported with equal frequency or accuracy. In general, persons and their acts, things and spatial relations are reported with a good deal of accuracy, but incidental features, especially the qualities of objects and their colors, are not accurately reported.

The introduction of suggestive or leading questions very noticeably decreases the accuracy of the report for children, and to a certain extent for adults.

Suggestive questions decrease accuracy.

When the account of a given experience is transmitted from one person to another by repetition ("rumor test"), the effect is to produce on the one hand exaggeration, and on the other hand the breaking down of the distinction between possibilities or inferences and actualities.

Effect of rumor on accuracy.

According to the evidence so far obtained from the experiments in the psychology of testimony, brief durations of time are strongly overestimated. Periods of from one to two minutes seem much longer than they really are, while from ten minutes on there appears to be a slowly increasing tendency to underestimation. Stern concludes that for objects of average dimensions, windows, blackboards, and so forth, the size is fairly well estimated. Smaller objects, *e.g.* a book, are somewhat overestimated. Larger dimensions, for example, a corridor, are again underestimated, but still larger ones, for example, a road, are generally overestimated.

Accuracy of estimating the size of objects.

When a given reporter is called upon to make his report several times, the effect of this repetition is complex, for in the first place it tends, in part, to establish in mind the items reported, whether true or false, and second it tends also to induce some departure in the later reports, because these are based more upon the memory of the verbal statements of the earlier reports than upon the original experience itself. It thus happens often that those statements in the earlier reports which were affirmed only with a slight degree of certainty later are taken to be true beyond any doubt. All false statements are given thus an added appearance of truth. In the later reports it becomes very difficult to distinguish

Effects of repetition.

between those phases which actually took place and those which were merely reported as having occurred. This illusion of memory makes it difficult for the individual to tell with certainty whether the supposed experiences of early childhood are actually recalled by him or whether they have been told to him by others.

The effect of practice. The simple practice of reporting, even without special training or conscious effort to improve, facilitates better reports. There is improvement in range and accuracy and in the assurance of the reporter that is warranted by the facts. Similar practice effects may be observed in the increased accuracy of replies to questions. The capacity of children to observe and report in a detailed and accurate manner may be improved by systematic training. This education may best be secured by an appeal to the interest and enthusiasm or the desire for improvement on the part of the child; more formal training of an intellectual type, *e.g.* suggestions for systematic observations, specific training in sense perception, and so forth are much less effective.[1]

Possibilities of improvement in reporting. Whipple concludes, "The inadequacy of the child's report is due not so much to poor memory as to the fact that he fails to perceive many features in the original experience, that he fails to put into words even what he does perceive, and especially to the fact that he is absurdly uncritical (his assurance, indeed, commonly reaches one hundred per cent). The education of the child in observation and report must, therefore, be directed in part to puncturing this bubble of unhesitating confidence and faith in his capacity to give unerring reports. . . . A witness whose testimony is poor because of his lack of judgment and proper caution may be trained by showing him how many and what kind of errors he commits; but a witness whose testimony is poor because of slips in memory is much harder to train, if,

[1] See Chapter XVI of this book.

indeed, this defect can really be repaired at all by educative measures."

The practical consequences of the investigations concerning the psychology of testimony may be summarized as follows.[1] There is no testimony concerning facts or reports of events that can be relied on in every particular. This is true to an extent with adults, but more particularly true in regard to children. Hence, statements of children in the home or in the school must not be accepted uncritically. If the child is discovered in a statement that is not in accord with the facts, it cannot, however, be assumed in all instances that he is telling an intentional lie.

Statements of children cannot be accepted uncritically.

Children's false statements arise from various causes. As has already been seen, these statements are due in part to inadequate comprehension and to a misapprehension of what they actually witness. Misstatements are, however, more often to be ascribed to the innate tendency of the child to exaggerate and to substitute unconsciously the products of phantasy for objective reality. The bearing of this problem in the school work of the child has already been discussed in connection with the chapter on imagination. The mistake is often made in assuming that because a certain statement is untrue in some of its aspects it is untrue in all. It often happens that a child may make a statement false in one particular that may be quite correct in others. It is, therefore, unwise to assume that the child is entirely mistaken in what he is reporting because he has been detected in a partial error. On the other hand, it very often happens that the child who gives the most accurate and careful statement in many particulars is absolutely unreliable in others.

A statement false in one particular may be correct in others.

A large part of the falsification of a report is due to the questioning of the child, who is often misled either by

[1] For the following compare Stern, *op. cit.*, pp. 93–94.

suggestive questions, intentional or otherwise, or by his desire to please the questioner. This latter tendency causes him to go far beyond his actual knowledge and to fill in his report with things of which he is uncertain. *The teacher should take the greatest of care not to ask leading or suggestive questions and in general to question only when there is an absolute need of it.* The child should be encouraged to tell a connected narrative as far as possible without being questioned. This applies in a measure to the method of school instruction. Perhaps in general there is a tendency on the part of the teacher to ask too many questions in conducting the recitation. When questions are asked, care should always be taken to make them as objective as possible, unless the teacher purposely desires to suggest an answer; and then he must be certain just what form his suggestion should take, and frame his questions accordingly. The teacher should not make the mistake of assuming that he can by questioning children singly or in groups necessarily discover their attitude toward their school work or determine their preferences. Almost invariably the teacher, making such inquiries, suggests to the pupil the sort of answer that he expects; and even if the questions themselves are not suggestive, the pupil tends to reply in a way which he thinks will please the teacher. For this reason a large amount of the data collected in regard to the preferences, interests, and ideals of children are to be taken with caution. Much of it is to be classed with the reply of a boy in a French school, who, when asked what book he most preferred, wrote: "I like my prayerbook best, for in it are nice prayers."

Danger of questioning children.

Since experiments have shown clearly that the accuracy and range of testimony may be greatly improved by training, it should be one of the conscious aims of the instruction in the school and of the training in the home to educate the child in accurate observation and report. As

Whipple has pointed out, this education is best secured by insisting on ideals of improvement, rather than attempting to formally discipline the child in methods of observation and perception. However, something may be done in this latter way. The insistence upon accuracy in reporting will stimulate the child in the direction of clearly separating the fantastic and the improbable from the real, and will be a wholesome corrective to the exuberance of imagination which may, especially in certain individuals, lead to such distortions and inaccuracies in learning as to seriously impair the value of instruction which the child receives in school and at home.

The child should be educated in accurate observation and report.

In regard to the testimony of children in courts, the ordinary methods of examination should be to a large measure superseded by those better suited to bring out the truth. The juvenile criminal is quite differently treated from the adult criminal in court procedure; in like manner the juvenile witness should be given special consideration. It is particularly disastrous to have the child examined before a single questioner who is interested more in winning his case than in arriving at the truth. The questioning of children, and indeed of adults, should be conducted by an *ex parte* examination. Children should not be examined in open court, but rather in private by a psychological expert. Children, and adults as well, should be examined immediately after the event, if possible. The greater the interval between the event and the report, the greater are the probabilities of the various falsifications of memory pointed out above. A large number of rehearsals of what the witness has experienced should be avoided, since such rehearsals have the tendency to fix the errors which appear in the earlier testimony. Further, if during these rehearsals the witness is questioned, the suggestions then received will add greatly to the unreliability of subsequent testimony. It is

The treatment of children as witnesses.

not too much to say that a child, under twelve years of age, who has been questioned a large number of times by interested persons concerning an event about which he is later to give testimony, is thereby precluded from a report that is sufficiently accurate to deserve credence. Stern advocates as a remedy for these difficulties "the introduction of special magistrates for juvenile witnesses, before whom the children should be examined but once, and then as soon as possible after the event." Many misunderstandings arise between parents and teachers, because the former take too seriously the reports of children concerning the happenings in the school. They are not aware that even with the best of intentions the children are liable to give the most untrustworthy accounts of what really has taken place. It is especially important that the general facts in regard to the reports of children that have been discussed above should be emphasized in parents' meetings and in similar gatherings.

CHAPTER XIII

THE ASSOCIATION METHOD IN APPLIED PSYCHOLOGY

A typical list of words in Jung's experiment.

THE so-called association method in applied psychology, especially as it has been conducted by Professor Carl G. Jung of Zurich, has shown some interesting facts in regard to the nature of association. This method is in essence an extremely simple one, and consists in giving the subject to be tested a list of perhaps a hundred words relating to the happenings in everyday life. As each word is presented, the subject reacts as quickly as possible by speaking the first word that comes into his mind in connection with the stimulus word. Such a list of words is given by Jung in a series of lectures recently delivered at Clark University.[1] This list is as follows: —

1. head
2. green
3. water
4. to sing
5. dead
6. long
7. ship
8. to pay
9. window
10. friendly
11. to cook
12. to ask
13. cold
14. stem
15. to dance
16. village
17. late
18. sick
19. pride
20. to cook
21. ink
22. angry
23. needle
24. to swim
25. voyage
26. blue
27. lamp
28. to sin
29. bread
30. rich
31. tree
32. to prick
33. pity
34. yellow
35. mountain
36. to die
37. salt
38. new
39. custom
40. to pray
41. money
42. foolish
43. pamphlet
44. despise
45. finger
46. expensive
47. bird
48. to fall
49. book
50. unjust
51. frog
52. to part
53. hunger
54. white
55. child
56. to take care
57. lead pencil
58. sad
59. plum
60. to marry
61. house
62. dear
63. glass
64. to quarrel
65. fur
66. big
67. carrot
68. paint

[1] "The Association Method," *Am. Jour. of Psychol.*, XXI, pp. 219–270 (1910).

69. part	77. cow	85. stalk	93. hay
70. old	78. friend	86. false	94. contented
71. flower	79. luck	87. anxiety	95. ridicule
72. to beat	80. lie	88. kiss	96. to sleep
73. box	81. deportment	89. bride	97. mouth
74. wild	82. narrow	90. pure	98. nice
75. family	83. brother	91. door	99. woman
76. to wash	84. to fear	92. choose	100. abused

Significance of lengthened reaction times.

It can be seen by inspecting the above list of words that they are extremely simple and that they are so chosen as to suggest a large number of possible situations. Naturally, if such a list of words is read, or presented visually to a subject, one by one, and he replies by responding by the first word that comes into his mind, the reaction time (that is, the time elapsing between the presentation of a word in the list and the response) will vary considerably. However, under normal conditions there should be a reasonable amount of consistency in these reaction times. Most of them will probably range between a second and a half and three seconds. If any of these reaction times is unusually long, as, for example, six, ten, or fifteen seconds, such a lengthened reaction indicates that there is some cause at work which results in this extension of interval between stimulus and response. It might be supposed that the lengthening of these reaction times is due to an intellectual reason, but this is not the explanation that is ordinarily given. The lengthened reaction is not due to the fact that the person lacks the knowledge or intelligence to reply immediately. The explanation lies rather in the emotional condition of the individual who is making the reactions.

As Jung points out, these excessively long reactions occur often with subjects that are highly intelligent and fluent of speech. It is because the words presented are "really something like condensed actions, situations and things." To use Jung's own language, "When I present a word to the test person which denotes an action, it is the same as if

I should present to him the action itself, and ask him 'how do you behave toward it?' 'What do you think of it?' 'What do you do in this situation?' If I were a magician, I should cause the situation corresponding to the stimulus word to appear in reality and place the test person in its midst. I should then study the manner of his reaction. The result of my stimulus word would thus undoubtedly approach infinitely nearer perfection. . . . The stimulus words are, therefore, merely a part of reality acting upon us; indeed, a person who shows such disturbances to the stimulus words is in a certain sense really, but imperfectly, adapted to reality."

The cause of lengthened reactions.

There are two reasons generally why lengthened reactions occur. The first is because of the various words presented, certains ones have unusual significance, while others are, so to speak, indifferent. In the list of words cited above, the word "money" might ordinarily have no unusual significance; if, however, the person reacting had committed a theft, such a word would arouse in him a strong emotion, and his reaction, consequently, would be greatly lengthened, or perhaps entirely "blocked." (He would fail to reply to the word altogether.) The second reason for greatly lengthened reaction times is to be found in the general emotional condition of the person who is being tested. If the person is under unusual excitement, or is suffering from hysteria, the reactions tend to show great prolongation and irregularities. Under these conditions marked disturbances in adjustment to individual words are shown. Sometimes the hysterical person, instead of replying with a single word, as requested, responds with a large number, — as, for example, custom — good — barbaric; foolish — narrow-minded — restricted; family — big — small — everything possible (cited by Jung).

Jung explains this tendency as showing one of the main characteristics of hysterical patients, namely "the tendency to allow themselves to be carried away by everything, to attach themselves enthusiastically to everything, and to always promise too much, and hence to do little." Another symptom of incomplete adjustment to the situation suggested by the stimulus word is found in the repetition of the stimulus word.

The person repeats this word as if he were trying to grasp its meaning. This is because the subject is confronted with a situation in which he finds great difficulty in acting. Sometimes the person tested responds to the various stimulus words throughout the test with the same word on several occasions, although this word may seem to have no significance in connection with the stimulus word. This is to be explained by the fact that during the test the subject is being dominated by a particular idea, which tends to arise on all occasions and under most varied conditions.

Uses of the association method.

Jung and others have made two main applications of the association method in practice. Jung himself has employed this method principally in diagnosing mental diseases which fall under the general type of psychoneuroses, or functional disturbances of the mind that appear in various forms of hysteria and neurasthenia. The use of the method in the detection of crime, however, is one that has proved of the most interest to the public in general. The method, when employed for this purpose, consists in presenting to the subject to be tested, among a considerable number of words that are neutral or indifferent, a number which refer to the crime itself. When these latter words are presented, the person tested is naturally more or less disturbed by the situations that these words call up, and the result is generally lengthened or emotional reaction times. The guilty person naturally tends, when he hears the word that is connected with his criminal act, to reply with the word that is most closely associated. This, however, he does not dare to do, as he fears the exposure of the crime. In seeking for another and an insignificant word with which to respond to the stimulus word, he sometimes becomes greatly confused and fails to react at all, or if he does react, the time is far longer than the normal.

Perhaps the best means of illustrating this method of detecting actual or artificially devised crimes is by describing, somewhat in detail, one of a considerable number of tests with the association method as conducted at the University of Illinois. Two students were instructed to go to a certain place, where they would find a sealed envelope. One of these students was to open the envelope, read its contents, and carry out its instructions; the other was to know nothing about the contents of the letter, and was to be in no way informed concerning what his companion did. The experimenter was subsequently to attempt, by applying the association method, to find out which of the two students had opened the envelope, read its contents, and carried out its instructions. The instructions were as follows: (1) Empty and fill a fountain pen; (2) Draw a memory picture of the head of your best friend; (3) Burn up the paper; (4) Cut with scissors the largest possible square out of an eight and a half by eleven inch sheet of paper; (5) Compute its area; (6) Shine your shoes; (7) Measure the width of D—— Street; (8) Put a dandelion in your buttonhole, and take it out in half an hour. In the test, a list of seventy-two words was presented to each of the two students. Among these, thirty-two were significant in relation to the acts indicated in the letter. Among the significant words were the following: Ink, match, strike, flower, yellow, dimensions, black, multiply, and flame. In the case of the student who had opened the envelope and followed out its instructions the reaction times to the significant words were considerably greater than were those of the student who did not know the contents of the envelope. For example, to the word "black," the "innocent" subject replied with the word "green" in one and eight tenths seconds, while the "guilty" student replied to the same word with the reaction "flag" in three and eight tenths seconds.

The following introspection by the "guilty" person will indicate somewhat the nature of the associations formed with the significant words. He says, "Naturally the acts most difficult to perform, or requiring the greatest time or effort, made the greatest impression. For instance, such an impossible performance as drawing a memory picture of my best friend, or an act requiring a little effort, such as shining my shoes, made a great impression. The shining of my shoes stood out strongly; first, because I knew that if the questioner cared to, he need only look at my shoes and he would know who was who; and second but not the least, because I experienced considerable trouble with the polish. I bought a box of what I thought to be paste polish, and after considerable pounding and scratching, succeeded in prying off the cover with the box on edge on the table. The contents itself, instead of being in the form of paste, was semi-fluid, and before I could turn the box right side up it had spread itself copiously on the table. But it was good shoe polish, and gave my shoes a rich black luster. So I remembered the *black* shoe polish and the 'black' shoes, and when I heard the word 'black' they stood out as irrepressible as mountains. In desperation all I could think of was a far-fetched 'black' pirate's flag." (It is to be recalled that the "innocent" subject reacted to the word "black" in one and eight tenths seconds, while the "guilty" student reacted in three and eight tenths seconds). "At the same time I was striving to think of some other word than 'shoes'; I was trying to convince myself that it was perfectly proper and logical that 'black' should suggest 'shoes,' and that I was not giving myself away by replying 'shoes.' But something insisted, 'You mustn't say shoes, you mustn't say shoes,' and although I knew full well that I might say shoes with impunity, I could not. In the same way the word 'polish' recalled things that I could not turn down, suggested words that I might have said as well as not, but I could not. In general, it was easy to distinguish between the significant and the non-significant words. In all cases it was necessary to make this distinction either consciously or unconsciously before any suggestion could even be considered: Thus the chief reason for hesitation on the word 'avenue' and 'decimal' was the difficulty in reaching this decision, and hence the reply was deferred. In some instances I was quite certain from the nature of the act I performed, what the key word would be, and had more or less definitely prepared an answer beforehand. In connection with putting the dandelion in my buttonhole, and taking it out in half an hour, I was quite sure that 'flower' and 'time' would be two of the key words. Also, in connection with emptying and filling the fountain pen, I had concluded that 'ink' would be one of the key words used, and that I must not, by any means, permit it to suggest fountain pen. These preparations were, however, but of little significance, for though not entirely forgotten they very rapidly gave way to a flood of other thoughts and suggestions."

Children strongly influenced by the type of thinking of their parents.

The most important part of Jung's work, as far as its educational aspects are concerned, is to be found in his analysis of the psychic life of the child. Significant among the early educative influences of the child's life are the ideas and emotional tendencies that arise in connection with the home environment. A pupil of Jung, Miss Fürst, has made a very interesting analysis through the association method of the likeness and differences in the types of association of various members of the same family group. It was found by her that in their associative types children approached nearer the manner of thinking of the mother than of the father. However, the son follows more the type of the father than he does of the mother, while the daughter resembles more nearly the mother in type. The similarity of thinking between mother and daughter is often very extraordinary.

As an illustration Jung gives the following examples: —

Stimulus Word	Mother	Daughter
to pay attention	diligent pupil	pupil
law	command of God	Moses
dear	child	father and mother
great	God	father
potato	bulbous root	bulbous root
family	many persons	five persons
strange	traveler	traveler
brother	dear to me	dear
to kiss	mother	mother
burn	great pain	painful
hay	dry	dry
door	wide	big
month	many days	31 days
coal	sooty	black
air	cool	moist
fruit	sweet	sweet
merry	happy child	child

Jung remarks, "Thus the daughter lives constantly in the same circle of ideas as her mother, not only in her thought, but in her form of expression; indeed, she even uses the same words. What seems more flighty, more inconstant, and more lawless than a fancy, a rapidly passing thought? It is not, however, lawless, and not free, but closely determined within the limits of the *milieu*." Jung analyzes in a very interesting way the case of a family, "the father of which is a drunkard and a demoralized creature." The mother is forty-five years of age, and there is a daughter of sixteen. The mother and the father have no interests in common, and the mother seeks her enjoyment from the outside of the family, and "for that reason she is an ardent participant in Christian Science meetings." The daughter, imitating her mother in ways of thinking, also seeks to obtain emotional satisfaction from without the home. "But for a girl of sixteen, such an emotional state is, to say the least, quite dangerous. Like her mother, she reacts to her environment as a sufferer soliciting sympathy. Such an emotional state is no longer dangerous in the mother, but for obvious reasons it is quite dangerous in the daughter. Once freed from her father and mother, she will be like her mother; that is, she will be a suffering woman, craving for inner gratification."[1]

The great importance of environment.

Jung urges that such considerations as this point to the great importance of the environment in education. What passes from the mother to the child "is not the good and pious precepts, nor is it any other inculcation of pedagogic truths. . . . The concealed discord between the parents, the secret worry, the repressed hidden wishes, all these produce in the individual a certain affective state . . . which works its way into the child's mind, producing therein the same conditions and hence the same reaction to external stimuli. . . . The father and mother impress deeply into the child's mind the seal of their personality; the more sensitive and mouldable the child, the deeper is the impression. Thus even things that are never spoken about are reflected in the child. . . . Just as the parents adapt themselves to the world, so does the child." *Jung believes that these prepubescent experiences of the child often determine his destiny in his entire adult life.* "Every patient furnishes contributions to this subject of the determination of destiny through the influence of family *milieus*. In every neurotic we see how the constellation of the infantile *milieu* influences not only the character of the neuroses, but also life's destiny, in its every detail. Numberless unhappy choices of profession and matrimonial failures can be traced to this constellation. There are, however, cases where the profession has been happily chosen, where the husband or wife leaves nothing to be desired, and where still the person does not feel well, but works and lives under constant difficulties. Such cases often appear in the guise of chronic

[1] Galton in his "Inquiry Concerning Human Faculty," found striking resemblances between the association complexes of twins, which, however, he attributed to heredity.

neurasthenia. Here the difficulty is due to the fact that the mind is unconsciously split into two parts of divergent tendencies which are impeding each other; one part lives with the husband or with the profession, while the other lives unconsciously in the past with the father or mother. . . . We can find here one of the most important tasks of pedagogy, namely — the solution of the problem, how to free the growing individual from his unconscious attachments to the influences of the infantile *milieu*, in such a manner that he may retain whatever there is in it that is suitable and reject whatever is unsuitable."

Freud's psycho-analysis.

In the importance which Jung places on the earlier associations of childhood, he is in agreement with another worker in the field of abnormal psychology, namely, Sigmund Freud of the University of Vienna. The great service Freud has rendered to applied psychology is in the so-called field of psycho-analysis. The method of psycho-analysis was first worked out with hysterical patients, and briefly consists in attempting, by a series of questions, to draw out of the subconscious life of the patient an account of those experiences that are the fundamental cause of the mental disturbance. To use Freud's own statement, "our hysterical patients suffer from reminiscences." The reminiscences are not, however, a clear and definite knowledge of the past experiences; they are rather symbols of these past experiences. The method of psycho-analysis attempts to discover behind these symbols the concrete experiences for which they stand. In this way the patient is led by expressing himself to free himself from the force of the subconscious associations which have been making havoc in his mental life; and thus a cure is often brought about.

The interesting part of Freud's theory lies in the fact that these hysterical conditions are in a large measure to be traced back to the suppressed wishes of early childhood, many of which make their appearance before the fourth year. Because of the incompatibility of these wishes with the general social environment, they are repressed and forgotten, and yet they are never entirely lost, since they determine to a very large measure the reactions of adult life, and are connected with this life by a long series of associated bonds. The apparent, almost complete, discontinuity between the pre-adolescent experiences and those of later life is due to the fact that the earlier experiences are repressed and blotted out of memory. Freud holds that because we are ignorant of the most important features of the mental life of childhood, and because of our personal forgetfulness of this period in our own life, the significance of these earlier associations is vastly underestimated. Accordingly not only do these repressed and forgotten experiences of childhood work themselves out disastrously in the life of the hysterical patient, but they also determine, to a considerable extent, the associative trends of adult experience. Freud believes that the vast majority of these suppressed wishes of early childhood are directly or indirectly sexual in their nature. He applies his theory to the interpretation of dream states, to art, and to wit. Dream states he considers as symbols of suppressed wishes. By applying the method of psycho-analysis, the individual can often discover what these suppressed wishes actually are. Art, like the dream state, may be thought of, according to Freud's theory, as a symbolic expression of suppressed wishes. Here we find a psychological value for myths, legends, and fairy tales, as expressions of perennial desires and as a means for giving an outlet to such desires in safer channels, than those along which they might naturally go. Wit, according to Freud, has much in it that resembles the mechanism of the dream. It allows the expression of a thought indirectly which could not, because of a certain repressive tendency be expressed in its natural way.[1]

Significance of suppressed wishes.

[1] An admirable summary of Freud's position is given by Jones in the *Journal of Nervous and Mental Diseases* (May, 1910).

From this point of view it appears that *civilization has imposed an ever increasing necessity on the child and on the adult to suppress their most fundamental wishes.* Such a repression, however desirable or necessary, is tremendously dangerous. Renunciation is not always a virtue.

Civilization makes the realization of many wishes impossible.

Thus we find reality generally thoroughly unsatisfactory, and we "keep up a life of fancy in which we love to compensate for what is lacking in the sphere of reality by the production of wish-fulfillments. In these phantasies is often contained very much of the particular constitutional essence of personality and of its tendency, repressed in real life. The energetic and successful man is he who succeeds by dint of labor in transforming his wish fancies into realities. Where this is not successful in consequence of the resistance of the outer world and the weakness of the individual, there begins the turning away from reality. The individual takes refuge in his satisfying world of fancy. . . . If the individual who is displeased with reality is in the possession of artistic talent, which is still a psychological riddle, he can transform his fancies into artistic creation. So he escapes the fate of a neurosis, and wins back his connection with reality by this roundabout way." Unless some such indirect way of expression is found, then the subject is confronted with a neurosis which "takes in our time the place of the cloister, in which were accustomed to take refuge all those whom life had undeceived or who felt themselves too weak for life."[1]

One of the most general conclusions that may be deduced from the work of Freud and Jung is that associative bonds between various thought complexes are much more imperative in their nature than we ordinarily suppose them to be. They cannot be broken at will. Never mind how much the individual may wish to dissociate an idea from the complex to which it naturally belongs, he finds himself often incapable of doing this, particularly under strong emotional excitement. Freud maintains that there is a "strict determination of mental life, which holds without exception." So fixed is this determination and so extensive

The imperative character of associative complexes.

[1] Quoted from Freud. "*Lectures and Addresses Delivered before the Departments of Psychology and Pedagogy*," Clark University, 1909, p. 34.

its scope that the threads of association lead back to the very beginnings of experience. *There is nothing that comes into the mind, but what has some connection with all the rest.* If then, it is true that such extensive and permanent associations are formed, it becomes of the greatest moment how they are formed and what direction they take. The educative process becomes under such a point of view even more significant than it is ordinarily supposed to be.

Importance of infantile experience.

The insistence of both Jung and Freud on the great importance of infantile experience changes the emphasis from adolescence to the pre-adolescent period. The educational philosophy of Hall and his pupils has made adolescence the great and determining period in child life. For this reason it may have seemed to many educators and teachers that, after all, nothing final could be accomplished before this period, and that, therefore, the great intellectual and moral problems in the life of the child were not those that confronted the teacher in the primary and in the grammar grades. *If the views of Jung and Freud, however, are correct, then, the crises of life are perhaps to be found in its earliest years, and the great educative problems of the race are to be solved in the nursery and the kindergarten, rather than in the high school, college and university.* The fact that the large majority of children never go beyond the grammar grades in their formal education is interesting and significant in this connection. If the formative period of life is largely in the pre-adolescent period, then the possibilities of determining character through the school environment are greatly enhanced.

Importance of the home.

The view of Jung in regard to the tremendous influence of the home environment emphasizes the value of education in improving heredity. The almost overwhelming importance of heredity in predetermining the whole life of the individual has been emphasized by a number of statistical investigations in the last few years.

Woods[1] and some others seem to believe that but a relatively small amount can be accomplished by environmental influences. Perhaps it is well to err in the opposite direction in overemphasis of the factor of environment, since it is the only factor over which education has any direct control. While in these early influences the home must always have a much greater place than the school, nevertheless, the school may be no insignificant factor in developing the right sort of association complexes. *The teacher should see to it particularly that all emotional and vexatious disturbances are removed from the atmosphere of the schoolroom; that the ideas inspired in the minds of the children are of the satisfying type. This will do vastly more in moral education than the insistence on any number of maxims, or the learning of many facts in regard to desirable or undesirable conduct.* From this point of view the rush and hurry that characterizes much of the school work becomes extremely dangerous. "Busy work" that makes excessive demands on both pupil and teacher, and creates an atmosphere of unrest, must be avoided. *The irritable teacher is a positive menace to the mental sanity of the pupils under his charge.*

The problem of sex education.

If, as Freud believes, a large part of the suppressed wishes of childhood arise in connection with direct or indirect sexual tendencies, the problem of dealing with matters of sex is one of the greatest importance. For a long time thoughtful educators have felt that we cannot do away with this problem by foolishly ignoring its existence and by attempting, in every way, to deceive the child in regard to the nature of sex and the origin of life. It is, however, a tremendously difficult problem to decide just what can be done in the way of properly educating the child in these matters. Jung

[1] See "Mental and Moral Heredity in Royalty" (New York, 1906). The author comes to the conclusion that "heredity is almost the entire cause of the mental achievements of these men and women, and that environment or free will must consequently play very minor rôles."

discusses in one of his lectures at Clark University the case of a little girl of four years of age, of intellectual vivacity and of a healthy, lively, and emotional temperament, who developed a remarkably strong interest in regard to the problem of sexual reproduction, and whose curiosity was finally legitimately satisfied by a frank explanation of the whole matter.[1]

Jung in summing up this discussion says, "I wish to impress firmly upon parents and educators this instructive example of child psychology. In the learned psychological discussions on the child's psyche, we hear nothing about those parts which are so important for the health and naturalness of our children, nor do we hear more about the child's emotions and their conflicts; and yet they play a most important rôle.

"It very often happens that children are erroneously treated as imprudent and irrational beings. . . . The idea should be dismissed once for all that children are held in bondage by, or that they are toys of, their parents. They are characteristic and new beings. In the matter of enlightenment on things sexual it can be affirmed that they suffer from the preconceived opinion that truth is harmful. Many neurologists are of the opinion that even in grownups enlightenment on their own psychosexual processes is harmful and even immoral. . . . One should not, however, go from this extreme of prudishness to the opposite one, — namely of enlightenment *à tout prix*, which may turn out as foolish as it is disagreeable. In this respect I believe the use of some discretion to be decidedly the wiser plan; still, if children come upon an idea, they should be deceived no more than adults." Doubtless, in the biological and physiological instruction in the schools, much could be done to answer the legitimate inquiries of children in regard to this whole problem.

Intimate acquaintance with the child's thoughts and desires.

Freud has shown in his psycho-analysis the therapeutic value of bringing into full consciousness and expression the obscure memories of the past. This form of confession may also have significance for children. If parents and teachers could enter into more intimate associations with children and could obtain their confidences, it would not only reveal much that is happening that would be well for

[1] *Op. cit.*, pp. 71–89.

adults to realize, but it would also serve as a means of expressing, in an indirect way, some of those childish wishes, which through suppression may result in highly undesirable consequences. The pedagogical value of confession has not been fully realized in the Protestant world. In an earlier part of our discussion we have considered the desirability of the teacher knowing the contents of children's minds in regard to their percepts, concepts, and general intellectual apperceptions. The content of children's minds in this more intimate sense is something which has hardly been realized as a problem until recently. The psycho-analyses of Freud and others will probably give us a more exact psychology in these respects than we have at present. As yet we have barely raised the problem; its ultimate solution is still remote, but in the meantime, *parents and teachers should strive to put themselves into such relations with children, that their most intimate thoughts should not be entirely unknown.* Here lies one of the greatest problems of moral education.

Wit, art, and moral and religious emotions.

Psycho-analysis has shown the possibility of *sublimating* wishes impossible of direct realization by giving them symbolic forms of expression. This roundabout way of expression seems to be extremely important. A wish that is completely repressed, that finds no avenue of realization, and sinks into the subconscious life, may become an extremely dangerous element therein. If, however, it can find some legitimate method of expression, it has lost its dangerous character. It is for this reason that Freud holds that dreams are extremely valuable to the individual, since in them he expresses in a symbolic way his hidden desires. More definite and certain forms of expression through symbols are to be found in artistic creations and in religious and moral ideals. Also various forms of wit and humor seem to serve the same sort of a purpose. In passing, the fact should be emphasized that education cannot ignore these as elements in the life of the child and still be of the highest service to the individual and the race. The school and the home should be the place for the encouragement of true artistic ability. It should give in the proper place religious and moral inspiration, and should emphasize the value of wit and humor as a mode of interpretation of the world of the child. The instruction in these very necessary forms of human expression cannot be merely of the formal and dogmatic sort. Much depends upon the tact and sympathy of the parent and teacher in their dealings with children.

Of recent years considerable attention has been given to the subject of children's drawings. It has been discovered that the child's first crude attempts are merely schematic or symbolic. These drawings are not representations of animals, men, *et cetera*, in the sense that they attempt to reproduce objects actually as they appear in nature. These drawings are ideographs. Later the child attempts to make objects that are more true to life, and gradually the technique of drawing becomes a conscious factor. However, the technical aspect of the matter is not the only thing to be considered. The creative aspect must also be kept in mind. Some children show marked genius in making their drawings express ideas or emotions. These children should be encouraged. The teacher of drawing should not confine his efforts to the teaching of technique alone. He should attempt to develop creative genius wherever he finds it.

Psycho-analysis in the home and the school.

In closing, a word may be said about the more direct applications of Jung's method of association and Freud's psycho-analysis in dealing with children in the home and in the school. The association method, as has already been pointed out, seems to be valuable for two chief reasons; one is, that by its application, various crimes, misdemeanors, and secrets in the lives of individuals may be brought to light. The application of this method in the discipline of the school at once suggests itself. It probably could accomplish something in the way of discovering facts that the teacher should know. If, however, it is practiced at all, it should be only with a large amount of caution, and only by skilled and intelligent persons. Psycho-analysis in the form of intimate and sympathetic discussions with children would be of considerable value, especially in the home. It can be carried out, however, only when the parent or teacher has the entire confidence and love of the child.

Importance of the elementary teacher.

It is for all these reasons that *children demand, in their earliest years, the most intelligent and considerate treatment.* The time may come if parents cannot give such treatment, when the state will be forced to place little children in an environment more suited to their healthful development. *The schools should recognize more than they do the importance of the elementary teacher.* Some educators are of the opinion that the instruction in the lower grades is very much less important than it is in the grammar grades and in the high school. They have come to this conclusion largely because, as has already been said, the memories of early childhood are no longer definitely retained in adult life, and because the adult has little ingenuity for penetrating into the innermost experiences of children. It appears to the adult, then, that these earlier experiences, since they are not definitely in consciousness, are of slight value. If the conclusions of Jung and Freud are correct, no greater mistake could possibly be made. It has been insisted in an earlier part of the discussion that education must interpret memory very much more broadly than mere recollection of the past. Anything that enters into the life of the child so as to modify his conscious experiences later, must be considered, from a practical standpoint, as memory. How much these earlier unconscious memories may modify adult experience has already been pointed out. It is possibly not too much to say, in the light of the work of the psycho-analyst, that the very best teachers, the ones best paid and the ones occupying the highest social positions, should be the teachers of little children rather than of mature students, for the forces of heredity and of infantile environment are such that less than is often assumed is left for the adult years to accomplish. Of course the education of the mature student cannot be ignored, and no one would maintain that our scheme of education in the high schools, colleges, and universities should be less efficient than it is at present. Educational reform in this direction consists in additions to the efficiency of teaching in the earlier years, but not at the expense of a decreased efficiency at a later period.

Jones, in a recent number of the *Journal of Educational Psychology*[1] has summed up in an interesting manner some of the more important applications of psycho-analysis to education. He says, among other things: "Success is best achieved by gradually weaning the child to social interests, and not by merely forcibly suppressing and forbidding the primitive ones without replacing them by others." In discussing the desirability of enlightening children on sexual matters at an early age he says: "The customary endeavor to keep the child's mind a blank on the subject is far from being a negative one, as parents commonly maintain: the organized conspiracy of silence is soon noticed by the child. . . . Those who object to direct enlightenment, therefore, should recognize that they are really defending a false enlightenment, a positive teaching of shame and guilt."

[1] Vol. I, pp. 497–520 (1910).

CHAPTER XIV

THE PROBLEM OF THE TRANSFER OF TRAINING. — EXPERIMENTAL EVIDENCE CONCERNING THE PROBLEM

Memory and the transfer of training.

THE consideration of the topic of memory and the laws that govern it is closely connected with the problem of the influence of practice in memorization in one particular field on memorization in general, and also with the wider problem of the effects of training of one mental function on allied mental functions. It thus relates itself to the question of the value of training in form as distinguished from training in content, and leads naturally to a discussion of the so-called "Dogma of Formal Discipline." [1]

The faculty psychology, and cortical localization.

In the early years of the nineteenth century Gall and his pupil Spurzheim gave to the world the "Anatomie et physiologie du système nerveux," in which is to be found a detailed exposition of Gall's System of Phrenology. According to this system, the brain is supposed to contain more than thirty separate and individual organs which are the seat of the most complex psychic capacities, or "internal senses," such as combativeness, the fear-of-God, a sense-of-fact, the impulse-of-self-preservation, philoprogenitiveness, and the sense-of-language. It was only an incident to this system that the locality of these internal senses was found on the surface of the brain, and that the external evidence for them existed in certain prominences on the skull. The interest in this now bizarre theory lies, as far as this discussion is concerned,

[1] The discussion in this and in the two following chapters is revised from a monograph by the writer, "A Partial Justification of the so-called Dogma of Formal Discipline." Bulletin No. 2, School of Educations, Univ. of Illinois.

in the fact that here we find in a most pronounced form two basal assumptions, one of which has served as a convenient vehicle for the justification of the dogma of formal discipline, while the other lies, in part at least, at the basis of the theories of those who in their reaction against this dogma have gone in the other direction to extremes which seem equally absurd and incapable of justification. The first of these assumptions is that the mind is composed of a number of separate faculties, and from this it readily followed that these can be educated in their entirety and made to serve in the various situations of life equally well for all purposes. The second assumption has looked upon the various activities of the nervous system, particularly of the cortex, as highly specialized and definitely localized, and has viewed the corresponding psychic functions as something quite discrete and separate. Carried to its logical extreme it would seem to imply that, for example, there is not only a cortical center for language, but a distinct area for nouns, or for verbs, or what not; not only a cortical center for vision, but a definite area for color; then why not for all the thirty-two thousand color qualities which the eye can sense? There seems to be no limit to the multiplication of centers which can result from such a theory, and it surely serves as a firm foundation for the doctrine that there is no education in general, and that the best we can do is to train the individual to interpret a certain number of definite sense stimuli and to respond to a limited number of concrete situations in the same old way. The faculty psychology assumed a number of fabulous entities which worked out the destinies of the individual, while the doctrine of absolute localization of nervous function has made the brain a machine of relatively unrelated parts and has created a doctrine of psychic atomism which is as untrue as it is impossible of practical application.

The faculty psychology of the last century is long since dead, and its resting place almost has been forgotten by the scientists of to-day; its ghost, however, stalks abroad among the masses, and its spirit still lives in the pedagogical theories of many an uncritical thinker. From this faculty psychology it is no far cry to the dogma of formal discipline in all its purity. The assumptions it contains are well expressed by a clergyman quoted by James in the first volume of his larger Psychology: "As for my memory," writes the clergyman, "it has improved year by year . . . like a gymnast's muscle." This is a favorite comparison, the likening of memory, or attention, or any other supposed psychic faculty to a muscle that can be developed for any use by any kind of exercise, and that is made equally strong by rowing, or boxing, or chopping wood, provided that the exercise is vigorous enough; and, having been made strong by one exercise, can be used equally well for all activities. No less a scientist than Helmholtz is quoted by Coover and Angell[1] as valuing particularly certain studies as a means of intellectual training, since these studies taxed "equally all the intellectual powers." Here we have the doctrine of formal discipline and its pedagogical consequence expressed definitely and clearly. The implication of Helmholtz's assumption seems to be that there are definite mental powers and that these powers can be developed in all directions by certain well-chosen studies.

The faculty psychology assumed mental powers.

Bagley in his "Educative Process"[2] puts the matter concretely in this way: "Certain subjects of the curriculum, if properly pursued, were believed to develop what might be termed 'generalized' habits. For example, a pupil may acquire a specific habit of producing neat papers in arithmetic. The doctrine of formal discipline assumes that if this habit is once thoroughly established, it will function equally well

Mind cannot be trained in general.

[1] *Amer. Jour. of Psychol.*, XVIII., pp. 328–340 (1907).

[2] Chapter XIII p. 203.

in connection with language and drawing; that, functioning successfully here, it cannot fail to insure neatness of person and attire, and that the habit of neatness thus ingrained upon the pupil will surely be carried into mature years." Thus it is assumed that there is a general faculty or habit of neatness, and that this, when trained by one set of exercise, will be serviceable in all the specific situations in life where neatness may be employed. Stated thus, the dogma of formal discipline is absolutely untenable. There is no general faculty of neatness, nor of any mental capacity, and if there were such an entity, training it to function in one direction would not mean that it is trained equally well to function in all directions.

The extreme doctrine of transfer and its opposite both untenable.

If there were nothing more to the doctrine of formal discipline than the old faculty psychology, or the thought that training in one direction can be transferred equally well in all directions, no attempt would be made here to further discuss this problem. It is quite obvious and beyond argument that training in mathematical reasoning does not necessarily mean ability to reason equally well in the affairs of everyday life; it seems certain that if I wish to increase my ability to discriminate between shades of gray, the best training is to attempt such discriminations, and not, for example, to practice discriminating between intensities of sound. It is a vastly different matter to affirm, however, that training in mathematical reasoning has no effect on the other rational processes, and that, as far as distinguishing shades of gray is concerned, it is quite indifferent whether the person has had previous training in sensory discrimination in other fields. To affirm that when the mind is trained in one direction it is first of all trained in that direction and not in some other is one thing; to affirm, however, that the training in one direction has no influence in other directions is quite a different affair. No one, I think, would be quite so rash as to make the latter assertion; but many would believe that such a transfer of training is in most instances slight, and in some cases such a transfer is not probable, even in the slightest degree. Some seem to assume that about all that education can hope to do is to give to the pupil certain facts in a limited department of knowledge, and to habituate him to definite reactions in a circumscribed field of human activity. They seem to despair of any education in general that amounts to much. Having, however, admitted the possibility of transfer from one field to another, never mind how little, they are incapable of determining *a priori* how great this transfer may be and what general effects it may have. Such persons may try to bring some definiteness into their conceptions as to the extent of this transfer by saying that such a transfer can take place only where there is a similar situation, and where like elements are involved; but it must be remembered that similarity and likeness are not primarily objective categories, but that they are constituted by the mind of the person who finds such similarity or likeness, and that it is never certain beforehand just where this similarity and likeness are to be found. Such a contention can be determined only by actual tests either in life itself, or in the psychological experiment. Fortunately we have had in the last few years a considerable number of such experiments reported, and the light which they throw on the whole question of formal discipline is more illuminating than that which can be secured from a discussion of *a priori* assumptions, or "half-baked" psychological theories. We, therefore, turn to them for the purpose of reviewing the most important of these.

The two pieces of experimental evidence which have probably had the most influence in discrediting the doctrine of formal discipline and in emphasizing the opposite doctrine are those of James of two decades ago, and the more recent series inspired by Thorndike of Columbia University. As will be pointed out later, Thorndike's experiments by no means proved the impossibility of transfer, though they seem to have been regarded as doing this by many of the opponents of formal discipline. The conclusions of James, on the other hand, are more radical than those of Thorndike. James, in his chapter on "Memory" in the larger "Psychology,"[1] says: *All improvement of memory consists, then, in the improvement of one's habitual methods of recording facts.* By this he means to deny that there is any improvement in memory power as such, the improvement being solely due to the method or the technique of memorizing. He then gives in a footnote a description of certain tests carried on by himself in support of his assertion. Since these tests are the first of a considerable number of later experiments conducted in a similar way, a brief description of their general nature will be given here. Like those that have been undertaken later by other investigators, the essential technique of these earliest experiments consisted in giving the subject of the test certain material to learn, thereby determining his capacity for learning as measured by a definite standard. The material for this first learning constitutes what is termed the "test series"; it is followed by a period of practice in learning some other kind of material, and this second material is known as the "practice series"; this practice series is then followed by another learning of the material of the test series, and the improvement or lack of improvement over the first trials gives a measure of the effect of the practice series on the ability to learn.

The experiments of James.

To take a concrete case, James tested himself by learning on eight successive days 150 lines of Victor Hugo's "Satyr." He says: "The total number of minutes required for this was 131$\frac{5}{6}$ — it should be said that I had learned nothing by heart for many years. I then, working for twenty-odd minutes daily, learned the entire first book of "Para-

[1] Vol. I, p. 667.

dise Lost," occupying 38 consecutive days in the process." He then went back to the learning of Victor Hugo, and found that, while before the training he had learned at the rate of one line in 50 seconds, after the training he learned at the slower rate of one line in 57 seconds. James added that during the second learning series he was perceptibly fagged with other work, which, of course, invalidated the entire experiment.

Other persons under James's direction carried on similar experiments under somewhat better conditions, and the results showed a slight positive effect of the training.

These experiments are to-day chiefly of historical interest. They were not carried on under the strictest experimental conditions and are valuable mainly as pioneer investigations in the field. They are important also because their conclusions were given to the world with the tremendous authority that the *ipse dixit* of their author has always carried. Thus they have done much to reform the entire notion of the possibilities of memory training and of training in general.

The experiments of Thorndike and Woodworth.

The second set of experiments which have been mentioned above as having had an important pedagogical consequence are those of Thorndike and Woodworth[1] reported under the title, "The Influence of Improvement in One Mental Function upon the Efficiency of Other Functions." Tests were conducted to determine the influence of the training in the estimation of magnitudes on the ability to estimate magnitudes of the same general sort; the influence of training in estimating weights on the ability to estimate the weight of miscellaneous objects of similar weight; and the influence of the practice in marking words containing certain letters on the marking of words containing other letters, misspelled words, *et cetera*. In these varied tests most of the subjects showed some improvement when tested after the practice series. Thorndike's general conclusion is that, while there is some improvement, it is not

[1] *Psychol. Rev.*, Vol. VIII, pp. 247–261; 348–395; 553–564 (1901).

due to any "mysterious transfer of practice, to an unanalyzable property of mental functions," but rather to a functioning of identical elements in the practice series and in the final test series. This improvement, on the whole, does not seem to be great, and its spread is limited largely to activities that closely resemble one another. Thorndike maintains that in "transfer" identical elements are always involved. This identity is of two sorts, — identity of substance and identity of procedure. Identity of substance constitutes the objective elements in the transfer, identity of procedure the subjective aspects. The latter covers a wide range, and includes general methods of technique in learning, attitudes, and dispositions. The subjective elements are, in part at least, constituted by the learner, and vary not altogether in terms of the subject matter that is being mastered; they are largely dependent on individual purposes and interests.

Another experimental study which seems to point in part to the same general conclusions as those of Thorndike and Woodworth was conducted also at Columbia University by Bair.[1] This experimenter made an extensive investigation and analysis of the practice curve. The writer, however, concludes that "any bit of special training also helps us to receive training in general. Any training helps us to find ourselves. It gives us a method of orientation which leaves us in our reactions not entirely at the mercy of chance, even in unfamiliar situations. The experience which we get from special training gives us a general power to meet an entirely new situation with a more favorable response than had we not had this special training."

Foster's experiments.

The recent experiments of Foster on the effect of practice on visualizing[2] leads the investigator to the conclusion that practice is specific. "Practice with one set of conditions is valuable in a new set, only in proportion as the second set of conditions contain identical ability-conditioning factors." He finds no evidence

[1] *Psychol. Rev., Monograph Supplement*, No. 19 (1902).

[2] *Jour. Ed. Psychol.*, II, pp. 11–22 (1911).

from his experiments to show that training has made his subjects (three in number) "noticeably better observers or memorizers in general, or given them any habits of observing closely or reporting correctly, or furnished any ability to meet better any situations generally met with. . . . It appears, moreover, that little ability is gained by continuing practice beyond a certain relatively short time. Specific practice is demanded for best results and becomes quickly effective." The author concludes by calling attention to the fact that since his experiments were made on adults already trained in habits of attentive observation, the conclusion arrived at may not apply to immature or untrained persons. For the latter, practice in visual reproduction may possess a general value not discovered under the conditions of his particular investigation.

The experiments of Coover and Angell.

A series of experiments on transfer was conducted a few years ago by Coover and Angell[1] on the general practice effects of special exercises. In one experiment the training series consisted in the discrimination of sound intensities, the test series in discriminating shades of gray. A clear transfer of the practice effects was shown, as was also the case in a lesser degree in a second test, in which the training series consisted in sorting cards and the test series in typewriter reactions. The authors conclude from the objective results and the introspections of the subjects that the improvement consists in "divesting the essential process of the unessential factors. There is a greater habituation and more economical adaptation of attention."

Likewise Bennet[2] reports the results of an experiment with sixteen children to determine the effects of discriminating between shades of blue on the subsequent ability to discriminate between shades of other colors and of black. His results seem to clearly indicate a transfer effect.

[1] *Op. cit.*

[2] "Formal Discipline, Teachers College," New York, (1907).

Fracker[1] recently carried on a series of experiments on the transference of training in the psychological laboratory of the State University of Iowa. The same general methods in the use of training and practice series were employed as in the previous experiments cited.

Fracker's experiments.

The training series consisted in memorizing the order of four tones. The test series were eight in number as follows: (1) memory for poetry; (2) memory for the order of four shades of gray; (3) memory for the order of nine tones; (4) memory for the order of nine shades of gray; (5) memory for the order of four tones; (6) memory for the order of nine geometrical figures; (7) memory for the order of nine numbers; (8) memory for the extent of arm movement. Clear indication of transfer was found, generally more marked in those cases where the test series and the practice series were similar, although it sometimes happened, as in Thorndike's experiments, that improvement was not noted in some cases where there was great similarity between the practice and test series; indeed, the practice seemed to have a negative effect. The results of the experiment did not, however, support Thorndike's contention that "improvement in any single mental function rarely brings about equal improvement in any other function, no matter how similar." In many cases Fracker found that improvement was absolutely greater in amount in the test than in the training series. During the experiment the introspections of the observers were carefully recorded, and they indicate that mental imagery and properly controlled attention have much to do with the transfer.

Bagley discusses in the "Educative Process"[2] results with children tested in the Montana State Normal College. The writer attempted "to determine whether the habit of producing neat papers in arithmetic will function with ref-

[1] *Psychol. Rev., Monograph Supplement,* IX, No. 2, pp. 56–102 (1907).

[2] Chapter XIII, p. 208.

erence to neat written work in other studies." He states that "the results are almost startling in their failure to show the slightest improvement in language and spelling papers, although the improvement in the arithmetic papers was noticeable from the first." Bagley suggests that the failure to secure transfer in the particular experiment reported by him was due to the fact that the habit of neatness had not been made a conscious ideal in the minds of the children.

Bagley's theory of transfer through ideals.

Ruediger[1] attempted to verify experimentally Bagley's theory. He carried on tests for eight weeks in three different schools, all with pupils in the seventh grade. He found that when the emphasis on neatness in one subject was accompanied by talks to pupils on neatness, so that the habit was raised to clear consciousness, decided improvement was shown in subjects no more closely related than geography, arithmetic, grammar, and history. In other words, the habit was constructed into an ideal, and a transfer was thus made which seemed entirely lacking when the whole procedure was on the level of the subconscious. More recently Ruger[2] has come to a somewhat similar conclusion in his experiments with complicated puzzles. He says, "In general, the value of specific habits under a change of conditions depended directly on the presence of a general idea which would serve for their control." Subjects who developed a general formula in the solution of one form of a puzzle experiment were able to utilize the special habit built up in the solution of this form when they attempted to solve the puzzle in a second form. Those who did not develop this general ideal of procedure were not capable of transferring the specific habits from one form of the puzzle to another."

The results of Ruediger and Ruger.

[1] "Improvement of Mental Functions through Ideals," *Educ. Rev.* XXXVI, 364–371 (1908).

[2] *Op. cit.*

Judd shows the importance of knowledge in transfer.

The experiments of Judd,[1] carried on nearly a decade ago concerning the effect of practice as determined by the knowledge of results, also emphasize the importance of general ideas of procedure in securing transfer.

The person tested was required to judge the length of certain lines, and he was seated in such a position that his right hand and arm were entirely hidden from view by a large screen. Whatever he did with his right hand was, therefore, unseen by him. "On the left side of the screen, and in full view, nine different lines were shown in succession, and he was required to place a pencil held in the unseen right hand in the direction indicated by the several lines seen before him." After this the reactor was given "fuller visual experience" with one line, and an improvement at once took place in regard to this line. This improvement was found to be transferred by later tests to the other lines, but in some instances this transfer was negative, *i.e.* there was an actual interference. The lines that in the original series had shown an error similar to that of the line with which fuller visual experience had been obtained, showed a positive improvement in the test series; those in which the error had been in an opposite direction grew worse. In both cases, however, there were clear evidences of a transfer effect, but in the second case the transfer was negative.

In a second series of tests, geometrical figures were compared. Because of an illusion, one of these was overestimated, another underestimated. During the experiment one observer was kept in ignorance of the results, while the other was fully informed. Then the figures were reversed and a second series of tests were begun. In this the observer who knew the effect of practice adjusted himself to the new conditions. The other observer, who did not know the effects, showed a greater error than at any time, and was unable to improve, because, as Judd believes, the habit had now become so firmly fixed that training could no longer modify the reaction.

A similar test was later carried on with school children, who were required to hit a target placed under water. This was difficult, because of the deflection of the light through refraction. In the test one group was instructed in the nature of refraction, while the others were kept in ignorance. The boys in this test who had been instructed did no better than the others, but in a second test, in which the depth of the target in the water was reduced from twelve inches to four, the boys who had the theory fitted themselves quickly to the new conditions, while with the other group the errors were large and persistent. These

[1] *Psychol. Rev.*, IX, pp. 27-39 (1902).

experiments clearly show the value of a knowledge of conditions in connection with the transfer of training.

Experiments at the University of Illinois.

The significance of raising the activities to be transferred above the plane of mere habit to the realm of conscious purpose is again illustrated by a series of tests carried on by the Department of Psychology at the University of Illinois, in which about two hundred children of the practice school of the Eastern Illinois Normal School, at Charleston, Illinois, and later nearly fifteen hundred in the grades at Bloomington, Illinois, were first trained in inscribing the letter X on sheets of paper ruled in squares for the particular experiment. Later, half the group were practiced in inscribing various geometrical figures in these squares; and at the end of the practice the entire group were tested a second time in inscribing the letter X. The results show in these experiments a positive transfer in accuracy, but a negative result in regard to speed. The explanation of this result is to be found in the fact that during the practice series the nature of the work done by the pupils emphasized the factor of exactness, and hence raised it to the level of clear consciousness in the minds of the pupils. This resulted in giving the practiced group in the second test a clear advantage over the non-practiced group, as far as accuracy was concerned.

Thorndike and Woodworth are in general agreement with the point of view that emphasizes the value of raising the activity to be transferred to clear consciousness. In their experiments they found the "acquisition of definite ideas an important part of the influence of improvement in one function on the efficiency of others."

The experiments described above have secured results that have been interpreted either by assuming a transfer of identical elements, in which case there can hardly be said to be an actual transfer, but rather the functioning of old elements in new complexes; or by assuming that incidental phases in the learning are transferred from one set of activities to another, these incidental aspects being classed in general under the term of a better technique of learning. They include, among other things, facile adaptation of attention, the control of mental imagery, the ignoring of distractions, and the divesting of the learning process of unessential elements. Another theory of transfer holds to a rather mysterious "spreading" of effects from one field of physical or psychic activity to another. Ebert and Meumann consider transfer to be primarily of this nature. These investigators conducted a series of tests of an extended nature to determine the effect of a special training in memory on the ability to memorize in general.[1]

Conclusions of Ebert and Meumann.

At the beginning of the Meumann tests, the memories of the subjects were determined for nonsense syllables, numbers, letters, one-syllabled substantives, Italian words, poetic words, prose words, and visual signs. In the training series which followed, the subjects were given nonsense syllables to memorize, and then the original test series was repeated to determine improvement, if any, both for immediate recall and for permanent retention. Later the experiment was carried still farther, a second training series followed by another test series being introduced. The special training with nonsense syllables evidently increased the ability of the subjects to memorize and retain the materials of the test series. The amount of the transfer was found to be great. The ability to memorize philosophic prose, for example, showed an increase of seventy per cent after the practice series, and to memorize visual signs, fifty-five per cent.

The investigators consider that increased power of attending, increase in voluntary effort, improvement in the technique of learning, and general decrease in discomfort and tediousness are the chief auxiliary causes for the improvement after practice. They believe, however, that beyond these conditions, and fundamental to the process of transfer, lies a sympathetic interaction of allied memory functions, based on an assumed psychophysical activity. The existence of such an uncertain relationship is denied

[1] See *Archiv f. d. gesamte Psychol*, IV, pp. 1–232 (1904).

by the reviewers of this piece of work. Müller,[1] who has criticized these experiments, believes that the transfer can be best explained by considering the so-called auxiliary aids as the *sole cause* of the results obtained.

Necessity of a parallel control experiment in transfer tests.

The most serious defect in the investigations of Ebert and Meumann consists in the fact that they did not provide a parallel control experiment in testing their observers. All the six persons tested were given both the test and the practice series. In a properly controlled experiment, on the other hand, a part of the subjects tested are not given the practice between the first and the second tests. Various experiments have shown that unless this precaution is taken no valid conclusions can be arrived at as to the amount of transfer, since both the practiced and the non-practiced groups show improvement in the second over the first test. It is only by a comparison of the relative amount of improvement in the two groups that the influence of the intermediate practice can be ascertained.

The necessity of the parallel control experiment was strikingly shown in the case of the Charleston investigations described above. Both the practiced and the non-practiced groups showed marked improvement in the second over the first test series; yet by comparison of the relative improvement of the two groups it was found that there had been slight positive transfer in the case of accuracy, and a negative transfer, or an inhibiting effect, in the case of rapidity.

Experiments of Winch.

One of the first experimenters to guard against this error was Winch,[2] who performed a series of experiments on three different groups of English school children some years ago. Winch divided the children into two groups of equal ability as to memory, as determined by a preliminary test in learning a passage from a historical or geographical reader, and also by the judgment of the teachers. Subsequently one group was practiced in the learning of poetry, while the second group

[1] *Zeitsch.* f. d. *Psychol.* u. *Physiol. d. Sinnesorgane,* XXXIX, pp. 111–125 (1905). [2] *Brit. Jour. of Psychol.*, II, pp. 284–293 (1908).

worked sums. In the various tests, improvement was shown for both the group practiced in memorizing poetry and the group engaged in sums. However, in the former group the improvement made was more marked.

Experiments bearing incidentally on the problem of transfer.

Various experiments in "cross education" throw some light on the possibility of transfer. The principal researches in this field were conducted in the Yale psychological laboratory under the direction of Scripture.[1] The first series of experiments considered the increase of muscular steadiness through practice in inserting a needle in a very small hole, and the transfer of this increase to the corresponding muscles of the opposite half of the body. The left hand was tested first, and showed fifty per cent of correct trials, but after practice with the right hand for ten days the left hand showed seventy-six per cent of successes. Scripture explains these results as due primarily to a training of the attention rather than to any carrying over of skill in adjustment. Experiments on the increase of muscular power after practice showed "a steady increase in the muscular power of the right hand due to practice, and also an increase in the power of the left hand, due to what might be called 'indirect practice.'"

Further experiments conducted by Davis under Scripture's direction on the rapidity of tapping a telegraph key showed improvement through practice not only for the part of the body practiced, but for other members as well. Experiments in strength of voluntary effort in lifting dumbbells showed a transference of the effects of practice from the right to the left arm in muscular development and endurance. Experiments in lunging at a target with a fencer's foil showed that practice with the right hand affected the left hand positively. According to Davis, the results of the experiments showed not only that effects of exercise may be transferred, but also that "will power and attention are educated by

[1] "On the Education of Muscular Control and Power," E. W. Scripture, T. L. Smith, and Emily M. Brown, *Studies from the Yale Psychological Laboratory*, Vol. II, pp. 114–119 (1894). Also "Research in Cross Education," by Walter W. Davis; *ibid.*, Vol. VI, pp. 6–50 (1898), and VIII, pp. 64–109 (1900).

physical training, and that when developed by any special act they are developed for all other acts."

Among minor investigations and observations bearing more or less directly on the problem may be mentioned Volkmann's [1] tests of a half century ago on the influence of practice on spatial discrimination. He investigated the fineness of space discrimination on the skin by means of the Weber compass, and found that practice with the finger tips of the left hand increased the fineness of discrimination of the finger tips of the right hand, but not of the left forearm. Practice with the third phalanx increased the fineness of discrimination on the first phalanx. Also of interest are the investigations of Urbantschisch, of Epstein, and of Vogt, cited by Coover and Angell.[2] Urbantschisch found that a sound stimulus increased the sensitivity of the subject for visual, gustatory, olfactory, and tactile stimuli. Similar results are reported by Epstein in regard to the relation between auditory and visual stimuli. Vogt showed that habituation to distractions in one situation could be carried over to other fields.

Wallin reports in the March number of the *Journal of Educational Psychology* for 1910 that practice with one eye in illusions of reversible perspective is clearly transferred to the unpracticed eye ; likewise practice effects are transferred from the fovea to the peripheral retina.

Lee, in discussing the nature of fatigue,[3] states that work of one tissue may cause the fatigue of other tissues.

Studies in correlation based on pupil's grades.

A number of investigations to ascertain the correlation existing between the grades of pupils in various subjects of the curriculum have been conducted and have been taken as indicating the existence of such reciprocal relations between the studies as would indicate the possibility of transfer effects. One of the most careful and striking of these was undertaken some years ago by Rietz and Shade.[4] This concerned itself with inquiring into "the facts of correlation between the efficiency of students in mathematics and their efficiency in (1) foreign languages, (2) natural science." The method of investigation may be characterized in a general way as

[1] "Bericht d. k. sächs. Ges. d. Wissenschaft" (1858).

[2] *Op. cit.*, p. 328.

[3] *Pop. Sci. Mo.*, LXXVI, pp. 182–195 (1910).

[4] "Correlation of Efficiency in Mathematics and Efficiency in Other Subjects. *The University of Illinois Studies*, VI, No. 10 (1908).

that of Galton and Pearson. The source of the data is the records of the registrar of the University of Illinois. The results of the investigation are, in brief, that "a high correlation exists between efficiency in mathematics and foreign languages." While the results here do not in any way indicate whether there has been a transfer of training in mathematics to the other subjects, they seem to show that studies as far apart as mathematics and foreign language evidently have many points in common, so that training in one subject might very well be made effective in the other. Other experiments in correlation between various studies have been carried on with various results, none of them, however, furnishing any conclusive evidence in favor of or against the possibility of transfer, since it cannot be argued because there is a high correlation between various courses that for this reason these courses are causally related, so that training in one will result in greater efficiency in the other.

This fact is plainly shown by the investigations of Winch on "Accuracy in School Children."[1] The investigation concerns the possibility of the transfer of accuracy in the working of simple sums to ability in solving arithmetical problems. Winch assumes that if there is a highly positive correlation between the two forms of accuracy, it is to be concluded "that one function causes the other, or that there is a common factor in the two functions, or that both functions are the result of some prior quality or power which develops approximately equally in both these directions, or, finally, that the high correlation is a mere togetherness without relations or interdependence." The result of the experiment showed that while a high positive correlation (in one case +.85) did exist in the various groups of children studied between accuracy in working rule sums and accuracy in arithmetical reasoning, there was practically no evidence of transfer effects from training in working sums to accuracy in reasoning. The writer concludes: "It seems to be possible to find highly correlated functions which appear to have very little relationship of pedagogical value. We cannot conclude without further inquiry on other lines that two highly correlated mental powers are causally related. . . . Two qualities may be highly correlated, but the ratios of their growth may not be; nor may we be able to produce increase in the one by producing increase in the other."

[1] *The Jour. of Ed. Psychol.*, I, pp. 557–589 (1910); also same journal, II, pp. 262–271 (1911).

CHAPTER XV

THEORETICAL ASPECTS OF THE PROBLEM

Discussions of Brown and Hinsdale.

DURING recent years a large number of theoretical treatments have appeared in regard to the possibility of formal discipline. Among the earlier discussions of the problem, those of Brown and Hinsdale are the most important. Brown,[1] while criticizing the general doctrine, urged that a considerable number of mental attitudes and affective dispositions, such as voluntary attention, methodical habits, self-confidence, and love of truth, are capable of transfer from one field of learning to another. Hinsdale[2] more vigorously attacked the views of the extreme "formalists," and asserted that "the power generated by any mental activity is far more special than general. No one kind of mental exercise can develop the mind as a whole." Gradually, because of these earlier theoretical discussions, and also because of the experimental results obtained by James, Thorndike, and others, there arose more and more a tendency to discredit *in toto* the doctrine of formal discipline, some writers like Bolton and O'Shea taking extreme positions in opposition to the belief in transfer of mental functions. More recently the expression of opinion has been less extreme, and most writers have admitted the probability of a considerable amount of transfer under certain conditions.

One of the most important of these mediating views is found in a symposium on formal discipline by J. R. Angell of the University of Chicago, W. B. Pillsbury of the Uni-

[1] "How is Formal Culture Possible?" *The Public School Journal*, December, 1893.

[2] "The Dogma of Formal Discipline." *Proceedings of the N. E. A.*, 1894.

versity of Michigan, and C. H. Judd of the University of Chicago. This symposium was given at a meeting of the Michigan Schoolmasters' Club in Ann Arbor, April 2, 1908, and subsequently published in the *Educational Review* for June, 1908.

The view of Angell favorable to transfer.

Angell summarized his discussion as follows: (1) "Certain habits gained in the mastery of one study may be appropriated directly in another; they may (2) be slightly modified before such application, and still show for their possessor a great gain as compared with the individual who has to start from the beginning. (3) These habits may be incorporated in larger habit groups, either with or without slight modification. (4) They may tend to impede certain antagonistic habits, and in turn be impeded by other previously extant and inhibitory habits. (5) But in all these cases, the instances of inhibition as well as those of reinforcement and incorporation, it seems probable that a certain gain in the power to use and sustain attention will accrue from any purposeful and persistent intellectual application. . . . (6) What subjects best reinforce one another; what ones most inevitably conflict with one another; whether these relations are dependent upon the mode of presentation, rather than upon the subject-matter itself, — these and other similar questions, too numerous to point out, must one and all be answered by experiment and experience. Dogmatism is wholly impossible in advance of such drastic and exhaustive investigation."

Pillsbury's views are similar.

Pillsbury says: "You can not be sure that any fact is absolutely unrelated to any other, and so far as they are related, learning the one makes easier learning the other. . . . Training one part thus trains related parts, and the whole in some degree. . . . So the man with well-rounded training is probably on the average better trained for learning in any field than the untrained man, or even than the man with a narrow education in any other field."

Judd concludes his paper as follows: "Does nature-study train in observation? Does washing of slates train in neatness? Does saying good-morning to the principal conduce to good manners on the playground? If there is any dogmatic answer given you when you ask these questions, put it aside. There is no single answer to any one of these questions. . . . We may make our pupils eager seekers after truth, or we may make them bigoted little dogmatists. What we do will depend very much upon what we and our interests are. If we believe in specialized functions, we shall probably do very little to generalize knowledge in our students. If, on the other hand, we have broad views of the subject we are teaching and of our task in teaching it, we shall find very little in practical experience to bind us to the narrow view that mental life is made up of water-tight compartments."

Judd holds that the mind is not made up of water-tight compartments.

A second symposium on formal discipline by E. B. Delabarre, E. N. Henderson, and H. H. Horne, was presented before the Brown University Teachers' Association at Providence, April 3, 1909, and published in *Education* for May of the same year. Delabarre in his article distinguishes between the content and the formal aspects of conciousness.

Discussion before the Brown University Teachers' Association.

He maintains that "no individual can, by his own unaided efforts, acquire any large number of essentially reliable forms." No one can enumerate all the important formal elements. "It must be a part of the task of educational theory to learn what they are; distinguish between those that are desirable and true and those that are unreliable." The writer concludes that "these formal elements can be taught; that one subject unquestionably helps in the learning of others; that there are disciplinary subjects that are of especial value for this purpose; that not only does good training in any subject improve methods of learning, of attention, of work, of comprehension; but it is also true that all knowledge possesses some elements in common, and the number of these may be very considerable, even in the case of subjects that appear at first sight little related."

Henderson in his discussion reviews the experimental work on the transfer of training, and concludes that it is difficult to determine whether discipline in form or discipline in content is more valuable. Training in each is possible.[1]

Horne in his discussion maintains that "present study helps us in the later situation in so far as common features are involved. . . . There are no subjects which give an 'all round mental training,' for no such training is possible."

Meikeljohn argues from the logical viewpoint.

Meikeljohn, in a paper read before the New England Association of Colleges and Preparatory Schools at Boston University, October 9, 1908, and published in the *Educational Review* for February, 1909, approaches the problem of formal discipline from the standpoint of the logician. He defines formal training as "discipline in certain discoverable forms of intellectual activity. It does not imply the bad psychology of the faculties; it does imply the thoroughly sound and respectable distinction of form and content which is made by the logician." The writer concludes that "it is one of the tasks of education to so train the mind that it may do well the work of thinking. In order to accomplish this, it must select those kinds of mental activity which seem most fundamental and important for the life of the student."

[1] In his recent book entitled, "Text Book on the Principles of Education" (New York, 1910), Henderson sums up an extensive review of the literature on formal discipline with the following statement: "There is something which may appropriately be called formal discipline. It consists in the establishment of habitual reactions that correspond to the form of situations; these reactions foster adjustments, attitudes, and ideas that favor the successful dealing with the emergencies that arouse them. On the other hand, both the form that we can learn to deal with more effectively, and the reactions that we associate with it, are definite. There is no general training of the powers or faculties, as far as we can determine."

W. C. Ruediger, in a recent volume on the "Principles of Education," devotes considerable space to the discussion of formal discipline. While not taking a positive position either for or against transfer of training, he maintains that the evidence deduced concerning such transfer "does not argue for an independence and discreteness of mental functions, but for an interdependence and interrelation of such functions. This being true, we should expect not only that one function will assist another somewhat related function, but that under different conditions the first would interfere with the second. . . . The channels through which improvement is carried from one mental function to another may apparently all be grouped together under the head of 'identical elements.' . . . As a means of transfer this is easily comprehensible and removes all mystery from the process. It, however, is frequently difficult to tell when two processes are mentally identical, and when they are not. An apparent resemblance or divergence may prove misleading when subjected to test. . . . If we have analyzed the doctrine of formal discipline correctly, it is evident that its extreme advocates and its extreme opponents are both wrong. Knowledge and training are not merely specific in their application, but they also have a general value."

Ruediger believes that training possesses a general value.

The various writers above cited in general find no little value in a modified statement of the doctrine of formal discipline. W. H. Heck, on the other hand, in a recently published monograph on "Mental Discipline and Educational Values," takes an opposite position, although not denying the clearly established fact of transfer of training. Heck believes that the doctrine of formal discipline is at present doing much harm in educational theory and practice, and he gives as the main purpose of his essay the effort to modify the doctrine, and "upon a modification to

Heck sees danger in an emphasis of the doctrine of formal discipline.

establish a standard of educational values." The doctrine "continues to make itself felt throughout our school system and . . . the opposition to it is disorganized, timid, and bookish," asserts the writer, in his introductory chapter; but later on he says that there is a "popular demand for more practical courses in schools. . . . The doctrine of formal discipline is retiring from the elementary schools, and is showing signs of increasing discomfort in the secondary schools." Further, "the adherents of the doctrine of formal discipline shrink from carrying their doctrine to its logical conclusions," while "the business and professional world relies more and more on the superiority of specialized ability, resulting from specialized training. Men are thereby becoming more efficient specialized workers, but less adaptable, less transferable, more dependent upon the specialized demand for their work." The "timid opposition" to the dogma of formal discipline does not seem to be so ineffectual as the writer at first would lead us to believe. Indeed, from his own statement of conditions, it seems legitimate to inquire whether in the theoretical and practical reaction against the dogma of formal discipline we have not already gone too far in the opposite direction. Are we not at present confronted rather by the danger of giving up our ideas of a general education, and becoming adherents of the *dogma of specific training?*

Specific arguments advanced by Heck.

Heck, in his arguments against the doctrine of formal discipline, does not attempt, in the light of the experimental evidence which he reviews, to deny the possibility of transfer. He rather tries to show that this result is not brought about through the transfer of skill in a specific activity or ability, but by the development of general concepts of methods which may be applied to various situations, and by the employment of common elements in various specific activities. Thus the writer is in substantial agreement with the conclusions reached by the several investigators cited above; yet the general impression he conveys is that the whole present attitude in regard to the possibility of formal training is wrong and dangerous. It should, however, be remembered that, while many who still hold to a belief in transfer of training do so from the standpoint of an exploded psychological theory, and that while it is extremely important to determine the exact nature of the transfer process from the standpoint of psychological theory, this determination is of relatively less significance from the standpoint of educational practice. The essential fact remains for the educator to consider that *training in one activity does help the performance of other activities.* For this reason it would be a great misfortune to convey the belief generally that because the doctrine of formal discipline may be wrong in certain of its theoretical aspects, the practical effect of learning in one field upon learning in another is *nil.* Such a belief would do more harm to educational theory and practice than any number of academic psychological heresies (even that of the old "faculty psychology") could possibly effect.

Heck identifies the doctrine of formal discipline with the old faculty psychology.

Heck's chief arguments against formal discipline are based, not on experimental evidence, but on certain theoretical assumptions. In the first place, he overstates the doctrine of formal discipline as it would be held to-day by any one whose opinion is of value or influence. He says, "The doctrine of formal discipline implies that the mind is made up or possessed of certain general powers or faculties. . . . Development in strength, breadth, accuracy, etc., of the power involved can be used in response to any other stimulus than the one by which the power was previously exercised, with little change in nature or diminution in amount." In the first place, no one will attempt to say in any undetermined case whether the exchange by transfer shall be slight or large, and further, as a matter of fact, the much abhorred "faculty psychology" of our fathers is not basal to a belief in the transfer of mental training. Naturally, when the doctrine was first formulated, it was stated in terms of the psychology then current. It could have been stated in terms of up-to-date functional psychology almost as well. This seems to be the common mistake that the opponents of transfer generally make, namely, the assumption that because the doctrine of formal discipline first appeared in the setting of the faculty psychology, it must of necessity be invalidated with the passing of that psychology. With equal justification from logic, one might argue that because the belief in heaven was originally coupled with the old Ptolemaic conception of the universe, this belief was destroyed when the Copernican system superseded the older cosmological ideas.

He objects to it on the ground of localization of nervous function.

A second theoretical objection which Heck finds to the doctrine of formal discipline is that it is not compatible with the current theories of localization of nervous function. Heck hold that "for every particular state of consciousness there is a concomitant stimulation of particular groups of cells in the cerebral cortex." In other words, he seems to adopt a theory of absolute localization, although he recognizes the fact that "cortical activity is not limited to these particular groups of cells in relation to a particular state of consciousness, for consciousness at any moment is related to an equilibrium of activity in the cortex as a whole."

This places Heck in a dilemma.

Heck appears to be here on the horns of a dilemma. If he denies the possibility of formal discipline on the ground of a narrowly interpreted theory of nervous localization, he is basing his contention on a hypothesis that not only has behind it no verifiable facts, but also is in conflict with what is known concerning the nature of conscious processes. If, on the other hand, we accept a view of relative localization which more nearly accords with the known neurological facts, and with the activities of consciousness, there is nothing in this latter view which precludes the possibility of a very general transfer of practice effects. In short, if we try to overthrow the doctrine of transfer on the ground of absolute localization of nervous functions, we are doing so on dubious theoretical grounds, and holding to a theory which runs counter to what we know of mental elements and mental organization. If, on the other hand, we accept the doctrine of relative rather than absolute localization, of colligation of remote functional areas, and of vicarious functioning (as does Wundt), we find that such an hypothesis, instead of making against the possibility of transfer, gives a clear basis and reason for such transfer. Indeed, a rational hypothesis of cerebral localization suggests coöperation and transfer of the widest possible sort.

He contends that habits are specific.

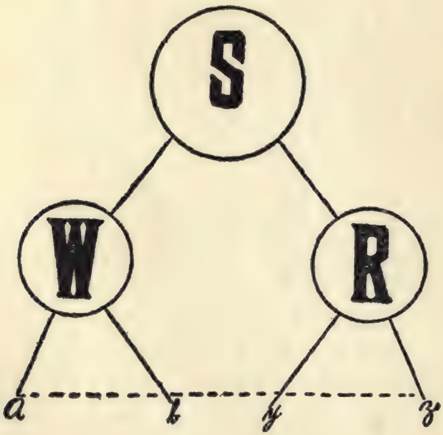
In the third place, Heck bases his opposition to the doctrine of formal discipline on the assertion, so commonly made, that habits are specific and that a generalized habit is impossible. The possibility of the existence of a generalized habit has been discussed in a preceding chapter[1] of this book. Here it was maintained that it was admissible to term certain habits general, first, when the specific stimulus calls forth a specific reaction common to a large variety of situations; second, when a reaction is under the dominance of a mood or emotion that so colors the objective environment that several different stimuli may call forth the habitual response; third, when in any definite reaction to a given situation not merely one elementary adjustment, but many, are involved. This particular principle was illustrated by the activity of writing, in which are included, beside the specific stimuli and reactions involved in the

[1] Chapter III, pp. 49–51.

writing as such, other stimuli and reactions in terms of the total schoolroom situation.

In forming specific habits other higher habits may be set up.

Perhaps this thought may be made more clear by the accompanying diagram. In this the script letters *a*, *b*, *y*, *z*, represent certain specific activities in which the pupil is being trained. *a*, however, involves the more general adjustment W, which in turn involves the still more general adjustment S. Now while in the activity *a*, W and S are both involved, these may also be involved equally well in still other activities. For example, W is involved among other things in the activity *b*, while S is involved not only in W, but in R as well. To be more concrete, let us suppose that *a* represents the *a*-copying habit, and W the writing habit and S the school habit, while R represents the reading habit and *y* the habit of reading in verse.



Now it is quite obvious that in learning to copy *a*, the other higher habits, if they have not already been formed, will of necessity gradually be set up. Suppose the child should begin his activities in school (which, of course, he actually would not) by learning to copy the letter *a*. In this activity he would gradually acquire the more fundamental habit of paying attention in the schoolroom and of the general technique of learning to write. Thus in learning to copy the *a*, he would have also acquired a stock of habits which could be transferred to other school situations. In other words, learning to copy *a* would constitute a general training as well as a specific habit-forming activity.

General habits of thinking and willing.

So we are justified in speaking of general habits of attending, or of thinking, or of willing, although, as Bagley would urge with justice, attention, thought, and resolution are mental states, which, as highly conscious, raise the individual above the plane of habitual activities, and make it possible for him to respond in a new way to a new situation. The fact, however, that he does attend, has the attitude of attention, is due to certain specific tendencies in reaction which have been gradually acquired and made reflex. The attending to the dictation of the teacher, for example, brings into the consciousness of the child a situation to which he may intelligently react, but the possibility of getting the attitude of this attention is largely dependent on many subconscious and habitual factors, such as ignoring unessential stimuli, disregarding tedium, and in general having developed a technique of learning. These elements have been emphasized by most of the investigators above cited as essential in the process of transfer.

If we consider again the diagram just discussed, we shall be able to see how it explains some of the facts of transfer or its lack, as shown in investigations above considered. In one of the tests of Thorndike, for example, the subjects were given practice in marking the words on a printed page containing the two letters *e* and *s*. Before and after this training these subjects were tested in marking the words containing other combinations of letters, misspelled words, different parts of speech, etc. Improvement in the second test series was measured by increased speed and accuracy. In general speed was more likely to be improved than accuracy. The reason for this is perfectly obvious in terms of our diagram, as can be seen from the following: Suppose that *a* represents the practice in marking the words containing *e* and *s*, while *b* represents the marking of words containing the other letters, etc. It is quite obvious that the specific marking habit acquired in the first series enters into conflict in a certain sense with the marking of words containing *m* and *l*, for example, since the attention is turned from words of one general make-up in the practice series to those of another composition, in the test series. Thus the acquired tendency to mark words containing *e* and *s* will actually tend to inhibit the marking of words containing *m* and *l*. Hence there may be a falling off in accuracy. On the other hand, the more general reaction of marking words has been trained at the same time as the habit of marking specific words. This latter phase of the habit (which Thorndike would term an identical element, but which may better be called a more general attitude) may be transferred from the marking of one kind of word to the other. This might result in greater speed, and at the same time diminished accuracy. If a subject had been trained to high efficiency in the word-marking habit, further training in marking certain specific words would tend to exercise a negative influence in marking other words similar to them. The nearer the activities were alike in this case, the greater would be the distraction of attention, and the greater the falling off in efficiency.

CHAPTER XVI

PRACTICAL CONCLUSIONS IN REGARD TO THE TRANSFER OF TRAINING

As a result of the various investigations and discussions concerning the possibility of the influence of certain mental functions on others, a number of definite facts are established. In the first place, it is quite evident that there is no one study that is of such a nature, either as to content or method of instruction, that it can train the mind equally well in all directions; neither can it be assumed that drill in this can be carried over without loss to other studies or practical activities, never mind how similar in nature. Equally absurd and unwarranted, on the other hand, is the attempt to deny all reciprocal influence between various mental activities, or to hold that such influence is so slight that it is not worth while to seriously consider it in planning and arranging courses of study. That there are transfer effects, often of a considerable amount, cannot be doubted by any one who seriously and impartially examines the evidence. *The fact of transfer cannot be doubted. The factors involved in such transfer, the extent to which transfer can take place under any given set of conditions, and the best methods of securing such transfer will long doubtless remain questions for investigation and discussion.*

The fact of transfer cannot be doubted.

The question whether the results are due to functioning of identical elements (Thorndike); to improvement of habitual methods of recording facts (James); to training the attention and will power (Scripture and Davis); to divesting the essential process of the unessential factors, greater habituation and more economical adaptation of attention (Coover and

Résumé of the various possible methods of transfer.

Angell); to the effective use of mental imagery and properly controlled attention (Fracker); to the development of ideals (Bagley, Ruediger, and Ruger); to general improvement in technique of learning, attention and will-power, but chiefly to a sympathetic interaction of allied memory functions (Ebert and Meumann), or to all of these, or to some other factors as yet not analyzed out, will doubtless for a long time offer a fruitful field of inquiry.

Rules for securing transfer.

The possibility of a general training is thus seemingly established both in theory and in fact, and it becomes the business of education to consider how such a training can best be secured. It seems possible in the light of all the evidence presented on the subject of transfer to lay down with tolerable certainty a few rules of procedure.

Raise the habit to be formed to the plane of ideas.

1. The first rule should be: Make those specific activities which you wish to transfer the object of thought. Let the significance of the habit and its general bearings become known to the person who is the subject of the training. Bagley has emphasized this factor in training, in his doctrine of transference through ideals, and the experiments of Ruediger and Ruger seem to justify the contention. The results of Judd, who, as previously stated, has shown that practice with knowledge has a value in the transfer of training which practice without knowledge does not possess, also point to the same general conclusion. Likewise, Meumann has found that it is desirable in training children formally to bring to their attention the significance of such training. It further should be said that our knowledge of the functioning of the nervous system is in strict accord with this general position in regard to transfer, since the association fibers of the cortex are the ones which connect various sensory and motor areas, and their function is probably primarily related to the higher conscious processes. It would seem, then, that we have a definite means which

education can pursue in formal training, and this means removes the criticism that such training is merely mechanical and deadening.

Train the pupil in the technique of learning.

2. Train the child in the technique of learning and in the processes that make learning effective and economical. Nearly all the investigations emphasize the value of properly adapted attention, of satisfactory physical and mental attitudes in securing transfer. Sustained attention should be developed in the school training, not merely for the sake of the object attended to (perhaps not primarily for the object's sake), but rather for the sake of attention itself. The whole art of learning should be carefully and skillfully controlled. The importance of right methods of learning has been emphasized in recent years, largely through the work of Meumann. It appears that one of the chief aims of education should be to teach the child how to acquire knowledge with the least expenditure of time and energy compatible with its retention for effective use. One of the greatest needs of formal training in this connection is the development of the child's mental imagery. See to it that children can employ various kinds of imagery effectively, develop the imagery for form and for color, the imagery for sounds and for kinæsthetic sensations of throat, hand, and fingers when possible. Many a poor reader cannot visualize, many a child deficient in nicety of motor control lacks kinæsthetic imagery; all training in musical notation is worthless knowledge unless the child has fair auditory imagery.

3. In seeking to secure transfer, especially where purpose does not play an important part, see to it that the stimulus which is to call forth the desired reaction is such that it may be a common element in many objective situations. If, for example, it is desired to promote in general the habit of observation, it will be unwise to cultivate this habit in a very narrow and unusual field of experience.

Habits of observation may doubtless be secured by training the observer to give careful attention to objects appearing under the microscope. This training in observation will on the whole probably have less possibilities of transfer to other fields than will training in observation cultivated in the study of more common objects of life, such as plants and animals that are often met with in the daily environment.

See that the reaction may be a common element in many situations.

In this connection it should be kept in mind that habits of a very simple nature are much less likely to transfer to activities other than those in which they originate than are habits of a more complex character. These latter can function, in part at least, in a large variety of situations. The practice effect of marking out *a*'s on a page containing various letters not only may not facilitate the marking out of *b*'s, *c*'s, etc., but it may actually hinder the rapidity with which these latter letters are marked out because of the previous training in attention in marking out *a*'s.[1] Likewise it should be remembered that a complex habit may act in various ways when transferred to other activities than those under which it first was set up. Some of the elements in such a complex habit may work positively under the novel conditions, and other elements negatively. In the habit of marking out letters referred to above, at least two elements seem to be present, the one consisting in making the proper eye movements over the page, the other in attending to the letter to be marked out. It is quite easy to understand how it might happen that in transferring the habit from marking out *a*'s to some other letter, one of three results might be obtained, depending upon the previous training of the subject of the test. Positive transfer effects would appear if the training in eye movement were more important for the subject than attending to the particular letter to be marked out. A neutral result would be reached when the two factors of eye movement and attention balanced each other, and a negative, or inhibiting, result would occur when the factors of attention were more important than the eye movements. It is because most habits are far from simple that even when there is a neutral result in the transfer experiment, it cannot therefore be concluded absolutely that there is no reciprocal relation between the two sets of functions tested.

[1] Such a result actually was reached in the experiments at the Charleston Normal School, previously referred to.

4. Education should cultivate through specific training general emotional attitudes. Moods and feelings often are the dominant elements in a situation, and these can readily be transferred. The child who has the proper emotional attitude toward his school life will be the one who will act most capably in the school environment. Education should see to it that such general feeling attitudes as docility, respect for authority, eagerness to be of service, and the like are developed through the school training. Such attitudes, unlike the ideals which Bagley emphasizes, need not (perhaps should not) be raised to full consciousness. This has a bearing on the moral instruction of the schools. It may be that intellectualizing what ought to be an emotional attitude is a dangerous procedure. It is a well known fact that the examination of an emotion tends to destroy it. This thought has significance in relation to temperance instruction and the like. The question may well be raised, has not the instruction on the effect of alcohol and narcotics the tendency to make the child's attitude merely a matter of intellect, when it should primarily remain one of feeling and of will?

Cultivate proper attitudes and moods.

5. Emphasize particularly the formal aspects of education in the elementary grades. Certain habits reach their saturation point, so to speak, in a relatively brief time. Further training, whether it be direct or indirect, cannot increase their efficiency to any great degree. If the pupil has already developed his maximal power of learning by rote various kinds of material, further practice in one kind of material of necessity cannot have any effect in improving rote memory with other materials, however similar they may be. On the other hand, if this rote memory has not reached its highest perfection in the pupil, training with one sort of material may transfer its effects to other materials, which are memorized in a similar manner. It would seem prob-

Emphasize the formal aspects of education.

able for this reason that highly trained laboratory subjects would show less general effect of training than would naïve subjects, and that adults would show less effect than would children. The laboratory subject who has mastered the technique of giving himself over to the test at hand, who knows how to hold his attention down to the minimum of fluctuation and to overcome the loss of interest arising through *ennui*, can expect to get little general training in carrying on such a specific activity as judging areas, tapping at dots on paper, or learning nonsense syllables. The greatest possibilities of transferring general attitudes of attention, thinking, etc., except as conscious ideals or purposes, lie, then, with untrained adults and with children, especially with the latter. This makes the educative process hopeful where children are concerned, and relatively hopeless with adults. It is not that adults cannot learn new habits, as James maintains in his famous chapter on "Habit"; it is that they cannot generalize these habits that makes the man of forty an old fogy.

Certain subjects offer a better discipline than do others.

Finally, if it is true that a formal training is possible, and if it is desirable that the schools furnish such a training, we come back to the old question as to whether there are certain studies that are better suited than others to offer this discipline. It can be safely asserted that there are subjects which, either because of the nature of their subject matter, or because of the better technique that goes with their instruction, are to-day more valuable than others from the standpoint of mental training. Other studies which are not now so well developed will, perhaps, some day take the place of mathematics, or natural science, or the classics and modern language, but to-day they are less valuable from a disciplinary standpoint.

It is not without interest to note at the present time, when so many are raising the question as to the fundamental value of the older disciplines, the reactionary attitude taken by Shorey in his defense of the classics,[1] among other things he says: "Information, knowledge, culture, originality, eloquence, genius may exist without a classical training; the critical sense and a sound feeling for the relativity of meaning rarely, if ever. . . . The law is the only discipline comparable to the classics in this regard." Shorey asserts that the critical interpretation or translation of one of the older languages "supplies the simplest and most effective all-round discipline of the greatest number of faculties." Because of its disciplinary and cultural value and its content, "Latin is a necessity in anything but an elementary or purely technical education. Greek is not in this sense a necessity, it is the first of luxuries."

The question of educational values has an important bearing on the desirability of a free elective system. If, as it appears, certain studies are worth more than others, and it is not a matter of indifference from the standpoint of mental discipline whether the student elects, for example, Latin, mathematics, philosophy, and chemistry on the one hand, or short stories, elementary agriculture, woodshop, and bird study on the other, the elective system in its extreme form must be modified. Indeed, this has been done in many institutions where a group elective system is in use.

It is necessary to limit the scope of an elective system.

There are signs from various quarters that there are likely to be framed further restrictions to prevent the student from taking just what suits his tastes, fancy, or convenience in a perfectly irresponsible way, in spite of the opposite tendency to extend the elective system into the secondary schools, and the insistence by certain persons that any course the pupil takes and passes in the high school should be accepted by the college and university without further question, as entrance credits, on the apparent assumption that any one study is as good as any other for mental discipline. That there is danger in such a tendency need not be further emphasized in the light of the foregoing discussion.

Just at present the most important controversy concerning educational values is being carried on between those who advocate the advantages of applied science, and those who hold to the greater advantage of pure science. The

[1] "The Case for the Classics." *School Review*, XVIII, No. 9, pp. 585–617 (1910).

proper solution of the relative importance of these two spheres of human knowledge will doubtless have much to do with the development of the most valuable curriculum of studies in our secondary schools and colleges. It would seem that, at least as far as mental discipline is concerned, pure science has much in its favor as a subject of instruction. In a recent volume on Educational Values, Bagley emphasizes the probable superiority of pure mathematics over applied mathematics with its utilitarian ends which tend to color every other consideration; thus obscuring the ideals of accuracy and rigidity that the pure science teaches. "Applied mathematics," says Bagley, "will inevitably demand quantity rather than quality. . . . With the better and more intelligent students, the discipline may come in spite of haste. With the average student, the longer and more penetrating processes from which the perception of the unique values of mathematical reasoning will emerge, will be omitted." What is true in regard to pure mathematics as compared with applied mathematics is true in regard to other pure sciences as compared with other applied sciences. The application of a science tends to emphasize certain human values more or less remote from the value of the science as science; hence, to restrict the field of the inquiry to those phases of the science that seem to relate most definitely to economic and other more or less narrow human values. With this point of view the investigator is apt not only to lose the ideals of rigidity which Bagley points out, but also the ideals of truth merely as truth; truth that is self-sufficient and confident, that knows that whatever is true is human and whatever is untrue or partially true can never have ultimate worth in human experience. This ideal, gained in one pure science and made a conscious end of endeavor in all fields of human experience, has a rich promise for the future. In general the great discoveries of science have been made

The comparative value of pure and of applied science.

by those who were primarily scientists; who were dominated in their actions by the scientific ideal. Applied science as a rule comes later than pure science. It uses the results of a Helmholtz, who invented the ophthalmoscope as a toy, or of a Darwin, who in the spirit of scientific curiosity collected data from which developed the theory of evolution, with its countless applications to human life. The mere facts of science are worth much; relatively less, however, in the first years of study before specialization has begun in the technical school or university; but the fact as fact has slight disciplinary value unless from it grows the spirit of curiosity, the emotional ideal, which the Greeks realized gave birth to all knowledge, and through which modern education has achieved such results.

Those who believe in the absolute necessity of cultivating the scientific ideal in all its purity should not despair because of the evident trend of the education of the day in the direction of utilitarian, particularly economic ends. The history of education shows clearly that applied and pure science bear a reciprocal relation, and in the end the emphasis of the one leads to the emphasis of the other. Before they have gone far, the advocates of applied science are brought to a realization of the fact that they must seek the assistance of pure science, if they are to get practical results; on the other hand, the supporters of pure science sooner or later must feel the need of applying theory to practice. A science that has no human significance, that has no ultimate use, cannot exist in a world of human values. An interesting example of the development of applied science in the direction of pure science is found in the tendency of the great universities of the Middle West, founded for the most part for practical reasons, to establish higher schools of pure science and research.[1] On the other hand, some of the Eastern institutions whose ideals have for generations been cultural and scientific have felt the necessity of establishment schools of engineering and commerce.

We may then conclude that pure science is of greater disciplinary value, because (1) through the facts which it presents, ideals of procedure and of truth may be de-

[1] This is particularly true of the University of Illinois, that has a special legislative appropriation for its graduate school.

The disciplinary value of pure as compared with applied science.

veloped which function in a wider human experience, greatly to the uplift of the race; (2) the content and method of pure science is such that it has a broader field of application than has applied science, and can function as an identical or similar element in more situations than can applied science; (3) the emotion which the pure seeking after truth arouses is higher and less likely to be deadened by other emotions than are the ideals of economic improvement and social betterment, which are the aims of an applied science. These latter are apt to conflict with each other and to obscure the greater issue.

The utilitarian value of a subject not the only consideration.

We must realize that not every subject that has utilitarian value, or that excites popular interest, is for that reason solely a fit subject for instruction in the schools. Ultra-conservatism has too often insisted on keeping in the curriculum those studies that have long since ceased to be vital; on the other hand, we are likewise in danger, particularly at the present moment, of going to the other and equally fatal extreme. There are so many special interests that just now seem to be clamoring for recognition, practical, humanitarian, æsthetic, that our school programs are in danger of being overcrowded with a variety of subjects which cannot well take the place in point of mental training of those which have for years been firmly established in the curriculum. The very multiplicity of the subjects that have enriched our programs offers a distraction, and furnishes a training in dispersed rather than concentrated attention, a training which is not needed and should not be desired. The trend of popular opinion is such that the new must come in, and it is not maintained that this opinion is not on the whole sound; but let us see to it that this new element is assigned its proper place and given its just value. In this time of rapid change we need sanity in educational doctrine and practice as scarcely ever before.

CHAPTER XVII

ATTENTION AND INTEREST

THE word "attention" has been employed not only in popular usage, but in psychology as well in various ways. At times it has been regarded as a power or faculty of the mind; it has been thought of as a characteristic of certain states of consciousness as distinguished from others; it has been interpreted as the sensations of muscular strain, accompanying adjustment to the object of attention, and again as a feeling characterized chiefly by interest.[1] Obviously some of these descriptions of attention are quite inadequate from the standpoint of modern psychology. For example, we cannot regard attention as a special power of the mind, since such terms as powers and faculties have no significance in our present-day thinking. Neither can we think of attention as a characteristic of certain states of consciousness as distinguished from others. There is no state of consciousness that is completely inattentive. States of consciousness that are characterized as inattentive are only relatively so. Consciousness, following James, may be thought of in its successive phases as a series of waves with a crest, or focus, and a margin for each of these waves. This analogy is usually accepted as a fairly accurate description of the facts. The focus of consciousness corresponds to the state of attention, and the margin to the state of inattention. In states of concentrated attention, when the mind seems completely buried in its object, the crest of the wave rises very sharp and high, and there is little fringe. We can think of the crest as becoming more and more

Attention an attribute of all conscious states.

[1] Titchener has summarized the various meanings of the term "attention" in his "Experimental Psychology," Vol. I, Student's Manual, pp. 108–109.

pointed, and at the same time the width of the wave as growing narrower and narrower, until at length it becomes a perpendicular line. The approximation to such a form of the conscious wave as this, would correspond in consciousness to a state of hypnosis or mono-ideism. However, the wave can never become this single line as long as consciousness remains. On the other hand, the crest of the wave may fall lower and lower, its width and those of the marginal states may grow more and more extended, until the wave approaches in form a single horizontal line. The approximation to such a form as this finds its correspondence in consciousness in dream states, semi-coma, and the like. It is clear again that the form of the wave can only be an approximation to this horizontal line and still represent consciousness. Between these two phases of the wave, the one with the extremely high and sharp crest and narrow margin, and the other with the broad and low crest and greatly extended margin, the whole attentive process may vary, but *there always must be a crest of some sort and a margin of some sort in any conscious state.*

Attention correlated with adjustment.

From this point of view attention may be defined as an aspect of all states of consciousness in which a part of the field is emphasized and a part relatively ignored. To use Titchener's words, we have in attentive consciousness an object or objects "attended to," and an object or objects "attended from." These two aspects of every conscious state are represented on the objective side by differences in adjustment. *We always adjust ourselves to the object of attention, and correspondingly we are out of adjustment to the object in the inattentive field.* There seems to have been in the development of attention, both in the individual and in the race, an exact parallelism between adjustment as an objective factor and attention as its subjective correlate.[1] Ade-

[1] Titchener holds that sensations of adjustment (kinæsthetic states of consciousness) are not the invariable accompaniments of attention. "There

quate adjustment corresponds to well-adapted attention, while inadequate adjustment represents that stage of consciousness which is characterized by fluctuation in attention. By adequate adjustment is here meant an adjustment which is working satisfactorily toward the mastery of a situation. It is to be distinguished from completed adjustment in which the situation is finally mastered. There are obviously various stages of adequacy in adjustment, depending upon the degree to which the situation is being mastered, or the problem being solved. When a situation first presents itself in attention, it often happens that the means for its mastery are not completely known. Indeed, if they were so known, there would hardly be a situation, since the reactions could be carried out on the habitual plane. It is evident that the greater the lack of knowledge in regard to the control of the situation, the less the possibility of habitual reaction, the greater is the uncertainty in adjustment and the greater the thought crisis. It is at such times as this that the individual seeks for proper reaction, and under these conditions the attentive consciousness fluctuates from one aspect of the situation to another until a satisfactory set of reactions is hit upon, and then it is that the attention becomes concentrated, and the reactions effective. In cases of strong emotional

may be a widespread arousal of kinæsthetic sensations, or there may be no sensible change of the muscular system; it depends upon circumstances." However, biological considerations make it probable that there can be no attentive state that is not accompanied by sensations or images of bodily adjustments. We have already pointed out in our discussion of the manner in which the child obtains experiences of the external world, that mere sensation is not sufficient to give him the idea of an object. A pure sensation is a hypothetical conscious process. In objectifying the sensation, we always adjust ourselves to the object that arouses it. This is true in visual sensations. Mere passive touch could not acquaint us with objects; our whole idea of space is interwoven with kinæsthetic sensations; a large number of our meanings are carried directly by kinæsthetic symbols, and finally all symbols of meaning must eventually be interpreted in terms of adjustment. (See Chapter V of this book, p. 73.)

excitement, where the situation offers no immediate means of solution, we have states of consciousness that are characterized by rapid shifts of the field of attention and by general confusion in the cognitive processes. On the other hand, when the problem is on the road to solution, when the adjustments are taking on definiteness and coherence, then it is that the cognitive aspects of consciousness become clear and the thought processes effective. Attention then seems to be correlated with cognitive clearness and with adequacy of adjustment on the one hand, and with affective intensity and inadequacy of adjustment on the other. An illustration may serve to make this statement more definite.

If I am sitting at my desk engaged in writing, my state of consciousness will be distributed between that which I am clearly and definitely aware of, in this case the ideal content of my thinking, and that which is but dimly and vaguely in the fringe of my consciousness, — the paper before me, the movement of the pencil over it, various indefinite noises coming from other parts of the house, the fragrance of flowers, as their odor comes through the open window, and so forth. Suddenly there comes the cry of fire, and my focus of attention shifts to the sounds from without. I notice also, clearly and definitely, the smell of smoke, and see puffs of smoke creeping through the door of my study. Up to this point the whole course of my consciousness may easily be described in terms of clearness. Suppose, however, when I open the door and rush out into the corridor, I find that the smoke has become stifling and that exit in that particular direction seems to be precluded. I turn back again to open my study door, but I find that the spring lock on it has closed it from within, and I have not my keys with me. Here my clear thinking for the time ends, and the states of consciousness which are mine are characterized by anything but definiteness and clearness. They are indefinitely intense. It would be entirely wrong to say, however, that in such a state of inadequate adjustment I am inattentive in the same sense that I was inattentive to the various sense stimuli that came to me when I was a few minutes ago sitting at my desk in the study and writing. This state of confusion exists until I, in my excitement, push strongly against the door to my study, and the lock yields, and I reënter the room. I then remember that at the open window there is a fire escape from which I can easily reach safety. The whole situation again becomes clear, my excitement disappears.

and I resume a state of consciousness in which attention is well adapted and adjustment adequate.

These considerations bring us face to face with the question of an adequate measure of attention. If we think of a single phase of the conscious wave that we have previously discussed, we may say that the nearer the focus of attention any object of consciousness is, the greater its clearness or vividness, and the more in the margin it is, by so much less is it vivid and clear. This is practically the view adopted by Titchener, who considers clearness the only unvarying accompaniment of attention. However, when we consider various phases of the attentive consciousness and attempt to compare them, it is not so certain that we can maintain that those states which are characterized by the greatest clearness are therefore the most highly attentive. Certainly Titchener's position is not applicable, if we limit ourselves in the use of the term "clearness" to clearness of meaning.

Is clearness an adequate measure of attention?

In considering Titchener's point of view in regard to the adequacy of the criterion of clearness as a complete and satisfactory measure of attention, we should keep in mind the fact that he is discussing the attentive consciousness structurally. He is asking the question, what is the structure or pattern of any state of consciousness as far as it is attentive? The fact, therefore, that the present discussion maintains that from certain points of view the concept of clearness is not wholly satisfactory as a measure of attention does not indicate more necessarily than that the structural treatment does not satisfy the demands of a functional consideration of consciousness. Titchener asks, what are the constituent elements of a conscious state? The present discussion inquires, what is the significance of certain conscious states in relation to the total onflowing of consciousness, particularly as it is exemplified in the learning process? Titchener, in following out his conception, describes the attentive consciousness as made up of a graded series, ranging from maximal to minimal clearness. Every sensation may be placed on this graded scale at some point, since clearness is an attribute, an unvarying accompaniment, of every sensation. This kind of clearness Titchener terms "attributive clearness." Attributive clearness is, in this sense of the term, meaningless fact. It is not a clearness due to the relation of the sensory experience to anything else. It is the primary equipment of all sensation as such before it has acquired meaning. A noise that I do not recognize, a scrawl that I fail to interpret, has some degree of attributive clearness, but no clearness due to its context or setting. The second kind of clearness, clearness of relation or meaning, is termed "cognitive clearness." Such clearness is considered by Titchener not as an attribute of the sensation, since it arises only as sensations become related and acquire significance. Therefore this variety of clearness is not a matter of the structure of the attentive consciousness, but of its function. These two kinds of clearness are quite different. Indeed, there is no necessary relation between them. According to Titchener, a state of consciousness may be attributively clear, and cognitively unclear, or the opposite.[1]

From the standpoint of the discussion of the learning process, it is scarcely possible to consider what Titchener terms attributive clearness. As has been stated in the chapter on sensation there is no warrant for the present discussion considering sensation as an isolated fact. Sensations only as they enter into relations and develop in the onflow of consciousness in terms of meaning or purpose are legitimate data for a functional psychology. Whenever we seek in the actual conscious process to find a sensation, we already discover something tinged with meaning. There is no meaningless fact. The slightest noise, the most unpromising scrawl, the merest glint of color, is still noise, or scrawl, or color, and thus has a meaning and a degree of cognitive clearness. For functional psychology, too, the sensation does not exist as something independent of its relations. These relations change it and make it over. A sensation recognized as a mere noise is not the same sensation as when it is later recognized as a musical note; it again changes its sensory character when the note is recognized as a bugle call; and still again it undergoes transformation when the bugle call is identified as that of a particular company. So the same original impression can continue to develop and change its character, as meanings develop and cognitive clearness becomes greater.

But in this process of development there is no stage so low that cognitive clearness is entirely absent; no stage so advanced that cognitive clearness has reached its maximum until the problem is finally solved. What seems to be attributive clearness at one stage of the process has been achieved by cognitive clearness at a previous stage. For

[1] The above outline of Titchener's position I have deduced in part from his published statements, but chiefly from a personal correspondence in regard to the matter. The chief differences in treatment between Titchener and myself lie apparently in difference of fundamental conceptions that make the two points of view difficult to compare.

example, the sound which now stands out, clear in this particular moment of consciousness, as a bugle call, and which seems to be merely clear in itself, and not because of a cognized relation to anything beyond, has attained this character of clearness because of previous instances in which the sound has been cognized. It has become attributively clear, when in an earlier experience it was merely cognitively clear. It is what it is, even as a sensation, because of such experiences that have developed in all their cognitive relations. Thus, while it may be serviceable in any given phase of consciousness to characterize the sensory and ideational elements as attributively clear, from the standpoint of functional psychology, which considers not what these elements are as given, but inquires into their origin and into their significance in the development of the thought processes, such a characterization seems not only useless, but, in the very nature of the case, impossible.

The foregoing then leads us to the conclusion that the only kind of clearness that the present discussion is warranted in considering is clearness of meaning. But clearness of meaning may be of a very low grade, and the attention of a high grade, or the opposite.

It seems, therefore, that in cases of strong emotional excitement at least, when we are confronted by situations in which we can find no direct and sufficient adjustment, that our attitude, while still strongly attentive, may be anything but cognitively clear.[1]

Attention both intellectual and affective in its nature.

From this point of view, it is more satisfactory to think of attention as being constituted of two elements, the relative prominence of either of which is determined by the degree of adequacy of the adjustment to the situation which calls forth the attentive consciousness. When the adjustment is being adequately and rapidly carried out, there is a large degree of clearness, and the affective element is in the margin of con-

[1] Whether the sensations at these times, as mere sensations, are clear, falls outside the scope of the present discussion. Titchener would maintain that since they are focal, they must of necessity be clear. However, in such a situation as this, the focal elements give the general impression of confusion and bewilderment. Perhaps they might better be described as attributively vivid.

sciousness to such an extent that at times its presence entirely escapes observation. There are other occasions, however, when the affective elements are prominent, and when these seem to "swamp" the clear, intellectual content. Here, as we have seen, we have states of strong emotional excitement, when the clearness of ideational content has almost vanished, while, on the other hand, we may have states of calm deliberation and consideration that seem cold, colorless, and non-affective. Clearness and affective intensity both become elements in the solution of a problem; they are relative to it; they represent various phases in the progressive solution of the problem. Generally speaking, as the problem becomes clearer, the means of solution more definite, their relation to the total thought content more exactly determined, the intensity of affection subsides, becomes more a matter of the margin, until in the end as the problem reaches a solution, the clearness has reached a maximum and the affective element a minimum. It seems that the attentive consciousness moves between two extremes; at one we may have a high intensity of affective consciousness with slight meaning, and, therefore, little clearness. If the attentive state progresses normally, relations are gradually formed, meanings arise, and clearness grows. When the problem is solved, this movement in the attentive consciousness ceases, and the whole drops into the inattentive field. As a result of this solution, and in consequence of the completed adjustment, there then appears in affective consciousness a glow of satisfaction, which, as a distinctly pleasurable state, stamps with approval the entire process of adjustment so completed, and assures its repetition when again a similar situation arises. Of course, it is quite obvious that every state of attentive consciousness does not run this entire course. However, when we measure the degree of attention in any phase of this course, as compared with any other phase, either preceding or following, we must take into consideration, not only the intellectual aspect of consciousness, which is the essence of clearness, but likewise the affective aspect that determines the intensity. Thus from the functional viewpoint, we can hardly assume that states of attention entirely devoid of the affective element can exist.

Psychology distinguishes, generally, various forms or aspects of attentive consciousness. One of the principal distinctions is between active and passive attention. Active attention is generally thought of as that form of attention which is due to the "will power" of the person who exercises it, while in passive attention it is supposed that the person attending, without any effort of his own, is impressed with the object before his consciousness. A favorite way of expressing this difference from a pedagogical point of view is that in active attention the mind goes out and seizes the object, while in passive attention the object seizes or takes possession of the mind. This is a mere simile, and contains certain assumptions that are untenable from the standpoint of theoretical psychology, and may become dangerous from the standpoint of practical pedagogy. Further, it is to be observed that if we conceive active and passive attention in terms of will power, or the lack of it, we are making an error in assuming such a power or force to exist, and are really interpreting our problem in terms of the outgrown and discarded "faculty" psychology. We must get another and more valid distinction between these two forms of attention, if we wish to be true to the facts of psychology, and also to find a serviceable point of view from which to work out our educational procedure.

The distinction between active and passive attention.

The difference between these two forms of attention can be stated in two ways. First, objectively, in terms of adjustment, and second, subjectively, in terms of mental content. The great difference between active and passive

The distinction in terms of adjustment and of mental content.

attention stated in terms of adjustment is that in the former there are tendencies of adjustment that lie outside of the object to which we are paying attention, while in the latter the entire adjustment is confined to the object itself.

A concrete illustration will serve to make clear this distinction. A child is sitting at his desk in the schoolroom, engaged in number work. If he is giving passive attention, all his activities are centered in the arithmetical processes which he is performing. If, however, while he is at work, he hears the call of children on the street and tends to look out of the window, thus adjusting himself partially to some object which falls outside of the problem at hand, but still partly or wholly inhibiting this tendency to turn away from his work, he is giving active attention.

On the subjective side the difference between these two forms of attention is to be found in the fact that in passive attention there are no evidences of distraction, no sensations of strain, or feelings of dissatisfaction in attending to the object before us. On the other hand, in active attention we get distinct impressions of tendencies that lead us away from the work at hand. These come often as allurements, and sometimes as distractions in the form of the fatigue accompanying concentrated attention, or of sense stimuli which cause our attention to fluctuate between the object which claims our thought and others that make demands on our interests. We have the feeling all the time that we must "bring" ourselves to attend to the object at hand. We are conscious of the expenditure of what seems to be to us "psychic energy," but which is rather a consciousness of conflicts in muscular adjustments. This gives us the impression of voluntary effort, and for this reason active attention is often given the name of voluntary attention.

Active attention in its most primitive forms, where it takes place on the lower levels of learning, consists in the fluctuation of attention between various objects of sensation, among which one of these by its greater vividness or interest calls forth predominatingly the attentive attitude. *In all higher forms of the learning process, however, active attention arises because of the conflict between immediate and present ends and remote and ideal euds.* For example, I hold my attention to the problem before me in spite of various sensory allurements and distractions, because of the desire to work it through to its ultimate conclusion. I have here in mind a remote, rather than an immediate end. It is for this reason that animals and little children, who live almost entirely, if not completely, within the round of immediate experience, have no ability to give active attention.

Active attention emphasizes remote ends.

Bagley, in his "Classroom Management"[1] has drawn the clearest and most helpful distinction between these two forms of attention, to be found in the literature on the subject. He says in part: "Whenever attention is determined by an end that is consciously beyond the needs of the moment, whenever present desires and impulses are inhibited or suppressed for the sake of some remote end to be gained, a struggle is inevitable between the thing that one knows one should attend to and the thing one knows one should not attend to. It is clear that, in general, the nearer the end, the more likelihood that it will win out over the momentary impulse. It is also clear that, the more vivid the image of the end to be reached, the more likelihood that the momentary impulse will be defeated. Likewise, the more highly the end is tinged with desire or positive emotional force, again the greater likelihood that it will be victorious in its struggles. All of these principles are simple correlaries of the general law; they are practically axiomatic; and yet it is safe to say that no principles so fundamental as these have been so woefully neglected in educational practice." The value of these remote ends, as contrasted with the immediate tendencies and desires in determining the proper reaction of the individual to his environment, need hardly to be commented on. It is these that distinguish largely the learning processes of man from those of the brute, and which make possible the whole scheme of human progress.

Beside active and passive attention, there is a third form which is known as secondary passive attention, and which Bagley makes of prime importance as an end of instruc-

[1] See Chapter IX, "The Problem of Attention," pp. 141–143.

tion. It is a well known fact that many of those things which we attend to only with a feeling of reluctance at the start, and which require a large amount of active attention, are ultimately attended to spontaneously. The young man who at the beginning of his business career goes to his work in the morning with reluctance, later on at maturity is entirely absorbed in its details. He cannot leave for a vacation, and even perhaps on Sundays and holidays we find him in the office, busily absorbed in its interests. The great reason for this change of attitude is due to habit. It is a common experience that many things which we attend to at first only with effort, gradually acquire an interest which they did not originally possess. As Bagley puts it, "We become habituated in course of time to almost anything that we persevere in, no matter how disagreeable that thing may have been at the outset. That is, the inhibition of distracting impulses becomes a habit, becomes unconscious."

Secondary passive attention.

Titchener [1] distinguishes three kinds of attention, as follows: —

"Attention appears in the human mind in three stages of development; as primary attention, determined by various influences that are able to produce a powerful effect on the nervous system; as secondary attention, during which the center of consciousness is held by a certain perception or idea, but is held in face of opposition; and lastly, as derived primary attention, when the perception or idea has gained an undisputed ascendency over its rivals. The attentive consciousness is at first simple; it then becomes complex, — reaching, indeed, in cases of hesitation and deliberation, a very high degree of complexity; and then it simplifies again. Looking at life in the large, we may say that the period of training or education is a period of secondary attention, and that the following period of achievement and mastery is a period of derived primary attention. Looking at experience more in detail, we see that education itself consists, psychologically, in the alternation of the two attentions; habit is made the basis of further acquisition, and acquisition, gained with pains, passes in its turn into habit; the cycle recurs, so long as the organism retains its nervous plasticity. Secondary attention thus ap-

[1] "A Text Book of Psychology," p. 275. (New York 1909).

pears, everywhere, as a stage of transition, of conflict, of waste of nervous energy, though it appears at the same time as the necessary preliminary to a stage of real knowledge."

Primary attention in the struggle for existence.

The most primitive learning is built obviously upon this primary form of attention, and is due to inherited tendencies to attend. The young child and animal alike spontaneously give attention to intense stimuli, like loud noises and brilliant lights; to stimuli that recur again and again, thus impressing themselves by repetition; to stimuli that come suddenly, producing marked changes in the environmental conditions; to stimuli in movement, to strange and unusual stimuli, and to stimuli falling in rhythm and cadence, as well as to all stimuli that make known organic needs. The organism has no interest in many of these stimuli in the ordinary sense of the word. Indeed, in adult life such stimuli call forth attention in opposition to interests, as, for example, when a person who is listening attentively to a lecturer turns suddenly when he hears a door opening or a person walking across the room. In another sense, however, these forms of attention are based upon racial needs and biological interests. Intense stimuli and often repeated stimuli are so imperative in their nature that, generally speaking, the organism is compelled, in the more rudimentary forms of struggle for existence, to take account of them if it survives. Novel stimuli, too, are important in the struggle for existence, and must be recognized in the more primitive forms of life.

Kuhlmann[1] in his study on the development of instincts in young birds has shown that the original reaction of the animal to the stimuli of the environment is one of fear, and that it gradually learns, by becoming accustomed to the stimuli, in so far as they are not harmful, not to fear them. If the reaction of the animal to those things to which he is unaccustomed were one of indifference, in which attention was slight

[1] *The Psychol. Rev., Monograph Supplement,* XI, No. 1, pp. 49–79 (1909).

or in which there was no attentive consciousness at all, he would shortly be eliminated in the struggle for existence.

It is scarcely necessary to comment on the fact that attention to organic needs is a *sine qua non* of survival. These instinctive interests which call forth the attention are so persistent that never can they be entirely ignored, not even in mature life; and in school instruction they must often be utilized when other means of securing attention fail.

Sensorial and ideational attention.

A distinction is sometimes made between sensorial and ideational attention. Sensorial attention is that which we give to the sensory stimulus, while ideational attention is that which we give to an ideational content. The former variety of attention is primitive, while the ability to develop the latter conditions the learning process in all its higher stages. It is not to be supposed, however, that in ideational attention we are dealing with materials that have divorced themselves entirely from a world of concrete reality. If the ideational content is to prove itself effective, it must have sufficient definiteness and clearness to bring about an adequate adjustment. Otherwise, it will be impossible for this ideal content to be held in mind long enough to secure the adjustment of which it is a symbol.

The teacher must find some interest to call forth attention.

An important problem presents itself concerning the relation between attention and interest. Here two questions arise at the outset. First, are we always interested in those objects and occurrences to which we pay attention; and, second, do we always pay attention to those things in which we are interested? From the biological viewpoint, we would naturally expect those things which are uninteresting to drop out of consciousness. Nevertheless, introspection seems to indicate that there are many objects that come into the focus of our consciousness, but to which we are indifferent. Some of these, indeed, are objects which may be said to possess not an individual, but a racial interest.

Every teacher has, doubtless, had the experience of observing members of his class grow less and less attentive to the lesson or lecture at hand, until perhaps he has walked across the room, or turned to the blackboard, or manipulated a piece of apparatus; whereupon the wandering attention would come back, and for a few minutes, at least, there would seem to be a genuine interest in what was being done. Such experiences as these clearly indicate the inherent force of these elementary forms of attention.

There are many occurrences which claim the attention from time to time that do not seem to possess the racial interest above pointed out, and that seem further to be without individual interest. A careful examination of most of these will probably reveal the fact that while they are not interesting in themselves, they possess interest in connection with a broader situation.

I may, for example, find the task of composition, on its mechanical side, entirely uninteresting, or even a bore, and yet I may pay attention to it, because of my wider interest in the end toward which my thought processes are working. There are always innumerable minor details in every occupation in which we engage, never mind how enthusiastically we enter into it, that are decidedly distasteful until they have become matters of habit, when they cease to have any affective value whatsoever. We attend to these only because they link themselves up to wider interests, or because habits themselves, as far as consciousness enters into them at all, become pleasurable through sheer repetition. It is true that, as Titchener says in discussing this matter, we may greet a friend with an absorbed interest, "with pleasurable concern or with foreboding unpleasantness; but we may also give him a perfunctory and mechanical attention, which leaves us wholly unaffected." This is, however, hardly the whole statement of the case. If I pay attention to him at all, it is because I have some interest in so doing, unless I do it entirely on the habitual and non-conscious plane, in which case it would not be fair to characterize my mental attitude (or rather lack of mental attitude) as attentive. I may not have, it is true, the slightest interest in greeting *him* at this particular time, and yet I have a wider interest which makes me react toward the total situation of which he is a part. This wider interest may be my desire to observe the ordinary social convention, or it may be my wish to conceal from him that I am not particularly pleased to see him on the occasion under discussion. It may be still something else, more remote; but, nevertheless, I cannot believe but that there is some incentive that leads me to attend at all.

If there are states of absolutely colorless attention, they are so rare that they can be ignored for all practical purposes; and educational psychology and applied pedagogy can with confidence adopt the maxim, "There is no phase of attention that is not accompanied by some positive or negative state of affection." It is a safe statement to make that *attention cannot be secured and held unless the object attended to possesses either an immediate or a derived interest of some sort.*

We attend to what interests us.

If we consider the second question which we have raised, as to the possibility of interesting objects and events being passed by without attention, we can reply with certainty that such a possibility is contrary to our general experience. Of course, it sometimes happens that there is a conflict of interests, and in this case matters of minor interest fall out of attention because of the fact that other matters possess a greater interest. This circumstance, however, in no way disproves the statement that we invariably attend to what interests us. It would, therefore, seem safe to assert that for all practical purposes interest and attention go hand in hand. Wherever there is attention there will be found some form of interest; and on the other hand, wherever there is interest, attention is bound to follow. The pedagogical significance of this principle is perhaps obvious. It will, however, be commented on more extensively later.

CHAPTER XVIII

ATTENTION IN RELATION TO LEARNING

EXPERIMENTAL psychology has brought out many interesting facts in regard to attention that have obvious bearings on educational theories and practices. Some of these may be stated as laws of attention. One of these is that the range of attention is limited. We cannot pay attention to many different things at the same time, and if we appear to do this, it is because we attend to these various things in different phases of attention. It is difficult to determine how many different things we can attend to in a single moment of consciousness. This difficulty is largely due to the fact that the meaning of a single thing varies under different conditions.

The range of attention is limited.

For example, written characters may be quite different if they are characters in the Chinese alphabet, or in an artificially constructed set of nonsense characters, from what they would be as letters in a familiar alphabet. We can grasp but a few of these nonsense characters in a single pulse of attention. On the other hand, letters of the English alphabet, if constructed into words and sentences, may be grasped in considerable numbers in a single phase of attention, because they are brought together in a meaningful unity.

It is safe to say that all the elements that may be grasped together in one pulse of attention, fit together in some general way; the greater the similarity, for the purpose at hand, the greater our experience with them, the more we can grasp in any one instant.

Experiments have shown that attention comes in waves; it tends to take a rhythmical form. If, when seated in a quiet room, you observe the ticking of a watch removed to the limits of audibility, you will notice that at times you will distinctly hear the watch, and at others it will appear to be silent. This is not because there is any change in the strength of the tick-

Attention comes in a rhythmical form.

ing, but it is because your attention ebbs and flows. Further, experiments have shown that these briefer waves of a few seconds' duration are parts of longer ones covering periods of perhaps hours.

As Seashore[1] has stated it, "There are infinitely short ripplets of attention hardly perceptible; these form the surface of ripples, which in turn form the surface of wavelets; and these wavelets, in turn, form the surface of the wave, and so on. Thus, all attention is rhythmic, and there is a rhythm within rhythm, from the infinitesimally short to the very long, even daily and annual periodicities." This rhythmic form of attention is, doubtless, in part, at least, to be explained on physiological grounds. It seems to be interwoven into our very beings, and doubtless explains why those external stimuli that come in a rhythmic form are so important from the standpoint of primary attention.

Motor accompaniments of attention.

The relation between certain bodily attitudes and attention has likewise been emphasized in experimental psychology. These bodily attitudes come in the form of either incipient or fully expressed motor accompaniments that seem to be essential to the attentive consciousness itself. This, of course, is as we should expect, from the point of view which we have held to throughout this discussion, namely, that attention is the subjective correlate of adaptation, or adjustment to a situation.[2] Some of the adjustments that accompany the attentive attitude are: (1) The adaptation of the sense organs, to give the greatest clearness and distinctness to the stimulus attended to. For example, the accommodation and the convergence of the eyes on the object that is to be brought into clear vision, or the turning of the head and the adjustment of the ear to sounds to which the person is listening. (2) The placing of the body in such a position as most advantageously to receive the stimulus; for example, the craning of the neck and bending forward to catch the least sound or the slightest visual appearance. (3) The inhibition, to a certain extent, of the breathing

[1] *Op. cit.*, p. 161. [2] See preceding Chapter, p. 260.

and changes in circulation; for example, holding the breath, and becoming absolutely quiet, when listening attentively. Without the proper attitude, it is very difficult, sometimes impossible, to give any attention whatsoever. These mechanical aspects of attention must be carefully considered in order to secure the highest degree of concentration in the work of the school.

Experiments have further been conducted on the relation between attention and distraction. It is found, in general, that if a distraction comes with regularity, and continues for some time, the attention soon adapts itself to this condition, so that no unfavorable effects are experienced.

The relation between attention and distraction.

Newspaper writers, for example, find at first the din and confusion of the office so distracting that they can do but little work. In a short time, however, they are able to ignore these distractions entirely, and in the end become so accustomed to them that they do their best work only when they hear the click of the typewriter and the telegraph key and the hum of conversation.

It has also been found, by experimental tests and through general observation, that the most concentrated forms of attention are not always secured through absolute freedom from distraction. The explanation for this seemingly remarkable fact is to be found in the circumstance that in the presence of the distracting influence the person puts forth a greater amount of attention to overcome the adverse conditions. This increase in attention is more than sufficient to overcome the injurious effects of the distraction, and hence a positive increase in attention is thus secured. In general, it seems to be true that *the optimal conditions for intellectual work are not always those that ideally seem to be the most satisfactory. The incentive of having certain difficulties to overcome often leads to a total accomplishment that would not be secured if these obstacles did not exist.*

Various attempts have been made to measure attention, but none of these has proved entirely successful. In fact, attention has not itself been measured, but rather the accompaniments of attention.[1] Among the various methods employed for the measurement is the record of the uniformity or lack of uniformity in a given activity. If there are wide fluctuations in this activity, it is assumed that these are due to periods of inattention. If, on the other hand, the activity proceeds without marked fluctuation, it is assumed that the attention is well and continuously adapted to the task on hand. Obviously, a high grade of mental work cannot be carried on when attention is constantly relaxing and the mind is turning away from the problem. A second method of measurement is to note whether a person engaged in a given activity is easily distracted or not. The intensity of the attention is supposed to be in proportion to the difficulty of turning it in some new direction. The evidence for distraction in this test is found in the relative deterioration of the efficiency with which the person performs his work. Both of these methods are capable of application in the schoolroom, and, assuming that they have validity, a considerable amount of data can be collected in regard to those distracting influences that decrease the efficiency of the pupil. The practical value of such data, if they are significant, would be considerable, since it is obviously a tremendous waste in learning to work except under the most advantageous concentration of attention. The consideration of attention, and the distractions which occur in active attention, bring us at once to the problem of mental fatigue.

Indirect methods of measuring attention.

The term "mental fatigue" is used with great inexactness, but may be taken, in general, to denote that sort of fatigue that is the accompaniment of mental work. In

[1] In the Cornell laboratory Geissler has attempted to devise an accurate method for measuring attention which may accomplish something definite in this direction. See *Amer. Jour. of Psychol.* XX, pp. 120–130; also 473–529 (1909).

this sense the term "mental fatigue" is to be distinguished from physical fatigue, which arises in connection with physical work. Most writers on the subject, however, use mental fatigue also to denote nervous fatigue as distinguished from muscular fatigue. It is obvious that these two meanings of the term are by no means identical. *Mental fatigue in the first sense of the term, including all fatigue that arises in connection with mental work, denotes muscular as well as nervous fatigue.* A large amount of so-called mental fatigue is probably due to sensations of muscular strain that accompany the processes of adjustment during active attention. It may be questioned whether there are any actual sensations that arise from nervous fatigue under ordinary circumstances. When we feel tired as a result of mental work, it is because in most instances we sense the weariness of the muscles that function in accommodation and convergence of the eyes and of the muscles of the neck and forehead, as well as of the trunk and other parts of the body. This fatigue is not so pronounced or so general as that connected with physical work, but it is different rather in degree and intensity than in kind. It is also true that no small part of that which ordinarily passes for mental fatigue is not fatigue in any genuine sense of the term (*i.e.* of exhaustion), but is rather distaste for the work at hand, and a desire to follow out more attractive activities that continually lure us from our task. Ordinarily, we are not so much tired by our work as "tired of" our work. When nervous fatigue has really reached the point where its effects are discernible by the subject experiencing them, he is in a condition more or less serious. Indeed, the signs of nervous fatigue sometimes do not appear until the patient has reached the stage of complete nervous exhaustion.

Distinction between mental and physical fatigue.

The cause of fatigue, whether muscular or nervous, is according to a widely accepted theory due to the deposit of poisonous by-products arising from the metabolic processes in the muscles and the nerve cells. These poisons act as a protection, especially in the case of muscular work, and prevent an excessive expenditure of physiological energy, which would prove injurious to the organism. If a muscle has been active continuously for some time, fatigue sets in, and it is incapable longer of contracting in response to the innervation of the nervous centers. If this same muscle, however, is washed out, so that the products of metabolism are carried away, it recovers from its fatigue, and is able again to perform work. Thorndike has suggested an interesting parallel to this washing out of the muscle in the case of so-called mental fatigue. Here the mind is capable of continuing its work when attention begins to flag by ignoring the sensations of weariness and various affective states accompanying them, and in this way, by refusing to pay attention to these distractions, in a sense washing them out of consciousness.

The common view of the cause of fatigue.

Recently a second theory in regard to the nature of fatigue has been advanced by Sherrington,[1] McDougall,[2] Yoakum,[3] and others, which holds that all fatigue is neuro-muscular in its nature, involving both the muscles and the nerve cells. Its essential nature consists in the blocking of the paths of discharge in the nerve tracts at the joining of the neurones (at the synapses). This results, according to Yoakum, in the shifting of nervous coördinations, and is accompanied by the shifting of attention in the conscious processes. These shifts of consciousness relieve the fatigue; however, if they do not occur in a coördinated system, but are scat-

The theory of Sherrington.

[1] "The Integrative Action of the Nervous System," particularly pp. 214–221 (New York, 1907).

[2] "The Conditions of Fatigue in the Nervous System." *Brain*, November, 1909, pp. 256–268.

[3] "An Experimental Study of Fatigue." *Psychol. Rev., Monograph Supplement*, IX, No. 46 (1909).

tered and diffuse, a high degree of mental work is impossible. On the other hand, slight fluctuations of attention within a definitely coördinated field can take place without injury to the thought processes. If there is not this mental organization, however, the thinking leads to no definite end, and is ineffectual. Here again we find emphasized the necessity for the control of the thought processes toward some definite end. This theory is well suited to a psychological explanation of the essential nature of fatigue, and fits the facts brought out in connection with mental fatigue more exactly than does the theory first discussed. However, the signs of fatigue are identical under either theory, and the methods of minimizing the effects of fatigue are not essentially different. Yet on the theory of Sherrington a more satisfactory treatment of the problem of fatigue in the schoolroom can be worked out. The pedagogical applications of this theory will be discussed in a subsequent paragraph.

Mental and physical tests for determining fatigue.

Various methods have been devised for determining mental fatigue, especially as it arises in connection with the work of the schoolroom. These tests may be divided into two classes, mental tests and physical tests. The physical tests concern the pulse volume and pulse rate, the breathing, the blood pressure, etc.; the algometer (pain sensitivity) test; the ergograph and dynamometer (muscular work and strength) tests; the tapping test (rate and accuracy of tapping); the æsthesiometer-compass test, and the like. This last-named test was first employed by Griesbach, and assumes that there is an essential relation between mental fatigue and the ability to discriminate sensory stimuli.[1] The greater the fatigue, the less is the test person able to distinguish two compass points when applied to the skin, as two. As fatigue increases, the points must be

[1] "Über Beziehungen zwischen geistiger Ermüdung und Empfindungsvermogen der Haut" (Leipzig, 1895).

separated more and more in order to obtain from the subject the judgment of duality. The assumption of Griesbach has been seriously questioned by later investigators, with the result that it is no longer considered more than an indication of fatigue, and by no means an absolute measure. The same may be said in general of the other physical tests.[1]

The mental tests aim to measure fatigue by determining the quality and quantity of mental work. The principal tests of this character are the adding test, the dictation test, and the memory test. Usually as fatigue sets in the quality of the work falls off before the quantity is affected. Indeed, for a time the quantity may be greater. As in the case of the tests for attention, the fatigue tests measure the accompaniments of fatigue rather than actual exhaustion. They do not distinguish between actual fatigue and concomitant conditions such as wandering attention, lack of interest, *ennui*, and the like. They do, however, in a fair way measure the conditions under which the school work is done under various circumstances, and, therefore, as far as they are accurate, have a significance for pedagogy.

The work curve.

As can be seen from the foregoing, the question of the course of the work curve is closely connected with that of fatigue, though these two curves are not identical. Kraepelin[2] and his pupils have given a large

[1] Practically all the methods for determining the course of fatigue during the school day have been brought in question. Leuba (*Psychol. Rev.*, VI, pp. 573–598) and Germann (*ibid.*, pp. 599–605) criticize particularly the æsthesiometer; Bolton (*ibid.*, VII, pp. 136–137) points out particularly the inadequacy of the ergograph test as used by Kemsies (see "Arbeitshygiene der Schule auf Grund von Ermüdungsmessungen," Berlin, 1898); Thorndike (*ibid.* VII, pp. 466–482 and 547–578) shows the inadequacy of various mental tests. In his discussion he draws a careful distinction between the lack of desire to work and the lack of ability to work. He concludes that "mental work effected no decided decrease of physical power." A criticism based on the use of the various methods as compared with each other is made by Ellis and Shipe (*Amer. Jour.*, XIV, pp. 496–509).

[2] "Die Arbeitskurve." *Wundts Philos. Stud.* XIX., pp. 459–507.

amount of attention to the character of this curve, and their results are significant. The work curve is a compound curve, made up of several factors, of which fatigue is the most important. Another factor is due to the initial warming-up and adaptation of attention. We seldom begin at our maximum. Then, too, if the work that we are engaged in is not purely habitual, we gain facility, if we continue it through a considerable period, by practice. We also tend to work by spurts. Further, we start in, as has been pointed out, with a considerable amount of interest in a new task, but rapidly or gradually this initial enthusiasm tends to run its course and disappear.[1] There are three general types of the work curve for any one work period. A certain number of individuals, by no means the majority, do their best work at the beginning of the task. Others show improvement for a relatively brief period up to a maximum, then with certain fluctuations the work deteriorates; still others, with slow adaptation of attention, but with slight tendencies toward fatigue, improve for a considerable period and reach their maximum toward the end of the work period. Probably on the whole the second type of the curve is more common. The quantity of work that can be done at various periods of the day likewise seems subjected to individual variations. Some do their best work in the morning hours, while others reach their maximum later in the day.

The most important results of various tests of the fatigue and *ennui* accompanying school work may be summarized as follows:—

Injurious fatigue not common.

1. Injurious fatigue is not common among school children. It is probable that the impor-

[1] "Unsere bisherigen Betrachtungen haben uns gezeigt, dass die Arbeitskurve eine recht verwickelte Zusammensetzung aufweist. Uebung und Ermüdung, Gewohnung, Anregung und Antrieb in wechselnder Grösse, dazu Uebungsverlust und Erholung wirken mit und gegen einander, um alle die mannigfaltigen Gestaltungen der Arbeitskurve, zu erzeugen." Kraepelin. *op. cit.*, p. 489.

tance of the whole question of fatigue in the schools has been greatly overestimated, as far as its physiological results are concerned.[1] As far as the mental effects go, however, it is highly important to know under what conditions the most effective learning can be accomplished, and it makes little difference to practical pedagogy whether the deterioration in work is to be traced to fatigue sensations or to mere *ennui* and lack of interest. If such conditions exist, they must be remedied, whatever their cause.

Well adapted attention minimizes fatigue effects.

2. The most effective remedy for so-called mental fatigue, as it arises in the school, lies in a better adaptation of attention to the work at hand with a corresponding ignoring of the distractions and sensations of weariness that appear as the work progresses. Most children, and indeed students more advanced in years, do not seem to be able successfully to resist these distractions. Many abandon work after a short period because they have not habituated themselves to ignore these conditions. Experiments by Seashore and Kent at the University of Iowa[2] and later by Thorndike at Columbia University[3] seem to show that if these distracting influences are disregarded, mature students can continue mental work for hours with practically no diminution in efficiency. In other words, the curve for mental work, while it shows insignificant fluctuations, indicates no pronounced falling off for periods extending over hours. As far as adults are concerned, there is little reason to believe that they cannot continue for long consecutive periods to do efficient mental work, if they have accustomed themselves to ignore incidental distractions and

[1] Both Lee (*op. cit.*) and Offner ("Die geistige Ermudüng," Berlin, 1910) assert that there is little cause for anxiety when children show signs of weariness. They should be accustomed within limits to ignore the discomforts of fatigue.

[2] *Psychol. Rev., Monograph Supplement*, VI, No. 5, pp. 46–102 (1905).

[3] *Jour. of Ed. Psychol.*, II, pp. 61–80. (1911)..

to resist feelings of distaste that are sure to arise, particularly during the first part of their efforts. With children, however, the problem is somewhat different, and it is probably unwise to demand as long periods of sustained work as would be expected of mature pupils, both because of actual fatigue and because children have not accustomed themselves to ignore the accompanying *ennui* that makes the work, after a short time, distasteful, and therefore, relatively ineffective.

Pleasant work less fatiguing than unpleasant.

3. Pleasant work seems to be much less fatiguing than unpleasant. This fact has two explanations. It is a physiological law, already pointed out in this discussion, that pleasure tends to heighten the activity of an organism and displeasure to lower it; therefore, under conditions of pleasurable experience, the positive fatigue will be less than under conditions of unpleasant experience. Further, as we have already seen, the tests for fatigue do not distinguish between physiological fatigue and mere dissatisfaction, or unwillingness to do the work, or lack of interest in it. The fact that the work is pleasant signifies that these latter factors do not exist, and for that reason the work is done under more favorable conditions.

Physical work more fatiguing than mental work.

4. Physical work is apparently more fatiguing than mental work, especially when the former is of a vigorous nature. Relief from the tedium of a school hour is not obtained by a period of gymnastics or similar exercises. Whether the fatigue be physical or mental, the most effective remedy has been held by many to be absolute rest. This statement may seem to run counter to the general experience that a person may relieve himself from the strain of mental work by walking or by other forms of mild exercise. The explanation of this seeming paradox is to be found in part in the fact that in mild exercise there are certain bodily effects of circulation and respiration that

are beneficial and more than counterbalance the fatigue effects of the exercise. Also there is a shift in the locus of the fatigue sensations that is beneficial. Further, it is to be remembered that since a part of the mental fatigue is really due to loss of interest in the work, a change from mental to physical work offers a relief and removes the tedium. For this reason it is probably desirable in long periods of school work to change its character from time to time, for although this change may not lessen actual fatigue, it creates a new interest that permits the work to be carried on more effectively.[1]

Automatic learning less fatiguing than learning with attention.

5. On the whole, automatic learning seems to be less fatiguing than learning with sustained attention. This is to be explained by the fact that in automatic learning the process is conducted on the level of habit, and active attention is not required to any considerable degree. Active attention, while necessary in school work, is accompanied, as has already been said, by certain wastes in physical energy due to the distractions that arise in its course. The larger the number of subjects in the school that can be reduced in part to the plane of automatic learning, the greater the economy. For example, it is a tremendous waste of time in number work for the pupil to be obliged to reason out the multiplication table, or in composition to puzzle over the spelling of certain words that he should have at his command.

Associative bonds weakened in states of fatigue.

6. In states of fatigue the mind seems less capable of forming associations. The whole learning process goes back to a lower level, and the ideas that appear in consciousness are due rather to "persistence" than to meaning. In other words, work of any high degree of significance cannot be accom-

[1] If fatigue is to be explained on the neuromuscular theory of Sherrington, there arises an actual relief in the shift of attention that is coördinated with the opening of new paths of nervous discharge.

plished when the person, because of fatigue or the general irksomeness of his task, is not able "to think." Under such conditions, his mind is apt to be filled with irrelevant ideas, which come up, unbidden apparently, from the depths of his consciousness.

Morning hours best for school work.

7. Experiments seem to indicate that the afternoon hours are less favorable to school work than morning hours. Also, for many children the first hour of the school work is not so effective as those immediately following. This is due, in part, to the fact that the warming-up process consumes time, and that attention is slow in adapting itself. It is also true that there is a natural letting up in the work just before the close of school, at noon or in the afternoon, and before holidays and vacations. This is to be explained rather because of the attitude of mind that the pupil brings than because of any real fatigue. It is safe to say that the most effective work in the school can be done in the middle morning hours, and that the afternoon work, on the whole, should be of a nature less exacting than the morning work.

Nervous fatigue of a serious nature demands special treatment.

8. The symptoms of mental fatigue in the sense of nervous exhaustion are quite different from those of the normal fatigue of an ordinary school day. If the child is not refreshed by his night's sleep, if he is nervous and irritable, if he cannot sit in an attitude of attention at his desk, at least part of the time, but lolls about, if his hands have a nervous droop when extended, and if he cannot stand erect with his eyes shut, if his face is flushed and his general attitude listless, and if, further, he shows on examination marked decrease in sensitivity, it is reasonable to conclude that he is a victim of grave nervous fatigue or some other similar disturbance. In this case, he is no longer a fit pupil to remain in the school, but requires special treatment. Cases of genuine fatigue that have reached

the pathological stage are often stubborn, and recovery is slow. The onset of such troubles should be taken note of at once by the teacher, and the pupil dealt with accordingly. Fortunately the average school child is protected from the dangers of excessive nervous fatigue, because of the diffuse nature of his attention, its tendencies to wander in an irresponsible way, and the impossibility of securing his interest, under normal circumstances, in his work for long periods at a time. There are, however, children of a somewhat precocious disposition who are capable of sustained attention for a much longer period, and whose general interest in and enthusiasm for their work offer a constant temptation to the teacher to crowd them. They are not protected so readily by these natural safeguards from overwork; and in many instances they possess a somewhat more unstable nervous system than do their less brilliant but more normal schoolmates. For the great majority of school children no such danger exists, and the problem for the teacher is to secure better attention and greater interest, so that learning will be under more economical and effective conditions.

Organization of work minimizes effects of fatigue.

9. Finally, the greatest safeguard against fluctuating attention and the distractions attendant on mental work is to be secured by the teacher so organizing the work that it presents a system of related and meaningful parts. When the attention wanders from one aspect of a subject so organized, it is brought back to the central thought by a closely related avenue. This is the most potent method of securing attentive application among the pupils of more advanced grades. No ordinary interest in the work at hand is so effective as is the proper organization of subject matter.[1] Such organization becomes more and more imperative as the pupils advance in age and in intelligence.

[1] It is impossible to secure the attention of animals for any length of time, even under the stimulus of extreme hunger, for among brutes there is an entire lack of mental organization.

CHAPTER XIX

PEDAGOGICAL APPLICATIONS OF THE DOCTRINE OF ATTENTION

The child cannot attend without the proper physical attitude.

It has already been pointed out in an earlier part of this discussion that attention may best be considered from the standpoint of adjustment, and that, therefore, the motor aspect of it is most important. It would, therefore, seem that in order to secure the highest degree of attention from the child he must be required to do something, have some positive attitude, in connection with the work at hand. This doing, however, does not necessarily mean the manipulation of charts, diagrams, and the like, although such activities tend to gain and hold the attention. Adjustment to the situation very often means simply correct attitudes of study. The adjustments in these cases are those of the eyes, head, and trunk, very largely. *The position in which the pupil sits at his desk is of a great deal of importance.* The hygienic aspect of a proper bodily attitude has often been discussed; a correct attitude from the standpoint of attention is equally important. *The child cannot attend unless he has the proper physical attitude.* It is no matter of small importance to see that he assumes this attitude.

The pupil who rises slowly from his seat, and shuffles to the blackboard, hanging himself on the chalk trough, is not in the proper attitude, as President L. C. Lord of the Charleston Normal School has pointed out. He is inattentive, largely because he has not adjusted himself to the situation. The remedy for his inattention is to make him rise quickly from his seat, walk briskly to the board, and stand in readiness to do the work given him.

On the other hand, there are numerous superfluous motor expressions of the child that do not indicate concentrated attention in its most effective form.

Superfluous motor expressions not the accompaniments of attention.

If, for example, children, particularly in the fourth and fifth grades of the elementary school, are given a series of words to commit to memory, they manifest in the learning all sorts of bodily contortions and facial grimaces. They wrinkle their foreheads, twist their mouths into unusual shapes, strike the fist of one hand into the palm of the other, and move about in their seats. This, is a manifestation of an inadequate and incomplete adjustment to the object of attention, and is probably accompanied by a considerable degree of emotion. For this reason, it is not the most effective attitude for learning. It seems to develop as a habit, at about this time of the school life, and although, to inhibit this habit, when it has been once formed, may cause a greater distraction to the pupil's attention than to allow him to continue in it, still it is desirable to see that no such habit is formed. It seems to be a part of the restlessness and haste which is characteristic of a great deal of the work, especially in the lower grades.

While experiments seem to indicate that children should not be compelled to keep perfectly still in their learning, it seems equally desirable that such excess activities as those discussed above should be discouraged in the schoolroom.

The relative value of active and of passive attention.

One of the most important questions in connection with the attention arises in discussing the relative value of active and of passive attention. As has already been pointed out, passive attention, whether fundamental or derived, is less wasteful of time and energy than is active attention; therefore, more can be accomplished in the stage of passive attention than in that of active attention. The goal of education would seem to be to turn all active attention into the passive type, or, in terms of the Herbartian phraseology, to create permanent interests. On the other hand, it is equally evident that if it were possible to present all subjects in the school curriculum in such a manner that the pupil were never compelled to give anything but secondary passive attention, such a state of affairs would be serious, since the pupil could never accustom himself by this means to pay attention to remote rather than immediate ends, if in the artificial school environment such a form of attention were not necessary. He would find, however, that he could not succeed in the life of the world outside, if he followed simply the line of least resistance and considered only those objects to which his immediate desires prompted him to give attention. Only through the direction of active attention is it possible to build up the higher learning processes.

Pedagogical significance of interest.

This consideration brings us at once to the pedagogical significance of interest in its relation to attention. The emphasis of the doctrine of interest in education during the last few decades has worked a profound change in our educational attitudes, and has brought about a revolution in our methods of teaching. It has been of incomparable benefit in many ways, and has been a most wholesome corrective to the dry-as-dust methods of the past. Yet its benefits have been accompanied by certain disadvantages and many misconceptions. The whole doctrine of interest has been misunderstood and perverted in many quarters. It has given rise to the "soft pedagogy" of recent days, which is as disastrous as it is futile and psychologically unsound. We have been told that we must interest the child if we wish to secure his attention, and to this we must assent; but to interest him does not mean simply to amuse him, or to demand from him in his learning only those things which suit his immediate desires. In the first place, it is to be remembered that a genuine interest is by no means incompatible with serious work, or at least with a determined expenditure of energy in overcoming obstacles and arriving at ultimate results. When it is necessary, — and it often will be in any well conducted school, — the teacher should not hesitate to demand the pupil's attention to those parts of the school work that have in them elements of drudgery and routine. *It is more valuable that the child should learn the lesson of controlling and directing his attention, than that he should master in the easiest manner the materials immediately at hand.* This does not mean that the teacher should go out of his way to make the school tasks unnecessarily difficult; they will be hard enough at the best; but it does mean that the teacher should never get around obstacles that should be overcome by the pupil rather than circumvented.

The boy in school who is encouraged to take the path only that his immediate and narrower interests prompt him to take, develops, perhaps, in the course of his primary and secondary education, a love for manual training, an aptitude for handling tools, and for constructing materials. "How splendid this is," says the advocate of soft pedagogy; "we could never have kept him in school, if he had not had these subjects to call forth his interests. It is true that he has done very little with his English or his mathematics. He simply did not care for them, and it would be a crime to force him into those subjects for which he has no interest and which do not appeal to him as being valuable." Very good. This seems a plausible argument. But the boy has ideals, since he is a human being, that lead him beyond the present, and suggest to him a career. To his town return, in the summer, a number of his older friends from the neighboring university. They tell him of the possibilities of a career as a mechanical engineer, and they arouse his ambitions. When he graduates from the high school, he goes to the university, and finds much to interest him in the metal and in the wood shops; and he works here with an interest so great that he receives high commendation from his instructors. But he does not like mathematics, and he has no taste for English and foreign languages. He finds out, however, that in order to be an engineer he must know a good deal of algebra, trigonometry, and calculus; he must have a smattering of foreign languages (at least these are required, wisely or unwisely, in the course of study which he is pursuing), and further, he must be able to write English at least tolerably well, and to be familiar with a few of the best books in literature. However, his training in soft pedagogy has proved too much for him. He has learned that it is a crime to follow anything but his immediate interests, and so, since he cannot take his engineering course without the substantial subject of mathematics and the "frills" of language and literature, he concludes it is not worth while, and drops out of the university, going back to his native town to become an invoice clerk in a local manufactory. Here at last he learns the lesson, but too late for him, that in order to succeed, one must subordinate one's present desires to one's higher purposes.

Interests need not always be intrinsic.

Connected closely with the fallacious assumptions of soft pedagogy in regard to the nature of interest is the belief among certain educators that the interests which the pupil has in a subject must be of an intrinsic nature, *i.e.* these interests must lie in the very nature of the subject itself, and not in any circumstance that is connected with it. For example, if the child is interested in his composition work, it must be because of a genuine desire to express his thoughts by such a medium; if he is interested in his number work, it must be because he recognizes its economic importance. Therefore, all the problems in arithmetic must be of the sort that appeal to the child from his own sense of commercial values. His geography lesson, too, must be worked out on the same plane, and it must never pass beyond the sphere of his immediate interests. This is the way, we are told, in which knowledge has developed. There have been no luxuries in intelligence. All the subjects of human study have arisen because of their practical significance. If it had not been for the necessity for measuring land, there would have been no geometry; in trade we have to count and make change, hence the necessity of arithmetic; in communication with others, we are obliged to speak and write, hence the development of language. While this account of the growth of knowledge is in a sense entirely correct, and accords with the pragmatic principles which we discussed in an earlier chapter, its pedagogical force is modified by two important considerations. In the first place it must be remembered that beyond the immediate necessities of knowing, the instinct of curiosity has led the human mind to push out beyond its most narrow confines. In this way knowledge has developed beyond immediate needs. It must also be remembered that this process of learning has been a very slow and wasteful one, and that since it is the business of education to prepare the child for a future environment of which the child has no adequate conception, it is necessary to short-circuit this racial method of gaining knowledge, and present a large body of facts to the child before they are inherently interesting. So it happens, in the first place, that we can interest the child in knowing merely for the sake of knowing, because the child is curious. We are not obliged to bring to his consciousness any social or practical notion whatsoever, in many instances, in order to stimulate him to learn. Learning has an interest in itself. It must further be remembered that there are many extrinsic interests that attach to the subject matter of the curriculum, *i.e.* interests that do not belong to the subject matter itself, but rather to the conditions that surround it, that may be legitimately appealed to in order to promote interest and attention in the subject itself.

Rivalry a strong incentive to learning.

One of the strongest incentives to learn that the pupil has is the incentive of a natural and healthy rivalry with his mates. This is an instinctive interest which actuates not only children, but adults, to do many things that are in themselves incapable of securing passive attention. *Social pressure and the desire for social approval have been among the most potent factors in giving to the world its treasures of material and even spiritual wealth.* Those educators who deny the value of this social sanction have seen only a very small part of the total problem, and have but dimly comprehended those forces which have been instrumental in producing the civilization of the present day. For this reason school grades have a practical justification, and the giving of prizes and other marks of distinction a decided pedagogical value. Of course, it hardly needs to be added that this spirit of emulation should never become so excessive as to arouse disappointment and bitterness, and produce an atmosphere of unrest in the schoolroom. In this, as in all other respects, the golden mean must be followed.[1]

It should, however, be kept in mind that whenever it is possible to link up economically the subject matter with some intrinsic interest, it should always be done. For example, the teaching of English composition can be accomplished by arousing the pupil's spirit of emulation, or by offering a prize for work of superior merit, or in other extrinsic ways his interests may be called forth. There is, however, in general a better way of accomplishing this result.

Intrinsic interests, however, have a superior worth.

In a series of investigations carried on by the writer, some years ago, in one of the high schools of Worcester, Massachusetts, [2] it was found that the compositions in which the pupils were encouraged to express those ideas that were interesting and vital to them showed a higher degree of merit, both in inventive ability and in form, than did those compositions that were turned out in the course of the ordinary "grind."

It would be difficult, however, to explain to the average pupil the value of learning the multiplication table except as a part of the ordinary school tasks. Its immediate practical advantage might be pointed out, but this would be of little significance to him. In seeking to develop subjects according to their intrinsic interests a good deal has been accomplished, and the attempt to further develop such interests should be encouraged up to the point where they do not waste a large amount of valuable time, and lead, as such attempts sometimes do, to all sorts of far-fetched and sometimes ridiculous excursions into "experimental" pedagogy.

In discussing the topic of interest, it should further be kept in mind that a subject, not originally interesting, may become so, after it has been comprehended and mastered. This acquired interest is due in part to the fact that the at-

[1] Compare Chapter II, p. 29, and Chapter IV, p. 61.

[2] "Invention vs. Form in English Composition." *Ped. Sem.*, IX, pp. 393–421 (1903).

tention is held to the subject matter until the attitude becomes habitual, and, therefore, at least not unpleasant. But the principal cause of the development of interest in such cases is due to the fact that the subject gradually acquires a meaning and significance. This significance appears because the various parts of the material learned have become associated in such a way that the relation between these parts is comprehended, and because the suggestion of one topic brings also to mind many others. When the pupil discovers that there is "something in the subject," he acquires a liking for it, especially in the work of the higher grades and in the high school. The teacher should never fear when there is a lack of interest at the start, if he feels capable of bringing to the minds of his pupils, as the course develops, the meaning of what they are studying. This is particularly true of such subjects as history and nature study, in which causal connections can be traced out and results definitely shown.

Subjects not originally interesting may become so.

The mistake is often made of supposing that interest is always positive, *i.e.* that we act in the direction only of the promptings of pleasure and desire. Interest may equally well be negative. The motive force which impels us to action may be the desire to escape punishment as well as to gain a reward. In experiments in animal psychology, the fact that painful stimuli are more potent in securing and holding attention than are pleasurable stimuli is significant. On the lower levels of learning this is the principal motive of conduct. On the higher levels, it plays a less important, but not an insignificant rôle. The question of punishment in the school is as important as that of reward.[1]

Interest may be negative as well as positive.

Soft pedagogy has interpreted the doctrine of interest in a manner which has led to serious theoretical and practical consequences; it has likewise made an error in its interpretation of the significance of effort. Work de-

[1] Compare Chapter IV, p. 60, of this book.

mands that obstacles shall be overcome. The work of the schoolroom is no exception to this rule. The fact that attention cannot attain its highest degree of efficiency without distraction is tremendously significant in the entire realm of education, and indeed in the whole course of racial development. A certain amount of hardness in the environmental conditions produces better results in the long reaches of evolution than does an environment entirely favorable. So it is throughout human life. *If the teacher could remove every difficulty in the schoolroom, he would have gone too far, and would have failed of the end that he is striving to reach. The easy chair has no place in the study.*

Soft pedagogy has misinterpreted the significance of work.

To secure the best attention in the schoolroom, the teacher must give careful consideration to the sequence of the various parts of the program of study, and must also intersperse judiciously periods of rest and recreation. As we have already said, the problem of fatigue includes, from the practical point of view, not merely fatigue as such, but the loss of interest as well. We must not continue any subject so long that it becomes a bore. When we remember that the average adult of ordinary intelligence finds a discourse extending over an hour too long, unless it be of unusual merit, we may readily see that little children will soon become tired of a subject that continues through a period of considerable length. In the lower grades, there should be many changes in the program. Probably not more than twenty minutes should be spent on any topic, unless in the course of its development different phases of this topic are emphasized. Likewise the periods of rest should be much more numerous. There should not be the same recess for the whole school. The small children should have several recesses, or breaks of some sort, during each session. There should be periods of

Periods of work and rest should alternate.

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rest, and others of free play, but little of regular gymnastic work or physical exercise, unless this latter is given for its own sake, and not for the sake of relief from the tedium of the school day. Since most children do their best work during the morning hours, the more difficult subjects should find a place in this part of the day, unless they are divided into two periods daily, in which case, as previously stated, one period may be advantageously placed in the morning, the other in the afternoon. Less is accomplished in the afternoon session than in the morning session. Indeed, the afternoon session, particularly in the winter, is in many instances too long. It might be better to limit the afternoon period to an hour and a half, even if in so doing we were obliged to cut out some of those subjects that enrich the curriculum, but at the expense of time and energy that could be applied in other directions with benefit to the child.

Grind essential to school work.

The fact that pleasant work lessens fatigue may seem again to show the necessity of a soft pedagogy. However, there are two sides to this question. It is highly desirable, on the one hand, that the schoolroom should be bright and cheerful, that the teacher should be mild and not irritable, and that the pupils should be free from nervousness and haste. Grinding tasks should not be imposed when not necessary. It is clear that the most effective work, whether physical or mental, can be accomplished only when the body and the mind are on a high level of living. Yet, on the other hand, just as the unpleasant is necessary in life outside the school in order that greater pleasure shall finally result, so in the schoolroom there must always be tasks that are irksome. If there is to be a sound and permanent foundation for knowledge, there must be drill, and even a certain amount of grind, throughout the entire process of learning. It would be fortunate if the drill and the grind could be conducted under the stimulus of interest, and its accompanying pleasure, but it is better that the school tasks should be performed with a certain modicum of unpleasantness, rather than that they should not be performed at all. If the work is important, it must be undertaken.

The pupil must learn to adapt his attention.

The fact that attention fluctuates, not only within brief periods, but within longer ones as well, has considerable educational significance. Ordinarily, in taking up an intellectual task, both the child and the adult approach it with a degree of reluctance. It is like taking a cold shower bath. When we are fairly in the midst of our subject, however, we forget the external interests that at first made it difficult for us to do our work, and which led us to accept any excuse, never mind how trivial, in order to postpone the task. Success in holding the attention upon the problem at hand will depend upon how thoroughly we get into the second phase of our work. Many children, and far too many adults, do not succeed in passing beyond this first phase of attention, in which it fluctuates between external interests and the work at hand. These "fool away" their time, and often wonder why it is that the study hour brings such slight results. For the mature student the solution of this difficulty consists in habituating himself to begin work immediately, to plunge into his subject without unnecessary preliminary preparation. For the teacher, the solution lies in forming in the pupil habits that shall lead to rapid adaptation of attention. The second phase of attention in long-continued work is followed by a third stage, which in time tends to make its appearance. This third phase is due, in part, to the fact that those physical adjustments that are made in order to keep the attention at its maximum gradually appear in consciousness as sensations of strain and muscular fatigue.

It is true, also, that we often form the bad habit of thinking that after a certain lapse of time we should quit work. This habit often causes us to stop when there is slight necessity for so doing. This is a serious loss when our thought processes are running smoothly, and our attention is so well adapted that we have reached the maximum of efficiency. How quickly we let up when we think of the approaching vacation that is close at hand! We conclude that we are tired and need a rest, when our physical and mental condition does not demand it. If the vacation were a month, rather than a week away, it would never occur to us that we were fatigued. So it is in setting limits to our periods of mental work during the day. If we conclude that two hours is a sufficiently lengthy period for intellectual labor, as the end of this time approaches we are certain to feel the necessity of rest and recreation. If the period were four hours instead of two, this feeling of the need for rest would not appear until the end of the four-hour period. So the problem for the adult becomes one of a proper mental attitude toward his work that leads to the establishment of systematic habits. From the child in the school no such lengthy periods of work can be expected, and the third stage of bodily distraction does not become so important as it does for the adult. However, the various recesses and rest periods that are dispersed throughout the school program should be devised to remove, as far as possible, these elements of distraction from the consciousness of the child.

The mental attitude of the learner important.

When those periods of the school day are reached at which naturally fatigue and lack of interest set in, the subjects of the program should be of such a character that they require as little of the higher thought processes as possible. The more mechanical learning can be better accomplished at such times, than can the higher forms that depend upon the intelligent forming of associations. It is easier to learn a multiplication table, or the spelling of a list of words, in such periods, than it is to solve a problem in arithmetic or to reason out a fact in natural science.

The school program in reference to fatigue.

When we come to the higher intellectual processes, attention appears to be even more necessary than it does in the lower and more mechanical forms, although it cannot be dispensed with at any level of learning. Mere repetition is of little avail to the pupil, unless he gives a reasonable amount of attention. In rational thought the direction of attention is essential in determining the kinds of associations that are formed. If we are interested in a certain aspect of a situation, we tend to pay attention to that aspect, and we soon find our associations grouping themselves together in a very definite way in the direction of our attention. The nature of reasoning, as we shall see in the following chapters, is very largely a matter of selective attention. *The person who reasons well is the one who is able to choose the proper aspect of the situation to which he is giving his attention, and who is further able to hold his attention to the point at issue.* The person who is not able to hold to the principal point in an argument is scatter-brained and ineffectual in his reasoning.

Properly adjusted attention necessary for higher thought.

Will, in the last analysis, is a matter of attention. The education of a right will consists in training those aspects of attention that have regard for situations that are stamped with social approval. Exclusive thought in a certain direction tends to lead to activity in that direction. It seems to be a fact without exception that a given idea will always lead to a response in the direction of the object which this idea calls up, unless it is inhibited by another idea which more powerfully claims the attention. This circumstance is tremendously significant in moral education. It cannot be adequately discussed within the limits of the present chapter, but in passing it may be said that it is a doubtful educational policy to refer in the schoolroom to undesirable acts, unless there is an immediate and pressing necessity for so doing. Negative suggestion is as potent as positive sug-

Will is fundamentally a matter of attention.

gestion in many cases. It further should be kept in mind that a well balanced will consists primarily in the ability to attend adequately to various aspects of a situation. Overemphasis of any one aspect tends to result in too hasty a decision, while overdeliberation results in indecision.

CHAPTER XX

THE HIGHER THOUGHT PROCESSES — LOGICAL THINKING

THE term "thought" is used in popular language in a loose and indefinite sense. We sometimes employ the expression "thinking of nothing," while, on the other hand, we assert that "we must think, if we wish to solve a difficulty or arrive at a conclusion." Manifestly, these two expressions are used in widely divergent senses, and yet they have an element in common. When I say that I am merely thinking, or thinking about nothing, I have in mind a state of consciousness that is well exemplified by what is termed day-dreaming. In such a condition of mind as this, conscious state succeeds conscious state with apparently very little connection, and with no active determination on my part. When, on the other hand, I am thinking in the sense of giving my attention to the solution of a problem, my thought processes are flowing on, but in a more orderly fashion. There is less passivity and more active direction of the thought. Yet, both the vaguest states of day-dreaming and the most sharply defined and logical thought processes have certain fundamental elements in common.

The term "thought" used in various senses.

In thinking, whether it be rational or haphazard, there is always an onflowing of consciousness. There is a process which is more or less definitely moving toward some end, and which contains more than the sensory datum. In other words, there must invariably be an ideational element. The mere succession of sensations in consciousness would not constitute thought. On the other hand, when consciousness goes beyond mere sensation, and deals in images, their succes-

Thinking involves an onflowing of consciousness.

sive appearance, in a more or less orderly manner, constitutes a thought process. *Further, thinking involves not only the onflowing of consciousness, but the onflowing in some direction, either definitely recognized or vaguely felt.* When I am building castles in Spain, my imagination is not developing in an absolutely arbitrary fashion; the images are controlled by my general intellectual attitude, or by the emotional tone of my consciousness. The products of my fancy may grow with an astonishing rapidity, but they grow in some order. I may have in mind the thought of acquiring great wealth, and with this thought in my consciousness as an end, the various images of my fancy arise and group themselves in terms of this thought.

Perhaps I fit out an expedition to go to some distant land in search of treasure; in which case I picture to myself a band of hardy adventurers, a ship sailing in remote waters; islands with tropical foliage, low lying on the distant horizon; the glistening sands of an unknown shore; strange adventures and hairbreadth escapes in entangled forests, or cavernous chambers within the earth; a chart with strange characters, which in the camp at night, under the flare of an ill-smelling torch, is deciphered; the sound of pickaxe and shovel as the adventurers work, digging near the roots of a gigantic tree in the weird light of the moon; the discovery of the long-hidden chest, with its curious carvings; the breaking of the rusty lock; the glitter of the gold and silver, and the shouts of joy of the exultant company. All these images flit across my mind as I lie in the grass with eyes half closed, dreamily conscious of the white clouds as they move across the blue summer's sky.

There is surely in such a process of thought as this little that resembles logical reasoning at first glance; and yet, from the standpoint of the thought processes themselves and the laws which dominate them, the resemblances are far greater than the differences. Both in day-dreaming and in logical thinking, the succession of ideational elements is determined by some conscious idea and a feeling or emotional background. When I dream of adventure, I have in some way before my consciousness the idea of its outcome, and if my mood be happy, the images that suggest themselves will fit into that mood. When, on the other hand, I am attempting to convince my opponent, or to gain the assent of my audience in a political debate, the succession of my ideas is again determined by the end I have in view, by the purpose which I set before me, and by the desire which I have to establish one proposition and to overthrow another. In logical thinking, as well as in mere castle building, my feeling attitudes, as well as the intellectual end of my thinking, exercise a selective influence in the choice and arrangement of my ideas. So in the end, rational thinking and day-dreaming are made on the same loom, and though the patterns and colors of the fabric may differ, the strands bear a striking resemblance, and both the garment of fancy and the garment of rational thinking are woven by an identical process.

Rational thought a subjectively controlled process.

Rational thought, then, differs chiefly from non-rational thought in that the former is a subjectively controlled process. Here the end in view is definitely defined, the goal in which the thought process terminates is sharply outlined, and this end, this goal, must be kept in consciousness through sustained attention. We have already referred in our earlier discussions to the necessity of keeping this end in view as a problem to be solved, as an adjustment to be accomplished. The direction which the thought takes depends absolutely upon the nature of the problem and upon the consistency with which it is held in mind. The problem, which is always present in any complicated thought process, appears on the subjective side as a thought crisis of greater or less intensity, and on the objective side as a reaction which goes beyond habit. This fact we have already noticed in our chapter on Habit.

Logical reasoning further involves symbols, which represent concrete realities and function as meanings. Meanings are of two sorts, sensorial and ideational. In any sensory experience, the more commonly recognized sense impressions are but a part of the total situation. These sensory experiences are the focal elements in consciousness, which stand for, or represent, the significance of the entire situation. For example, the tree which I see before me brings to me a certain visual impression of color and form. This visual impression, however, represents vastly more than it directly reveals. It carries an attitude, which is in the fringe of consciousness, and in the last analysis signifies my adjustments to the tree. Perhaps it is a tree that I knew when a boy, and its meaning comes to me largely in terms of climbing it and swinging from its branches, or reaching up and picking the fruit that grows from its limbs. These adjustments are not in the focus of my consciousness, but in the margin, while the focal element, the visual sensation, represents, or stands for, these various adjustments.

Logical thought involves symbols.

We can find countless examples of the fact that the meaning of a concrete object of sensation is, in the last analysis, focally represented by a sensation or an image and completed by the fringe or halo, constituted by images or sensations of adjustments that we tend to make or actually do make in the presence of the object. *All meaning, then, is completed in motor terms.* This fact is clearly brought out by the definitions which young children give to objects. An object for the child is invariably that which does something, or with which something is done. "Mother is to kiss"; "Candy is to eat"; "Horse is to ride"; and so on. As thought progresses in complexity, we find the concrete object which constitutes the core around which the meanings center, replaced by ideational elements and symbols, largely verbal in their nature. Words now carry the meanings of the concrete situations for which they stand. The element in the focus of consciousness is no longer the tree itself, but the word "tree" spoken, or printed, or heard; but in any case there goes with this

Meaning completed in motor terms.

symbol of the external object the fringe of adjustment which the idea calls forth and which appears in consciousness as an attitude.[1] In the case of the concrete object, these kinæsthetic fringes may be, as we have already said, due to actual adjustments. We may, on seeing the tree, complete its meaning by actually climbing it and swinging from its branches, or we may reach up and pick its fruit. Here the meaning has been finally worked out. Before the actual tree, however, we may stand and comprehend its meaning, either through incipient kinæsthetic sensations, or through images of those sensations. In the first place, we may actually start toward the tree as if to climb it, or we may innervate the muscles of our arms, as if to raise them and pick the fruit. When we do not have the concrete, but the merely verbal image of the tree before us, we cannot make a complete and final adjustment to the object of our thought; but we can climb the tree in imagination, or we can have incipient images which stand for experiences of climbing. In this latter case, the meaning as such is always a matter of the fringe, while in the case when the meaning is actually completed, either in reality or in imagination, it may enter the focus of our consciousness, and become the predominating element in it. On the other hand, generally the meaning of a situation is not carried out to its ultimate completion, or, if it is so carried out, it is expressed by reactions largely habitual, and hence not directed by consciousness. Thus generally the concrete or the verbal representatives of the meaning occupy the center of consciousness.

This doctrine that meaning is a matter of the fringe was first definitely stated by James.[2] He says, "The meaning is a function of the more 'transitive' parts of con-

[1] In this discussion, the term "attitude" is used to signify the subjective aspect of adjustment or behavior. The attitude is as mental content kinæsthetic sensation or image.

[2] "Principles of Psychology," Vol. II, p. 49 (New York 1890).

sciousness, the 'fringe' of relation which we feel surrounding the image, be the latter sharp or dim." Bagley[1] has further developed this thought of meaning residing in the fringe of consciousness, as follows: "The kinæsthetic elements are predominantly marginal elements, and the marginal elements 'carry the meaning.'"

So-called "imageless thought" has vague kinæsthetic images or sensations.

This view of meaning is thoroughly in accord with the standpoint we have taken throughout our discussion, namely, that *an object in the last analysis means something to which we make an adjustment.* Now, as has been said, it happens that the attitudes accompanying the adjustment itself under ordinary circumstances are not that which is in the focus of our attention; it is rather the object as something seen, or heard, or touched to which we give attention. The moment that we shift our attention to the motor side of the situation, the adjustment itself tends to become imperfect and unsatisfactory. Here we are going back to our earlier principle of habit. When a situation has become entirely mastered, *i.e.* when it has fully acquired meaning, so that nothing new needs to be known about it, then, all the adjustments that constitute that meaning have become facile and automatic. It is further to be remembered that when the adjustment is so completed, when the thought crises have entirely disappeared, the meaning, carried in the fringe, becomes less and less a matter of consciousness, and finally tends to disappear. The whole world acquires significance as adjustments become more and more perfected; but the focal character of this significance at the same time gradually fades out. Under these conditions we do not need to consider these adjustments as such; but sensations and images, both concrete and verbal, of the objects, stand for these tendencies to reaction, and, therefore, are representative.

[1] "The Apperception of the Spoken Sentence." *Amer. Jour. of Psychol.*, XII, pp. 80–130 (1900).

However, there remain, as an indefinite and scarcely discernible nimbus attached to these symbols, the vestiges of former adjustments in the nature of those kinæsthetic images that we discussed in the section on mimetic imagery.[1] Here we said that, having once assumed that the meaning of a situation is after all an attitude, and that an attitude must be in the last analysis a motor affair, it is but a step to the conclusion that this general dependence of experience for its significance on motor adjustments has left a deposit that stands for concrete situations, not actually present, but ideally represented. We further concluded that this fringe of kinæsthetic imagery, this attitude, has escaped the introspective analyses of those investigators who have inferred from their experiments in reasoning and judging that there is such a mental state as imageless thought;[2] in other words, that thought

[1] See Chapter VII, pp. 109–112.

[2] Among writers in English who have maintained the existence of imageless thought are Stout, who holds that there are modes of consciousness "not composed of visual, auditory, tactual, or other experiences derived from them" ("Analytic Psychology," I, pp. 78–96, 1896), and Woodworth, who does not believe that "images plus sensations exhaust the content of a thought" (*Jour. of Phil., Psychol., and Scientific Methods*, III, pp. 701–708, 1906). Binet, Bühler, Watt, Messer, Mayer and Orth, Ach and Marbe, among foreign investigators, are in substantial agreement with this position. Mayer and Orth in their investigations (*Zeits. f. Psychol. u. Physiol. d. Sinnesorgane*, XXVI, 1901) found, in addition to the ordinarily recognized thought elements, a *Bewusstseinslage*, or conscious attitude, and most of the other writers have detected a similar element. Marbe (*Experimentell-psychologische Untersuchungen über das Urteil*, Leipzig, 1901) distinguishes various varieties of *Bewusstseinslagen*. It is fair to assume that this conscious attitude has an actual sensory basis, and is, indeed, as far as it is conscious at all, in part at least, constituted by the vestiges of former adjustments that have become dim and marginal, but which still have a reality and an imaginal character. Titchener, who gives a most comprehensive review and analysis of this whole literature in his "Experimental Psychology of the Thought Processes" (New York, 1909), concludes that meanings may be carried without consciousness at all, and hence may be purely physiological. When the conscious attitude actually is present, it may be carried in various ways; but, in part at least, the writer believes, by kinæsthetic sensations or kinæs-

is capable of proceeding without any "mind-stuff" whatsoever, and that there are tendencies and relations in the human mind that have no observable existence in the sensory content itself.

Rational thinking involves the conceptual attitude.

Rational thought involves conception. The conceptual attitude is generally distinguished from the perceptual, and the concept from the percept. The percept is often thought of as something individual, existing at a certain definite time and in some particular place, as this chair, this table, this friend; while the concept is considered as an abstract or general idea, — as chair, table, friend, existing at no definite time and in no particular place. According to this point of view, I may have a clear percept of a particular chair that is to be found in a particular room, in a certain definite position; on the other hand, if I have a concept of a chair, I have no such definite object in mind. In the latter case, my mental state represents a chair of any size, color, or shape, existing in any position in space whatsoever, and without reference to any particular time.

Is the concept a general idea?

The above statement of the difference between percept and concept, while relatively simple, is, however, inadequate, and in a measure, incorrect. The identification of the concept with the general idea likewise leads to a difficulty that was long ago pointed out and clearly formulated by Berkeley,[1] who denied that it was possible to have in consciousness a general idea that represented nothing in particular, but stood for certain identical features common to a class of objects. How is it possible, the query goes, to have an idea of a chair which

thetic images. Angell (*Philos. Rev.*, VI, 1897), writing on "Thought and Imagery," combats the view of imageless thought; and recently Book, writing "On the Genesis and Development of Conscious Attitudes" (*Psychol. Rev.*, XVII, pp. 381–398, 1910), shows in an interesting way how the processes of adjustment in typewriter reactions become more and more vague as the adjustments become more adequate and habitual.

[1] "A Treatise concerning the Principles of Human Knowledge."

refers to a chair with no particular color or shape or size? Whenever the idea of an object comes up, it must come in some definite form, and with concrete qualities. Berkeley seems to have been right in denying the possibility of the existence of a general idea in the sense in which he used the term. When we think of "horse" in general, are we not obliged to recall in imagination some particular horse with which we are familiar, or which we construct from our experiences with various horses, or to recall in rapid succession numbers of particular horses? When, for example, I think of triangle, there come to my mind in rapid succession images of different triangles, — isosceles, equilateral, right angle, large and small, indistinctly following each other. I do not, however, experience in imagination a "general" triangle. If the conceptual experience means the experience of a general idea in the above sense of the word, such an experience is problematical, to say the least.[1]

The conceptual attitude a generalized attitude.

The difficulty regarding the nature of conceptual thought lies in the attempt to interpret the concept structurally rather than functionally. Structurally we are perhaps warranted in assuming that there is no general idea. We always find on introspection either one or many particular images or symbols for such images. However, a functional interpretation removes the difficulty involved in the structural viewpoint. Whatever the mental content with respect to the conceptual attitude may be, — and doubtless the content varies from time to time, — the attitude itself may be termed a generalized attitude, *i.e.* an attitude that applies to many different and particular objects. *The conceptual attitude arises in*

[1] Watt, in an investigation conducted some years ago ("Experimentelle Beiträge zu einer Theorie des Denkens," *Archiv f. d. gesamte Psychol.*, IV, pp. 289–436, 1905), found that some of his subjects reported an extreme vagueness in the mental imagery connected with abstract attitudes of thought. The report of these subjects, however, indicates indistinctness rather than lack of concreteness in such states of consciousness. It is not to be assumed that lack of clearness is identical with a general idea.

the process of adjustment, and in essence it signifies that the object now present to the senses or to the imagination is to be reacted to in a certain typical manner. In a sense, this is likewise true of the perceptual attitude as well. When, on revisiting my boyhood home, I recognize a particular tree, this object of sensory experience calls up a definite attitude that is in reality the meaning that this tree possesses for me, a meaning due to previous adjustments that I have made to the tree; for example, the climbing or the fruit-picking attitude. When I think of "tree" in general, however, the meaning is found in some one specific adjustment, or several such adjustments, that I tend to make in the presence of all trees, irrespective of their individual differences. This means in terms of consciousness that among various and dissimilar attitudes that I have in relation to various and dissimilar trees there is at least one specific attitude that remains constant in this diversity. If all the attitudes that I have in my various experiences with trees are practically identical, I have a perceptual attitude; if, on the other hand, there are marked differences in certain attitudes, with identity or similarity in one or a few, then I have the conceptual attitude. Objectively considered (*i.e.* from the standpoint of adjustment or behavior), the concept appears as an adjustment to various objects in terms of some particular aspect or aspects that these objects have in common, as indicated by an identity of adjustment in certain particulars. Subjectively considered, however, the conceptual attitude arises only when, among various tendencies toward adjustment, one at least is selected as adequate in terms of past adjustments. In other words, a reaction in a typical way is not conceptual if there are not accompanying tendencies to react in various other ways. *In so far as these various attitudes are identical, the state of mind is perceptual; in so far, however, as they differ in certain particulars, while being identical or similar in others, these attitudes are conceptual.*

An example may make this point clearer. I am visited by an old acquaintance, toward whom I have definite attitudes, which because of their practically habitual character, may be termed "perceptual." This means that I do certain definite things in his presence, treat him in certain specific ways, behave in a customary manner. I tell him my private affairs, invite him to a game of cards, suggest a walk, or a visit to the theater, and so on. In these respects I am reacting to him entirely as an individual, consulting his particular tastes and doing those things that I have learned through experience will accord with his wishes, — and in all this I am acting with little thought. Since I know his personality so well, the meaning for me of his personality will express itself in relatively habitual attitudes toward him, and thus this meaning is not clearly present, but is in the fringe of consciousness. Suppose, however, I observe in this friend, for the first time, some hitherto unknown trait. I discuss politics, for example, and to my surprise I arouse his resentment. I can no longer treat him entirely on the habitual plane; I must readjust my attitude toward him, and to do this I must treat him in general terms, namely, as an individual who exhibits anger. I must bring to bear on this new situation general experiences with angry persons. I have thus, for the time being, passed from the perceptual to the conceptual attitude, and have left the level of habitual responses for that of focalized meanings. My friend, in a sense, when angry means more in terms of clear consciousness than he did before.

Perceptual and conceptual attitudes interwoven.

It may be seen from the above example that in all our thinking the perceptual and conceptual attitudes are interwoven. *When our reactions are relatively unvarying, we are treating the objects of these reactions from the perceptual standpoint; when, however, there is considerable variability in reaction, when thought crises arise and meanings become explicit, and symbolized in some focal element of consciousness (as, for example, the flush on the cheek of my friend, indicating or meaning anger), then, we have the conceptual attitude.* However, in the last analysis the difference between the percept and concept is a matter of degree rather than of kind. Except in completely habitual responses, where consciousness is reduced to the vanishing point, there is a modicum of generalized attitude in the response, even toward individual situations, that is to say, every percept is in a sense a concept, and conversely every generalized situation has in it some elements identical with previous situations that have called forth in some particulars similar attitudes of response. To this extent every concept has in it an element of perception. The focal content that symbolizes the conceptual attitude may be some definite object of sense; it may be the image of such an object, either concrete or verbal; it may be a series of such images; this is not a material matter. It is the attitude found in the fringe, representing a uniform type of reaction under varying conditions, that makes the concept and gives it a general character.

Binet[1] has expressed practically the same point of view in his statement that an image may represent a particular or a general meaning. It depends upon what the subject *intends* as to whether the mental content is to be considered as perceptual or conceptual. Dewey[2] states even more clearly this fact, as follows: "Conceptions are general because of their use and application, not because of their ingredients. . . . Generality resides in application to the comprehension of new cases, not in constituent parts. A collection of traits left as the *common residuum*, the *caput mortuum* of a million objects, would be merely a collection, an inventory or aggregate, not a *general idea*; a striking trait emphasized in any one experience which then served to help understand some one other experience would become, in virtue of that service of application, in so far general. Synthesis is not a matter of mechanical addition, but of application of something discovered in one case to bring other cases into line."

Concepts not arrived at by a pure process of abstraction.

The assumption, then, generally made by logicians that our concepts are arrived at by a process of observing particulars and by emphasizing in these elements of identity or similarity, and by ignoring elements that are unlike, seems untenable from the standpoint of psychology. Even if we should hold to the belief, as did Huxley,[3] that there is such an entity as

[1] *L'Étude expérimentale de l'intelligence* (Paris, 1903).

[2] "How We Think," p. 129 (Boston, 1910).

[3] "David Hume," p. 169 (New York, 1879).

a generalized idea, which exists in consciousness as a sort of a composite photograph of all the particulars which it represents, we still would not be justified in regarding the conceptual process as essentially a comparison of identical elements in various individuals of a group. If we ask ourselves what are the marks to be found in a general idea that are shared by the individuals that come under it, we will not find any specific marks. Our idea of a table in the sense of a general notion, is a table without any particular color, shape, or size. The table may be made of any material whatsoever, and may be found in any part of the wide universe and in any imaginable time. The marks which the "general" table possesses, in common with particular tables, thus vanish on analysis. *The only similarity between all the tables which make them alike for the purposes of thought, is the similarity of human reaction to them. We may form a general notion of the uses of a table from our experience with one table, and apply this conception of tables to all future objects toward which we can react in a similar manner.*[1]

The study of consciousness from its genetic standpoint shows us, likewise, that the notion that a concept is derived from a large number of particular percepts is unten-

[1] The assumption that the essence of abstraction is of the extremely formal nature held to by the logicians, has entered the field of psychology and found its place in the experimental literature. In a monograph recently written by Moore on the "Process of Abstraction" (*University of California Publications in Psychology*, Vol. I, No. 2, pp. 79–197, November, 1910), which contains much that is excellent, the fundamental assumption made in devising and carrying out the experiment is that concepts are formed in just this artificial way. The results, therefore, are doubtful to the extent to which the assumption is unwarranted. The experimenter states that the investigations were commenced in Wundt's laboratory and that Wundt himself gave valuable suggestions as to the method of the experiment. Thorndike of Columbia is also mentioned by the writer as having given the original stimulus to his investigations. These facts are mentioned to indicate how widespread, and with what eminent authority, this theory of abstraction which, may be regarded as false as it is unfortunate, finds support among psychologists.

able. The behavior of most of the higher animals shows us very clearly that they have generalized types of reaction toward class objects. The dog reacts to bones of all descriptions in a certain typical way. It is true that we cannot assume that the animal has a definite concept, that is, a felt attitude, as an element of consciousness; but his experience functions in this general way, and for all practical purposes he has incipient conception of a bone. We find the little child at one stage of development treating all male adults as his father. The child makes no distinction whatever between various individuals, but they all function for one general kind of reaction. So too at another stage of the child's development, all strangers arouse the generalized fear reaction. Probably in the brute to a slight extent, and certainly in the child to a much greater extent, there comes a period in which these most general attitudes are broken up through experiences into reactions of a more circumscribed type. The child, for example, after a time, no longer treats all men as his father, nor does he fear all strangers. This is because his attitudes then become more specific, and within the larger group there arise smaller groups. Dewey[1] has expressed the general manner in which such concepts are formed, as follows: "Not through the senses, but by means of the reaction, the responsive adjustment, is the impression made distinctive, and given a character marked off from other qualities that call out unlike reactions."

A concept not necessarily derived from a number of particulars.

The above point of view does not mean that education is in error in assuming that in order to have clear concepts, there must be wide experience and careful discrimination between the various parts of experience; but it does emphasize the fact that the essence of conception is in reaction and in the conscious attitudes accompanying reaction, rather than in logical comparison and discrimination. If the child is to be taught the nature of a river system, he must, if possible, be shown a river; he must at least see pictures and maps of rivers, he must con-

[1] *Op. cit.*, p. 122.

struct, through clay models and otherwise, beds of rivers, river banks, watersheds, and so on. In these various experiences the child will have arrived at certain characteristics that are essential in his reaction to a river. Nevertheless, the child could have had a generalized attitude if he had had an experience with only one river. Doubtless, the boy who takes up the study of geography after he has acquired a wide experience with the particular river that flows through his town, and thus extends his experience by this study, gets a more correct notion of rivers in general than he had when he was acquainted with the single river in his locality. Nevertheless, it would be wrong to assume that his experience with one river had not established in his mind a certain type-reaction which could function in regard to rivers that he might meet in other places than his own native town.

Dewey[1] expresses the above thought as follows, in discussing the manner in which the concept of dog is formed by the child: "As a matter of fact, the child begins with whatever significance he has got out of the one dog he has seen, heard, and handled. He has found that he can carry over from one experience of this object to subsequent experiences certain expectations of certain characteristic modes of behavior — may expect these even before they show themselves, . . . but finding that other expected traits and modes of behavior are not fulfilled, he is forced to throw out certain traits from the dog-meaning, while by contrast certain other traits are selected and emphasized. . . . He has not begun with a lot of ready-made objects from which he extracts a common meaning; he tries to apply to every new experience whatever, from his old experience, will help him to understand it, and as this process of constant assumption and experimentation is fulfilled and refined by results, his conceptions get body and clearness."

[1] *Op. cit.*, p. 128.

CHAPTER XXI

THE THOUGHT PROCESS IN JUDGMENT AND REASONING

The judgment an expanded concept.

THE nature of the judgment does not differ essentially from that of the concept, except that the judgment exists in a more expanded form and is more clearly conscious. A judgment on the subjective side represents a definite problem that is brought to the attention of consciousness and solved; on the objective side it involves the possibility of a positive or a negative reaction, or the inhibition of a reaction in various ways, and finally a reaction in one definite way. On the subjective side, it is characterized, first by doubt, and secondly by affirmation or denial; on the objective side, it is made manifest first by a hesitancy in reaction, and a tendency to react in various ways without a completion of the reaction, and finally by a reaction, either positive or negative, in some definite way. When there is no doubt, when the meaning of the situation has in it nothing essentially new, then the thought does not go beyond the perceptual type of reaction.

If I discover a yellow flower in a field, I may recognize it at once as a particular specimen of a variety with which I am familiar. Its meaning is perfectly evident, though not in clear consciousness, and it is in no sense a matter of question or debate. I pick the flower, smell its fragrance, and put it in my buttonhole. On the other hand, I may come across another flower in my rambles over the fields that I cannot quite so completely identify. Its nature, then, comes to me in the form of a question, and I finally make a judgment affirming that it is a certain type of flower with which I am familiar; or the judgment may take the form of a doubt in regard to its nature. Accompanying this subjective attitude of debate and decision, there is an objective attitude. While I am questioning whether the flower is ill-smelling or fragrant, poisonous or harmless, I may inhibit my incipient tendency to pick it and examine it. Finally, when I conclude it is something of a harmless nature, this conclusion is objectively expressed in a definite and positive reaction to the flower.

Judgment interprets the new in terms of the old.

Such a process as this involves the bringing of a past experience to bear on a present situation. It is the interpretation of the new in terms of the old. It is the subsumption of the present narrower experience under the broader and more inclusive experience. The judgment is well illustrated by the definition. We say, for example, that iron is a metal. Here I place the narrower concept of iron in definite relation to the broader concept of metal. I may, however, find the same general principle in a judgment that is not in the strict sense of the word a definition, as when I observe, approaching in the distance, a person whom I do not at first recognize, and afterwards arrive at the conclusion that this person is my father. Here the narrower experience of the present moment is subsumed under the broader and more general experience of father. A judgment then arises when there is a definitely formulated question as to the meaning of the object of conception or perception, and the judgment is stated in a form which identifies it in some way with a broader knowledge into which it fits. In this sense it is at the very basis of the learning process, which has been defined as the determination of the present experience in terms of the past. It would be wrong, however, to consider such determinations on the lower levels of consciousness (and, indeed, in more developed consciousness that is proceeding along its ordinary course without marked interruption of the habitual responses) as anything more than implicit judgment, — in other words, situations that have in them the potentiality of judgment when thought crises arise.

The foregoing analysis should make the statement clear that perception, conception, and judgment are but different stages of the same fundamental process. In all, the past experiences function as attitudes under present conditions; in the perception the explicit aspect is reduced to a minimum, and exists in the mind merely as an "attitudinal feel"; [1] in conception the bringing of the past to bear in the interpretation of the present has become more of a conscious matter, and there appears a symbol in the core of consciousness that stands for, or means, a type reaction in the present situation. In the judgment, this tendency has become more explicit and more highly focalized. A more developed form of the same fundamental process, found implicitly in perception and definitely and explicitly in conception, is inference. Here we have not merely a single judgment, but several, leading to some expressed conclusion. Logical thinking, both inductive and deductive, is a matter of inference.

Perception, conception, and judgment different stages of the same fundamental process.

The essence of the rational process, as has already been pointed out, does not lie in anything peculiar in regard to the manner in which the thought flows on. Like all other thinking, reasoning involves an end or termination of the process in some conclusion to which the thought is leading. The principal difference between loose thinking and logical thinking has been discussed in the previous chapter, where it was insisted that logical thought must have its end clearly outlined and distinctly in view, and that it must hold this end in consciousness to the exclusion of all other considerations. To attain this result all superfluous thought processes must be eliminated, and the thinking must be carried out chiefly through symbols

Logical thinking selective in its nature.

[1] This expresses a fact similar to that termed by the German investigators the *Bewusstseinslage*, and by Bagley the "marginal halo of kinæsthesis."

and abstract methods of handling its data. The process of abstraction in this relation becomes extremely important. It consists essentially in grouping together in the thought processes those elements which contribute in some way, positively or negatively, to the final aim of the total rational process. How much the result of the thinking depends on selection, reconstruction, and positive control has already been insisted on, and finds ample confirmation in daily life, and in the psychological experiment as well.

Watt[1] has shown conclusively that the nature of the rational associations depends to a large degree on what he terms the *Aufgabe* (the task or problem) in the mind of the reagent. The same fact is also brought out in the results of Messer[2] in a subsequent experiment, conducted in the same laboratory (Würzburg), and with Watt himself acting as a subject.

Induction and deduction not processes entirely separate.

There are two ways in which the thought movement can take place. It may proceed from particulars to generals, or in the opposite direction from generals to particulars. These two processes have ordinarily been thought of as separate, but in actual thinking, they are joined together in most instances. As Dewey[3] points out, any complete movement of thought involves both induction and deduction. Indeed, a high degree of certainty in reasoning can be reached only when both phases are equally emphasized. From a large number of particulars we arrive at some generalization. We then take this generalization and find how other facts fit into it. The various processes of logical reflection are, according to Dewey as follows: "(i) a felt difficulty; (ii) its location and definition; (iii) suggestion of a possible solution; (iv) development by reasoning

[1] *Op. cit.*

[2] "Experimentell-psychologische Untersuchungen über das Denken." *Archiv f. d. gesamte. Psychol.*, VIII., pp. 1–224 (1906).

[3] *Op. cit.*, p. 72.

of the bearings of the suggestion; (v) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief." This first stage of the process indicates a thought crisis. The habitual ways of reacting have for some reason been interfered with, and it is no longer possible to make the customary adjustments. In this state of mind, unless the emotional attitude becomes so dominant that it obscures clear thinking, the individual seeks to discover those elements in the situation which will suggest a way out of the difficulty. In attempting to locate the exact nature of this difficulty, he arrives eventually at some tentative conclusion or hypothesis. Further investigations show whether this hypothesis is tenable or not. After the hypothesis has been reasonably well established, it then is used to explain all the facts of the situation; and if this explanation serves, the difficulty is finally solved and an adequate reaction secured.

The following illustration of the above principles of thought is given by Dewey:[1] "A man who has left his rooms in order finds them upon his return in a state of confusion, articles being scattered at random. Automatically, the notion comes to his mind that burglary would account for the disorder. He has not seen the burglars; their presence is not a fact of observation, but is a thought, an idea. Moreover, the man has no special burglars in mind; it is the *relation*, the meaning of burglary, something general, that comes to mind. The state of his room is perceived, and is particular, definite, — exactly as it is; burglars are inferred, and have a general status. The state of the room is a *fact* certain and speaking for itself; the presence of burglars is a possible *meaning* which may explain the facts.

"So far there is an inductive tendency, suggested by particular and present facts. In the same inductive way, it occurs to him that his children are mischievous, and that they may have thrown the things about. This rival hypothesis (or conditional principle of explanation) prevents him from dogmatically accepting the first suggestion. Judgment is held in suspense, and a positive conclusion postponed.

"Then deductive movement begins. Further observations, recollec-

[1] *Op. cit.*, p. 82.

tions, reasonings, are conducted on the basis of a development of the ideas suggested: *if* burglars were responsible, such and such things would have happened; articles of value would be missing. Here the man is going from a general principle or relation to special features that accompany it, to particulars, — not back, however, merely to the original particulars (which would be fruitless or take him in a circle), but to new details, the actual discovery or non-discovery of which will test the principle. The man turns to a box of valuables; some things are gone; some, however, are still there. Perhaps he has himself removed the missing articles, but has forgotten it. His experiment is not a decisive test. He thinks of the silver in the sideboard — the children would not have taken that nor would he absent-mindedly have changed its place. He looks; all the solid ware is gone. The conception of burglars is confirmed; examination of windows and doors shows that they have been tampered with. Belief culminates; the original isolated facts have been woven into a coherent fabric. The idea first suggested (inductively) has been employed to reason out hypothetically certain additional particulars not yet experienced, that *ought* to be there, if the suggestion is correct. Then new acts of observation have shown that the particulars theoretically called for are present, and by this process the hypothesis is strengthened, corroborated. This moving back and forth between the observed facts and the conditional idea is kept up till a coherent experience of an object is substituted for the experience of conflicting details — or else the whole matter is given up as a bad job."

The selection of significant facts essential in reasoning.

Perhaps one of the best illustrations of this method of reasoning is found in the ordinary procedure employed in the detection of crime. The commission of the crime presents a definite crisis or difficulty that must be in some way met and solved. The particular circumstances and facts that are significant in connection with the crime must be isolated and separated from a large mass of similar facts that have no particular importance as far as the commission of the crime is concerned. We have become familiar in Conan Doyle's delineation of the character of Sherlock Holmes of a person whose chief skill consisted in the location of the essential facts bearing upon the solution of the problem.[1] The essential facts may seem trivial to the un-

[1] In the "Sign of the Four," Watson remarks to Holmes: "I have heard

skilled investigator, but they are the all-important elements of the situation in the final outcome. James has suggested that reasoning correctly is essentially a matter of genius. The ability to reason well consists largely in the selection of the significant aspects of the situation, and this is what the skillful detective accomplishes. This it is, too, that lies at the basis of all great scientific deductions, discoveries, and inventions. Out of the enormous mass of seemingly irrelevant material, the great thinker selects those elements that lead to his hypotheses and that reveal ultimate facts. A large number of facts are not necessary. The important thing is to single out the *significant* facts. Indeed, too many facts may lead to confusion. The investigator is lost in the multiplicity of details, and cannot find in the wilderness of facts a path that shall lead him to the truth.

you say that it is difficult for a man to have any object in daily use without leaving the impress of his individuality upon it in such a way that a trained observer might read it. Now, I have here a watch that has recently come into my possession. Would you have the kindness to let me have an opinion of the character of the late owner ?"

After examining the watch, Holmes concludes that it belonged to Watson's elder brother, who was a man of untidy habits, and who, although left with good prospects, "lived for some time in poverty, with occasional short intervals of prosperity, and finally, taking to drink, he died."

These facts, Holmes explains to the astonished Watson, he discovers from observing seemingly trivial markings on the watch. The initials, H. W., on the back of the watch, give a clue to the owner. The fact that the watch-case is cut and marked all over from the circumstance that other hard objects were kept in the watch-pocket with the timepiece, shows the owner's carelessness. The value of the watch suggests that the owner must have had at one time other articles of value. Pin-point scratches, giving the numbers of pawn tickets, reveal the fact that the owner was often in financial difficulties; while the fact that he redeemed his pledges, since the watch was pawned at least four times, shows that he had occasional bursts of prosperity. Finally, the thousands of scratches around the keyhole — marks made by the key slipping — indicate that the watch belonged to a drunkard, who on winding it at night left the trace of his unsteady hand.

This seemingly remarkable piece of induction was accomplished primarily because Holmes selected what to the ordinary person would appear unessential features, but which in reality contained the solution of Watson's question.

The third step of the process in detecting a crime, or in arriving at a scientific generalization, is to obtain from the significant data the general point of view that shall make further investigation possible. This step is what is ordinarily termed in criminal investigations "a clue," and in scientific inquiry a tentative hypothesis. The great value of the clue and the tentative hypothesis lies in the fact that they turn the attention in such a direction that the selection of other facts that fit in with those which led to the formation of the hypothesis is relatively easy. It is remarkable what such a point of view will do in the further development of the logical process toward its conclusion. In this tendency of the rational processes to develop in the direction of a hypothesis lies a danger to accurate thinking, as well as a great aid. It is a well known fact that we are apt to find what we are looking for, and it is quite likely that we may approach the field of investigation with an unwarranted prejudice, and that our selection of facts to substantiate the clue or hypothesis will be tinged by our subjective prejudices. It is a notorious fact that when the detectives and police have once decided that a certain suspect is guilty, they are certain to find all sorts of evidence, a good deal of it untrustworthy, which will bear out their suppositions. For this reason, a person who has once been put down by the police as the criminal has great difficulty, although innocent, in freeing himself from the web of evidence which entangles him. Not only do detectives and others not skilled in logical reasoning make such an error as this, but even men of science, forming hypotheses too hastily or approaching their problem from a prejudiced viewpoint, are apt to find what they are looking for, although their conclusions may not be warranted by the fact.

Value of a general point of view.

What James terms "The Will to Believe" seems to be one of the most important elements in ordinary thinking, and it is extremely difficult to escape its effects. The advocate, in particular, who tries to prove his case uses only those arguments that will serve to substantiate it. Political debates are notoriously of this character. From the same objective facts totally divergent conclusions are arrived at, because of the original hypothesis, and the determination of those advocating a particular hypothesis to advance those arguments which will prove its correctness. For this reason the art of the rhetorician and of the public debater has since the days of the Sophists been open to suspicion. Caring more to prove their point than to establish the truth in any particular instance, the Sophists acquired the unenviable reputation of being perverters of truth and morality. If, however, the hypothesis is carefully selected, and if the investigator keeps a mind open to those circumstances that will throw light upon the subject of his investigation, whether positively in favor of the hypothesis or negatively against it, the final conclusion may be accepted as reasonably trustworthy. *Effective reasoning, then, does not consist so much in following logical norms as they have been elaborated in great detail in various texts, as it does in having certain correct attitudes of mind, and a genius to select those particular elements in the situation that bear upon the problem.*

The danger of forming hasty hypotheses.

CHAPTER XXII

THE EDUCATIONAL PROBLEMS OF RATIONAL THINKING

SINCE rational thinking involves a definite and clearly conscious end or aim, it is important at all stages of the learning process that the pupil keep his mind on the end to be arrived at in the lesson before him. This is the reason why a considerable part of the instruction should be cast in the form of a problem. This can be done almost from the beginning of the elementary school course, but only in a very simple way. Problems that are introduced should increase in complexity and difficulty as the pupil advances in grade and age.[1] The rational process in the form of

Instruction cast in the form of the problem.

[1] It is an error to assume that children have little or no capacity for logical thought, until they have reached the upper grades of the elementary school or have entered the secondary school. Various studies have shown evidence of different forms of reasoning ability throughout the grades. Bonser, who studied children of the fourth, fifth, and sixth grades to ascertain their reasoning ability (*Teachers College, Columbia University, Contributions to Education*, No. 37, New York City, 1910), found that, according to his tests, there is a gain from grade 4A to 6A for the boys of 338.77 per cent, and for the girls of 246.15 per cent. The boys reach a maximum in median ability in the period from eleven to twelve years, the girls from twelve to thirteen years. Beyond the maximum there is a decline in ability for both boys and girls, the ability for boys being less from thirteen to fourteen than from ten to eleven. Both sexes advance after the decrease. In median ability the girls are superior to the boys in every grade. The boys show greater variability than do the girls, and they are superior to the girls in mathematical judgment and in the selection of the significant elements in a rational process that lead to some particular conclusion. The girls, on the other hand, show superiority in the more simple associative discriminations and in the intellectual interpretation of literature. Bonser believes that "this superiority may be due to the element of attention to detail, or patience in analysis, or a keener sense in the meaning of words and phrases, or a more accurate form of expressing their meaning, or a combination of all these."

a problem is most easily exemplified by the work in arithmetic. Examples of such problems as employed in Bonser's tests are as follows: —

John sold four sheep at five dollars each. He kept one half of the money, and with the other one half he bought lambs at two dollars each. How many did he buy?

A man spent two thirds of his money, and had eight dollars left. How much had he at first?

What number added to sixteen gives a number four less than twenty-seven?

If a train travels half a mile a minute, what is its rate per hour?

The problem can be found in all subjects in the curriculum.

While the problem appears perhaps most clearly in number work, it can be found in all subjects in the curriculum except those that are distinctly of the nature of drill. Even in spelling the teacher may present phases of the work in the form of the problem, as, for example, when he asks the pupil to write down all the words in the reading lesson that contain in them certain syllables that he wishes to emphasize, or when he compares the meanings of certain words that are spelled alike, but pronounced differently. In the physiology lesson such questions should be asked as, "In what respects is the heart like a pump?" In the geography lesson, the teacher may inquire, for example, why the largest cities generally are situated on or near a large body of water. In the history lesson the question may be, "What were the qualities that Grant had that made him a good general?" Similar questions may be asked in work in science and literature. Of course this does not mean that all the instruction should be in the form of a problem. We have insisted all along on the necessity of drill, and it is further to be remembered that a large amount of what is interesting to the pupil in history and similar subjects lies in the simple narrative and in the descriptive elements, while explanations of historical events, in terms of their causes are apt to become uninteresting and even incomprehensible, if insisted on exclusively, or even largely. In nature study, too, and in geography, the descriptive and illustrative elements constitute the materials that arouse the greatest interest in the early years. Only occasionally in these subjects can the teacher demand causal explanations from the younger pupils. However, such explanations should be sought from time to time and their number should be increased as the pupil advances in the grades.

The pupil must select the significant elements in a problem.

Equally important with the keeping in view of the end or problem in the rational process, is the selection by the pupil of those elements that bear upon this problem. Most of the questions cited in the above discussion involve for their intelligent answers such a selection. The pupil, however, must often be guided by the teacher in the selection of these elements. Such a device as that used by Bonser[1] in certain of his tests may be employed to advantage, with necessary modifications, in the ordinary work of the school.

The following are illustrations: —

"The following reasons have been given to show why New York has become a larger city than Boston. As quickly as you can, place a cross like this, +, before each reason you think a good one: —

1. New York is an island.
2. More foreigners live in New York than in Boston.
3. New York is on a large river, coming from a rich agricultural region.
4. Mr. Rockefeller has a fine home in New York.
5. New York has more churches than Boston.
6. New York has better communication with the states lying to the west.
7. New York has elevated railroads.
8. New York is in the midst of a rich fruit and agricultural district.
9. New York is nine or ten years older than Boston.
10. New York has a Republican governor.

[1] *Op. cit.*, pp. 5–6.

"These reasons have been given to show that oak wood is better than pine for making furniture. — Check the good reasons.

1. Oak wood is harder than pine.
2. Oak trees have acorns, pine trees do not.
3. Oak wood takes a finer polish than pine.
4. Oak trees have more beautiful leaves.
5. Oak trees make good homes for squirrels.
6. Pine wood will not last as long as oak.
7. Pine is more easily dented and defaced than oak.
8. When polished and varnished, oak is much more beautiful than pine.
9. Pine trees are sometimes used for Christmas trees.
10. Oak trees are easier to climb than pine trees."

It can be seen from the above examples that the process of reasoning required in these tests consists essentially in discovering those particular circumstances and facts that have significance in connection with the question in hand and the isolation and separation of these from a larger mass of similar facts that have no particular importance for the immediate problem.[1] Suppose, for example, the teacher has asked the children to read about the oak and the pine tree. He then may further require them to write out the essential facts that they have learned from their lesson, and then to select those facts that have a particular *significance* for the problem which he may suggest in connection with the work. Such exercises as these, particularly for the higher grammar grades, are valuable in impressing upon the pupil care in the selecting of essential details.

The teacher should also keep in mind the importance of not presenting too many details, or requiring the pupil to learn too many facts at any one time, since some of these are likely to be irrelevant as far as the particular problem is concerned, and are likely to confuse clearness in thinking for this reason. In the higher grades particularly, and in the work in the secondary schools, colleges, and universities, the mistake is often made of supposing that it is absolutely necessary to present every detail of a subject. This demand for completeness and thoroughness, while desirable in itself, often defeats its own ends, for there can

[1] Compare the above discussion with that in Chapter XI, p. 178.

be no completeness and thoroughness, unless the multiplicity of details are in some way mastered and constructed into a unitary system. In this connection it should further be remembered that, while it is desirable to encourage questioning, especially on the part of the more mature pupils, the teacher must exercise great pedagogic skill in keeping these questions within the general scope of the topic that is being discussed. Students even of college grade are quite likely to raise queries that are often beside the point and confuse the main issue. The teacher here has a splendid opportunity of directing and limiting the questions in such a way as to impress upon the class the correct ideal of selective reasoning.

Necessity of adequate ideas in regard to subject matter.

Since conceptual thinking is an essential part of the rational process, the school should attempt, through presentation, comparison, discrimination, and the like, to develop adequate ideas in regard to the subject matter taught. These must be at first presented as vividly as possible. Vivid presentation demands the use of concrete materials and laboratory methods of teaching. In commercial geography, for example, the materials of commerce should be exhibited in the classroom, and the different stages in the processes by which commodities are manufactured should be illustrated through samples of the materials in various stages of manufacture. When the actual concrete material is not present, charts, models, and lantern slides should be used. It must be remembered, however, that material should be used primarily for the purpose of illustration, and not for entertainment. It is highly desirable in teaching geography that the school should possess a varied collection of stereographic pictures and a sufficient number of hand stereographs. However, it is probably not wise to allow the pupils to use these indiscriminately. They should be used in connection with the particular lesson, at definite times, and not for the more general purposes of entertainment. While the teacher must insist on careful observation and comparison of facts, he must remember always that mere facts are nothing, and that innumerable facts are of no value in forming a conceptual idea, unless the essential elements in these facts are emphasized in the proper way. A large number of particulars are not always necessary in order to bring out a general idea, and clearness of illustration is of no value unless the proper elements of the illustration are singled out and comprehended. Above all, it should be kept in mind that a valid concept must somehow relate itself to an adjustment or the image of such an adjustment. The child must be encouraged to do something or to imagine something being done, if he is to arrive at a correct general idea.

For example, if the pupil is being taught the nature of a river current, he should be asked such a question as this : "If you were rowing in a boat upstream, would it be easier for you to keep in the middle of the stream or to row along its edges?" Or if he is being taught the meaning of high altitudes, he may be asked, "Would it be as easy for you to run if you were on a lofty plateau as it would be on a similar level surface by the sea ? Under which condition would you get out of breath sooner ? If you were making a balloon ascension, would it be necessary to provide yourself with warm clothing ?" Such questions as these bring to the pupil's mind the actual adjustments that he must make under such circumstances, and, therefore, give to the concept more than a merely formal significance. While it is sometimes necessary and advisable not to attempt to develop such concepts to their ultimate conclusions, it must be remembered that finally such conclusions must be arrived at if the results of instruction are to be vital and significant.

The value of the definition.

Concepts are put in permanent forms, and are made fixed points of departure for thinking by means of the definition. Definitions, however, should not come at the beginning of the exposition, but the end. They should sum up and crystallize the thought. There has been a tendency in recent years to undervalue the worth of definition, largely because its value had been overemphasized at an earlier period in the development of educational practice. While the definition, to be of value for the pupil, must be comprehended by him, and must be the result of previous thinking, rules of procedure may properly be employed from the standpoint of mental economy, even before the fundamental reason for these rules is understood. It is not necessary, for example, that the pupil should always comprehend the significance of the rules that he puts into practice in long division, percentage, square root, and the like.

Principles should be employed in many novel ways.

Since one of the most significant elements in rational thinking is the interpretation of the new situation in terms of previous experience, it is important that the methods of procedure arrived at through school instruction should be employed in as many novel ways as possible. This can be done to unusual advantage in those studies in the school curriculum that emphasize construction, such as manual training, in its several forms. This principle applies also to various kinds of laboratory practice, although it is not limited in its scope to any one part of the school program.

Naïve dogmatism must be shaken.

The fact that rational thought invariably involves a crisis in the habitual mental processes makes it necessary at times to stir up the pupil to intellectual unrest in order to break up his dogmatic methods of thinking. It is the function of the teacher to guard against too great assurance and inertia in the reasoning of the pupil, who must be made to feel that complete dependence on his own previous opinions and those of others is intellectual slavery. However, it must be remembered that such a radical method of procedure as is involved in raising serious doubts in regard to ordinarily accepted facts is not as permissible in the earlier as in the more advanced stages of education. Still the teacher in the pre-adolescent period should seek to inculcate in the minds of his pupils a certain caution in accepting general beliefs and statements simply because such statements are made. The pupil, although he is naturally under the dominance of authority in this period of his development, and although for the most part he cannot be taught to reason correctly by having his belief in such authority overthrown, still cannot be made with safety an absolute slave in his intellectual and moral life to the scientific and ethical standards of his parents and teachers. Both Freud and Jung have pointed out the danger of too much parental authority and reverence for this authority on the part of the child, in that child's later development. The danger, however, applies less to American children than it does to the children of European parents. In America we have perhaps gone to the other extreme, and have not considered the great significance of authority for the child, particularly in his formation of religious and social ideals.[1]

The significance of the Socratic pedagogy.

For the more mature students who have arrived at the middle adolescent period an attempt to shatter their naïve dogmatism is often desirable and necessary. This is the principal significance of the Socratic pedagogy. Socrates revealed to the youth of Athens their own ignorance by pointing out to them the utter untrustworthiness of their ordinary beliefs. In some cases he did more than convict them of ignorance; he tried to lead their minds to the higher truth. However, he emphasized the first step in the search after truth, the clearing of the mind of error in order to give place to a higher verity.

A lack of confidence fatal to reasoning.

While on the one hand dogmatic assurance leads to overconfidence and to a lack of scrutiny in the rational processes, on the other hand, the importance of a reasonable confidence in one's ability to solve a problem, or to meet a situation, should not be forgotten. Ruger found that often the first success that came to his subjects in solving the puzzles,

[1] Ruger has shown in his discussion of the learning processes involved in the solution of puzzles that, on the one hand, dogmatic and uncritical attitudes of mind affected the results unfavorably; likewise, a dependence upon others and a lack of confidence on the part of the subject worked unfavorably.

appeared as a transfer of mood in which the "subject's idea of himself from that of one being incapable of solving such a problem to one capable of doing so probably played a part." It is a familiar fact to teachers that the child's general attitude in regard to his ability to do the work of the grade is extremely important. Often the backward pupil becomes a hopeless problem, not so much because of native inability, as because of the discouragement that repeated failures have developed in him.

The elimination of incorrect attitudes of mind.

Dewey,[1] citing Locke, enumerates certain attitudes and mental dispositions to be avoided, some of which have already been touched on in the above discussion. Others are, a narrow self-interest which can see only that side of the question which has for the individual a practical significance; illiberal points of view, arising from limited experience; extreme unwillingness to form conclusions, which is, however, not often characteristic of children, but generally of mature students of adult age. If these and other incorrect attitudes of mind can be eliminated, vastly more will be accomplished in training pupils to reason than can be attained by any study of, or practice in, logical form.

Consequences, not isolated facts, the ends of thought.

It must also be remembered that consequences, not isolated facts, are the ends of thought. The child must be trained more and more to comprehend remote consequences, and to proceed from the practical to the theoretical. At the same time care must be taken that theoretical thinking shall not weaken the practical attitude. In school instruction methods should not be based exclusively on symbols and verbal forms, and overemphasis of instruction of this character was one of the principal faults of the education of a few generations ago. It is equally fatal, however, to make the opposite mistake of dealing exclusively with objects. While interest may primarily

[1] *Op. cit.*, pp. 22–25.

be aroused through dealing with concrete and narrowly practical situations, it must not end here.

A genuine love for truth at the basis of intellectual advancement.

Finally it must be remembered that the most important of all attitudes for rational thought is that which springs from a genuine love for truth. The noetic passion is the most exalted and unselfish of all human emotions, and when it becomes the ideal of the thought process, it changes the whole character of this process. We have already seen how this passion for truth begins as curiosity; we have emphasized the fact that to it has been due the development of pure science which has brought results of inestimable value to the human race. Truth knows no narrowly practical ends; it recognizes no private interests; it pleads for no special cause. For this reason it has been feared throughout the ages by those who have had selfish ends which they sought to promote. The statesman has often perverted it, and the churchman has put his ban upon it. Yet it has prevailed because of its own inherent strength and because error of necessity destroys itself through the sifting of the ages.

The teacher must insist on truth.

No ideal as worthy as truth can be placed before the learner. The teacher who does not give truth the highest place, as the goal of education, is false to the service to which he has been called. To strive for truth, to make his pupils earnest seekers after truth, is his final and single duty; it includes all others. No scheme of moral or religious education can substitute an ideal so exalted as the quest for truth. To pervert it in the interests of any cause, however worthy in itself, must lead to ultimate disaster. Centuries ago the Sophists, denying all objective values, and emphasizing narrowly practical ends, sought to teach their countrymen the art of reasoning as mere dialectic skill. They prided themselves on their ability to prove their point, irrespective of its merit. The foremost rhetorician was he who could argue one side of the case on one day and establish his contention; who could argue the opposite side on the succeeding day, and still gain the verdict. To-day two debating teams from the same institution of learning argue a question in one case to prove a proposition and in the other to overthrow it. Here, as in the days of Athenian ascendency, the end sought is not the establishment of some fact, but the victory of gaining a point; the merit that is emphasized is not that of rational excellence, but of disputative ability. Such a training has a value, especially for those who enter public life; but there is a great danger in all this. Skill in argument, when coupled with a disregard for truth, is one of the most questionable of all accomplishments. The pupil must be taught to reason well, but paramount to this he must be taught to reason truthfully, otherwise, he is being trained in sophistry. To reason justly he must be made to recognize that truth has but one aim, to know itself. With this aim in view, it has a greater emotional uplift than any other fundamental human impulse. It is as deeply planted in the human life as are the economic and the social needs, and is capable of ranges of flight toward the ideal that are denied to other instinctive longings. Yet while this quest for truth takes upon itself the nature of a duty and may even be accompanied by a religious fervor, we are not for a moment to suppose that truth is something abstract and apart from human life. Truth is immanent, not transcendent; it gives us a world of pulsating vital values, which, however, cannot be seen by the sordid eye of prejudice, nor comprehended by a mind dulled and besotted by narrowly practical and selfish ends.

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