APPLICATIONS OF PSYCHOLOGY IN EDUCATION.

Professor Royce, in a most suggestive paper, recently published (Educational Review, I: 15, 121), has observed that what the teacher has first and chiefly to gain from the study of psychology, is the psychological spirit; that is, the love and the skill that are required for the purposes of mental diagnosis. The teacher should be a naturalist, in the habit of observing the mental life of children for its own sake. "It is in this fashion that naturalists always have to work. What is here in this live thing? Why does it move thus? What is it doing? What feelings does it appear to have? What type of rudimentary intelligence is it showing? Ask such things not because they will give you a systematic theory, but because they will help you to form the habit of watching minds." This is admirably said. But it is not quite all that is necessary; for the teacher is not only an observing naturalist. He is an agent appointed to solve problems, to produce effects on a living organism, to modify forces, which begin by being psychological, but end by being social.

One way of stating the problem is the following: "The child must be developed into an harmonious organism." This formula is more ambiguous than it sounds. For an organism implies a medium, and the medium in which the psychic organism of the child is to live consists of ideas. Harmony of the organism, therefore, means its adjustment to ideas. But ideas also constitute integral parts of this mental organism. Therefore harmony means adjustment of internal ideas, or those existing in
the mind, to external ideas, or those existing in the social mind, or imposed by the constitution of things. But again, all ideas are not accessible to all minds; and therefore minds do not live in the same media, but are often in worlds widely remote, even when the bodies of these minds are in close propinquity with one another. Each mind selects, creates, the world in which it is to live. And conversely, all the events which have transpired in the history of the world are but the outward realization of ideas which have been associated with brains like these. Despotisms, wars, revolutions, pyramids, crusades, inquisitions, cathedrals, dynasties, religions, sciences—all are only projected thoughts. Of what fearful importance is it, then, to know what thoughts shall spring up in the growing brain, and, if possible, how to modify their nature and their sequence!

The problems of psychology and education are so interesting, and their points of contact so numerous, that for a brief discussion it is equally necessary and difficult to make a choice. I will make this choice in favor of the theme which is most prominently forced upon the attention of all teachers. This is the process by which a child acquires the knowledge which it is the business of the teacher to impart. I may state this subject in the form of a definite problem, as follows:

Given, a child with a small amount of knowledge spontaneously acquired, to increase his knowledge in directions where spontaneous activity would not suffice for the acquisition. Knowledge of a thing out of the mind constitutes an idea in the mind. Therefore, the problem of imparting knowledge to the child may be stated as the problem of exciting or generating ideas in the child's mind.

I do not propose to discuss this problem exactly from the practical point of view. Nor have I to suggest any very new methods of practical instruction. I desire rather to inquire into the principles which underlie methods already in operation. For as soon as we examine into the matter a little, we find that some of the most commonplace tasks of the school involve processes which are complex, intricate, and to...
a considerable extent mysterious. A sense of this intricacy and this mystery cannot, of course, directly tell the teacher how to solve the educational problem, but it may, nevertheless, often guide him insensibly to principles which will prove fruitful for this solution. At all events, the theoretical discussion is interesting for all who care, not only that a thing should be done, but that the how and wherefore of the doing should be understood.

The child who is patiently or impatiently waiting to be taught, has a brain which, in some mysterious manner, functions during the process of learning. He is expected to remember what has been told him, and must do so in accordance with the laws of memory; and when he forgets, it is probable that these laws have been thwarted or violated. The knowledge spontaneously acquired before the child is old enough to go to school, chiefly concerns sensible objects; and the laws of the formation of sense perception become, therefore, of the greatest importance to the teacher. This is true, not only for this earliest knowledge, but also because a large amount of all subsequent knowledge continues to consist of material furnished by the senses, and because, also, these sense perceptions constitute the type and model, if not the origin, of all subsequent ideas. And when we find that all thoughts are blent with feelings and volitions; that the mind acts as a unit, and not as a bundle of separate faculties; then as we try to interest the child in a subject by kindling his feelings, or by employing his restless energies in some active work, we can remember that there is a philosophical basis for such a method, that the latter is not a mere practical device for making study agreeable and the child less rebellious, but that it is grounded in the deepest nature of the mind and brain.

Let me return now to my original proposition: "The problem of imparting knowledge means the problem of generating ideas in the child's mind." Therefore, we must point out at once that it does not mean simply presenting a verbal statement to the child, and requesting him to learn this by heart. Such
a procedure is inadequate, even if, as is by no means always the case, some pains be taken to inquire if the child can define all the words and terms used in the statement. For while different verbal sentences resemble each other, the facts they imply may be widely different; so that their apprehension by the child's mind becomes a different process in each case. To overlook this is to fall into a cardinal fallacy, only too often immanent in the teaching of children. Then the child, instead of coming under the discipline of several kinds of knowledge and mental work, is submitted to only one kind; the work, namely, of memorizing sentences.

What has been just said will be rendered clearer by considering four different pieces of information which easily might, in ordinary school curricula, be presented to the child on the same day. Let these be, for instance: (1) The properties of a wooden cube; (2) the contour of the north shore of Long Island Sound; (3) the date of the landing of the Pilgrims; (4) the relation of the subjunctive mood to the indicative. Before the child could really know these things, he must have experienced four different kinds of thoughts or phases of consciousness. For the knowledge or idea of a cube depends on an immediate sense perception. The knowledge of the north shore of Long Island Sound involves a mediate sense perception, an idea of relations in space actually existing but not actually perceived, but only conceivable. The date of the landing of the Pilgrims is a knowledge of relations in time. Knowledge of the subjunctive mood is knowledge of relations between ideas. How are we to generate in the child's mind these four different kinds of ideas? How are we to introduce them among the ideas which already exist in his mind, and make up the content of his consciousness? What occurs when the child has a perception of an external object? What when he tries to conceive of an object which he will never be able to see? How does his idea of a time-relation differ from that of his idea of space? And how can such an idea be acquired about a time of which he can have no personal experience? Finally, how is it possible to make a child conceive of
relations which are neither of space nor time, but which only exist between ideas; and these not ideas which have arisen in his own mind, but which belong to a mental experience widely remote and different from his own?

The answer to these questions implies some theory of the nature of the mind and some doctrine of the generation of ideas. Is the mind a product of the brain, and can we excite ideas in the mind by direct action on the brain? Or is the brain the organ of the mind, and can we influence the processes in the brain by means of ideas? To what do our words appeal when we communicate with the child by means of language? Do external objects affect the senses irresistibly, and in a fixed proportion to the intensity of the stimulus they afford? Or does the mind select for its own purposes from among the mass of material soliciting its senses? Do ideas simply stream through mind in an endless succession? Or do they associate into groups according to some principle of organic cohesion? Upon these difficult questions I may touch just sufficiently to find some general background of thought which will be useful in the teacher's practical work.

The first suggestion, that the mind is the product of the brain, is adopted, though unconsciously, by many persons who would not call themselves materialists. It is really held by all those who think any special care or strenuousness in mental education to be unimportant, and who believe that if the physical health of children be properly provided for, intellect and character will develop spontaneously in any desired direction. Obviously the persons holding such opinions are much more often parents than teachers. But, even when we have secured the most vigorous nutrition and circulation of the brain, we are entirely unable to foretell what kind of processes will take place in it. The healthiest brain may originate the feeblest thoughts, and conversely powerful mental processes may be sustained by brains of frail physical power. Apart from strength or feebleness, we are still less able to say what kind of thoughts or ideas will be manifested in connection with the brain processes (unknown to us) which do occur. We,
can make a muscle contract, and produce a given movement; we can so stimulate a gland as to secure a given secretion; but, even when we are able, as we occasionally are by drugs and other agencies, to stimulate the brain, we are as far as ever removed from producing a given thought or given train of thoughts. The only means at our command for exciting a thought, is that of appealing to thoughts previously existing. If it be true, that whenever thoughts arise in consciousness, some nerve process is simultaneously sustained in the brain, we must infer that we are able to excite this physical process in the brain by awakening an idea, though we are quite unable to awaken an idea by any direct excitation of a brain process. Thus, whatever may be its ability in other respects, the materialistic doctrine is quite useless for the purposes of education. Nevertheless, we are constantly compelled to remember the close connection and inter-action of psychical and physical activities. These may be merely double forms of one fundamental activity; or, really and fundamentally they may be different, but the fact of their incessant mutual influence is obvious both to our consciousness and to our observation. A headache or an indigestion may blur our thought, or a quickened circulation stimulate it to activity and a groundless sense of pleasurable being. But there are also thoughts which can stop the pulse, and blanch the cheek, and make the very sun turn pale.

I have represented the formula which expresses our simple consciousness in this matter, in the diagram [Fig. 1]. It consists of a series of wavy lines, of which the lower, darker part may be taken for the physical activities; the upper, lighter part for the psychic or mental activities. The arrows
show that these waves are constantly passing both from below upward and from above downward; bodily conditions influencing the mind; mental conditions influencing the health and physical development.

I have endeavored to illustrate several definitions of mind by means of diagrams. Fig. 2 illustrates Hume's theory that "the mind is the sum of its thoughts." It shows a succession of waves endlessly following each other in a stream of thought, and whose sum taken together makes up the totality of consciousness. Fig. 3 is borrowed from Professor James, being the diagram given by him to illustrate his definition. He observes that each thought represents a cross section in the stream; he calls it a pulse of thought, or consciousness.

Fig. 4 is intended to show Spencer's theory that "the mind is a circumscribed aggregate of activities; and the cohesion of these activities, one with another, throughout the aggregate, compels the postulation of something of which they are the activities." Here also is an aggregate or sum, as shown by

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1 Professor James's expression accords perfectly with Hume's theory, though he adds to it various details.
the cluster of dots. But these do not stand simply for phases of consciousness, or conscious thoughts and feelings, but include with these, forces and tendencies, of which many may be for a long time below the threshold of consciousness. The term activities includes, therefore, thoughts, feelings, volitions, tendencies, all that makes up the character of the mind, its behavior to external things, and its internal horizons and content. I have no diagram to illustrate the definition of Volkmann, namely, that ideas are successive states of an underlying substance, the mind.

These diagrams show distinctly, I hope, that when we approach a child’s mind for the purpose of conveying to it some information, we approach groups or clusters of ideas which at each moment are unified into consciousness.

One way of stating the fundamental problem of education is the following: Education aims to enlarge the periphery of consciousness in proportion to the central nucleus; it aims to make disinterested ideas predominate over central egotisms. The peripheric rim of consciousness is enlarged by multiplying the number of thoughts in it, by increasing their recurrences, by suffusing them with feeling, and by quickening them with volition. Contrast the consciousness of the individual to whom the thought of the battle of Marathon, for instance, has become a felt experience, with another to whom the description of the battle, if heard, would remain only a form of words. In the first case, the peripheric rim of consciousness becomes enriched with a new element, and repeated recurrence of such elements or thoughts would give this part of the conscious cluster a density, and therefore a force, comparable with that of its organic nucleus. In the second case the intellectual periphery remains unaffected, and when it long remains so, it tends to atrophy and shrivel, to shrink to a mere membrane, thinly covering the primitive personality. The whole being becomes a mere self of instincts; no disinterested thoughts remain in it. Fig. 5 shows how the cluster which represents consciousness at any given moment, arises out of the moments which precede this. Fig. 5 is a cylinder, of
which Fig. 4 is a cross section. The mutual relations of the center and periphery are the same in both.

There remains another diagram which can be made useful in educational thinking, and which is intended to illustrate a definition given by Professor James: "The mind is the medium upon which the manifold processes in the brain combine their effects." This formula I have illustrated by a diagram of a storage battery charged from a group of galvanic cells [Fig. 6]. The four large cells, which constitute the storage battery, stand as the symbol of the mind; the group of smaller cells, generating the electricity by chemical action, represent the manifold processes in the brain. The same diagram might be used to symbolize the relations of the manifold processes in the general nervous system, to the brain, which certainly stores these up, and in so doing becomes a reservoir of force. Thus the manifold impressions to which the child is subjected are constantly being unified in the brain, and, by their accumulation at this focus, are serving for the generation of force.

To secure an abundant generation of force is the second fundamental aim of education. The great method in nature for the generation of force is the concentration, in as narrow
an area as possible, of impressions derived from a very wide area. The most striking—I might say the most tremendous—illustration of this method is furnished by the germ cell. Here an enormous amount of antecedent impressions, tendencies and potentialities, physical, mental, and social, are concentrated upon a point of matter just barely perceptible. A comparatively immense amount of force is produced, sufficient indeed to sustain the germ throughout its entire career of development [see Fig. 7]. Thus the more completely the child's mind unifies the impressions impinging on it, the more mental power results. Conversely, when impressions, though multiple, are not unified, but impinge on the mind in a fragmentary, desultory mass, then no single thought results, and power fails to be generated.

This statement may be paraphrased in terms of brain processes thus: Every thought or activity of consciousness is associated with the excitation of some tract of nerve-tissue in the brain. The fusion of such thoughts into a single conception implies that diffused cerebral excitations have been converged into a single massive impulse, which corresponds to the activity of the brain in its totality.

If we analyze the first piece of knowledge which we are imparting to the child—the properties of the wooden cube—we shall encounter three grades of fusion. In the first grade rays of light from the cube are brought to a focus at a certain part of the retina, the point of distinct vision, called the macula
lutea or yellow spot. This focusing necessitates fixation of the eyes by a voluntary effort on the part of the child—effort which constitutes his first act of attention. After this has been effected, color impressions from the retina are transmitted to the brain, and together with them, other impressions from the muscles employed in the fixation of the eye, and in the successive fixations required to bring successive segments of the cube's outline at the ocular focus. There is a certain area of the brain, on its posterior or occipital lobe, known as the visual center, whose excitation seems essential to the act of vision. It is probable that the two sets of impressions I have mentioned as arising from the eyes, meet at this visual center and there fuse together. This is the second grade of fusion, and results for the first time in a distinct perception of the object, the cube. The fusion of rays in the retinal image took place below the level of consciousness. The perception rises just above that level. In other words, the first thing of which the child is conscious in regard to the cube is that he perceives it. This perception constitutes a new thought or phase of consciousness. [See Fig. 8.]

In a third grade of fusion, perceptions of individual objects are combined into the concept of a class, or a number of simple ideas, or propositions, are combined into a complex conception. Where, however, this third combination takes place, we do not at all know.

Upon the basis of the facts above mentioned, the following proposition may be constructed: When the brain processes involved in visual perceptions—as of the wooden cube—have been frequently repeated; when they have been associated with brain processes involved in tactual perceptions of the same cube; when these perceptions and processes excited by the cube have coexisted with perceptions and processes excited by other
objects, and revived by memory in consciousness for comparison; then a state of consciousness is aroused which may be called an internal perception. This is a single pulse of thought, but it embraces, as objects, the multiple details of the previous states. They therefore may be said to be unified in it.

It is possible that this internal perception of self-consciousness, this single pulse of unifying thought, corresponds to a total excitation of the brain. And that is why injury of any part of the brain, and even of a very limited part, is liable to be followed by a defect of consciousness, or even by its total loss. What is important to remember is, the necessity that perceptions should in some way converge upon a focus in order to originate a definite conception in consciousness, and that this focusing process seems to be a continuation of those already described at the retina and at the visual center of the brain. The two lower processes of focusing I have illustrated in the diagram [Fig. 8]. The two other processes I have left unillustrated, because of the profound mystery which surrounds them; mystery which it is not well either to belittle or slur over with cheap explanations.

When ideas are to be combined in a single conception, we can always combine statements into a single proposition, and express this graphically in a diagram. All the diagrams I have used to illustrate my own propositions serve, I hope, to show this fact. In addition, I will present a few more designed for purposes of specific school instruction. Thus Fig. 9 condenses,

1. Molar motion of percussion generates molecular motion that we call heat.

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\begin{align*}
M & \rightarrow m m = II \left\{ P \right. \\
& \rightarrow m m
\end{align*}
\]

2. Molecular motions of chemical action constitute heat, and have a mechanical value, i.e., in reference to molar motion or masses.

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\begin{align*}
C. A. & \rightarrow m m \rightarrow m m = M
\end{align*}
\]

Fig. 9.

under a single visual symbol, several propositions in physics. In Fig. 10 an apparently reverse process is followed. A single
proposition is taken, and shown to be in fundamental agreement with several other propositions, which to superficial inspection seem widely removed. This is the proposition. Electricity flows from a body of high potential, into a body of low potential. These propositions all condense into this single conception: Differentiation passes into equilibrium, and during the transition, force is evolved.

This brief suggestion of a method whereby all items of knowledge are constantly being fused into single concep-
tions, is radically opposed to much prevailing custom. Habitually a dozen fragments of knowledge are presented to the child in as many different text-books, and are liable to remain in his mind as isolated, fragmentary, and lifeless, as are the scattered bones in the valley of Jehoshaphat. How often is a child expected to study separately, reading, writing, spelling, composition, definitions, elocution, synonyms, rhetoric, etymology, Latin, French, and English grammar, mythology, history, and geography! The essentials of these subjects,—indeed for many of them, all that the child needs to know,—might be obtained from the penetrating study of a page of Livy or of Cornelius Nepos.² In such a study, these different topics, as on the diagrams, are associated with each other in logical and indispensable relationships, and the child memorizes them all as a whole.
subjects would fall into place as the naturally related parts of a complex whole, the whole being the narrative given by the Latin author. The processes of distinct mental perception are closely modeled upon those of visual perception. An idea, like an object, must be apprehended either as an independent whole, or as a part occupying a relative position in a whole. The cube is perceived by the child as an independent whole object: the surfaces and angles of the cube are seen as its parts, and as such are comprehensible and interesting. Should we, however, attempt to abstract the surfaces and angles from the individual cube, and present these to the child to be studied, we should probably entirely fail to awaken in him any mental reaction whatever. A cube is a solid object; before looking at the cube, he had previously accumulated a stock of experience about solid objects, and to this the new experience of the cube can be referred. But of isolated surfaces and angles, he has no glimmer of previous experience; he has never been conscious of such things apart from solid bodies, and for a long time it would be useless to try to call his attention to them. When we apparently do so by drawing lines on paper, we simply transfer the attention to another whole object, this time a flat piece of paper, which can then be compared with the cube.

There is a similar waste of effort in directing a child to the mass of details, which must seem unrelated to each other until some whole is understood. The aspect of the case entirely changes when the spelling, grammar, etc., are taken up as merely subsidiary to a comprehensible purpose, that namely of understanding the Latin narrative. Something happened, that is history. It necessarily occurred in a definite locality, which can only be appreciated by geographical notions. The narrative cannot be understood except by understanding the words, grammatical construction, and style of the Latin language. This involves an incessant, though incidental, comparison with

of pedagogics. Never having had an opportunity to study this system, the fact that the same idea has occurred to me independently, shows how naturally it arises from the unbiased consideration of the nature of things.
at least two other languages, English and French. Spelling, writing, so-called etymology and pretended synonyms of these words, the art of composition, the ethical and even religious ideas incidentally touched upon in the narrative, can similarly be studied under the stimulus of a distinct definite purpose, that, namely, of making the narrative clear in all its parts—of transforming it into an internal perception.

The process of unifying such a mass of details into a single thought is attended by generation of mental force. This is shown in several ways. In the first place, as any one may be convinced who examines his own consciousness, the work of combining several ideas into one is always attended by a sense of invigorating effort. Even such elementary combinations of ideas as are needed to make a single verbal statement is attended by a sense of some degree of exerted power, which increases with the complexity of the combination and with the terseness of its verbal expression. The feeling closely resembles that which is experienced after effective muscular exercise.

The generation of force is also shown by the fact that all acquisitions of ideas, as all processes of combination of ideas into higher concepts, involve acts of conscious volition. We have seen that the first step in acquiring knowledge about the cube was an act of voluntary attention, in which the child fixed the object with his eyes. Each successive step in the process of learning demanded a new act of attention, new adjustments of the eyes and hands, by means of which the different properties of the cube might be seen and handled more minutely. Through these successive acts of attention, the senses become sensitive to more delicate degrees of difference. The relation between the stimulus and the sensation is removed to a different scale. For the same degree of stimulus there is an increasing quantum of sensation; or there is the same quantum of sensation for a diminished degree of stimulus. The trained or attentive eye perceives details entirely overlooked by the unprepared or inattentive observer.

What is this mysterious act of attention, which thus changes
the whole relations of the child to the external world? Mr. Sully will have it that there is no mystery in the case. “Attention,” he says, “is simply detention in consciousness.” But what is it that commands and effects the detention, that says to the idea, “Stay!” and it stays, instead of passing at once to be lost in the stream of thought? The detention is always determined by the condition of the previous consciousness.

Thus, in a being previously only conscious of sensations, as a baby, or a dog, it is necessary, in order to call attention, to increase the strength of the sensory stimulus. A bright or moving object will be perceived where a dull or motionless one will not. So we move a bright colored ball before the eyes of the baby, or throw a stone before a dog. In the child, older and accustomed to obey, the command of the teacher is sufficient; the expectant idea of something to happen suffices to dominate consciousness, and to inhibit trains of thought irrelevant to the matter demanding attention—that is, the cube. In two other cases, the child’s attention may be fixed spontaneously, and in a way identical with that which must be followed in adult life. The child may wish to use the cube as a building block, and will then attentively examine its shape and angles, to see if these will suit his own purpose; or, knowledge of a wooden cube having been previously acquired, he may examine a glass cube from simple curiosity to see how far the properties of the new, and generally resembling object, may agree with those of the one previously known. In the first case the idea of an expectant purpose detains the cube perception in consciousness. A more extensive volition directs the voluntary act of attention. In the second case the attention is commanded by a feeling, the feeling of intellectual curiosity about the relations of things. This feeling serves to detain in consciousness the perception of the cube. Thus either desire or will are essential to the acts of voluntary attention, by which alone the simplest definite knowledge can be acquired. The reason that so many people fail to learn anything after they have left school, is because they are incapable of initiating the deliberate or sustained attention
which is necessary, and this incapacity is due to lack either of the characteristic feeling which should command attention,—that is, intellectual curiosity,—or to the lack of any purpose which the knowledge could be made to serve, were this purpose only the further continuations of ideas. This is why, for the majority of adult human beings, no ideas enter the mind, except such as are revived in the repetition of cerebro-mental processes which have already been carried on. Such people can only think what they already know, and have neither desire nor power to learn anything new.

Since the acquisition of ideas is so closely dependent upon feeling and volition, it becomes necessary for the instructor in ideas to use every means to arouse the feelings of the child and to encourage the performance of voluntary acts.

Empirically, emotion is constantly appealed to in education. Fear, affection, vanity, ambition, self-love, these have been played upon by pedagogues for centuries. They cannot be entirely neglected. Yet to the extent to which these feelings operate, they cannot but tend to increase the area of that personal nucleus, whose relative diminution is a principal aim of education. It is little use to acquire knowledge of impersonal things and relations, if this knowledge only serves to feed the cravings of personal vanity, and afford no satisfaction unless these be gratified.

The feeling which should accompany ideas is that of disinterested curiosity. Of this children are far more susceptible than is often supposed; indeed, far more so than is the average adult, whose indifference to new knowledge is frequently exasperating. But there is no prettier sight in the world than the flushed cheeks and kindling eyes of children upon whom a new idea has just dawned. The task of engaging the volition of children during the excitation of ideas is more complex. In the most simple way it is often profitable to set the child to work at something which interests him, in order that he may incidentally acquire certain information which is in itself distasteful or tedious, and yet which it is desirable that he should know. Thus Miss Edgeworth, in one of her charming stories,
shows how a naughty boy, who has absolutely refused to learn how to read, is brought to do so with avidity, in order to procure some information about the cultivation of radishes—in which practical enterprise he has been made keenly interested. So, as I have already suggested, much substantial knowledge of the cube can readily be acquired, when the child is encouraged to use it as a building block. Innumerable applications of this method will suggest themselves to every skillful teacher. The internal activity of the mind is aroused by desire, and no desire is more effective than that to accomplish a purpose. Many individuals, throughout their lifetime, never think except in connection with something they do. And indeed if we consider the world at large, we may perceive that all thought has developed out of impulses to action. Why should it be otherwise with the growing child?

When experiments are performed by the pupil for the purpose of demonstrating the properties of sensible objects, the influence of his voluntary action becomes still more obvious. The experiment may be as simple as that of dissecting an apple, or it may be among the most abstruse offered in the study of the physical sciences. But in every case the pupil is compelled to do something in order to bring about a situation or elicit a phenomenon which he may subsequently observe. Each action involves cerebro-mental excitation, thus a phase of consciousness, a moment of life to be woven into the chain of existence. Thus the immense importance of experimental study and physical science does not consist, as is sometimes crudely claimed, in a training of the senses. It lies in the circumstance that sensible facts are constantly being transformed into mental facts through the energy of human volition. The world external to the brain becomes resolved into perceptions or ideas in the mind. Such training of the senses as occurs is incidental. At present we cannot be said to possess any system of elementary training for the senses beyond what is afforded by the study of music, or by the exercises of the gymnasium.

8 The sound philosophy of Miss Edgeworth's stories is often concealed by the simplicity of the garb in which it is clothed.
Such a system might very usefully be devised, based upon psycho-physical investigations.

One very interesting consideration lies right in my path, and should be mentioned, for it concerns a much-mooted but really futile question. The question is: Shall the child study Latin or science? I call the question futile because in reality the child must study Latin in order to be able to study science. In the Latin language, which is also ours, we are enabled to witness an extraordinary phenomenon, which has become the basis of all our thoughts. We are able to witness the incessant transformation of sense perceptions into concepts and abstract ideas. The Latin words are all alive with sensuous force; they move, and fall, and leap, and burn, and sing. Every word is either a picture of a thing, or an event; or else it indicates some space relation between things. Things are above or below, within or without other things. We do not possess superior or subordinate ideas, but ideas of subordination or superiority. That is, we have mental images of objects standing in a superior or inferior position to other objects. Hence there are no such things as synonyms. There are equivalences in nature, but there can be no synonyms in language, for every word represents a different angle of vision for the mind contemplating nature. I have tabulated a small group of words which would most readily be classed as synonymous, and are often carelessly interchanged in English. But read in Latin, and in their native picturesqueness, they are seen to be quite distinct. "Illustrious" is what the light shines upon; "conspicuous," what is espied; "distinguished," what is separated from the rest; "notable," or "notorious," what is known by a sign; and "egregious," which we now only use for blunders, was, originally applied to any celebrity that raised his head out of the flock, as an ambitious ram was so often seen to do.

In a commonplace way of considering these things, the child is merely told that the words are derived from such and such circumstances. The impression is left—is perhaps intended—that some one, already possessed of an abstract idea, seized
upon the sensory image as a means of expressing this. But the reverse is true. The sensory images were first perceived, grouped together, and the relations common to all abstracted, then these relations remained as a residuum in consciousness, an idea mysteriously capable of expression by a sign—a word. This process of the genesis of thought for the race, is exactly repeated for each child. Whoever would acquire some little of the masterful grasp of the world which has forever characterized the Romans, must follow them, and allow their thoughts and language to grow up from their vision of the world. What the eye sees clearly, and the speech reproduces truthfully, that will the hand grasp forcibly, and the mind thoroughly dominate. Because of this mode of evolution of thought, experimental volition can be invoked for the aid of other ideas than sense perceptions.

Let me return to the three other pieces of information which I have imagined to be presented to the child. The next after the cube was the contour of the north shore of Long Island Sound.

This is an actual object in space; but it can never be an object of direct perception to the child, because his visual sense can never embrace it. The space relations of the different points on the outline in question, can, however, be estimated by means of actual surveys, and these space relations be expressed diagrammatically in a visual image, that is, in a map. It is this visual image which must be presented to the child, in order to excite an idea; it is the map outline which is perceived, and the space relations of its different segments. The visual perception of the map becomes an idea in the mind; its revival in memory, as an internal mental image, is effected by an act of attention.

The third knowledge to be imparted, the date of the landing of the Pilgrims, no longer involves space relations, but relations in time. These are immensely more difficult of apprehension. Relations in space are directly apprehended by the visual sense, or inferred from signs which are directly perceived. But the perception of time is a matter of internal
experience. We know time because we are conscious of a change of our own state; we are aware of a series of sequences in such changes. But how can this inform us of periods of time which lie entirely outside of our personal experience? How can a child be informed, whose experience is so much narrower, who forgets so much even of that experience, and who therefore only has an idea of the shortest series of events? The problem is in many respects analogous to that of calling up a mental image of geographical relations, which can never be directly perceived. This problem was solved by means of a symbol, the map. The symbol itself is constructed by means of a series of laborious inferences from direct space observations, those involved in the process of surveying. In the same way, our knowledge of historical sequences depends upon a complicated series of laborious inferences which are far beyond the capacity of the child, to whom nevertheless it may be convenient to tell the story of the Pilgrims, and the date of their landing. These inferences, to be intelligible to the child, must be represented by means of a space symbol. A date has no meaning except in relation to something before and behind it. This relation of sequence in time can be expressed by a coexistence in space, and as such converted into a visual image, which can pass into the child's consciousness as an idea. The symbol might be nothing but a very long line drawn on the wall, and intersected at suitable proportionate intervals by vertical lines, representing salient epochs, as, the Trojan War, the first Olympiad, the birth of Christ, the discovery of America, the landing of the Pilgrims, and the last Presidential election. [Fig. 11.] Other more complex diagrams may be used, and Bern's historical charts are admirable. But the single line already suffices to convey the funda-
mental idea of before and after, and without this idea, knowledge of historical dates is an illusion.

I think everyone on examining his own mind will notice that the conception of a time period always presents itself as a space tract. We must think of some event from which to date any other event; and therefore at least two ideas must be present in consciousness. But what is simultaneous in consciousness can always be represented as coexistent in space. We only live in the present, and can only think of the past by recalling it into the present. This fact is the foundation for the entire graphic method, which is of such immense importance in modern science. The beatings of the pulse, the movements of the chest in respiration, even the ebb and flow of the body temperature during long weeks of fever, may all be represented on a chart, and thus brought within the limits of a single visual perception. The essential physiognomy of special diseases may thus be imaged. At a glance it is possible to see that one series of curves is taken from a typhoid fever patient, and another from a case of famine fever. For everything is motion: and the stillest form only indicates the direction in which many masses of molecules move.

Our fourth piece of knowledge is the relation of the subjunctive to the indicative mood. This is a specimen of as abstract a kind of knowledge as can be presented to the child. The refined modality of an action, its possibility, its relation to a dozen different mental states, doubt, fear, concession, and the rest—all this is difficult to convey to a child’s understanding. Frequently, on that account, I suppose, such conveyance is not attempted, but a form of words is substituted, to be learned by heart. In Fig. 12, I have tried to show how some of the most salient characteristics of the subjunctive mood can be shown. The parallelogram standing for the subjunc-
tive, is placed below and to the side of the indicative. It lacks the index pointer of the primary mood. The grammars divide the uses of the subjunctive mood into cases of desire and of possibility. I have ventured to symbolize these two cases by hieroglyphic pictures—a heart standing for desire, a falling stone for possibility. This is a return to the primitive mode of written expression, when all words were pictures, and the pictures had not yet been worn away to mere signs. The construction of the diagram symbolizes the mental construction, gives it the material body which seems to be indispensable to definiteness and thoroughness of thought, and associates with the perception of relations an act of volition, by which the relatively faint excitation of the perception becomes broadened, deepened, and diffused in the brain and mind.

The anatomical basis for volition and emotion is really better known than that for ideas proper or their complex combinations. The initial stage of volition is the conception of the end to be attained. This conception is correlated with some nervous process, sustained on the cortex or superficial part of the brain. When a voluntary act is performed, a long tract of fibers is excited—the so-called motor tract, which descends from the ideo-motor region of the cortex to the ganglia at the base of the brain and below it, where the innervations of voluntary muscles originate. When the volition is not at once carried into effect, but remains before consciousness as an intuition, it is supposed that this motor tract is also excited, but less vividly than when an act is performed.

Similarly for emotion, the theories which characterize emotion by the various disturbances in the viscera, in circulation, and in respiration, which are known to accompany strong feeling, may be especially supported by the fact that in the medulla are concentrated nervous foci which preside over all the vital functions; namely, the cardiac, respiratory, and vasomotor centers. Thus, when the pulse or respiration quickens by emotion, we are compelled to assume, as in the case of

4 The now celebrated theory of Professor James.
volition, that an excitation was diffused throughout the brain, from the cortex to the base. [Fig. 16.]

To secure such massive cerebro-mental action is the fundamental reason for trying to excite feelings, and to suggest voluntary acts to a child, whenever we attempt to generate in his mind a new idea.

I have now drawn this line of thought to a close, and will sum up the three or four propositions I have tried to elucidate. I have only touched upon one or two of the most general psychological aspects of education, and have passed by many that might seem especially to call for discussion. Thus I have left entirely untouched the great fact that the child’s mind is an organism in course of evolution; that on this account its processes often differ radically from those of an adult mind; and may often be most fruitfully studied along the lines explored by Romanes, who traces the evolution of mind from the lower animals up. Again, I have hardly alluded to the recent experiments in psycho-physics, which some writers seem inclined to consider the most practical and fruitful part of modern psychology. These experiments investigate, in fractions of a second, the time relations of many cerebro-mental phenomena, especially acts of perception as modified by the attention of the subject, or the complexity of the recognition required. Other experiments investigate the
quantum relations between stimuli and sensations; and these again as modified by the attention, or experience—that is, by the previous life of the subject.

Themes like these are equally large and special, and it has seemed better to dwell upon a few more fundamental considerations, which may determine the most general attitude of the teacher toward his charge. I will sum up these considerations as follows:

To the self-consciousness of each individual the mind is a cluster of ideas; to every one else, an aggregate of activities.

The attempt to impart knowledge to a child means the attempt to introduce a new idea into this cluster, or to excite a new activity in this aggregate.

The fundamental fallacy to which educational effort is liable is that of mistaking the presentation of a verbal statement for the effective generation of an idea.

The generation of a new idea in consciousness constitutes an actual enlargement of the area of an individual being. To have an idea is to live an idea, and, therefore, the more ideas the more life. There is no other way known to us of having more life.

Ideas, in the most general sense, are phases of consciousness. They may be divided into feelings and perceptions. The feelings are of external origin, that is, sensations; or of internal origin, when they are either emotions or volitions.

Perceptions are also either external or internal. External perceptions result from a fusion in consciousness of sensations, and are directed either to external objects or to the space relations between them. Internal perceptions are directed either to the revived, that is, the ideal, feelings of things, or to the relations between these revived feelings or ideas. When combined they are called concepts.

Relations of time can only be appreciated as feelings of conscious change of personal condition. Outside of ourselves we never know time, but only space. A series of sequences in time, therefore, to be vividly appreciated, must always be expressed as a group of coexistences in space.
The perception of a sensible object, which is the foundation of all knowledge, remains the permanent type of all knowledge. Internal perception of general concepts and abstract ideas can be guided by study of external perception of concrete things.

Two things are essential to each perception: multiplicity of impressions, and their fusion into unity at some focus to which they converge. The fusion of sensations into sense perceptions can be plausibly traced in nerve tracts of the brain. The fusion of perceptions cannot, at present at least, be so traced. We are compelled to speak of a fusion in consciousness, at a mental focus.

Distinct thought always implies fusion of multiple mental impressions into a unique pulse of thought. Each pulse of thought occupies the center area of consciousness for a given moment of existence, however brief.

It is essential that all impressions made from without upon the child's mind should be made to converge into this unity. If no new pulse of thought be generated, the impressions have failed to affect the mind. As is commonly said, either they are not understood, or they are forgotten.

The most comprehensive aim of education is the development of power, the generation of force. The educational subject must be able to think more, feel more, do more than he who is not educated. The efforts of education must constantly be limited by the conditions imposed by heredity, and the amount of nervous energy originally possessed by the child. But within these limits there remains a wide range of possibility.

NEW YORK.

MARY PUTNAM JACOBI.