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Source: *The American Journal of Psychology*, Vol. 27, No. 1 (Jan., 1916), pp. 71-86

Published by: University of Illinois Press

Stable URL: <http://www.jstor.org/stable/1412854>

Accessed: 31/08/2009 15:19

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SOME DEVELOPMENTAL PSYCHOLOGY IN LOWER ANIMALS AND IN MAN AND ITS CONTRIBUTION TO CERTAIN THEORIES OF ADULT MENTAL TESTS

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Before coming to the main body of this paper it may be well to review some unfamiliar facts of experimental psychology upon which I intend to base my theoretical superstructure. In this review I shall first present some data gathered from observation of dogs under training. Secondly, I shall describe some of the effects of vocal drill upon stuttering children. Next I shall record some of the steps in mental growth taken by a feeble-minded person who has long been under training for a defect of speech. Finally, I shall present some anatomical, neurological and neuropathological data collected in study of adult mental life, considered in a purely developmental aspect. Using these facts as a foundation, I intend to evolve from them several theories which they can be shown to warrant, suggest or imply.

1. *Center Development in Dogs.* Nine dogs were put under a uniform method of systematic training designed to teach them to differentiate between two tones. The process was as follows: The dogs were placed before a dish containing meat and then two notes were sounded—a low note and a high note. They were allowed to eat the meat at the sound of the low note but were punished for eating it when the high note was sounded. The training was continued until they developed the power to distinguish the two notes. They were trained three times a day for periods of about fifteen minutes and with the following results: At first they snapped up the meat without any regard to the two notes or to the punishment, but in a few days they began to show some hesitation after the sounding of the high note. This hesitation increased gradually until a fairly correct and constant reaction to the two tones had been developed. The time required for this development is important. On an average, it took fourteen days for the perfected reaction to occur with any uniformity.

We have here a condition reflex which, through severe

experience or punishment and regular daily drill developed in two weeks into a firmly established reflex that differentiated tone.

Just what is this and how should it be interpreted? Some may consider it only a simple, low-type reflex similar to the knee jerk in human beings and other analogous reflexes well known to all. The characteristic of these reflexes is that they follow immediately after a sensory stimulation that is taken up on the afferent side of the nervous system, sent across the cord as rapidly as such impulses can traverse it and is expressed externally in a motion corresponding more or less closely to the level of the stimulus. It seems to me that these characteristics are quite different from those of our above-mentioned condition reflex. In the distinguishing between the two tones there was surely sensory intake, a crossing over of that impression to a motor area and an external expression in the attempt to eat. Thus we have stimulus, conduction and motor action, elements which are all found, to be sure, in the simple knee jerk, but we also have another element which is shown in a pause made by the dog long enough for him to distinguish between the two tones and to act according to the distinction made. Here, then, we have a holding up of the motor expression pending the result of a rather complicated mental differentiation, whereas, in the simpler reflex, we have merely an immediate response.

In this reaction, then, there is added a collaborative control. That is, there is an idea of differentiation that holds up the expression of the stimulus until the differentiation can be made.

This differentiation must be localized higher in the nervous system than mere sensory intake and output. For it is a developed function not exercised before; it can be retained in the memory for months after its attainment; its function is different from the functions of the lower centers. Choosing words general enough to cover the field of these data and their logical implications without inspiring criticism, I think I may claim that a new function or a new condition reflex has been set up, or I might say that a new form of activity has been developed which controls, through delay and direction, certain motor acts. In two weeks a functional center has been developed which controls, by interpretation of a sensory stimulus and by guiding a motor output, a certain developed reflex.

2. *Training the Stutterer.* We come next to a consideration of somewhat similar methods employed in treating a severe speech defect in man. The development in man is in many

ways like that which has been noted in dogs, but we shall have to note certain points of difference which will serve our present purpose better than data gathered from observation of dogs could do. In detailing the training of stutterers, I shall omit many points irrelevant to our investigation and shall do no more than outline the material, stressing those phases which should be borne most clearly in mind. First, I need to present some new psychological findings relative to the disease known as stuttering.

Some twenty or more stutterers at the Voice Clinic of the Psychopathic Hospital in Boston were subjected to a uniform set of visualization tests. Then there followed an introspection to ascertain whether there was any visual picture held in the mind previous to utterance, during utterance and after utterance. The relationship of the presence of stuttering to the presence or absence of these visualized pictures during utterance was carefully noted.

It was found that when stutterers stumble there is no visualization and that when stuttering is absent visualization is present. Upon the basis of this discovery a new method of treatment has been evolved which has been applied in the following manner:

Beginning with very simple methods of holding a visualized picture above utterance, we advance to more and more complicated processes of visualization coupled with certain exercises for concentration. I have noticed that in about two weeks these patients show what we might call a flowering out of mentality; that is, they acquire an ease of visualization which approaches almost to spontaneity, during speech. The situation is like the one we had before. A new function, or at least a more highly developed function, has been acquired which is amplified and extended in various ways so as to act as a new center of activity during the process of speech.

The result of this development of a new function is manifest. There occurs a delay in utterance and a waiting for the control of the higher center. A visual image is being built up and held during the process of utterance with the result that the image guides and controls the expression in speech. I have noticed that after the complete development of the new function there is never an absolute relapse to former conditions of spastic speech in cases which have been properly trained. We are justified, therefore, in the view that a new and permanently founded center of control has been developed. It is evidenced in new delays, new hesitations, new picture formations, new control of vocal expression and by an absence of the sudden,

low-reflex utterance that occurred before the training. I feel justified in the claim that something which we might call a new brain area has been developed, a new functional center of speech control.

Comparing this situation with that observed in the dogs subjected to training, we find the following similarities: A previously uncontrolled reflex, a previously sudden action devoid of inhibition in any form is in both cases changed by about two weeks of drill of the collaborative centers into a greatly modified reflex which really deserves to be dignified by the name "condition reflex." This change is so marked that there is pause, consideration and interpretation of the stimulus and the action which follows is of such nature as to show conclusively that it is controlled and directed by higher developed centers.

3. *Mental Growth in a Mental Defective.* I wish now to describe the case of a defective boy who has been for two years under a very intensive system of vocal drill. Omitting numerous unnecessary and irrelevant details, it will suffice to say that the boy was eleven years old, that he belonged to a special class in school and that one chief symptom of his deficiency was indistinct speech. Before the treatment of the case began the boy spoke so indistinctly that only his own family could understand him and it was frequently necessary to repeat what was said to him. He measured $4\frac{4}{5}$ years by the Binet scale. He spent most of his time sitting about the house and was interested in little.

A very intensive vocal drill extending over two years resulted in a marked flowering out of the boy's mentality which is indicated in the following particulars which were noted in the order in which they are stated:

Slight improvement in attention and in speed of utterance. This increased speed is not shown, however, in the framing of fresh sentences.

His teacher remarks upon his improvement in reading.

His mother notices stronger and more protracted effort in all his work.

He becomes interested in the meanings of words and wants to have pictures explained to him.

He learns a second poem in two days as well as he did his first one in three weeks.

He shows more interest in general reading.

His mother reports that he is growing more observing, takes more interest in people, asks who they are and what they are doing.

He shows an increased interest in writing and submits a poem which he has written at his sister's dictation.

He uses the octave twist spontaneously in talking.

He improves at school and in conversation with the neighbors.

Memorizing the *Psalm of Life* proves too big a task for him.

He improves in speed in recitation.

A change is seen in his facial expression. It becomes brighter, more expressive, more responsive.

He reads long words in the newspapers, draws some pictures, writes more and develops several minor activities which he had never had before coming to the clinic.

He shows marked improvement in telling stories at the table, putting them into short sentences. This had never been done before.

He makes remarks about the dress of persons he meets.

He learns the names of some of the months and wants to know more.

He plays baseball.

His eyes grow brighter and his mouth hints increased strength of character.

He has more control over the movements of his body.

Increased powers of concentration enable him to learn more rapidly.

A summary and application of these steps will follow.

4. *Data Derived from the Location of Brain Centers.* Just anterior to the Fissure of Rolando in the brain is located what is known as the great motor area. This motor area controls the motions of the leg, arm and face. The area for the leg is at the top, that for the arm is in the middle and that for the face below. Opposite the arm area and a little way out into the frontal convolution is built up the area of writing. It is the function of the area of writing to control finer motions of the hand than can be managed by the motor area below it. You recall, also, that it requires a long time to build up this writing area. It is never inherited nor is it quickly acquired. There are, then, low motor areas governing the more generalized actions and high, built-up or painfully acquired motor areas which govern the more delicate and complicated actions. This distinction holds not only for the motor side of the brain's construction but for the sensory side as well. Just behind this same Fissure of Rolando is what is known as the great sensory area, divided in a way similar to that of the motor area. Above the arm region of this area, where sensations from the arm are recorded, is built up a higher area whose function it is to interpret these sensations. This function of interpretation is known in neurology as stereognosis, and when there is an involvement in this area a pathological condition results in which the patient is unable to interpret sensations. This condition is known as astereognosis.

Let us turn now to the cortical areas related to some sense other than that of feeling. Take, for example, the sense of sight. The low sensory impressions received through the eye are reported in the area of the occipital lobe known as the cuneus. Those low eye sensations are then interpreted by an area of the brain which lies around a corner, so to speak, from

the cuneus. This function of interpreting sight impressions is called "psychic seeing." For a very simple illustration of this, take the following: I pass through the street and impressions of dark moving objects are made upon my retina and thence upon my cuneus. But I do not stop there. I interpret these impressions and sensations. I find that the dark moving objects represent people and I distinguish, among these people, between strangers and friends. That is, in neurological terms, I carry the sensation round the corner, outside the cuneus and into the area of psychic seeing.

If I were to try to picture the architecture of the brain on both its motor and its sensory side in a word, I should say: there are low sensory areas for the deposit of sensation and there are high sensory and motor areas for interpretation and guidance. The architecture of the brain is an intricate complex of forcibly evolved low-sensory areas, low motor-areas together with higher interpretative sensory areas and higher guiding motor areas.

It would be well, perhaps, at this juncture, to still clarify the points already made by referring to the pathological phases of brain anatomy and physiology. The scheme of cerebral architecture just given is confirmed by pathology. It is well known that when injuries to certain brain localities occur the functions of those localities are lost and that if degeneration results the functions never return. Suppose that a man has a hemorrhage that results from pressure over the motor area of the right side and that this extends into the inferior frontal convolutions and overlaps anteriorly, covering the back part of the central frontal convolution. This results, as you know, in a hemiplegia or one-sided paralysis of the opposite side of the body, with loss of motor speech and of the power of writing. In the parts of the brain just mentioned the cortical areas of motor speech and of writing are involved. Now when such a lesion occurs and the hemorrhage extends no further, the patient can hear what is said to him, can contemplate and think about what he hears, but he can utter nothing. In other words, his sensory speech area, which is in the middle of the first temporal convolution, receives impressions. These impressions are interpreted by the nearby areas and the interpretation is modified by certain thought processes. But when the patient tries to express himself in speech or writing his efforts are blocked. He can gesticulate and express his wishes or conclusions in this way, but as far as motor expression in words is concerned he is dead.

Suppose we locate the hemorrhage in another region, such

as that of the occipital lobe. Suppose that we have a hemorrhage just outside of the cuneus and over the corner of the occipital lobe, in the area in which, as we have noted, the function of psychic seeing is exercised. If this area of nerve cells is destroyed there results an inability to interpret eye sensations which is known as psychic blindness. The patient can see his friends but he cannot recognize them.

I have adduced data from several different fields of investigation not with the intention of communicating new or even unfamiliar facts alone but with the design of bringing together the fundamental notions which I shall have to deal with later. What conclusions are we justified in drawing from the data already considered? The conclusions most germane to our present purpose are as follows:

The experiment with the dogs shows that a superior controlling center can be developed by drill even in the lower animals to such an extent as to dominate and modify actions under certain conditions.

The effects of vocal drill upon the stammerer show that an abstract speech-controlling center may be opened up which, by long and persistent work along certain definite lines, may be largely developed. There is a curious uniformity between the cases of the dogs and the stammerer in the fact that the arrival of the two developed centers was noted in about two weeks after training began.

The growth of the mental defective through long years of drill shows that an extended series of cortical centers,—low sensory, interpretative sensory, collaborative and controlling motor—can be forced through a long series of developmental periods. Watching this case step by step, we can almost see the arrival of the different functions in succession. The picture, moreover, is interesting as a sort of epitome of normal development. In its early years the child spends most of its mental effort in sensory registration. Later there is a period of sensory interpretation. By and by collaborative processes take the lead and, with them, a marked control and guidance of expression. I do not mean to imply that there is no activity prior to the completion of this evolution, but at first there is surely some sensory registration minus its motor expression. Then the motor expression develops along with all these other periods: First, sensory registration, together with a sort of reflex motor expression that lacks interpretation and collaboration. Then follow the growth of interpretative and collaborative processes respectively until finally a complex and intricately inter-related mental mechanism is built up. All

this is to be seen in epitome in the case of the mental defect. His training acts upon his sensorium until reflex action results. Interpretation is built up and collaboration is added to it and the mental expression is dominated in turn by all the different stages of growth.

Anatomically, pathologically and experimentally located brain areas afford evidence that the whole cerebral system consists of a variety of centers, sensory and motor, with higher centers above each to interpret and control. This scheme of architecture is seen throughout the anatomy of the brain. The anatomical method of investigation locates these areas in specific parts of the brain and shows how the centers are built up near each other as well as their relationship to other centers. For example, we do not find the function of stereognosis near the cuneus or the function of motor speech in the temporal lobe. Stereognosis is located just above the arm area, where it should be. Motor speech is located just above the face area, where it should be. There is therefore a certain logical system in the location of these numerous cortical areas. And anatomy also gives us ground for assuming an inter-relationship between these areas. We find that there are nerve fibres running from one convolution to the next or running from one convolution to the next but one or extending to more distant points on the same side. There are cross fibres which connect one side with the other. One author has gone so far as to say that all centers are related to all others. As we have seen, cerebral pathology provides evidence that supports this localization of functional areas and we can readily see, by the aid of pathology, how and why other areas are left free to act when the function of one area has been destroyed. Pathology also shows that even a few centers may continue to act after many are gone. The experimental method, used only upon the lower animals, offers further confirmation.

The intricacy, system and method of the brain and its functions provide one of the most beautiful examples of orderly construction to be found in all nature. Study of the brain is usually considered difficult or even uninteresting, but it ceases to be either of these when one brings to bear upon it an ability to reconstruct in the imagination its entire beautiful structure and its complicated inter-relationships. But, not allowing ourselves to be led away by the wonder of this picture, we should return to a consideration of the theoretical applications and practical results of the facts we have been considering.

I. *Theoretical Education.* These facts deserve application to several spheres of knowledge. I doubt whether educational

methods have in all cases been formulated and promulgated with a proper regard to what is known of the anatomy and developmental possibilities of the brain. Let me give one example. The Binet tests for intelligence are supposed to tell at what age a child should know certain things. In more scientific terms, Binet tests relate or compare the real age with the psychological development. These tests were based, originally, upon observations of French school children. When the system was transferred to America it was found that since American education follows somewhat different lines a modification of the French tests was necessary.

Now, if there is this difference between French and American children, there may also be a difference between every two children—a difference determined by the centers with superior interpretative and collaborative activities which have been especially or particularly developed. Therefore, I see no reason why another entirely new inter-relationship of developmental areas might not be instituted in infancy and worked up, with the result that the age type would be entirely changed. I see no reason why it should not be possible to conduct education solely along individual lines, leaving all others out. Such a process as this may account for prodigies of precocity, genius, and the like. Why, for example, can we not all have the exquisitely perfected development of the sense of hearing possessed by the blind child or the extraordinary activity of the cuneus of the deaf child? It is obvious that there are tremendous possibilities in this untrodden field and that their bearing upon education is of great importance.

2. *Type Study of Man.* Individual development along definite lines results finally in what we all agree in calling by the vague name "individuality." We hear, for example, of a "legal mind," and there might just as well be other terms such as "medical mind" or "psychological mind." There might even be a certain constant connotation behind the term "student mind." Suppose we analyze the meaning of that last term, "student mind." I choose it because it is less definite, less accepted, less formulated than the others. It may be well to narrow it a little and discuss the "Harvard type of student mind." The Harvard type of student is forced for four years along certain definite lines. They claim in Cambridge that they develop individuality. I may be allowed to criticize this view because I hold three Harvard degrees. What they actually do do is this: They force the student to listen, then they force him to write down what he hears, with little collaboration and with little effort to digest or think over

the material which passes through his ears and off the tip of his pen. At last the student is called up to another situation where the demand is made that he write the material all out again. Now, what sort of type is being developed here? A listening, slightly collaborating, writing individual. And this is the standard type of student put forth by Harvard. There are indeed many exceptions and a great deal depends upon the courses taken, but I think that in general my characterization of the typical Harvard student holds. He is a listening, slightly collaborating, writing individual.

I first became acquainted with this type of mentality while teaching neuropathology and ever since that time I have made a strenuous effort to modify the type into another and entirely different type. I thought of the matter in this way: These students take notes; they have little time to digest the subject matter; they simply write it down, and keep on writing it down for four years. Anatomically, this results in great activity of the hearing center in the temporal lobe, little collaboration in the higher centers, large development of the writing area—the listening, slightly collaborating, writing individual. It occurred to me to wonder what these students ought to be and I concluded that I should try to develop a type of student who saw, fully collaborated and talked; that is, a man who had developed his cuneus, his higher collaborative centers and his motor speech areas. The methods employed to this end need not detain us. I mention the matter only to show how the abundant data at our command may be used not only to describe or to treat the type of human beings now in the world but also to provide a basis for the evolution of better types in the future,—an educational application.

3. *Vocational Prophecies.* The data we have reviewed have an important bearing upon the choice of a vocation. The different vocations demand different types of individuals and they find them only with difficulty. One cannot readily tell whether a given individual belongs to the required type or not. But if we could evolve some method of type registration which would describe the whole past mental constitution and all the inter-related activities of the present and all lines of possible future growth, we should have accomplished something of inestimable value both to the individual and to society at large. This would solve in a new way the pressing problem of the choice of vocation. But this is not the place in which to elaborate the matter.

4. *Ultimate Divisions of Consciousness.* The general prob-

lems of consciousness have, of course, been studied with great care, but certain important ones remain unsolved, unattempted. Southard has tentatively located consciousness in the post-pallium; that is, behind the Fissure of Rolando, but he makes no more minute localization of subdivisions. His statement is satisfactory as far as it goes, but on the basis of the data just reviewed we are justified in carrying the subdivision much further.

If our different sensations become conscious in different brain areas and these are widely separated and also inter-related and their inter-relations become conscious, then there is room for an elaborate division and for minute localizations of consciousness. Consciousness should be divided not only into low sensory areas, interpretative areas and collaborative areas, but into more minute subdivisions of each of these so that our ultimate divisions of consciousness would be those which correspond to all the different and separate brain localizations.

With all its ramifications and intricacies, this problem is extremely interesting and important, but we can do no more than mention it here as one deserving of more attention.

5. *Theories of Mental Measurements.* Of all the different fields into which it would be possible to carry the developmental data which have been reviewed, I have chosen only this final one for extended consideration. Even of this one I do not propose to make an exhaustive presentation but only to outline some of the theories and foundation principles that should dominate any complete discussion of the problem of adult mental measurements. I shall discuss the subject under the following three heads:

First, I shall construct a theory of cortical center relationships. Second, I shall suggest a theory of the inter-relationship of ideation components. Third, I shall present a theory of age relationships.

1. *A Theory of Center Relationships.* I have mentioned the dogs that showed development of one conditional reflex. I have mentioned the defective who built up in himself several related centers. I have mentioned other psychological developments which showed still more complex relationships between the centers developed. In all this there seems to be evidence that centers should be taken into consideration in mental measurements. Low sensory centers of perception should be considered, then the higher centers which interpret them should receive attention, then the collaborative centers

which work upon the interpreted sensations should be taken into the account. We have seen, moreover, that the motor expression of these processes is controlled by higher areas also, and these must not be omitted. Having, then, this serial view of cortical centers, we must necessarily consider all the functions of the individual mind—not only all its perceptions but all its interpretations, all its collaborative methods and all its inhibitions of output.

I do not wish to be hasty in discarding all of the many methods of mental testing now in vogue, but one can have little hesitation in saying, after careful examination of them, that they are limited, narrow and unsatisfactory. The Binet scheme, which is valuable in testing children up to the age of twelve or fifteen, is of doubtful value in the last two or three years. The Yerkes point scale which has improved the methods of testing children between the ages of twelve and fifteen is not applicable above the age of fifteen. Haines has recently presented a new system for use with the blind. Nute, of the Immigration Bureau, has another method which is adapted for use in the immigration service, and I have just heard that Haberman of New York has devised another scheme which differs from all the rest.

The problem has been attacked only recently and it is still too early to expect a perfect system. The mere fact that there are so many systems in use is a sufficient criticism upon them all. The rapidity with which new ones are devised shows that the old ones are unsatisfactory. The principal defect to be noticed in them all is that they have not taken into account all the possibilities of center growth. As systems, they have not been all-inclusive and exhaustive. Often they have fallen into the historical pitfall and have tabulated or systematized only the situation of the moment. By the historical pitfall I mean this: Hysteria was once diagnosed as a uterus running round the body; then came Babinski who said that hysteria is due to suggestion. Then came Janet, with an exclusively psychological eye, who held that hysteria is a limitation of consciousness. Now comes Freud, with a propensity for interpretation in terms of the subconscious, and he says that hysteria is an external manifestation of subconscious complexes. As another illustration, let us consider stuttering: This disease was once diagnosed as trouble with the tongue and the tongue was operated upon, a part of it being excised. Since that time the seat or location of the disease of stuttering has been pursued through both sides of the nervous system and into the brain and a new diagnosis and new form of treat-

ment has been devised for every part. Last spring it was chased into the subconscious. This summer it has been driven into the thymus gland. This fall, as the result of a long psychological investigation, it has appeared for the first time in the conscious side of the mental makeup and in association with conscious collaborative processes. About the same thing may be said of psychiatry. First came the demonological theory and then the governmental conception. Next, there was a long period in which the clinical interpretation was dominant, but now the subconscious and psychological phases of these investigations occupy us almost exclusively.

I am not certain, but I suppose that the case is much the same with philosophy and that each philosopher's system is simply the psychologizing of his own individual type of mind. This is what I mean by the "historical pitfall." All along the ages students have been interpreting and explaining one man in terms of another. There have been so-called Platonists and Aristotelians for two thousand years. Thus all thinkers have been in the pit except those who have dared to climb over the edges and to see the broad horizon with their own eyes.

All this has its application to the mental test problem of today. It is very desirable that some one should outline and master the situation as a whole and, instead of tinkering at the systems already in use, devise one which shall include the good points in earlier systems, avoid the weaknesses and supplement the deficiencies.

At present we can do no more than outline the theory which should be followed in this matter, but the theory should be one that includes in its consideration all of the brain centers. I disagree with those who would begin their tests upon children at the age of two or three. There should be a complete tabulation of all that has been deposited in the sensorium up to that age. Has the child heard exquisite music for two years? Has he been subjected to an exquisite variety of smells so as to develop the corresponding sensorial area to a high degree? Have certain attitudes of individuals towards each other in the child's environment been so obvious, so repeated and so drummed in as to determine the child's later action when he comes to act for himself? Even these few suggestions will show the inadequacy that there is in beginning mental tests by tabulating the output at the age of two or three.

The theory of centers should really enable us to find the amount of sensorial intake, its length of time and its quality. This should be determined for all sensory areas. Then I

should tabulate all the interpretative reactions upon these sensory intake areas, those that are spontaneous, those that are consciously taught and those that are forced upon the individual, whether accepted or objected to. After this, I should pass into the collaborative area and use a tabulating method to record all the processes and uses to which the intake material has been put. Finally, the motor control area should be studied in its methods of sifting, inhibiting and guiding expression.

We have been considering a theory of cortical centers and have spoken repeatedly of a relationship between cortical centers, but the exact nature of this relationship has not been discussed. It will be well to treat this matter more definitely.

2. *A Theory of Whole and Part.* I shall try to present an outline or method to be used in correlating exhaustive data tabulated from mental types. As an illustration, consider the painter who is in the act of composing a picture, in his mind. As a first step, he thinks the matter out as a whole. That is, he seeks a motive. This motive lies in a vague outline; it is the first conception, the first vague hint or intuition of the picture that is to be. His first step, then, is to select his *whole*. After this has been chosen and fixed, his mind turns naturally to the parts of his picture, mass, color, form, background, and in a more or less tentative way he selects certain details that may be included. In simple terms, this may be said to be his consideration of the *parts*. Next he thinks out the *relation of these parts to the whole*. He tries to make each of them serve and support the whole in some way. Finally he turns to what is perhaps the most difficult phase of his work. He begins to consider just how the parts *should be related one to another*. Thus we have a consideration of the whole, of the parts, of the relation of the parts to the whole and of the relation of the parts to one another as four pretty distinct processes which the mind of the artist must pass through, consciously or unconsciously, in order to complete his picture.

This may serve as a guide in our study of the theory of centers. We should begin by considering the individual or the type as a whole; then we should tabulate the parts of this type or individual as parts of the whole. Next we should tabulate the relationships of these parts to the whole and finally we should consider the relationships of the parts to one another. It is clear, at least, that a methodical procedure such as this must be far better than no method whatever.

3. *A Theory of Age Domination.* It is well known that mental measurements bear a definite relation to age periods. Viewing life as a whole, we are reminded of Shakespeare's seven divisions, but when we view it from the plane of the history of philosophy, the history of education, the history of practical business life, we are warranted in making certain deductions that do not harmonize with the division made in *As You Like It*.

The life of a normal human being who reaches old age is divided into four overlapping but distinct periods. Each of these periods is dominated by a different attitude towards the world and towards himself.

The first period lasts until puberty. It is dominated, as I see it, by sensorial registration. That is, registration of sensations upon the cortical areas is the dominant mental activity. Other mental activities are either undeveloped or are dominated and overshadowed by this one. There is little besides registration. This may be called, very vaguely, the "sense-period."

The second period begins at puberty and lasts for several years. It is marked by a profound mental disturbance as well as by many well-known physical changes. In this period a new center comes into activity which takes precedence over all others and guides and transforms the whole nature. This period may be described as affective, interpretative and it may be called the "period of affection."

In the third period another form of interpretation dominates. The affairs of life are taken up in relation to a developed personal self and they are decided upon, rejected or accepted in relation to that self's aims, hopes and ideals. In this period there is, of course, an element of each of the earlier stages, but these have lost their dominant and directing power. This may be called the "period of will."

The fourth period is that in which the collaborative processes of the individual finally become dominant. He is now, chiefly, a thinking being. All the other spheres or phases of his activity are taken up into this last one, but he regards them as mere avenues to this final goal or station of thought. He lives in those old shells of sensory registration, affection and will, to be sure, but he is no longer dominated by them. He is not led hither and thither by their overpowering influence. He is now led only by the workings of his developed collaborative processes. This period may be said to begin at the age of forty and to last perhaps to death. The period

might be called collaborative, but we may dominate it more simply, the "period of intellect." Now let's put this all together.

I have tried to show that all these related theories serve in the formulation of exhaustive tabulations of mental tests which should cover the *entire life* with all of its variations. Mental tests should relate all sensorial content, all interpretative reaction, all forms of collaboration, all controlled methods of expressive output according to the correlations laid down in the theory of the whole and the parts. It should be kept in mind that these are dominated in the different life periods by sense, affection, will and intellect respectively, each of which is relegated in succession to its subordinate place. These should be related in such a way as to picture the past, present and future of all possible mental types in their perfected development and the percentage relationship should be shown between the present individual and his final, ultimate, developmental perfection. Thus I would summarize my paper.

So long as we confine our discussion to matters of theory we may picture to ourselves an ideal which is realizable, if at all, only in the dim future. This is what I have done. I grant that an exhaustive tabulation of really exhaustive mental tests is, according to our present knowledge at least, unthinkable. But theory works in the ideal. Practice, when we come to it, may lead into new scientific relationships.