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THE TRAINING OF THE SENSES

Theodore Dreiser.

In science and philosophy, there has always existed the faith that mind is illimitable and that the senses are capable of much greater development. This thought has heretofore lingered in the realm of speculation like a fascinating will-o'-wisp, leading the scientific worker most steadily on. But now there comes the individual who declares directly for the proof of this wonderfully fascinating dream and calls mankind to witness that the senses can be educated to a much higher degree of accuracy. He is ready to avow *that* the method is even now at hand, and, in proof, he submits a system, which, for its educational value and broad scientific illumination, is one of the most fascinating demonstrations of brain power that the world has ever seen.

The individual who makes this interesting assertion, and submits the proof, is Prof. Elmer Gates, the head of the Gates Laboratory of Psychology and Psychurgy at Washington, an institution which is entirely unique and individual in the world of science. We have, the able investigator declares at least nine, instead of five senses, and these may all be separately and rapidly trained to an acuteness and power of discrimination hitherto unknown. The greatest pianist, the most delicate painter, he who can astound the senses by swift jugglery or who possesses any marvelous power in the sensory realm is but the forerunner—the chance example of what the commonest mortal may some day be, and do, but with an acuteness higher than possessed by anyone now living. He declares that it is necessary only to show the method by which the separate senses of the mind shall be distinguished and reached with special training, and the greatest results can be readily accomplished. He is ready to demonstrate that this discrimination has already been made and he has proved that the senses so discriminated can be rapidly sharpened.

Perhaps the best proof that nine senses have been recognized, one distinctly from the other, is contained in the method adapted to reach and train each separately. Everyone knows that hearing, seeing, tasting and smelling constitute four distinct senses, but it is

not so generally known that touch comprises the separate senses of touch, pressure, warmth and cold, constituting four senses instead of one. To this list we must add that of muscular feeling, making nine senses of value in observing objects scientifically. The joint sensations, the sensations of tickling, etc., are not deemed of sufficient importance to be trained. Each one of these nine senses enumerated are, he declares, just as important in a complete course of training, as any of the others and should be as carefully discriminated between, since the whole intellectual progress of the race depends primarily on this perfect sensory development.

"For," he says, "if the sensory data are true — that is, if they are accurate and complete, then, out of them may arise an accurate intellectual development of images, concepts, ideas and thoughts; and out of a normal intellectual development will arise normal emotions; and out of true knowledge and normal emotions will arise normal motives, motives which, when carried out into conduct, lead to desirable results. False knowledge, abnormal emotions, all result from the false or weak registration of sensations, images, concepts and ideas."

In the laboratory at Washington is a small and very simple device, composed of a pulley and cord, which is used not only to detect, *but* train one of the senses, namely, that of the feeling: of muscular energy. This instrument is known as the Myergesthesiometer, and is calculated to accurately measure the mind's power to discriminate differences in the feeling of muscular energy which accompany slight differences in the dynamic energy required to move the lever or string. The pupil takes hold of the handle and repeatedly pulls the cord, which unwinds from a pulley. Owing to the nature of the mechanism, the pull requires a uniform amount of energy throughout the whole length of the motion, and it is by moving this cord to and fro that the pupil first becomes aware of the energy-feeling of muscular motion as distinguished from the speed-feeling or the direction-feeling of muscular movement. This is so because in this device the energy-sense is not confused with the speed-sense or anything else.

In other devices for measuring muscular energy, the faster you move a given weight, the more energy is required to move it; hence, muscular energy-feeling cannot be tested with springs or elastic cords, because it would be necessary either to measure the speed or to move the arm at an absolutely uniform speed, which is difficult. Besides, springs become harder to move as they become more and more tightly stretched. With this instrument, however; which requires a uniform amount of energy throughout the entire motion, at any speed the student may feel *energy-effort* without noticing speed-effort and without increase or decrease—a stable, actual thing, steadily repeated and impressed. By the variation of

which the mechanism of the instrument permits, the pupil may be taught not only the different degrees of energy-feeling as a distinct sense, but may be made to perceive differences in it, due to speed-direction, just as one may be taught to distinguish between a loud and a less loud sound. In short, these different muscle feelings can be not only instantly made plain to any mind, but may be as readily trained to far higher degrees of skill.

The method by which this is accomplished is as follows: The pupil is made to pull the cord to and fro until he becomes accustomed to the effort-feeling required to make that particular motion—a feeling which has in it neither increase of strain nor suggestion of relaxation and which is the same at all speeds of motion. Suddenly, and unknown to the pupil, the instrument, is made to move 2 per cent. harder. If the pupil cannot detect the increased energy required to move the machine, he is again allowed to try the original standard for a few moments, when again, suddenly and unknown to him, the pull is again increased. This not being noticed, the return is made to the original standard and then to three per cent. harder. A variation of this sort is continued until the mind takes notice of the [smallest] increase which it is capable of detecting—say, three and one-half per cent. This is then a measure of the inefficiency, so to speak, of this sense of muscular energy which can only detect a 3 1/2% increase over the normal pull of the Myergesthesiometer, and this is registered as "the least noticeable difference" of the pupil's discriminative power between muscular energy-efforts or sensations.

Mr. Gates found that if a pupil be made to practice detecting, perceiving and discriminating this "least noticeable difference," forty or fifty tines an hour, for one hour daily during two or three days, an increased discriminating power results, and the knowledge of this sense becomes very clear.

One of the most striking results of this exercise has been observed in the field of drawing—that peculiar field to which, in its higher forms men are thought to be born. At the laboratory, pupils well drilled in this sense were ordered to trace a line with a pencil, as if making a mark upon a blackboard; but the line was traced upon the surface of an instrument designed to measure the variations in energy with which the motion was made. Before training by means of the Myergesthesiometer, these pupils could draw a line with a given degree of energy and showing a certain uneven quality, but when asked to draw another line with the least additional degree of energy the instrument showed that the energy was varied without any sense of greater or less force—that, in fact, they had no comprehension of the degrees of difference of which the muscular-energy sense is capable. All used four or more per cent. more energy and thought they had made the least difference

possible between the energy used in making the first line and that in making the second. By use of the Myergesthesiometer, however, all were brought to a knowledge of this muscular-energy sense, and its possible differences, and then the line drawing was repeated. In the second instance, line motions were made, involving less than 2 per cent. energy difference, and that after a short practice covering less than six days.

Now, it is obvious that one of the elements of skill in the use of muscles in any free-hand or manual movements is the mind's power to discriminate slight energy-differences. Whether it be the finely proportioned shading of lines of letters in drawing or penmanship, or the delicate handling of tools in fine workmanship, this power of discrimination underlies it all. And here is this newest training of this sense, governing all such muscular effort, which looks to endless improvement along this lines. "For to discriminate least noticeable differences of muscular motion," says Prof. Gates, "is to create brain changes; and *these* new growths in brain-cells and fibres constitute new capacities; and these structures when refunctioned or exercised, enable smaller discriminations to be made in the energy with which a movement is performed and thus is continued the wonderful progress on and on."

What is true of the muscular energy sense is equally true of the other eight, a suitable training having already been evolved, which blazes the pathway of progress for thousands of years. I asked the author of this profoundly optimistic method of mental development how he went about to train the sensory capacity of an individual, and he replied.

"By keeping each sense, under training decidedly and systematically active in making discriminations just at the verge where consciousness becomes subconsciousness. You can detect a sound suddenly made 30 per cent. louder, but you cannot detect it when made only *20* per cent, louder, at least not without special training. Hence, to have you listen to sounds only 20 per cent, louder would not enable you to practice discriminating, because you could not perceive that the sounds were louder. Likewise to make you practice detecting 30 per cent, louder sounds day after day would never lead you to detect sounds *28* per cent. louder. There is a lowest limit somewhere below 30 per cent, and above *28* per cent., to be found by measurement, where you must practice. It must be with the degrees of sound ranging between what you can easily detect. and what is almost too faint a difference to detect that the discriminative function must he exercised. It must be constantly tested with the sound that it only faintly hears to be sure that it cannot hear one slightly fainter, and then, by practice with that degree, the growth soon comes enabling you to hear a fainter

difference. Out of the one distinctly heard and the one but faintly heard is born the ability to distinguish a still fainter sound—the beginning of the sensory discrimination of the one not heard at all."

The working method, looking to the acquiring of this increased power, is very much as follows. The student is taught to become quiet at a certain hour every day, that is, he voluntarily [places] himself into physiological rest or quiescence. He sits still and refuses to make any muscular motions, to pay attention to any sensations, imaginations or ideas and, as far as possible, rests his emotions. He aims to do nothing. After several weeks, the body, by force of habit, becomes restful at the customary time of this rest and the mind, free from distractions, is more free to discriminate slight changes in itself; and in this condition the senses are more than ordinarily acute.

Once he has acquired this ability to induce physical quiescence the limits of his senses are measured. For example, his sense of touch is tested with billets of cork weighing from one to five milligrams; his *sense* of hearing, with mild sounds; his taste, with spices; his smell, with odors. When the least that he can distinguish in these separate fields has been accurately measured the real training begins.

It would be impossible to discuss the entire nine senses in this relation, but since muscular energy has been disposed of, the other sense, that of sound may serve.

By means of an electric tuning fork, a sound of approximately uniform loudness can be produced, and by means of a device for regulating the intensity of the electric current that flows through the magnets of a tuning fork, its loudness can be readily regulated. Thus, while the fork is emitting a tone of a given loudness it can suddenly be made to sound *5%,* or 10%, or 20% louder, the same being regulated by means of a rheostat. While a pupil is listening to a given tone, the operator suddenly makes it sound 10% louder. Perhaps no person living, without special training, would notice the difference. Then, recurring to the original loudness of tone, the pupil is given time to become familiar with the given loudness, and then it is made to sound one-fourth louder, and a few may possibly he found who will he able to detect that it is a louder sound. By repeating the experiment a sufficient number of times, the pupil's capacity to detect differences in the loudness of tones can he accurately measured, and it will generally he found to he at an increase of 33%. One pupil, whose least-noticeable-difference for loudnesses of tone was found to be, at the start, 33%, was able, as soon as the test began, to detect 29%, and after a few trials, *28%;* and after 2 weeks' practice, 26%; after 3 weeks he could readily detect *24%,* and this is an average capacity for individuals of the

human race end can he attained by anyone who will secure physiological quiescence. Now came the special training which this pupil received. A tone was sounded until he became accustomed to it and then it was suddenly made 24.1% louder and he was asked to indicate by raising his hand, when the tone increased. This he would always do, but if the tone was made only 24% louder, he would never raise his hand, showing that he could not detect a 24% loudness-difference. When he had once detected 24.1% fifty or eighty times an hour, two hours daily for two days, it was found next day that he could detect a little less difference than 24.1%, namely, *23.8%.* After another day's practice it was 22%, and the ninth day it was 20% difference. Had he then been kept practicing this 20% month after month; and year after year, he would have made no further, progress. For instance, when he could detect 20% loudness differences, he could not detect 19.9% difference. At the upper edge of this' range, namely, a little below 20% and a little above 19.9% he could detect it. He was practicing detecting this loudness difference which was gradually diminished at each 30th or 40th trial, and thus the discriminative activity was kept active just at the verge where consciousness becomes suhconsciousness. Seven weeks' practice brought this down to a detection of 10% loudness-differences. This is a tone-loudness so slight that if it were made 200% louder the average human being could not hear it.

Thus again, a pupil who could detect 1/100th difference in the brightness of a light was trained to detect a 1/200th difference in the amount of illumination in 3 weeks. A pupil who could detect 1/20th difference between 2 pressures was trained in 4 weeks to detect 1/40th difference, and so on with the different senses, the principle being that to increase any sensory capacity there must be a training in the mind's power to discriminatively detect differences right at the verge where a conscious sensation tends to become too faint to he noticed.

Of course, this increased sensory capacity has value to the chemist who wishes to see minuter changes in colors, in precipitates, and in solutions; or to the machinist who wishes to more accurately temper his tools by the aid of the color changes which they undergo while being heated; or to the artist who wishes to more carefully grade his colors in shade, tints, and hue; but it is not this kind of utilitarian value for which this training is made alone. Because one must understand the senses before he can understand the next step in intellection; because it is by means of perceiving sensory differences that we arrive at accurate images of objects, and because the senses are the instruments of observation by which we get images of objects, and the investigator who can see color—differences and hear sound-differences and feel touch-

differences more minutely than another will he able to detect physical differences in objects not before detected and so increase the sum of human knowledge—herein lies one aspect of the value of these discoveries as their investigator sees them.

It is very evident, according to his practice, that no one sense should take undue precedence over another in the matter of training. To train one sense more than another, is to produce, according to him unequal brain-building, unequal mind-development, and one-sidedness, at the very foundation of the intellectual life. The most important senses, of course, are those of sight and touch; but it is almost impossible to arrange any order of comparative importance; inasmuch as to omit any one of the senses in this training is to leave the mind unbalanced and the observations in after life all one-sided. But remember that sensory training is important only because it is the first necessary step to image training; and image training leads to concept training; conceptuation leads to ideation; ideation, to thinking.

It might be thought, at first glance, that such a theory as is here outlined could be the work of some dreamer, who had a school to found or a living to make thereby. The laboratory from which it issues, is, however, an institution so broad, so profoundly philosophic in its aims, that it defies suggestion in the comprehensible space of a paper. Still, it may he said that the general object is to train a body of mentators in the arts of invention and discovery, and to organize them into a cooperative body for scientific research. They are to devote their lives to the ascertainment and diffusion of truth and to carry this on as a religious mission. The institution will be owned by the students when once a sufficient number have been trained in each science; and they are to carry it on not according to the founder's hobby or theirs, but according to the principles of mental development as these principles may be improved by the further progress of science; they are to attack no belief, creed, or system, but to work constructively, and to organize around the knowledge obtained and not, as has hitherto been the case in the world's history, around some philosophical doctrine or political belief which, as progress continues, becomes a stumbling block.

Of the general system here set forth, it can be said that if we wish to guide our conduct accurately we must have correct knowledge of the things which constitute our surroundings.

This knowledge is obtained by means of the intellect. The intellect consists of a series of functions of increasing degrees of complexity, of higher and higher order, from lowest to highest; the lowest being the senses; the next highest being the imaging functions, and then in order come, conceptuation, ideation, the several orders of thinking and introspection. In order to achieve

skill in the higher intellectual processes, such as ideation and thinking, it is necessary first to achieve skill in the sensory capacities. The training in the senses amounts to this: It consists in training the instruments by which we make examinations of objects. If we wish to find differences in an object by means of touch, or pressure, or by the capacity to feel warmth and cold, or by muscular energy, or sight, or sound, or smell, or taste, we will better succeed in doing so if we have previously trained our senses to a greater accuracy so as to perceive more minute differences in objects. This training enables us to get more correct images of objects, and having more correct images we will get more correct concepts. If our concepts are correct and complete, we will be able to get more accurate and more numerous ideas of relations between objects which concepts represent and so on. Now, the same method by which the sensory discriminative capacity is increased can be applied to the higher intellectual functions, and by so doing the imaging function can be accelerated in speed, say 20 or 30 times. In like manner, the pupil can he taught to conceptuate 20 times more rapidly, to ideate more rapidly, to think more rapidly. False images, false concepts, and false ideas will be eliminated. The pupil is taught to image, conceptuate, ideate and think without useless expenditure of energy, as when one first learns to ride a bicycle he uses many muscles he need not use.

We have no mode of normalizing the emotions save that of accurate knowledge. Feeling can be misled by false knowledge; abnormal emotion will mislead all our feeling, and if we wish to adapt ourselves to our environment we must get a correct knowledge of that environment as well as of the Self which we wish to adapt to it. We have now become conscious of the processes by which knowledge is achieved and by which it is applied to the betterment of human affairs. It is the mind which makes discoveries and inventions, and, therefore, we must learn how to promote and regulate its functionings, and prevent the obstruction of its normal processes. It is the business of the intellect to discover, and the discoveries made become valuable to us as they have meaning to our emotional life, and the thing which we know and the beauty which we feel is finally achieved in character or deed. This constitutes conation. Intellection, emotion, and conation should go hand in hand as the highest known processes of that fundamental Life and Feeling and Will, out of which we are all evolved.