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PSYCHOLOGY AND SCIENTIFIC METHODS

IMAGE AND AFFECTION IN BEHAVIOR¹

I

IN the thesis which I recently advanced² I had scant time to discuss two topics, which may seem to many to be stumbling-blocks in the way of a free passage from structuralism to *behaviorism*.

The first of these, and by all odds the more serious of the obstacles, is the "centrally aroused sensation" or "image." If thought goes on in terms of centrally aroused sensations, as is maintained by the majority of both structural and functional psychologists, we should have to admit that there is a serious limitation on the side of method in behaviorism. Imagery from Galton on has been the inner stronghold of a psychology based on introspection. All of the outer defenses might be given over to the enemy, but the cause could never be wholly lost as long as the pass (introspection) to this stronghold (image) could be maintained.

So well guarded is the image that it would seem almost foolhardy for us to make an attack upon it. If I did not perceive certain signs of weakening on the part of the garrison, I think I should agree with Professor Cattell that I am becoming too radical, and that I should better admit the claims of imagery and try to work out a scheme for behaviorism which will embrace the image. Suppose we consider this aspect of the question first: Does the inclusion of the image weaken the claims of the behaviorist? I am ready to admit that it does. Take a case like that ordinarily urged. Some one suggests in words that I borrow one thousand dollars and go abroad for a year. I think over the situation—the present condition of my research problems, my debts, whether I can leave my family, etc. I am in a brown study for days, trying to make up my mind. Now

¹ An address given before the Psychological Seminary of Columbia University, April 3, 1913.

² "Psychology as the Behaviorist Views It," *Psychological Review*, March, 1913.

the train of thoughts going on in my mind, according to the upholders of the image, has no adequate behavior counterpart while it is in transit. The behaviorist, observing me, might note that my appetite had departed, that I was smoking and drinking more than usual, and that I was distraught. Finally, experimental tests might show that my ability to make fine coordination had been seriously interfered with, that my dynamometric threshold was lowered, and so *ad infinitum*. The introspectionists would say that all of these tests failed to give anything like a complete record of my "mental content" or of the "totality of conscious processes." Indeed, they would urge that such tests have only an analogical reference. Only direct observation of the mental states themselves by the method of introspection will ever tell whether I am grieving over past sins or whether I am really trying to reach a decision about going abroad! If we grant this, and such an impulse is very strong, the behaviorist must content himself with this reflection: "I care not what goes on in his so-called mind; the important thing is that, given the stimulation (in this case a series of spoken words) it must produce response, or else modify responses which have been already initiated. This is the all-important thing and I will be content with it." In other words, he contents himself with observing the initial object (stimulation) and the end object (the reaction). Possibly the old saying "a half loaf is better than no bread at all" expresses the attitude the behaviorist ought to take; and yet I for one dislike to admit anything which may be construed as an admission of even partial defeat.

Feeling so, I prefer to attack rather than to remain upon the defensive. I spoke above of certain signs of disaffection and mutiny among the ranks of the faithful. These signs manifest themselves in three different ways: (1) The attempt on the part of Woodworth, Thorndike, and others to question the dogma of the image and to show that thought processes may go on independently of imagery—or, indeed, as I understand it, even independently of peripherally initiated processes. To this last contention I do not accede, as I shall undertake later to show. It is needless for me to discuss this phase of the problem at any length before this laboratory. (2) The failure on the part of the most earnest upholders of the doctrine of the centrally aroused sensation to obtain any objective experimental evidence of the presence of different image-types. I refer here to the researches of Angell and of Fernald. I think this admission paves the way for the complete dismissal of the image from psychology. Furthermore, I believe that most psychologists are willing to admit that introspection furnishes no guide for the determination of one's own image-type. In this field, above all others, introspec-

tion, if it is a legitimate method at all, ought to yield its best results. It is just here that it has failed, except in the case of a few fortunate men who seem to have become adept in the use of it. We who are less happy in its use must forever do without this wonderful Aladdin's lamp which, upon demand, illumines the dark places of the human mind. (3) The attempts even of the structuralists to reduce the so-called higher thought processes to groups of obscure organic processes. I have in mind the recent work on recognition, abstraction, etc.

All of these tendencies, initiated by the psychologists themselves, lead directly over to my principal contention, viz., that there are no centrally initiated processes.³

The environment in the widest sense forces the formation of habits. These are exhibited first in the organs which are most mobile: the arms, hands, fingers, legs, etc. By this I do not mean to imply that there is any fixed order in their formation. After such general bodily habits are well under way, speech habits begin. All of the recent work shows that these reach enormous complexity in a comparatively short time. Furthermore, as language habits become more and more complex there arise associations (neural) between words and acts. Behavior then takes on refinement: short cuts are formed, and finally words come to be, on occasion, substituted for acts. That is, a stimulus which, in early stages, would produce an act (and which will always do so under appropriate conditions) now produces merely a spoken word or a mere movement of the larynx (or of some other expressive organ).

When the stimulus produces either an *immediate overt response* (as, for example, when I tell John to go to the sideboard and get an apple, taking it for granted that he goes), or a *delayed overt response* (as, for example, when I ask an engineer to think out and make an apparatus for the conversion of salt water into sweet, which may consume years before overt action begins), we have examples of what one may call *explicit behavior*. In contrast to behavior of this type, which involves the larger musculature in a way plainly apparent to direct observation, we have behavior involving only the speech mechanisms (or the larger musculature in a minimal way; for example, bodily attitudes or sets). This form of behavior, for lack of a better name, I will call *implicit behavior*.⁴ Where explicit behavior is delayed (*i. e.*, where deliberation ensues), the intervening

³ I may have to grant a few sporadic cases of imagery to him who will not be otherwise convinced, but I insist that the images of such a one are sporadic, and as unnecessary to his well-being and *well-thinking* as a few hairs more or less on his head.

⁴ It may be said in passing that the explicit and implicit forms of behavior referred to throughout the paper are acquired and not congenital.

time between stimulus and response is given over to implicit behavior (to "thought processes").

Now it is this type of implicit behavior that the introspectionist claims as his own and denies to us because its neural seat is cortical and because it goes on without adequate bodily portrayal. Why in psychology the stage for the neural drama was ever transferred from periphery to cortex must remain somewhat of a mystery. The old idea of strict localization of brain function is in part responsible. I feel, however, that religious convictions are even more largely responsible for it. I do not mean that the men originally responsible for the transfer were aware of this religious tendency at all. When the psychologist threw away the soul he compromised with his conscience by setting up a "mind" which was to remain always hidden and difficult of access.⁵ The transfer from periphery to cortex has been the incentive for driving psychology into vain and fruitless searches of the unknown and unknowable. I am quite sure that if the idea of the image had never taken such firm hold upon us we would never have originated the notion that we are seeking to explain consciousness. We would have been content to study the very tangible phenomena of the growth and control of explicit and implicit habits.

It is implied in my words that there exists or ought to exist a method of observing implicit behavior. There is none at present. The larynx, I believe, is the seat of most of the phenomena. If its movements could be adequately portrayed we should obtain a record similar in character to that of the phonogram.⁶ Certainly nothing so definite as this could be obtained, but we should get a record, at least, which would largely reveal the subject's word-habits, which, if I am not mistaken, make up the bulk of the implicit forms of behavior.

Now it is admitted by all of us that words spoken or faintly articulated belong really in the realm of behavior as much as do movements of the arms and legs. If implicit behavior can be shown to consist of nothing but word movements (or expressive movements of the word-type) the behavior of the human being as a whole is as open to objective observation and control as is the behavior of the lowest organism.⁷

⁵ The tendency to make the brain itself something more than a mechanism for coordinating incoming and outgoing impulses has been very strong among psychologists, and even among psychologically inclined neurologists.

⁶ I have been trying to find out whether any of the spoken phonographic records can be read by experts in that work. I have not been able to ascertain this information, but I am sure there is nothing inherently difficult about the problem. Records of laryngeal movements could likewise be read directly.

⁷ It is implied here and elsewhere in my position that there is no scientific

II

Affection is the other stumbling-block in the way of our main thesis. It is needless for us to enter into a lengthy discussion of the various views about affection. It is sufficient to call attention to the generally accepted position that affection is a mental process distinct from cognition. Both Angell and Titchener in this country admit the independence of the two. In Germany, likewise, with the exception of the followers of Stumpf, the independence is admitted. Indeed, as is well known, Wundt and his pupils are attempting to introduce into affection the same wealth of detail they have already succeeded in bringing into cognition. I refer to the addition to the elemental processes of pleasure-pain, those of strain-relaxation, excitement-calm.

In maintaining his position as to the independence of the two processes, Titchener states that affection and sensation are closely similar in the following respects. Both possess certain common attributes, viz., *quality, intensity, duration*. Sensation possesses the additional attribute of *clearness*, which affection lacks. "The lack of the attribute of clearness is sufficient in itself to differentiate affection from sensation; a process that can not be made the object of attention is radically different, and must play a radically different part in consciousness, from a process which is held and enhanced by attention." Furthermore, the lack of *clearness* distinguishes affection from organic sensation—the cognitive processes with which it is most closely allied. On the whole, while sensation and affection are closely allied, "the difference is so great that we have no choice but to rank affection in human psychology as a second type of mental element, distinct from sensation."

Adherents of the view that affection is merely an attribute of sensation have not been lacking. Külpe has been given credit for demolishing this assumption.

There remains the view in contrast to the one first outlined, advanced principally by Stumpf and accepted and amended by Helen Thompson Woolley, viz., that affection is really organic sensation. The theory as advanced by Stumpf is all but unintelligible in view of the fact that the simplification that he obtains by his reduction is more than offset by the complexity he introduces when he states value (or at most only temporary and provisional value) in self-observation. I sincerely believe that psychology would make far more rapid progress in the next twenty-five years than in all of its previous history, if it would conduct its experiments upon the assumption that the (normal) subject can hear but can not innervate the speech musculature beyond the point of making *silent whispers*. The same result might be obtained by working upon the assumption that the experimenter is deaf.

that the emotions, in addition to the complex of sensations, contain a mysterious "kernel." Mrs. Woolley, while rejecting the "kernel" hypothesis, insists that affection can be identified with sensation. She gives no clear reason for the solidarity and distinctness of the two groups, nor for the rather constant presence of the one or the other of these two groups. Stumpf no more than she meets these two points. My own view—which I advance as a theory, not as something introspectively ascertained or introspectively verifiable—may be stated somewhat as follows. I agree with Stumpf and with Woolley in holding that affection is an organic sensory response. Through lack of evidence, I reject the view that there are special pleasure and displeasure nerves. I admit, from the work of von Frey and that of Rivers and Head, that there are special cutaneous (proprioceptive) nerves which mediate pain. The first question which concerns us is how happens it that organic processes have become integrated into two such well-marked, solid groups known as pleasantness and unpleasantness? As they now stand they are really perceptions (objects) which at times may be examined as other objects, such as hunger, thirst, etc. At times they are as clear, and can be attended to in the same way, as the objects which arouse the exteroceptors. I have no sympathy with Titchener's view that these processes are never clear. It is a plain assumption, and a very weak one, arrived at largely in the interest of obtaining a structural differentiation between sensation and affection. At times these processes occur in conjunction with those from the eye and the ear, and since in certain situations the latter have very great stimulating value, the organic feature is extremely hard to observe. Under these conditions they are to some extent "obscure," as are all other organic processes, such as breathing, activity of the glands, circulation, etc. It is here, possibly, that Titchener gets his evidence for the view that they can not be attended to.

Secondly we are concerned with the question why the affective processes seem to be such constant accompaniments of other processes.

What I shall have to say in answer to these questions will not be surprising to any one who has followed the recent Freudian movement. I may preface my own remarks by saying that I do not follow this movement into all of its extravagances. I nevertheless feel that they have made good their main point concerning the sex references of all behavior. Since my first study of the movement I have been rather surprised that no one has connected pleasantness with the activity of the receptors stimulated by tumescence and unpleasantness with those stimulated by a shrinkage of the sex

organs.⁸ To those who have inherent objections to admitting that the esthetic, artistic, and religious sides of life are at bottom sexual, this view will not sound convincing. I shall not attempt to develop the point further at the present time. I find in the hypothesis, however, sufficient reasons for taking the theoretical views (1) that "affection" is mediated by enteroceptors, as is hunger, thirst, etc.; (2) that there should be two well-marked groups of such sense processes which possess the solidarity, distinctness, and unity claimed for them by those who hold that affections are elementary; (3) that one or the other should usually be present—actually serving as "personal evaluators of experience"; (4) that their observation should be easy at times and difficult at others.

This view makes them open, as are all other forms of behavior, to objective investigation. You will tell me that expressive methods have already failed to show any constant physiological processes occurring in conjunction with the examination of "pleasant" and "unpleasant" objects. I have worked for years upon the expressive methods and no one will admit their failure in the past more readily than I. My present feeling is that we have taken our plethysmograms from the wrong organs. Whether there are too many technical difficulties in the way of the objective registration of the many delicate changes in the sex organs (circulation, secretion, etc.), remains for the future to decide.

Having thus summarily dismissed the image and the affective elements, I crave permission to restate the essential contention of the behaviorist. It is this: the world of the physicist, the biologist, and the psychologist is the same, a world consisting of objects—their interests center around different objects, to be sure, but the method of observation of these objects is not essentially different in the three branches of science. Given increased accuracy and scope

⁸ The whole area involved in sex functions embraces a much wider zone than that of the sex organs proper. The erogenous areas are in infancy widely distributed throughout the body surfaces. Only gradually does the sex organ come to be looked upon as the focus of sex experience. Even in the case of most adults certain of these primitive zones remain functional, as, for example, the nipples, etc. The receptors lying in such areas are stimulated by the reflex motor processes initiated by the primary stimulus (*i. e.*, the object under observation).

[There are two things which possibly ought to be said in connection with this view. In the first place it is not essential to my contention that the above vague suggestion should be true. *It is essential to our position to have affection reducible to sense processes.* It is even more probable that the mechanism is glandular; that very slight increase in the secretion products gives us the one group; checking, or decreasing the secretion, probably the other. Finally it may be said that such a view is entirely independent of the ultimate fate of the Freudian movement.]

of technique, and the behaviorist will be able to give a complete account of a subject's behavior both as regards *immediate response* to stimulation, which is effected through the larger muscles; *delayed response*, which is effected through the same muscles (so-called action after deliberation)—these two forms comprising what I have called *explicit behavior*; and the more elusive types, such as the movements of the larynx, which go on in cases where action upon stimulation is delayed (so-called thought processes). This latter form of behavior, which manifests itself chiefly in movements of the larynx, but which may go on in (to the eye) imperceptible form, in the fingers, hands, and body as a whole, I should call *implicit behavior*. For years to come, possibly always, we shall have to content ourselves with experimental observation and control of explicit behavior. I have a very decided conviction, though, that not many years will pass before implicit behavior will likewise yield to experimental treatment.

Possibly the most immediate result of the acceptance of the behaviorist's view will be the elimination of self-observation and of the introspective reports resulting from such a method.

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A NEW ALGEBRA OF IMPLICATIONS AND SOME CONSEQUENCES¹

THE development of the algebra of logic has done more than emphasize the close relation of logic and mathematics. It has helped to show the possibility of an ideal development of pure mathematics in general, free—or nearly free—from tacit assumptions, parsimonious in its postulates, and absolutely rigorous in its methods of proof. In this ideal development, the algebra of implications, or "calculus of propositions," appears as the organon of proof in general, and hence as the necessary first step. The work of Russell and Whitehead and others has called attention to this method of procedure.² It is the logical outcome of the denial that mathematics must appeal to "construction" or any other empirical datum, once its postulates are laid down.

From this point of view, the drawing of conclusions is not a process in which premises retire into somebody's reasoning faculty and emerge in the form of the result; nor is the conclusion obtained

¹ Read in brief before the American Mathematical Society, San Francisco Section, October 26, 1912.

² "Principia Mathematica," Whitehead and Russell, intends to exhibit just this development of at least the fundamental branches of mathematics.