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*Essays in Motivation and Learning*

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To recapitulate, we would suppose the rat's total process of learning to be something as follows: First, the animal, after a greater or smaller number of trials, would come, when faced with the white or the black, to make an adjustment for running back and forth. And he would thereby become conscious of the whiteness or blackness. Similarly, when faced with the food or the nonfood, he would make an adjustment for running back and forth and thus become conscious of the foodiness or nonfoodiness. Finally, when faced with the white or the black, he would also make an adjustment to entering that one or the other and thereby become conscious of the to-be-expected food or nonfood result. On the basis of all three such adjustments, resulting, let us say, in one grand total Gestalt, he would respond. This total Gestalt would contain the differentiation of white from black, of food from nonfood, and of the sign relationship of white as leading to food from that of black as leading to nonfood. And on the occasions of its first appearances there would be consciousness. On later occasions this grand total Gestalt would eventually occur by mere associative extension, without the intervention of behavior adjustments, i.e., without consciousness.

One last word. You will perhaps be doubtful that the lowly rat is capable of all this. So, I think, am I. The important point is merely that if a rat learns consciously, the above gives a perfectly objective definition of how he might do it. It may be that he learns unconsciously. If he learns unconsciously, then we should have to assume that the changes from the readiness for undifferentiated behavior (i.e., behavior mediated by very simply "Gestalted" stimuli) to the readiness for differentiated behavior (i.e., behavior mediated by more complexly "Gestalted" stimuli) occurs somehow automatically between trials. We would then assume no mediating adjustments to introduce these changes. We should be forced to suppose rather that the initial stimuli somehow grow large and properly "Gestalted" by mere mechanical accretion.

*Though the recently reported results of McDougall and his son (J. Comp. Psychol., 7 (1927), 145-179) tend to minimize the probability of such unconscious learning.

**SIGN-GESTALT OR CONDITIONED REFLEX?**

*Psychological Review, May, 1933*

The general fact that specific acts tend to be learned or not learned according to the "goodness" or "badness" of their consequences is an empirical generalization with which, I suppose, we would now all agree. Our disputes will arise not with respect to this empirical fact but rather with regard to the hypotheses we would adopt for its underlying explanation. The "trial and error" psychologists would explain this influence of consequences upon the learning by their laws of "effect." They would say that those stimulus-response connections which are followed by "good" effects, whether these latter be conceived as pleasure, increased sensory consequences, or what not, will be strengthened, whereas those which are followed by "bad" effects will be weakened. And they will hint at various neurological concepts to explain this back-action of effects upon learning. But it is not this trial and error doctrine, in any of its forms, in which I am interested in this paper. Rather I wish now to draw your attention to a conditioned response doctrine of consequences.

At first blush it might seem that the conditioned response psychologists could have no doctrine of consequences. For in their original and pristine statement they seem to assert that a response gets learned (i.e., attached to a new stimulus) in so far as that new stimulus has been presented enough times preceding or just simultaneously with an original stimulus. Good or bad consequences do not come into the picture. It is the mere concatenation of the two stimuli which does the work.

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And yet the conditioned response psychologists, at least those in this country, do have a doctrine of consequences. And one can but admit that they, in achieving it, have been both "as wise as serpents and as harmless as doves." For they have invented a way of allowing for the different effects of good and bad consequences and yet at the same time of apparently still adhering to their original bona fide conditioning principles. Let me illustrate in terms of a concrete experiment.

Figure 1 shows the ground plan of a discrimination box similar to one which I have recently using. B and W are black and white curtains hanging just behind the two exits from the choice box. They are interchangeable. The task is always to choose the white curtain. D is a door which in each trial is so placed that, if the animal chooses the white curtain he gets to the food, whereas, if he chooses the black he runs into a blind alley and also he can be given an electric shock in this blind alley. How do our conditioned response friends explain such a discrimination learning?

They argue somewhat as follows: Learning consists in conditioning a positive response to the white curtain and a negative response to the black curtain. The rat learns to enter the door which, in the given trial, has the white curtain behind it because this white-curtained door, as stimulus, is followed by a free open path and by food. And to such free open path and food the positive responses of approach and of eating are already attached. That is, the unconditioned positive responses which the animal makes to the food or to the free open path get conditioned back to the stimulus, white-curtained door, which always precedes them. Similarly the rat learns not to enter the black-curtained door because this latter, as stimulus, is always followed by the further stimuli of blind end and electric grill to which latter negative responses are already attached. And these negative responses get conditioned back to the black curtain which just precedes them.

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It appears that what our conditioned response friends really do is to divide all responses into two sorts—positive and negative. And they argue that in a trial and error situation the acts which get learned are those which result in bringing the animals into the presence of further stimuli to which positive responses are already attached. And the acts which do not get learned are those which result in bringing the animal into the presence of further stimuli to which negative responses are already attached. This resultant positive and negative responses get conditioned back to the cue stimuli. It must be noted, however, that the positive and negative responses which thus get conditioned back may in concrete terms be as different from the original responses from which they are supposed to be derived as entering is from eating or as not-entering is from jumping back and squealing. But this last is a little point which is not stressed by the theory. Our conditioned response friends are truly both serpentish and dovish.

But let us not be too captious. For it must be admitted that this conditioned response formula, even though it be thus a bit—shall we say—jesuitical, is really surprisingly workable. It can be applied usefully to most discrimination box and maze problems and, as such, it seems to provide a helpful schema for holding together past results and for predicting future ones. Nevertheless my purpose here must be to show that there are (or at any rate there ought to be) types of maze or discrimination box finding for which this all-useful though emasculated conditioned response formula will not hold.

By way of a first example, let me return to an experiment of my own which used a discrimination box like that just shown. After having, as part of another problem, overtrained rats in this discrimination box, I tried putting them directly into the food compartments and shocking them then and there. Then I carried them immediately around to S and started a run in the usual fashion. My assumption was that as a result of all their preceding training, in which they had been running through the box as the way to get to food, the rats would have built up what in my barbarous terminology I have called sign-gestalt expectations. These sign-gestalt expectations I assumed would be to the effect that the earlier parts of the discrimination apparatus would have become a sign or a set of signs to the rats that the encountering of the

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1 This elaboration of the conditioned reflex formula is probably to be credited in the first instance to Smith and Guthrie [41], to Wilson [18] and to Emslie [6]. See also Guthrie [4]. Recently it has been further elaborated in a series of striking articles by Hull [7, 8, 9, 10, 11]. Finally, for a criticism of it see Williams [17].

2 For a further elaboration of this concept of the sign-gestalt-expectation, see Tolman [19], chapters ix, x, xi and xii.
food compartments was to be achieved by running through this discrimination apparatus. And, if the rats had built up such sign-gestalt expectations, I assumed further that a single experience of the changed character of the food compartments (or, as I should put it, this changed character of the significates of the sign-gestalts) should have been enough so that upon being reintroduced to the signs (that is, to the first parts of the discrimination box) the rats would at once have inferred or remembered this new changed character in the goal compartments. And hence they should have refused to run.

But alas, no such thing. Each rat (I must confess that I tried it with only four), after having been shocked in the food compartment and then carried to the starting point, immediately dashed off gaily and just as usual through the whole discrimination apparatus and bang whack into the very food compartment in which he had just been shocked. If the rats had sign-gestalt expectations, then sign-gestalt expectations are not as intelligent as I have supposed them to be.

Furthermore, after some more days of the original training I tried a second procedure. I ran the rats through the discrimination box first and gave them their shocks only then when they had reached the food compartments at the termination of such a run. I then ran them a second trial. And on this second trial they all balked before finally getting to the food. In this second procedure the rats first ran the discrimination box and received the shocks immediately after such runs. And this procedure worked. They all made the connection and refused to run on an immediately subsequent trial. In the former procedure, on the other hand, the rats were put into the food box and shocked there first without any just-preceding run; and it failed. They did not make the connection. (I may remark parenthetically that I tried both procedures several times with plenty of additional straight training in between and that I am convinced of the general validity of the results, at least for the special conditions of my experiment.)

But what is the significance of this difference in outcome? Obviously our conditioned response friends will immediately say: "Of course, in the case when the rats had just been run through the box before being shocked in the food compartment the negative response to the shock had a chance, by virtue of the just preceding run, to get conditioned back to the various stimuli of the discrimination box. But in the other procedure in which the discrimination box was not run through just prior to experiencing the shock in the food compartment there was no such chance for the negative response to the shock thus to become conditioned back. Hence the difference in the two outcomes."

Sign-gestalt or Conditioned Reflex?

Discretion is, no doubt, the better part of valor. So I suppose I must admit that it does look as though the conditioned response people were here going to be justified. And yet I am not quite ready to be completely and finally downed. Thus, first of all as a very general alibi, I would point out that even though further work does continue to verify the above findings—even though it be indicated consistently and repeatedly that a change in goal character can be carried back to the apparatus leading to that goal only if the stimuli of the apparatus have just preceded those of the new goal,—still this very fact is one which it took a sign-gestalt psychologist to discover. In other words, I would venture to assert that a dyed-in-the-wool, or I should say a drunk-from-saliva, conditioned responder would never have thought of even trying such an experiment. The sign-gestalt hypothesis has to that extent justified itself. It has initiated an interesting and illuminating experiment which was necessary to prove its own downfall.

But anyway I still have in addition a couple of more specific alibis. The foremost of these would be to assert that the negativity of my results (that is, their negativity from my own sign-gestalt point of view) may possibly have been due to one particular feature of my special set-up. For it must be noted that I tried this experiment only after my rats had had a very great deal of overtraining. And this may have meant that they had become what Gilhousen would call "fixed" before the experiment began. That is, if the change in the character of the goal had been made earlier, the rats might still have been able to respond to it in true sign-gestalt fashion. And the fact that under the conditions of the experiment, as I carried it out, they did not make this sign-gestalt adjustment may mean merely that at the time of the experiment they had sunk to the level of something much more automatic and "fixed"—something, if you will, like a true conditioned response. And we would then conclude that whereas under such overtrained conditions learning would follow conditioned response principles, at earlier stages in the learning curve it would follow sign-gestalt principles.

Finally, my last alibi lies in the results of another somewhat different set of experiments already on record. These are the experiments of Hsia [13] and of Honzik and myself [16] with what we called the "insight" maze. We found that under certain conditions a rat will avoid a given alley entrance not only when he has experienced that this alley

\footnote{For the original discussion of this concept of "fixation" see Gilhousen [3] and for a subsequent further experimental investigation of it see Krechovsky and Honzik [14]. Finally, for still other investigations of what seems to be essentially the same phenomena but which has been called by them "Behavior Constancy" see Hamilton and Ellis [1, 5, 6].}
entrance itself is followed by a negative-evoking stimulus (in this case a block) but also when he has experienced this negative stimulus (block) merely as the result of another alley entrance which debouches into the former one.

Figure 2 shows the ground plan of the elevated maze which was used by Honzik and myself. It will be observed that path 2 debouches into path 1 and that block N makes path 2, as well as path 1, useless. In the preliminary training the rats were forced down all three paths in an irregular order by putting blocks near the entrances of any two of the three paths at such points as x, y, and z and they soon learned, as the result of this preliminary training, first to try path 1 and then, if this was blocked at x, to try path 2 and only then, if this also was blocked at y, to try path 3. But, finally, in the test trial (and it is only this test trial which will interest us here) the block was inserted at N which, as has been noted, is in the common segment of paths 1 and 2. In this test trial the rats as before entered path 1 first but they found themselves blocked at N and hence retraced. Then, however, instead of next trying path 2, as they had practically always done before, they now immediately chose path 3. In other words, it appears that the negative-evoking character of N was carried back not only to the stimuli at the entrance to path 1, which stimuli had actually just preceded it, but also to the stimuli at the entrance to path 2, which stimuli had never thus preceded N.

Here, evidently, the conditioned response formula will not and does not suffice. To explain these results some other formula must be found. And I suggest something like my sign-gestalt formula as the proper substitute. The rat because of all his preliminary training is ready after he has found the block at N to cognize that he will in all probability meet this same block N if he now enters path 2. For he has built up sign-gestalt expectations in the sense that the entrance to path 1 has become for him a sign for the coming of the common segment and that the entrance to path 2 has also become a sign for the coming of this same common segment. So, now, when he discovers the negative character, N, in this segment as a result of entering it from path 1, he necessarily infers this same negative character to be met as a result of entering it from path 2.

So much by way of alibis. Let me sum up.

1. A change from positive to negative goal character if met by the rat just after an actual run affects his behavior on the next trial. This finding can be explained by the conditioned response formula, or at any rate by that jesuitical form of it which passes current among psychologists in this country.

2. A change in goal character (or rather in this case in the character of a part of the maze just proximate to the goal) which a rat meets at the end of one path will carry back to a second path which the rat has already learned as debouching into the first. This finding cannot however be explained by the conditioned response formula. It suggests something more like the sign-gestalt formula.

3. Finally, a change from positive to negative goal character which the rat experiences quite de novo, without, that is, having just run over the path which leads to the goal (although he has previously frequently been over this path as the way to get to the goal) does not affect his behavior on the next trial. At least it did not under the special conditions of the experiment as I carried it out. This negative finding forces
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us to conclude either that the conditioned response doctrinaire is to some extent correct after all, or else that my animals, because of over-training, were unduly “fixated.” If this latter were the case, we might conclude that the sign-gestalt formula is appropriate only for the earlier stages of learning, and not for the later ones.

But obviously many more experiments are needed. Some of these I hope to carry out myself in the near future.

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GESTALT AND SIGN-GESTALT

[Psychological Review, September, 1933]

In the present article I wish to point out some of the similarities and differences between sign-gestalts and true Gestalts. For sign-gestalts, as I have conceived them, are, it would seem, only in some measure of the nature of the true Gestalts of Gestalt psychology proper.

Sensationalism, perceptualism, propositionalism.—Perhaps the most significant way in which sign-gestalts can be set off, for purposes of contrast, from true Gestalts is to point out that sign-gestalts constitute the third term in a progression beginning with the sensations of Structuralism as the first term and passing through the Gestalts of Gestalt psychology as the second term. Or, to put it still another way: whereas Structuralism is a “sensationalism” and Gestalt psychology a “perceptualism,” Sign-Gestalt psychology is, I would assert, a “propositionalism.” That is, whereas according to Structuralism an organism responds to a complex of stimuli by a congeries of pointlike “sensations” and “images” and according to Gestalt psychology by a configurated “percept,” according to Sign-Gestalt psychology it responds rather by some total “proposition” or “propositions” (i.e., by a sign-gestalt or sign-gestalts).

The “percepts” of Gestalt psychology cannot we are told be analyzed into mere algebraic sums of sensations and images. For according to Gestalt psychology the organism always responds with an indissoluble “group” or “figure on ground” or “step up phenomenon” or “phi movement” or whatever. Such a total percept includes, to be sure, those

1 For a first statement concerning sign-gestalts see Tolman [10], especially chapter ix and following.