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A MULTIBEHAVIORAL ANALYSIS OF THE LABORATORY  
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CONFLICT AND THE STRUCTURE OF BEHAVIOR:  
A MULTIBEHAVIORAL ANALYSIS OF THE  
LABORATORY RAT OVER EXTENDED TIME PERIODS

by

Kenneth Duane McIntire

A DISSERTATION

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**TITLE**

**CONFLICT AND THE STRUCTURE OF BEHAVIOR: A MULTIBEHAVIORAL  
ANALYSIS OF THE LABORATORY RAT OVER EXTENDED TIME PERIODS**

**BY**

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PREVIEW

The living organism is constantly in the presence of an ever changing multidimensional pattern of physical energies. The sensory receptors and systems of an organism delimit the energy dimensions and values of those dimensions which may be effective in controlling the behavior of the organism. Energy dimensions which have been found to be useful in establishing control over behavior are commonly referred to as stimulus dimensions and specific values of those dimensions are called stimuli. Of the total set of stimuli present at any point in time, only specific stimuli or stimulus patterns will be effective in controlling an organism's behavior. Stimulus control over behavior can be inferred when an organism responds in a reliable manner in the presence of a particular stimulus configuration.

The conditions necessary or sufficient for the establishment, maintenance and sharpening of stimulus control are only partially understood at present. Part of the difficulty in firmly establishing relevant variables is that those variables differ among species, responses and stimulus dimensions. The variables affecting stimulus control which have received the greatest emphasis are environmental in nature involving the effects of contingencies of reinforcement. Other variables which are not as well understood, but which undoubtedly influence stimulus control, lie within the organism. These internal variables

may be related to environmental manipulations, e. g., deprivation. Internal variables include hormone changes, lesions, intracranial stimulation, and maturation.

The concept of stimulus control is a necessary part of any general theory of behavior and has been present in some form at least since the inception of psychology as a separate discipline. It has been variously presented as attention, stimulus selection, proximal, nominal or effective stimulation or, as Guthrie (1959) succinctly said, "what is being noticed."

Though stimulus control is a useful concept and it is possible to investigate variables influencing control, the fact remains that in few if any situations do variables present influence but a single isolated bit of behavior, a single response. In any situation there are many interacting factors affecting an organism and, thus, affecting the range of "potential" responses in that situation. The notion of differential response probabilities has been presented under various labels such as "habit family hierarchy" (Hull, 1943), "response strength" (Skinner, 1938) and the "hierarchy of responses " (Hinde, 1970). A situation in which there are variables simultaneously present which control two or more highly probable but incompatible responses can be labeled a conflict situation. Incompatible merely means that two (or more) behaviors cannot physically occur at the same time.

The detailed analysis of behavior in conflict situations is of importance for three closely related reasons.



First, seldom, if ever in its life history, is an animal confronted with a stimulus complex in which each stimulus element of the complex has been continuously associated with the same reinforcement contingency. Only in controlled laboratory environments does one approach an unconfounded instance of control. Second, the conflict situation involves at least two interacting reinforcement contingencies. The behaviors which occur in a conflict situation will be shown to not be predictable from a knowledge of the behaviors under the control of the independent stimulus elements of the situation. Behavior patterns can emerge in conflict which may bear no apparent direct relationship to the behaviors required by the separate reinforcement contingencies. Third, when complex, unpredicted behaviors obtain from the interaction of simple reinforcement contingencies, the generality of the data obtained from the analysis of simple contingencies becomes questionable. The analysis of simple effects, i.e., rate change, on a single response class, i.e., lever press, may be unnecessarily restrictive. The data base and theories of behavior may be profitably extended by observing the effects of an independent variable on more than one isolated response class. The investigation of conflict behavior provides a means by which the empirical and theoretical utility of a multibehavioral approach to behavior analysis can be judged against the alternative and more traditional unibehavioral approach.

### The Unibehavioral Investigation of Conflict

Operant behavior may be defined as behavior which serves to change the relationship between an organism and its environment. Responses directed toward a stimulus may be termed "approach" behavior and responses directed away from a stimulus can be called "withdrawal" behavior (Schnierla, 1959). Within the functional approach of Skinner (1959) and others, when an operant response creates a stimulus onset which increases the probability of further approach behavior, the stimulus is traditionally termed a positive reinforcer. When the stimulus onset increases the probability of withdrawal behavior, it is termed a negative reinforcer, i. e., offset is reinforcing.

Using approach and withdrawal as mutually exclusive (incompatible) events, it is possible to define stimulus complexes in terms of combinations of variables which determine approach, withdrawal, or an interaction between approach and withdrawal, i. e., conflict. When an organism is introduced to a stimulus situation in which a stimulus is associated with a positive reinforcement contingency and another stimulus is associated with a second positive reinforcement contingency and the behaviors involved in the separate contingencies are incompatible, the situation is traditionally labelled "approach-approach" conflict (Miller, 1959). Both stimuli are correlated with approach behavior, but only one of the two responses can be emitted. As only one of the two possible reinforcement contingencies can be fulfilled, the organism necessarily loses a potential

reinforcement.

If one stimulus is associated with a negative reinforcement contingency and a second stimulus is associated with a second negative reinforcement contingency, the situation has been termed "avoidance-avoidance" conflict (Miller, 1959). Schnierla (1959) makes a distinction between avoidance and withdrawal. In the interest of consistency and in accordance with Schnierla, the term withdrawal will be used in place of the more commonly used avoidance. The withdrawal-withdrawal situation is characterized by the necessity of the organism to approach one of the two stimuli previously controlling withdrawal behavior in order that the stimulus situation be terminated. The withdrawal-withdrawal situation is one from which the organism will escape unless there is an additional contingency or barrier maintaining it in the conflict environment.

A third stimulus situation, the approach-withdrawal conflict situation, may be produced by one of two methods. In the first method, stable approach behavior is established in the presence of stimulus A and reliable withdrawal behavior is maintained in the presence of stimulus B. Stimuli A and B are then presented simultaneously. The second method involves the establishment of approach behavior in the presence of a stimulus and, later, intro-

ducing a concomitant negatively reinforcing contingency (establishing withdrawal behavior) in the presence of the same stimulus. Most of the research reported here uses the latter method.

LaFave (1969) has concluded that the conflict situations listed above do not represent distinct categories, but logically reduce to a single category. This logical reduction provides little aid in determining the controlling variables or generating useful research. The more traditional labels used here, while not as logically precise as those proposed by LaFave, have a long history of shared meaning among psychologists, offsetting for the present any disadvantages accrued through logical imprecision.

The theoretical foundations of research concerned with variables affecting approach and withdrawal behavior and the unibehaviorally defined effects of conflict must be credited to Lewin (1935). Lewin's contribution was not a rigorous data based theory, but it was sufficiently well formulated that it could be molded to the uses of an empirically based behaviorism. A detailed analysis of Lewin's theory would not serve the purpose of increasing our understanding of interacting reinforcement contingencies; however, several deductions from Lewin's theory influenced the kinds of questions asked by later behaviorists. According to Lewin, "the strength of the field forces which correspond to the negative valence diminishes much

more rapidly with increasing spacial distance than do the field forces corresponding to the positive valence" (1935, p. 52). That is, the generalization gradients exhibited by behaviors under aversive control should be much steeper than those under the control of positive reinforcement. Secondly, "from the direction and strength of the field forces of the various points of the field it can be deduced that the child must move to point P where equilibrium occurs" (ibid., p. 92). Bearing in mind that Lewin was talking about psychological "life space" rather than "real world" distances, he predicted that there would be a point at which the variables controlling the incompatible responses would effectively work against each other and the organism would do nothing (provided it cannot escape from the situation). Thirdly, "corresponding to the momentary oscillations in the situation, above all to the more or less threatening aspects this point of equilibrium approaches and retreats" (ibid., p. 92). Rather than propose a constant point P and having the organism oscillate about that point, Lewin proposed that the point of equilibrium itself oscillated. Finally, Lewin proposed that "the opposition of the two field forces in a conflict situation leads directly to an increase in the total state of tension" (ibid., p. 94). Translated into more classical terms, conflict is a drive inducing stimulus situation.

Though Lewin's conflict model was couched in field theory terminology, it is easy to see how the basic

concept of "force" might be readily translated into the conceptual framework of Hullian or Neo-Hullian theory as "drive" or "reaction potential." Although Neal Miller gave no specific mention of Lewin, it is generally recognized (e. g., Yates, 1962, p. 147) that Miller's (1959) model bears more than a coincidental resemblance to that of Lewin. Miller, however, being a researcher as well as a theoretician, reworked and extended the model in behaviorist terminology, specified postulates, made predictions and tested those predictions. The resultant model of conflict behavior is probably one of the most well-known single models in psychology. The abbreviated review here will rely heavily on Miller's (1959) final, composite formulation of the conflict model.

Miller's model involves six basic assumptions:

A. The tendency to approach a goal is stronger the nearer the subject is to it.

B. The tendency to withdraw from a feared stimulus is stronger the nearer the subject is to it.

C. The strength of withdrawal increases more rapidly with nearness than does that of approach, i. e., gradient of withdrawal is steeper than the gradient of approach.

D. The strength of tendencies to approach or withdraw varies directly with the strength of the drive upon which they are based, i. e., increasing drive increases the height of the entire gradient.

E. Below the asymptote of learning, increasing the

number of reinforced trials will increase the strength of the response tendency that is reinforced.

F. When two incompatible responses are in conflict, the stronger will occur (Miller, 1959).

Using these postulates, Miller and his colleagues could make certain fairly precise predictions, depending upon how "tendency" and "strength" were defined.

1. The subject should approach the goal part way, then stop.
2. Increasing the strength of hunger, i. e., drive, should cause the subjects to approach nearer the goal.
3. Increasing the number of reinforced training trials should cause the subject to approach nearer the goal.
4. Increasing the strength of fear should cause the subjects to remain further away from the goal.
5. Increasing the number of reinforced avoidance trials should cause the subjects to remain further away from the goal.

Using rats as subjects in a straight alley situation in which the goal box contained food, shock or both food and shock, Miller's research has resulted in evidence which directly or indirectly confirms most of the postulates and predictions. Brown (1948) tested assumption A by measuring the strength of pull of food-deprived rats near or far from the goal box which contained food. The mean pulling force was 56.5 gm. near the goal box, and 40.9 gm. farther from the goal box, thus confirming the assumption. The gradient, however, was fairly flat.



The results were similar to those of Lambert and Solomon (1952). Bugelski and Miller (1938) provided evidence for assumption B. Rats were trained to avoid the lighted end of an alley by shocks and then divided into three groups. Group 1 was placed in the part of the alley where shock was given. Group 2 was placed 12 inches from the shock point and Group 3 was placed at 36 inches. Start time and running speed were measured. A gradient of avoidance was found for both start time and running speed. Brown (1948) used strong and weak shock groups and also found a gradient of avoidance. The mean pulling force of strongly shocked rats was 198.4 gm. when placed near the shock point but only 2.1 gm. at a distance from the shock point.

Assumption D was tested by Brown (1942a) with regard to the approach gradient. When the deprivation level in rats was changed from 46 hours to one hour, the mean strength of pull toward the positively reinforced goal box decreased from 65.4 gm. to 27.5 gm., while starting times increased from .89 to 6.67 seconds. Brown (1948) found similar results. With regard to the avoidance gradient, Brown (1948) found that rats receiving a strong shock exerted a mean pull of 198.4 gm. when placed in the shocked end of the alley. Subjects receiving a weak shock showed a mean pull of 141.2 gm.

Assumption E was tested by Kaufman and Miller (1949). Rats were trained to run an alley for food reward under a



constant 22 hour food deprivation. Shock was introduced in the goal box after 1, 3, 9, 27 and 81 food reinforced trials. A direct relationship was obtained between the number of reinforced trials and the persistence to approach the goal box. Thus it can be seen that all of the assumptions except F (which is perhaps not testable) have received some degree of empirical support.

In a theoretical analysis, Brown (1942b) argued that at the point of intersection of the approach and withdrawal gradients, response tendencies will be approximately equal. Consequently, if two stimuli intermediate between the positive and negative stimuli are presented, a state of conflict will be present. In this manner, Brown was able to derive the conflict situations postulated by Lewin. An approach-approach conflict results when identical stimuli are both positive. A double approach-withdrawal conflict results when identical stimuli are midway between the positive and negative stimuli. And a withdrawal-withdrawal conflict occurs when the stimuli are both aversive.

An important and investigable assumption of Miller's conflict model is the postulation of different gradients for approach and withdrawal, with the withdrawal slope always being steeper than the approach slope. As to why the approach slope should be flatter than the withdrawal slope, Miller and Murray (1952) and Miller (1959) proposed that "...fear is a learned drive elicited primarily by

situational cues but hunger is more dependent on internal physiological factors," and "...the strength of the learned drive...varies inversely with the distance from the point of reinforcement."

Miller's formulation can be restated in terms of gradients of stimulus generalization. The implications are that the gradients of stimulus generalization for a response under aversive control should be steeper than those for a positively reinforced response. Hearst (1970) reviews a body of literature which indicates that this assumption is not generally valid. Hearst (1960) trained monkeys to simultaneously pull a chain to avoid shock on a non-discriminated shock avoidance schedule, i. e., Sidman avoidance, and to press a lever to obtain food on a VI schedule of reinforcement. When tested in extinction on the stimulus dimension of illumination in the chamber, all subjects showed significantly steeper gradients for the food reinforced bar press than for the shock avoidance response. The shock avoidance response was, for all practical purposes, not under the control of the chamber illumination. To determine whether or not discrimination training would affect the slopes of the generalization gradients, two different light intensities were used. One intensity ( $S^+$ ) was correlated with food and shock, the other was not ( $S^-$ ). By training, both shock avoidance and food reinforced responses were brought more under the control of chamber illumination. However, the post

discrimination gradient for the shock avoidance response was still flatter than that of the food reinforced response. In an extension of these studies, Hearst (1965) again used monkeys concurrently responding on a shock avoidance schedule (lever press) and for food reinforcement (lever press). Discrimination training and generalization testing were conducted simultaneously.  $S^+$ , one illumination intensity, was alternated with seven other ( $S^-$ ) stimuli. As the number of sessions increased, both behaviors were increasingly brought under the control of the  $S^+$ . At no time, however, did the generalization gradient for the avoidance response become as steep as that of the food reinforced response. Hearst (1965) reviews data indicating that these results are not determined by the species, response used, shock intensity, deprivation parameters or stimulus qualities.

There are other results which also do not appear to support certain of Miller's assumptions. Smith (1960) attempted to verify the gradient of approach in detail. He measured strength of pull in an approach situation at five distances from the starting point, using two kinds of rats (albino and hooded). He was able to replicate Brown's (1948) results with albino rats; hooded rats showed the opposite type of gradient. His results also suggested that the gradients were not linear. Trapold, Miller and Coons (1960) used a 100 ft. long approach-avoidance straight alley situation. If rats were placed between the hypothetical point of maximal conflict and the

shocked goal box, they often moved toward not away from the goal. Miller's theory predicts the opposite.

Maier (1961) and Hearst (1970), on the basis of the existing data, conclude that there are no universal slopes for approach and avoidance. As Hearst states, "...by proper manipulation of certain experimental conditions, one can produce a steep approach gradient or a flat approach gradient, a steep avoidance gradient or a flat avoidance gradient" (p. 263).

Of more direct relevance to the developing theme of this paper, Miller's original conflict model was extended to make predictions about "displacement"<sup>1</sup> behavior, the understanding of which is dependent upon some familiarity with the basic model. Specifically, assuming the approach gradient to be flatter than the withdrawal gradient, the approach behavior will be more readily emitted to stimuli remote from the originally conditioned stimulus than to stimuli very similar to it. Miller and Kraeling (1952) tested this hypothesis by training rats to lift a cover at the end of a straight alley to obtain food. They were then shocked when they touched the cover. They were given test trials (without food or shock) in one of three alleys: a wide white alley identical to that used in training; a medium-gray alley; and a narrow black alley. The prediction that the rats in the third alley (the most

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<sup>1</sup>"Displacement" within the unibehavioral context of Miller's conflict theory is a class of stimulus generalization and is not the same as "displacement behaviors" in an ethological, multibehavioral context.

dissimilar to the training alley) would approach more closely the end of the alley than the group in the grey alley was confirmed. The group tested in the grey alley proceeded further than the rats tested in the original training alley. However, of a control group which had received only approach training on the original alley, only 15 per cent reached the end of their respective alleys during testing. Murray and Miller (1952) attempted to correct methodological flaws in the Miller and Kraeling (1952) study by using independent groups. The results were in accordance with the prediction.

An important series of studies was performed by Murray and Berkun (1955). They used a three rather than two dimensional model involving the strength of the behavioral tendency, similarity between original and displaced goal and physical nearness to original and displaced goal. They used three adjacent alleyways (wide-white, medium-grey and narrow-black) which contained spaces where the animal could cross from one alley to the next. Rats were trained to approach food at the end of the wide-white alley and then shocked. Their model predicted that the subjects would approach in the white alley to the point of maximal conflict, cross into the grey alley and again advance. When the point of maximal conflict was reached in the grey alley, the black alley would be entered. The experimental results confirmed these predictions. All eleven of the subjects displaced to the

grey alley and 8/11 displaced to the black alley. All subjects approached further in the grey and black alley than in the white alley.

Berkun (1957) extended these results by showing that the displacement response, i. e., responding in other than the training alley, could help resolve the conflict, i. e., responding in the training alley. He also found that reinforcement of the displaced response increased speed of recovery in the original alley. These results were confirmed by Taylor and Maher (1959).

There was, however, one major flaw in the Murray and Berkun (1955) and Berkun (1957) studies. The three alleys used were always in the same spacial arrangement, thus confounding spacial cues with the color and width cues. Elder, Noblin and Maher (1962) used four alleys whose spacial relationships could be varied. The only variable which significantly affected the reinstatement of the approach response was that of the distance of the displaced alley from the training alley, thus indicating that the hypothesized stimulus effects of Murraray and Berkun (1955) and Berkun (1957) were insignificant. Noblin and Maher (1962) conclusively confirmed the importance of the distance effect by extinguishing the approach response in either a white or black alley with distance held constant. There was no difference between them in the number of trials required to extinction. In a more recent study, Schwartz and Johnson (1968) found that the alley color itself may,

under certain circumstances, be a powerful variable for rats. It was found that rats progressed further down a black-rough alley than a white-smooth or grey-textured alley regardless of the alley in which they received the shocks.

Miller's model of conflict and displacement has been included in this paper primarily because of the great influence it has had on so many students and instructors. As has been fairly well demonstrated, however, the model is not generally substantiated by the data. And predictions about displacement, while intuitively beguiling, are empirically limited. The assumptions from the original theory which have withstood the rigors of testing fairly well concern the relationship between proximity to goal and response "tendency". If the assumption is made (as does Miller) that spacial distance is a special dimension of stimulus generalization, then almost every study carried out testing stimulus control along a single stimulus dimension would substantiate this position. It would thus seem potentially more fruitful to analyze the variables affecting stimulus control. This is essentially the position taken by Hearst (1969).

There is, however, a major shortcoming in reducing the study of conflict behavior to the analysis of variables affecting generalization gradients. Stimulus control is tested along one or two stimulus dimensions with regard to a single response, i. e., unibehaviorally.



The result is a data base analagous to "strength of pull" or running speed in the straight alley. If only a bar press or key peck is taken as the source of data, information is provided only about the bar press or key peck. The unibehavioral approach has been useful in the analysis of stimulus control; however, the data already reviewed and the data yet to be reviewed show the unibehavioral approach to be limited in the analysis of complex controlling interactions. Lever press vs. non-lever press represents a neat dichotomy of behavior. Non-lever pressing behavior, however, may range from complete immobility to extreme agitation (Terrace, 1963). And the non-recorded, often ignored, "other" behavior can be as important for a functional analysis of behavior as the well respected unibehavioral response rate. As with many events in psychology, probably the first reported instance demonstrating the value of observing the entire pattern of an animal's behavior in a conflict situation occurred in Pavlov's laboratories.

#### The Multibehavioral Investigation of Conflict

In a classic experiment, Shenger-Krestovnikova (1913) used the conditioned salivary response of dogs as an indication of discrimination learning. A circle was presented on a screen in front of the subject and paired with food presentation. When an ellipse was presented on the screen, no food was presented. The salivary response was brought under differential control very easily. The