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Chapter 14

EXPERIMENTAL STUDIES OF CONFLICT

By NEAL E. MILLER, Ph.D.*

CONFLICTS CAN DISTRACT, DELAY, AND FATIGUE the individual and force him to make maladaptive compromise responses. In fact, clinical studies demonstrate that severe conflict is one of the crucial factors in functional disorders of personality.[1] These observations receive additional support from experiments demonstrating that difficult discriminations and other situations creating intense conflict can cause animals to break down into a so-called experimental neurosis. Many laboratory studies of conflict have been attempts to produce these states seemingly analogous to human mental disorders. They have been summarized in Chapter 12 by Liddell. The present chapter does not deal with the problem of producing such abnormal states; it is concerned with the principles or laws of conflict behavior.

Conflict is produced by competition between incompatible responses. But not all situations tending to elicit such responses produce that hesitancy, tension, vacillation, or complete blocking, which are ordinarily considered to be conflict behavior. Almost every situation tends to elicit a variety of responses which cannot all be made at once; nevertheless, first one and then another of these responses usually becomes dominant so that behavior ripples smoothly on. What are the factors which make some choices easy and others so difficult?

Some Fundamental Distinctions.—Smith and Guthrie (1921, pp. 126–127) have pointed out that some types of competition are much more likely than others to produce a stalemate. They make the useful distinction between states of stable and unstable equilibrium.

In *unstable equilibrium,* as soon as one response gets started it produces effects which either increase its own strength or decrease that of its competitors. Therefore, the first response to get started continues to increase in relative strength and becomes completely dominant. The situation is like that in which a pencil, balanced on a razor-sharp point, starts

* The author is grateful to Mr. Fred D. Sheffield for helping with references, drawing the diagrams and criticizing parts of the theory and manuscript.

[1] See Chapters 28 and 29 of this book, Freud (1920, p. 302), Guthrie (1938, pp. 29, 171), Janet (1925, Vol. I, p. 450), McDougall (1926, pp. 217–220), Prince (1921, pp. 448–528), Rivers (1923, p. 144), and Strecker and Ebaugh (1940, p. 34).

to fall one way or the other and always topples completely over in that direction. Though incompatible, the responses do not continue to inhibit each other.

In *stable equilibrium* the dynamics are reversed: as soon as any response gets started, it produces effects which either reduce its strength or increase that of its competitors. Thus, unless the first response is very strong to begin with, it is likely to lose its dominance before it is completed. The situation is like that of a ball, suspended on a string, always tending to return to a point of balance. Incompatible responses continue to inhibit each other unless there is a great difference in their relative strengths.

A basic type of situation producing stable equilibrium is one in which the subject has strong tendencies both to approach and to avoid the same goal. For example, a timid person, urged to demand a higher salary but fearing to do so, has tendencies both to approach and to avoid the chief's office. This type of situation is likely to produce conflict behavior. It will be refered to as an *approach-avoidance* competition.

A second type of situation likely to produce stable equilibrium, and hence conflict behavior, is one in which the individual is hemmed in by stimuli all of which elicit only avoidance. This is proverbially called being placed between the devil and the deep blue sea, but will be more drably described as an *avoidance-avoidance* competition.

Both of these situations are to be contrasted with a third type, one in which the competition is between tendencies to approach two or more desirable goals. Such situations produce a state of unstable equilibrium unless concealed tendencies to avoid are also involved. As soon as the response of approaching one goal gets started, it becomes completely dominant and choice is easy. The behavior actually observed is in striking contrast to the mythical plight of Buridan's ass starving in conflict between two equally desirable stacks of hay. This type of situation will be referred to as an *approach-approach* competition.

Lewin (1931) has made a penetrating analysis of these three types of conflict situation. His analysis is in terms of spatial diagrams of so-called field forces. The important thing about Lewin's analysis is that it indicates clearly the reasons why the first two types of situation tend to produce stable equilibrium with indecision, while the third leads to unstable equilibrium in which no conflict is expected. Hull (1938) has translated this analysis into the terminology of the goal-gradient and Miller (1937) has elaborated upon it. A considerable body of experimental work has grown out of this analysis. These experiments have started with simple situations involving spatial approach or avoidance and led toward a better understanding of some of the more complicated conflicts met in the clinic.

Plan of the Chapter.—This discussion will first list the principles most essential to an understanding of conflicts involving approach and avoidance. It will describe a series of experiments aimed directly at verifying these principles. Then it will deal with their application to relatively simple approach-avoidance, approach-approach, and avoidance-avoidance situations. The logic of the deductions leading from the simple principles to the details of behavior to be expected in these different situations will be outlined and the experimental evidence testing these deductions will be summarized.

Having dealt with these relatively simple types of situations, the analysis will progress to more complicated ones. It will show that under certain conditions, avoidance tendencies will be expected to appear in choices between desirable goals. Where such latent avoidance lurks, it changes the choice from a pure approach-approach competition not producing any conflict, into a double approach-avoidance one which, as will be shown, may produce serious conflict.

Next the analysis will show how difficult discriminations can produce approach or avoidance competitions. It will describe the chief conditions determining which type of competition is produced, and hence what type of behavior is to be expected.

After the basic types of approach and avoidance conflict have been delineated, other factors which can produce stable and unstable equilibrium will be briefly considered. As soon as the discussion departs from responses, such as approach and avoidance, which are obviously mutually exclusive, it will be necessary to give at least a passing bow to the problem of incompatibility. Then a few data from experiments on dynamogenesis and transfer of training will be considered. Since the logic in a condensed panorama of this kind cannot even pretend to be rigorously systematic, from time to time certain additional assumptions, not considered as thoroughly as the rest, will have to be introduced. This will be especially true of the latter portions of the chapter.

In conclusion, the analysis will deal with the way in which compromise responses are produced and the manner in which conflicts spread from one situation to another.

Four Fundamental Principles

A theoretical analysis verified by experimental work indicates that four simple assumptions are fundamental to an understanding of conflicts between tendencies to approach and to avoid:

1. The tendency to approach a goal is stronger the nearer the subject is to it. This will be called the *approach gradient.*
2. The tendency to go away from a place or object avoided is stronger the nearer the subject is to it. This will be called the *avoidance gradient.*
3. The strength of avoidance increases more rapidly with nearness than does that of approach. In other words, it may be said that the avoidance gradient is *steeper* than the approach gradient.

4. The strength of the tendencies to approach or avoid varies with the strength of the drive upon which they are based. Thus, an increased drive may be said to raise the *height* of the entire gradient.[2]

These assumptions are closely related to the still more basic idea of *a gradient of reinforcement* and to other general principles of learning which have been found useful in explaining a wide range of human behavior.[3]

Independent Verification of Assumptions.—Each of the four fundamental assumptions has been investigated separately in a series of studies by Brown (1940). His tests all involve one additional assumption, namely, that the stronger the subject's tendency to respond, the harder he will pull against a temporary restraint.

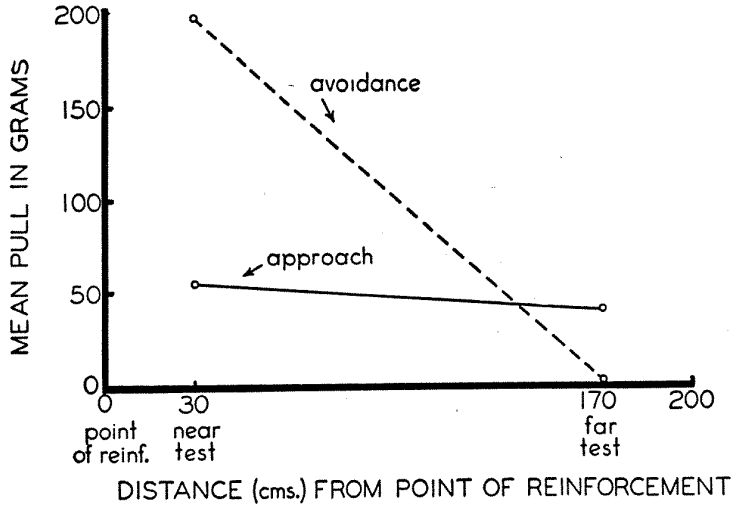

Figure 1. Gradients of Approach and Avoidance

The approach gradient represents the force with which rats under a 48-hour hunger drive pulled against a restraining harness at different distances from the point at which they had been fed. The avoidance gradient shows the force with which rats pulled away from the point at which they had received a strong shock on the previous trial. It should be noted that in this and succeeding diagrams the only reason why the test points are joined by a straight line is because that helps the clarity of the exposition; assuming a curvilinear function would not change the essential deductions.

[2] For equivalent assumptions stated in terms of so-called field forces see Lewin (1931) or (1935.)

[3] For a simple exposition of the broader scope of learning theory and a more detailed discussion of some of the more general concepts referred to in this chapter, see Miller & Dollard (1941); for a rigorous technical exposition, see Hull (1943).

In the study of the approach gradient Brown trained a group of hungry albino rats to run down an alley to secure food at a point made distinctive by the presence of a light. During these trials, the animals wore a little harness attached to a cord which moved so easily that it was not a hindrance. After they had learned to run down the alley to approach food, some of the animals were restrained for one second at a point near the goal and others at a point far from the goal. During this restraint, they pulled against a calibrated spring attached to a marker tracing on a polygraph so that the average force of their pull could be computed. The results are represented by the solid line in Figure 1. It was found that the animals restrained near the goal of food pulled reliably harder than those restrained farther away. This test verified the first assumption, that of an approach gradient.

In an investigation of the avoidance gradient Brown gave a different group of animals a brief electric shock at the same end of the alley. After receiving two shocks the animals, when placed in that end of the alley *without shock*, showed a marked tendency to avoid it. Brown restrained half of them near the place they were avoiding and the other half far from this place. The rats pulled harder when restrained near than when restrained far, thus verifying the second assumption, that of an avoidance gradient. These results are represented by the dotted line in Figure 1.

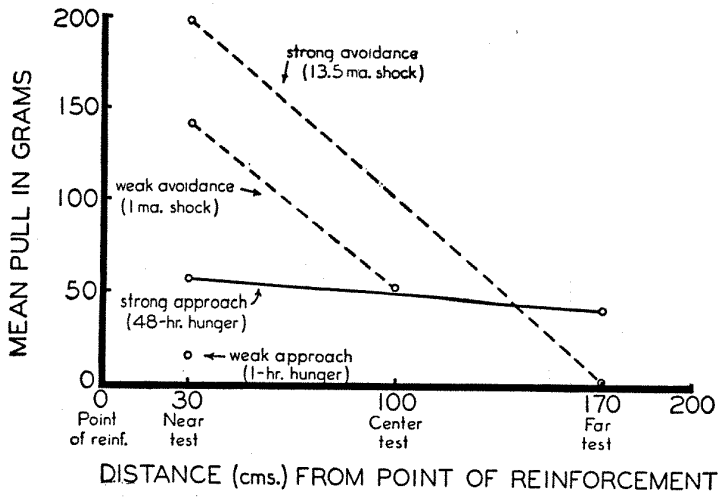

Figure 2. Effect of Strength of Drive upon Height of Gradient

The two avoidance gradients represent the strength of pull on near and far nonshock tests of two groups of rats that had received shocks of different strengths. The approach gradient represents the strength of pull at near and far points of animals tested after 48 hours of food deprivation; weak approach represents a single test at the near point of another group of animals with one hour of food deprivation.

A comparison of the separate measurements of approach and avoidance tendencies indicates that the strength of avoidance increases more rapidly with nearness than does that of approach. This verifies the third assumption, the greater steepness of the avoidance gradient. Since the two gradients actually cross each other in these tests, this verification depends only on the assumption that stronger tendencies produce stronger pulls; it does not involve any assumption that this relationship is linear.

In his final experiments Brown demonstrated that a reduction in the strength of either hunger or shock produced a reduction in the strength of pull. Thus he verified the assumption that the heights of the gradients vary with the strengths of the drives involved. These results, verifying the fourth assumption, are presented in Figure 2.

Approach-Avoidance Competition

Approach and avoidance have been studied separately; what happens when they are both present at the same time? An analysis of the situation in which the individual has strong tendencies both to approach and to avoid the same goal is fundamental to an understanding of human conflict. The young swain who is hard smitten but very bashful vacillates helplessly at a distance from the object of his affection. Why is he unable to go resolutely either forward to get her or away to forget?

From the principles verified in the separate studies of approach and avoidance, one can predict what behavior to expect when these two tendencies are in conflict with each other. The first deductions arise from the fact that the avoidance gradient is steeper than the approach, so that the two may cross. Under the conditions represented in Figure 2 (strong approach and avoidance) it can be seen that at a distance from the goal the approach tendency is stronger than avoidance. Whenever the subject is in this region, he should advance toward the goal. As he gets nearer, however, the strength of avoidance increases more rapidly than that of approach. Thus, he eventually reaches a point at which the strength of avoidance equals that of approach; the two gradients cross. At this point he should stop. Similarly, whenever the subject is too near to the goal, he should retreat with the strength of avoidance falling off more rapidly than that of approach till he reaches the point at which the two are equal, and consequently is stopped. Thus it can be seen that the subject (like the timid man wanting to demand a higher salary, or the bashful lover) should tend to remain trapped at an intermediate point of stable equilibrium where the two gradients cross.[4]

[4] The pattern of going part way and then stopping can be predicted only on the assumption that the gradient of avoidance is steeper than that of approach. If the two gradients were parallel, the relative strengths of the two tendencies would not change with distance; there would be nothing to cause the subject to stop. If the approach gradient were steeper than the avoidance, the subject would tend to move away from the point at which they crossed so that whatever difference there was would be not reduced but increased. This would produce easily resolved, unstable equilibrium.

The location of this point will, as can be seen in Figure 2, vary with the relative heights of the two gradients. As avoidance is lowered or approach is raised, the intersection will shift toward the goal. If either of these changes is carried far enough, it is obvious that the two gradients may not cross at all, so that the subject will be expected to reach the goal.

Verification of Simple Deductions.—These deductions have been tested in experiments by Miller, Brown, and Lipofsky (1943). They studied the behavior of albino rats in situations in which tendencies to approach and avoid were in conflict. First the experimenters trained hungry rats to run the length of an alley to secure food at a point made distinctive by the presence of a small light. Then they established tendencies to avoid this point by giving the animals a brief electric shock there while eating. Finally the animals received test trials without shock; the experimenters placed them at the start of the alley and observed their conflict behavior. During both training and tests a light cord attached to a little harness on the animals operated a device which recorded their locomotion without restraining it.

To determine the effects of different strengths of avoidance the experimenters divided the animals into groups, each of which received a different strength of shock during training. To determine the effects of different strengths of approach, they further divided each of these groups into halves, one of which was tested with a strong, and the other with a weak, hunger drive.

The results confirm the deductions. The characteristic behavior was to approach part way and then stop. The place at which the animals stopped was determined by the relative strength of the two drives. Stronger hunger or weaker shock caused the animals to come nearer to the goal before stopping.

Vacillation.—Thus far we have been concerned with the fact that the subject should stop, and not with the manner in which he will stop. If we assume that the opposing tendencies add up in something resembling algebraic summation, we can deduce that as the subject approaches the point where the gradients cross, he will be expected to become increasingly hesitant. If stimulation from the external situation were all that is involved, the subject would be expected to stop exactly at the point of intersection. But in making the responses of going forward, he produces additional stimulation from anticipatory goal responses and from the proprioceptors in his muscles. This internal stimulation should add to the tendency to continue advancing and thus function like a psychological momentum. It should carry the subject forward beyond the point of intersection, so that by the time he is stopped (and this stimulation disappears) avoidance is considerably stronger than approach. Furthermore, as soon as he starts retreating, his responses should produce additional cues helping to elicit a still more hasty withdrawal. Thus, after slowing down and eventually stopping, the subject will be expected to retreat rapidly. Similarly, when the additional stimulation produced by

retreating carries him too far beyond the point of intersection, he will be expected to slow down again and start another advance. In short, the subject will be expected to oscillate in the region in which the gradients cross.

While the reinforcement of securing food has been most immediately associated with the internal stimuli from the last steps of approach, that of escaping shock has coincided with those from the first ones of retreat. Thus, according to the gradient of reinforcement, stronger tendencies should be elicited by the internal stimuli from later steps of approach and the first of retreat than by those from the first of approach and later ones of retreat. Therefore, shifting from approach to avoidance should produce a greater effect than from avoidance to approach; the subject should move faster during the first part of retreat than the first part of approach.

These deductions are in general borne out by the records secured in the experiments. The animals showed a definite tendency to vacillate in the conflict situation. In some cases the form of the oscillations was in the exact pattern predicted by the theory. An increasingly hesitant approach was followed by an abrupt retreat which was far more rapid than the approach. In some records a succession of such oscillations, all in the same pattern, occurred with a consistency that can scarcely be attributed to chance. Rasmussen (1940) has also observed similar behavior without recording it.

In other records, however, a different pattern was observed. The animal would move forward, hesitate, stop for a while, then abruptly move forward, hesitate, and stop again. The repetition of this performance gave his record the appearance of a series of steps, ending in either a plateau or a retreat. Why these animals merely stopped instead of retreating is not known. It would be interesting if further experiments should demonstrate that such animals are ones whose initial reaction to the original shock was crouching. It seems probable that the tendency for these animals to move forward after a period of time can be explained by the progressive extinction of their fear responses and that the abruptness of the shifts from one type of behavior to another is to be attributed to the momentum-like effects of response-produced stimulation.

With many other animals the form of the oscillations was so irregular that no consistent pattern could be detected.

Strengths of the Competing Tendencies.—From the theoretical analysis it is obvious that if the relative strength of the approach tendencies is strong enough so that the two gradients do not cross, the animals will be expected to go completely to the goal and not show any vacillating behavior.[5] Conversely, if the relative strength of the avoidance tendencies is so strong that the point of intersection lies outside of the alley, the

[5] Furthermore, once they have reached the goal, approach will be strengthened by reward, and avoidance weakened by extinction, so that the relative difference between the two will be further increased and vacillation will become progressively less likely.

animals will be expected to remain against the far end without vacillation. The experimental results confirmed these deductions. The maximum amount of vacillating behavior occurred at an intermediate strength of shock. As would be expected, the amount of shock producing the maximum amount of vacillation was stronger for the animals with a strong drive than for those with a weak one. Presumably maximum oscillation occurred when the two tendencies were relatively equal near to the goal.

The records also showed that competition between strong tendencies produced more oscillation than competition between weak ones.

A still further analysis of the effects to be deduced from changes in the relative strengths of the competing tendencies leads inexorably to two rather unexpected conclusions of interesting clinical significance. The immediately preceding discussion has dealt with conditions in which on the one hand the subject was able to go completely up to the goal because the relative strength of approach was so great that the two gradients did not cross, or on the other hand, the subject was unable to complete the retreat elicited by strong avoidance because of the physical limitation of the end of the alley. The following discussion deals with different circumstances; it applies only to conditions of approach-avoidance conflict in which the subject has enough time and space to retreat without physical restraint and in which avoidance is strong enough to intersect approach and prevent the subject from completely reaching the goal. Such conditions are frequently met in the life situation.

Under the conditions just specified, increases in the strength of approach will, as has already been demonstrated, cause the subject to move nearer to the goal. But at this closer distance to the dangerous goal, stronger avoidance tendencies will be elicited. The situation is illustrated graphically in Figure 3A in which it will be noted that when the approach gradient is raised, the point of intersection not only is shifted nearer to the goal, but also occurs at a higher point on the avoidance gradient. Conversely, if tendencies to approach are absent or quite weak, the subject will be expected to remain far enough away from the dangerous goal so that little if any avoidance will actually be elicited. Therefore, as long as the gradients intersect and the subject has had time and space for free movement, the strength of avoidance aroused (usually accompanied by fear) should be a function of the strength of approach present.[6]

This deduction from stimulus-response principles affords a plausible basis for a Freudian contention which superficially seems paradoxical if not deliberately perverse: namely, that evidence of strong fear or with-

[6] On the basis of the stimulus function of anticipatory responses Hull (1930), Miller and Dollard (1941, pp. 54–90), it can be deduced that a certain amount of increased fear may be expected with increases in the approach tendencies even if the subject is restrained from moving nearer to the dangerous goal. Furthermore, it seems possible that anxiety may become conditioned directly to the drive stimulus itself.

drawal may often be taken as a sign that strong tendencies to approach are present.

Similar paradoxical effects may be deduced when the attractiveness of the goal is held constant and its repulsiveness varied within limits allowing the two gradients to cross. As the strength of avoidance at the goal is weakened, the subject will be expected to move forward. But as he moves forward, the strength of approach increases so that stronger avoidance must be aroused before his advance is stopped. The fact that the subject moves nearer to the dangerous goal more than compensates

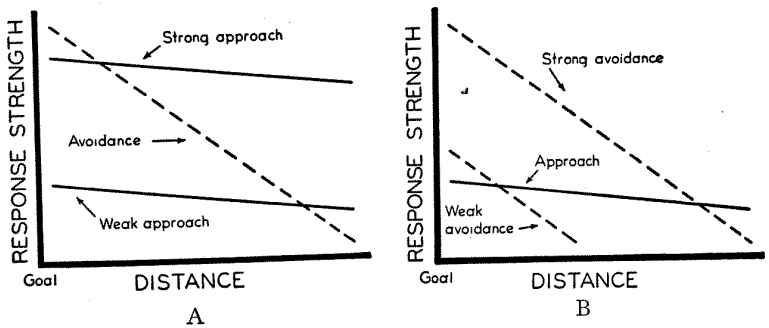

Figure 3. Paradoxical Effects of Changes in Strength

Diagram A demonstrates that with an increase in the strength of approach tendencies the intersection is not only moved nearer to the goal but also occurs at a higher point on the avoidance gradient. Diagram B demonstrates that within the limits in which the two gradients cross, decreasing the strength of avoidance increases the height of the point of intersection. Thus in both cases the amount of avoidance actually aroused will be increased.

for its reduction in unattractiveness. This is illustrated in Figure 3B in which it can be seen that the intersection with the approach gradient is higher for weak than for strong avoidance. Since this effect depends on the slope of the relatively flat approach gradient, it will be less marked than the one illustrated in Figure 3A.

Conversely, if the strength of avoidance is increased to the point where it drives the subject to a distance at which little if any approach is elicited, there will be almost no conflict; the subject will no longer be tempted to go near enough to experience appreciable fear.

These last deductions afford a possible basis for the unfavorable reaction which patients sometimes show after a therapist has taken steps to reduce a strong fear associated with one of their goals. Of course, if the fear can be reduced to the point where the two gradients no longer intersect, the subject should go completely to the goal so that this paradoxical increase in anxiety will no longer be expected with further decreases in the dangerousness of the goal.

Position of the Source of Avoidance.—In the situations just analyzed the source of avoidance was at the goal; Miller and Davis (1943)

have performed experiments in which the source of avoidance did not coincide with the goal. After having learned to run the length of the alley to secure food, one group of hungry rats received a brief electric shock when they reached a point half-way to the goal, another immediately before reaching the goal, and a third 5 seconds after reaching it. Trials in which the animals received shock were alternated with nonshock trials, during which their conflict behavior was recorded. On successive shock trials the strength of current was increased.

From the gradient principles it will be expected that shocks, as a means of preventing the subjects from reaching the goal on subsequent trials, will be more effective the earlier they occur in the sequence leading to the goal, and less effective the later they occur after it has been reached. The experimental results afforded a little evidence (statistically unreliable) in support of the first part of this deduction, and reliable evidence in support of the second.

Varying the position of the source of avoidance should change the effectiveness with which it prevents the subject from reaching the goal; it should not change the general form of the approach-avoidance conflict behavior to be expected except under one set of conditions: namely, that in which a shock too weak to prevent the subject from reaching the goal is administered part way to it. In this situation a new type of behavior should appear. As the subject nears the source of danger, avoidance will increase at a faster rate than approach and will conflict with it. Thus the subject should slow down. But as soon as he passes the source of danger, the conflict will cease; both tendencies will be operating in the same direction. Therefore an increasingly hesitant approach should be followed by a sudden dash forward. This is exactly the type of behavior that was recorded in the nonshock trials of the experiment by Miller and Davis.

From the mechanism of anticipation [7] it may be deduced that the response of suddenly dashing forward should tend to occur before the place where the shock has been received. This deduction was also confirmed by the experimental records.

Nonspatial Situations.—Deductions of the details of approach-avoidance conflict behavior have been verified in simple experiments in which the responses involved produced forward or backward movement through space. The more complicated situations met in life often involve sequences which are partly nonspatial, for example, the series of responses leading toward or away from a fateful decision, an open act of aggression, or a sexual adjustment. It seems probable that the same principles will also be found useful in analyzing these situations. One step in this direction would be a series of experiments determining whether or not the temporal gradient of reinforcement is steeper for responses of avoidance than for those of approach.

[7] See Hull (1929), or Miller & Dollard (1941, pp. 49–52).

Difference Between Approach and Avoidance Choices

Approach-Approach Competition.—Figure 4 may be used to represent the situation in which the individual is confronted with a choice between two equally desirable alternatives, both eliciting *only* tendencies to approach. It can be seen that if the subject is not exactly at the center, the tendency to approach the nearest goal will be the strongest, so that the subject will move toward it. The nearer he goes to this goal the greater becomes the relative difference favoring continuing to approach it. Thus the situation is one of unstable equilibrium, like the pencil balanced on its point which, as soon as it starts, has an ever-increasing tendency to continue falling, and hence never reverses its direction. Since it is extremely unlikely that the two alternatives will be perfectly balanced, and since even in such cases a slight distraction will be likely to upset the equilibrium, choices between purely desirable alternatives will be expected to be made quickly without vacillation.

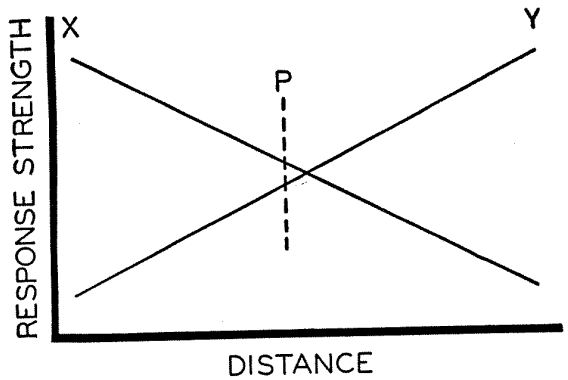

Figure 4. Difference Between Approach and Avoidance Choices

This is a schematic diagram of the gradient to approach (or to avoid) two stimulus objects, *X* and *Y*. If the two objects elicit only approach, the individual started at *P* will be expected to go directly to *X*; if they elicit only avoidance, he will be expected to go away from *X* until he passes the point at which the gradients cross, and then to turn back.

Avoidance-Avoidance Competition.—Quite the opposite is to be expected when the individual is forced to choose one of two undesirable alternatives. In this case he will be expected to go away from the nearest evil. But as he retreats farther the tendency to avoid that evil will become weaker, while that to avoid the other will become stronger. Thus the situation is one of stable equilibrium, like a pendulum suspended so that the farther it is pushed off center the stronger is its tendency to return. Provided that there is no third way out, the individual will remain vacillating in conflict, trapped between the two sources of avoidance.

If one of the alternatives elicits much stronger avoidance than the other, it is obvious that the intersection of the gradients, and hence the region in which the subject will remain trapped, will be farther away from that alternative. If the difference is too great, the gradients will not cross and the subject will be driven past the weaker source of avoidance and out of the situation. From the diagram it can be seen that with shorter distances between the two sources of avoidance, less difference will be required to produce this effect.

Going Out of the Field.—In the preceding deductions it has been assumed that the conditions are such that the subject must go toward either one or the other of the sources of avoidance. Frequently he is not limited in this way. Perhaps the clearest illustration is the case of a free subject in an open space between two point sources of avoidance, for example, a man in a field between two nasty dogs. In originally learning to avoid dangerous objects, each person has tried many different responses. The ones resulting in motion directly away from the object have been rewarded most immediately and frequently by escape from pain and fear. Movement away at a less direct angle has also been rewarded but less immediately and frequently. This should establish a hierarchy of avoidance habits, with strengths varying as the directness of the line of avoidance. It can be seen that as soon as the subject in a direct line between the two nasty dogs starts moving to one side or the other, continuing on is a more direct avoidance than turning back. Thus the tendency to continue should be stronger than that to go in the opposite direction. The farther the subject moves, the greater the difference becomes between continuing the same line of retreat and reversing it. Therefore, the situation is one of unstable equilibrium which should be easily resolved without conflict behavior. Unless hemmed in, the subject should escape.

Relevant Experiments.—Results from a considerable number of experiments are relevant to these deductions. Though most of the experiments did not deal with pure cases in which tendencies to approach or avoid were uncomplicated by other factors, they clearly indicate that being forced to select one of two alternatives elicits much more vacillation and blocking when they are predominantly sources of avoidance instead of approach. They also indicate that the more difference there is between the strengths of the two competing tendencies, the less likely conflict behavior is to appear. When the subject is not hemmed in, avoidance-avoidance competition is unstable, producing strong responses of lateral escape.

Hovland and Sears (1938) had human subjects sit at a table on which was exposed a surface of paper six inches square, framed by brass strips. In the middle of the side toward the subject was a nick in which he rested his pencil at the beginning of each trial. At the two corners away from the subjects were lights. One group of subjects was instructed to draw a diagonal line as quickly as possible directly to whichever light was

turned on. Another group was instructed to draw a line diagonally forward to the corner opposite the flashing light, that is, they were to go to the corner at which the bulb was not lighted. After giving the subjects 20 practice trials, the experimenters created a conflict by flashing on both lights at once.

Only 9% of the subjects instructed to go directly to the light were blocked in the conflict test; 46% of those instructed to go to the corner away from the light were blocked. This difference is in line with theoretical expectations. That it was not still greater may perhaps be explained by assuming that instructions to go to the opposite corner established in some cases tendencies to approach this corner rather than to avoid the light flashed.[8] It is also possible that when the subjects instructed to go toward the light were tested for conflict, they did not want to be fooled into making a wrong response, and hence were not in a pure approach-approach choice. Hovland and Sears point out that many choices encountered in life produce mixed, or double approach-avoidance conflicts.

In other similar experiments, Sears and Hovland (1941) demonstrated that avoidance-avoidance choices are less likely to produce conflict the greater the difference in the strengths of the competing tendencies. This occurred when the different strengths were produced by different amounts of training and also when they were the results of different amounts of motivation from electric shock.

Barker (1942) required ten-year-old boys to choose which of two liquids they were going to drink. In some cases the subjects were confronted with a choice between small glasses containing liquids they liked (i.e., orange vs. pineapple juice), in other cases liquids they disliked (i.e., vinegar vs. a saturated salt solution), and in still other cases relatively neutral liquids. Each boy indicated his choice by moving a lever toward the glass he decided to drink. Movements were timed by a concealed device attached to the lever. When confronted with neutral or pleasant choices the subjects exhibited little conflict behavior. When confronted with unpleasant alternatives they required much longer and shifted the lever back and forth more times. The greater the difference in the desirability of the alternatives, the more rapid the choice and the fewer the vacillations.

Barker points out that the avoidance conflict, when the subjects were confronted with bad-tasting solutions, was complicated by the tendency to select some alternative and thus move toward the goal of finishing the task and getting paid for the experiment. The rise in the strength of this factor with increasing delay was presumably what caused the subjects eventually to resolve the conflict.

Klebanoff (1939) trained hungry rats to secure food by approaching whichever end of an alley was distinguished by a light and a buzzer. Then he placed them in an approach-approach competition by turning

[8] Hovland and Sears report in a footnote that when the incompatible responses were made to two lights directly opposite each other instead of at the opposite corners of a V, they secured a larger percentage of blocking.

on the lights and buzzers at both ends of the alley. He found that, if the animals were started some distance away from the center, they always went directly to the nearest goal. If started at the center, they went quickly to one goal or the other with little tendency to vacillate.

He trained another group of animals to escape an electric shock by running away from whichever end of the alley was distinguished by a light and buzzer, and then placed them in an avoidance-avoidance conflict by turning on the lights and buzzers at both ends of the alley. When released a considerable distance away from the center, all of the animals started by avoiding the nearest light. After running in one direction these animals stopped and turned back, remaining in conflict between the two lights. When released at the center, they started more slowly than the approach-approach animals, vacillated much more, and remained nearer the starting point. In the avoidance-avoidance conflicts, the animals showed a definite tendency to try to escape to the side and up out of the alley.

Hunt (1943) placed rats in a starting chamber from which they could move forward into either of two separate compartments. Five seconds after the appearance of a light in either of the two compartments a grid on the floor of the starting chamber was electrified. One group of animals could escape shock only by going to the lighted compartment, another only by going to the dark compartment. After the animals had learned this discrimination they were given tests in which both compartments were lighted. Those trained to approach the light showed no more hesitancy or vacillation than during preceding training trials; those trained to go to the dark compartment (and presumably to avoid the light) did not move forward into either compartment, but made frantic efforts to claw their way out of the starting chamber.

According to our theoretical analysis, the subject who is not completely hemmed in tends to escape from avoidance-avoidance conflicts by lateral compromise responses because of the fact that he has learned not only the single habit of going directly away, but also a whole hierarchy of other habits of moving away at various indirect angles. Hovland and Sears (1944) have secured evidence supporting this interpretation by demonstrating that the frequency of compromise responses is indeed dependent upon the previous training of the subject. They had men hold a vertical lever mounted on a universal joint below which a recording mechanism was concealed. Signal lights were mounted off to each side of the pivot point. All subjects started from a central position and practiced moving the lever arm directly away from whichever light flashed. One control group received only this training. Another control group was trained to go directly to the position of the right-hand light whenever a buzzer was sounded. Experimental groups learned the habit of moving the lever off at various angles whenever the buzzer was sounded. Then all subjects were presented test trials in which both lights were flashed at once.

The subjects who had learned the habit of moving the lever off at various angles exhibited more compromise responses than either of the two control groups. Those who had learned to move the lever at right angles to the line of the lights made more such responses than those who had learned to move it at 30° or 60° angles. This study would have been more realistic and should have shown still greater differences between the experimental and control groups if the responses of moving off at an angle had been attached directly to the lights during part of the previous training instead of being attached to the buzzer and generalized to the lights.

Double Approach-Avoidance Competition

According to the theoretical analysis, choices between goals which elicit *only* tendencies to approach should be made rapidly with no signs of conflict; those between undesirable alternatives should produce continuous conflict. Two experiments on animals and two on people have afforded evidence supporting this analysis in that far more signs of conflict were produced when the alternatives were undesirable than when they were desirable. Though the difference was definite, and in the direction demanded by the theory, a slight amount of oscillation was produced in choices between desirable goals. Furthermore, such choices sometimes produce definite signs of conflict in life situations. The question thus arises: is the theory wrong in demanding that choices involving only approach tendencies should produce neither blocking nor vacillation, or are some factors entering to induce avoidance even though both goals are desirable?

In some cases, of course, the goals may not be completely desirable, so that tendencies to avoid (concealed by still stronger tendencies to approach) are brought into the choice situation. In other cases certain factors in the choice situation itself may induce avoidance and hence conflict. Godbeer (1940) has studied the influence of such factors. First she made observations on a group of adolescent girls in social situations. She found that choices between desirable alternatives were often complicated by the necessity of relinquishing one goal in order to achieve the other. Often an unwillingness to relinquish either goal seemed to induce a tendency to avoid a definite commitment to one of them. The subject had tendencies both to approach and avoid each goal.

The dynamics of such a double approach-avoidance conflict are represented in Figure 5. It can be seen that the greater steepness of avoidance leads to a situation in which the net tendencies to approach a given goal are weaker the nearer the subject gets to it. Thus the distant goal seems more attractive, and he is likely to turn back toward it. In such a situation the subject should remain in conflict indefinitely unless the stable equilibrium is disturbed by other factors. With sophisticated subjects the disturbing factor is likely to be a desire to come to a decision. This may be produced by the fact that the state of conflict

is uncomfortable, or by the fact that the subject has in the past been punished for waiting too long by losing both goals.

From the diagram it can be seen that if the net approach to one of the goals is strengthened (i.e., the gradient raised), the point of intersection will be moved toward that goal and the difference between the two gradients at the goal decreased. Thus it will be easier for any factor

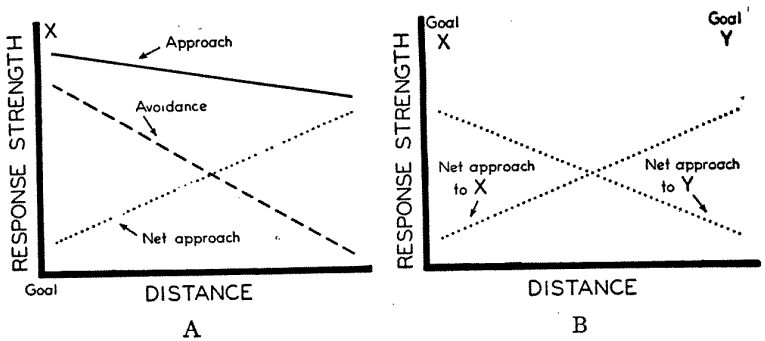

Figure 5. Double Approach-Avoidance Competition

In A is represented a single approach-avoidance situation. Subtracting the strength of the avoidance from that of the approach results in a net approach tendency which becomes weaker nearer the goal. In B the two net tendencies are represented in a double approach-avoidance situation. As the individual moves toward either of the two goals, *X* or *Y*, the net tendency to approach that goal becomes weaker, and to approach the other, stronger. This should produce vacillation.

which builds up an avoidance of the central point of indecision to force the subject up to that goal. The more unequal the net approaches, the easier it should be to resolve the conflict.

Experimental Tests of Factors Inducing Conflict.—After the preliminary observations in social situations Godbeer devised an experiment to test for the effects of having to relinquish one goal when selecting the other. A child was seated at a table directly in front of a vertical board into which two windows were cut. These were covered by sliding plates of glass and tin shutters. Candy was exposed on the shelf behind one of the windows when the experimenter lifted its shutter. The child was instructed to secure the candy as quickly as possible by pushing a handle attached to a lever diagonally forward so that it hit a button under the window where the candy was exposed. As soon as he did this the experimenter lifted the glass so that the child could secure the candy.

After the children had learned to secure candy in this way the effects of three conditions were tested in a balanced order:

1. Only one window containing candy was exposed. This was a control trial to determine the behavior when there was no competition between incompatible responses.

2. The children were told that they could get the presents which would be exposed behind both windows. Since they could not move toward both at once, competition between incompatible responses occurred, but was not complicated by the necessity of relinquishing one of the goals.
3. The children were told that as soon as they selected the present in one window the shutter on the other would close. Thus the competition between incompatible responses was complicated by the fact that choosing one goal meant relinquishing the other.

During these tests movements of the lever toward the windows were recorded by a concealed pantograph, and electrically timed. The child's eye movements were counted as he looked back and forth between the two windows.

Under the first two conditions the children behaved the same. When the choice of the present in one window did not mean that the present in the other had to be relinquished, the exposure of presents in both windows did not increase the choice time nor the number of eye movements made during the choice, and did not affect the path over which the subject moved the lever toward the window first approached.[9] Thus a pure approach-approach choice produced no conflict behavior.

Tests under the third condition produced different results. The subjects took longer to choose, made more eye movements back and forth from one window to the other, and the path over which they moved the lever to the window chosen was reliably deflected somewhat in the direction of the other window. The necessity of relinquishing one present when selecting the other induced conflict behavior.

In her preliminary study of girls in social situations, Godbeer noticed that when the goals were qualitatively dissimilar the choices seemed to be more difficult. Apparently the more dissimiliar the goals, the less one of them was a substitute for the other; hence the girls were more reluctant to renounce either of them by making a definite choice.

In order to determine the effects of qualitative dissimilarity, another group of subjects was given tests similar to those just described, except that the choice was between qualitatively different types of reward instead of between two highly similar pieces of candy. The present exposed in one window was a large gumdrop, that exposed in the other was a group of little tin soldiers. For each child an attempt was made to determine the number of tin soldiers which he considered equally desirable to a large gumdrop, so that the choice would be between equally attractive goals. These tests demonstrated that confronting the subjects with qualitatively dissimilar goals increased the choice time, the number of eye

[9] A control group demonstrated that this lack of difference was not produced by the fact that the children got more candy when both windows were exposed under condition 2.

movements, and the deflection of the path in the direction of the other window. Some increases were produced even when selecting one goal first did not mean that the other had to be relinquished. Greater increases were produced when selecting one goal meant giving up the other.

The effects of inequality of reward were determined as a control on the results in the preceding experiment. After the soldiers had been equated with the candy, one group was tested as before in a choice between a piece of candy and a number of soldiers stated to be of a value equal to it. Another group was tested in a choice between goals of unequal value. For half of these the value of the soldiers presented exceeded that of the candy; for the other half it was less. The subjects choosing between rewards of unequal value chose more quickly, made fewer eye movements, and went in a more normal path than those choosing between equal rewards. Thus in the previous experiment any effects of failing perfectly to equate the value of the qualitatively dissimilar rewards could only have served to work against the results actually secured.

In her observations of behavior of girls in social situations it seemed to Godbeer that yet another factor frequently induced latent avoidance tendencies strong enough to increase the amount of conflict behavior. This was the factor of uncertainty. When a girl was not sure whether or not she would have a good time at either of two parties, the choice between them was more difficult. This type of situation, of course, is one in which the subject's reactions to the goals are somewhat ambivalent, even before the necessity of a choice appears.

She tested for the influence of the factor of uncertainty by exposing, instead of candies directly, two small metal boxes either of which might or might not contain candy. Under these conditions evidence of conflict appeared in a longer reaction time, more eye movements, and a deflection of the path.

Greater Steepness of the Avoidance Gradient

The deductions concerning the type of behavior to be expected in both single and double approach-avoidance situations hinge on the assumption that the gradient of avoidance is steeper than that of approach. The experimental results have demonstrated that this assumption is applicable to some situtaions. A deeper analysis of the reason for this greater steepness is desirable as a means of determining whether similar results will be expected in all situations or only under certain definite conditions. A complete analysis has not yet been made and tested. It seems plausible, however, that at least two factors are relevant to the relative steepness of the two gradients.

Constant Elements.—Both tendencies to approach and those to avoid are in part directly dependent upon external cues present in the

environment. Cues nearer the goal will be expected to elicit stronger responses because they are more immediately associated with the event of reinforcement and because they are more similar to those present during reinforcement. But in both cases the external stimuli are only a part of the pattern; the responses of approaching and avoiding are also dependent upon the drive stimulus. In the case of the avoidance used in the non-shock trials of the experiment this was an acquired drive, fear, which was elicited by the external cues, and hence would be expected to be stronger the nearer the animal is to the point of reinforcement.[10] In the case of approach a primary drive, hunger, was present, which was dependent upon internal conditions and would not be expected to vary with distance from the goal. This greater constancy of the hunger drive as a stimulus element common to the near and far situations will be expected to make the gradient of approach flatter than that of avoidance. Unpublished exploratory work by Miller and Brown has indicated that if a constant stimulus from the primary drive of pain is supplied by having the whole length of the grid electrified during the test trials, the slope of the avoidance gradient becomes much flatter.

Past Experience.—If the individual is consistently rewarded for approaching near goals but not far ones, he should learn to discriminate on the basis of cues indicating distance and cease attempting to approach far goals. Such learning actually seems to occur in the case of adults, who will not attempt to reach through small openings for objects obviously more than an arm's length away. In these situations learning produces an approach gradient which falls off very steeply, in an almost step-wise manner at about the limit of the subject's reach. Similarly, the principles of learning, backed up by casual observation, indicate that the steepness of the avoidance gradient should be subject to modification. If this analysis is correct, the relative slopes of the two gradients will depend upon whether or not the conditions of learning have been the same for both. In many situations approach is almost as likely to be reinforced when the subject is at a distance as when he is nearby;[11] avoidance is not. Wherever such conditions are found they should tend to increase the relative steepness of the avoidance gradient.

It seems probable that in the experiments described, as well as in many life situations, both of these factors operate to produce greater steepness of the avoidance gradient. Further analysis of these and other factors influencing the slopes should enable the investigator to delimit more exactly the types of situations to which he can legitimately apply deductions dependent upon the greater steepness of the avoidance gradient.

[10] For a more detailed discussion of the mechanism of acquired drives see Ch. 4 of Miller and Dollard (1941).

[11] The gradient of reinforcement will, of course, weaken somewhat the effectiveness of rewards for starting distant approaches so that the resulting gradient of approach will not be expected to be absolutely flat.

Contrast Between Types of Choice Situations

The results of theoretical analysis verified by experimental evidence may be briefly summarized to bring out more clearly the contrast between different types of situations:

1. *Approach-approach* competition should be resolved quickly without vacillation unless contaminated by latent avoidance.

2. *Avoidance-avoidance* competition should be characterized by compromise resolutions; the individual should escape both evils unless restrained by physical limitations or additional sources of avoidance. When lateral escape is impossible, vacillation and blocking should occur.

3. In *approach-avoidance* competition no barriers will be needed to hold the subject in the conflict situation; the approach tendency will bring him into it. As long as the gradients cross, the subject should remain trapped part way to the goal, unable either to achieve or leave it.

4. In double *approach-avoidance* competition no barriers are needed to hold the subject in the situation. Choices between goals toward which the subject is ambivalent may elicit vacillation and blocking even though the avoidance tendencies are too weak to prevent approach when the subject is confronted with each goal separately. Furthermore, additional avoidance may be aroused by the necessity of renouncing one of the goals in making the choice.

5. In each of the three preceding types of competition, conflict behavior does not appear if the opposing tendencies are so unequal that the gradients do not intersect.

The Relation Between Anxiety and Conflict

In the preceding analysis it will be noticed that pure approach-approach choices are easily resolved; conflict only appears when avoidance is present. This suggests that whenever unexplained indecision and conflict appear, it may be wise to look for concealed sources of avoidance. Since fear is one of the strongest sources of avoidance, one may often profitably ask: What is feared?

The relationship also works the other way. As has been suggested, the subject who is not physically restrained will soon escape from most fear-producing situations unless he is prevented by conflicts arising from other sources of avoidance keeping him away from the avenues of escape or unsatisfied drives stimulating him to approach goals in the region of the danger. Therefore, when unexplained anxieties persist, one should ask: What conflicting tendencies prevent the subject from escaping the fear-provoking stimuli?[12, 13]

[12] In addition to physical limitations and conflict, two other conditions may prevent escape: the anxiety may be conditioned to internal stimuli, such as primary drives over which the subject has no control; or it may be attached to stimuli which are ubiquitous.

[13] Mowrer (1941) has clearly called attention to the relationship between conflict and anxiety, though tending to emphasize a different type of explanation.

Discrimination Conflict

According to the principle of generalization, after a response has been connected to a given stimulus there is a tendency for similar stimuli to elicit the same response; the more similar the stimuli, the stronger the tendency. Spence (1936) and Gulliksen and Wolfle (1938) have pointed out that this principle affords an explanation of why the discrimination between similar stimuli is more difficult to learn than that between dissimilar ones. When the two stimuli are more similar, the greater tendency for the response attached to each of them to transfer to the other interferes with the learning of differential responses; thus discrimination is more difficult.

Brown (1942b) has collaborated with Miller in further applying the principle of generalization to the analysis of the type of conflict behavior

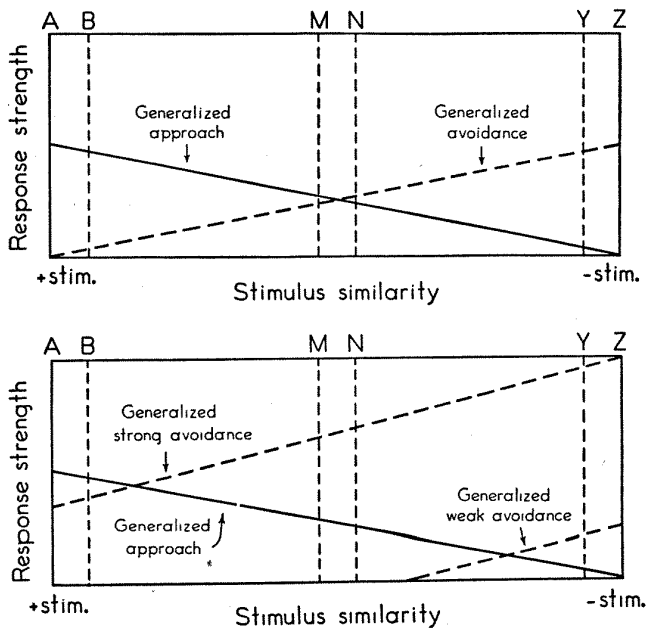

Figure 6. Analysis of Discrimination Conflicts

The upper diagram represents the situation in which the subject has been rewarded for approaching the bright light, *A*, and punished for approaching the dim light, *Z*. It is assumed that these two stimuli are so dissimilar that almost no generalization occurs from one to the other. Then, a discrimination between the two similar bright lights *A* and *B* produces an approach-approach competition; the intermediate lights, *M* and *L*, produce a double approach-avoidance conflict, and the two dim lights, *Y* and *Z*, produce an avoidance-avoidance conflict.

The lower diagram shows that increasing the strength of punishment shifts all discriminations toward the avoidance-avoidance type; weakening its strength shifts them toward the approach-approach type.

which difficult discriminations should produce. Let us assume that a subject has been trained to approach a positive stimulus, *A*, and to avoid a negative one, *Z*. These may be thought of as a very bright and a very dim light, respectively. It is assumed that the two are so different that but little of the tendency to approach *A* generalizes to *Z*, and but little of the tendency to avoid *Z* generalizes to *A*. These assumptions are represented diagrammatically in the upper part of Figure 6.

It can be seen that when the subject is confronted with the two dissimilar stimuli, there is a strong tendency to approach *A* and to avoid *Z*, so no conflict behavior will be expected. If, instead of this easy discrimination, the subject is now confronted with a choice between *A*, the positive cue, and *B*, another similar stimulus, it is apparent that the situation will be predominantly one of approach-approach. In this type of choice, as has already been shown, the subject will be expected to go directly to that goal toward which he happens to start. Since *A* elicits the stronger approach, he should be more likely to start in that direction. But as the similarity between the two stimuli is increased, the tendencies to approach them will become more nearly equal, so that it will be easier for chance factors to get the subject started in the other direction. This will be an error. Under these conditions difficult discriminations should be disrupted by indiscriminate approaches.

In like manner, if the subject is presented with a choice between two similar stimuli of intermediate brightness, say *K* and *L*, it can be seen that each of them will elicit generalized tendencies of both approach and avoidance, and that the more similar the two stimuli are, the more nearly equal amounts of either tendency they will elicit. Since the effects of double approach-avoidance conflicts have already been analyzed and are known to be greater the more evenly matched the two goals, it can be predicted that under these conditions difficult discriminations should be disrupted by vacillation and blocking in the region of the choice point.

Finally, if the difficult discrimination is between stimuli resembling the original negative stimulus, for example between two dim lights, *Y* and *Z*, the subject will be in a situation which is predominantly avoidance-avoidance, and hence will be expected to withdraw from the choice point if possible, and if not, to remain blocked.

In short, the types of conflict situation produced by difficult discriminations should range on a continuum from pure approach-approach at one extreme, through intermediate degrees of double approach-avoidance, to pure avoidance-avoidance. The kinds of behavior expected to characterize the different points in this continuum are respectively: indiscriminate approach, blocking and vacillation at the choice point, and withdrawal from the choice point.

The behavior should be shifted toward the approach-approach type the more the stimuli being discriminated resemble the one that was originally positive, and toward avoidance-avoidance the more they resemble the one that was originally negative.

From the lower part of Figure 6, it can be seen that a shift toward

the approach-approach type of behavior should also be produced by any change, such as an increase in the strength of the hunger drive, that raises the height of the entire gradient of generalized approach. Similarly, any change, such as an increase in the strength of punishment, increasing the relative height of generalized avoidance, should produce a shift toward the avoidance-avoidance end of the continuum.

Experimental Verification.—These deductions have been verified in a series of experiments by Brown. First (1942a) he studied separately the fundamental assumptions involved. He demonstrated the gradient of generalization by showing that if hungry rats are trained to approach a light of a given brightness for food they will approach lights of other brightness, and if restrained will pull harder the more similar the illumination is to that used in the original training. He also verified the assumption that increases in the strength of drive raise the whole gradient of generalization by demonstrating that increased hunger caused the animal to pull harder to both similar and dissimilar stimuli.[14]

After having studied generalization of responses to a single light varying in brightness, Brown (1942b) investigated the behavior of animals trained to discriminate between two lights of different intensities. He measured approach responses by electric contact recorders on the platforms leading to each of the stimuli, determined the strength of withdrawal by measuring the force that animals exerted when they were temporarily restrained in a retreat from the choice point, and secured an index of vacillation by counting the number of head movements, first to one side and then the other.

He found that as the discrimination was made more difficult, differential behavior was disrupted. The type of disruption depended upon the conditions in the manner demanded by our deductions. The difficult discrimination was more likely to be disrupted by indiscriminate approaches, the stronger the hunger drive, the weaker the punishment for making wrong choices, or the more the stimuli resembled the one that had originally been positive. Conversely, the difficult discrimination was more likely to be disrupted by withdrawal from the choice point, the weaker the hunger drive, the stronger the punishment, or the more the stimuli resembled the one that had originally been negative. Conditions between the two extremes produced vacillation.

It should be noted that when the discrimination is easy, both of the stimuli are still somewhat similar to those involved in difficult discrimination. Furthermore, the general features of the choice situation remain unaltered. Therefore, it would be expected that the habits involved in indiscriminate reactions to a difficult comparison should tend to generalize to subsequent easy ones. Brown also verified this deduction. After the

[14] The principle of a gradient of generalization has, of course, been verified by many other studies. See Hilgard and Marquis (1940), Ch. 8. The dependence of the height of the whole gradient upon the strength of drive had not previously been studied.

choice reactions had been broken down by too fine a discrimination, there was a definite tendency for the same type of disruption to appear in subsequent coarser ones. This, of course, is in line with the work described in more detail by Liddell in Chapter 12.

Throughout this analysis the conflict was between tendencies to approach or avoid a region in space. In other types of discrimination the reactions may vary in their temporal nearness to a goal or point of reinforcement. It remains for further work to indicate whether or not an analysis in terms of approach and avoidance can be made relevant to all such instances.

In all cases, however, it seems probable that the principle of generalization will be found relevant, and that the discrimination will be more likely to break down the more similar the stimuli. Thus, in psychophysical investigations, the choice time increases when the stimuli being compared are more similar (Kellogg, 1931).[15] Furthermore, Gibson (1940) has successfully used an analysis in terms of generalization to explain the type of interference commonly called retroactive inhibition. She has shown (1941) that learning a new set of responses causes more blocking and errors in the performance of previously learned habits the more similar the stimuli eliciting the old and new responses.

Other Factors Influencing Type of Equilibrium

As has been shown, gradients in the strength of approach and avoidance tendencies are very important in determining whether the situation will be one of stable or unstable equilibrium. They are not, however, the only factors which can be involved.

Any crucial changes which the responses produce in the stimulus situation will influence the type of equilibrium. If the response creates additional stimulation which facilitates it, unstable equilibrium will be produced. Similar results will be produced if the response removes sources of stimulation supporting its competitors. In most approach-approach situations, starting for one of the goals involves turning toward it and away from its competitor. This increases stimulation from the chosen goal and decreases that from the competitor. Therefore it strengthens the tendency to continue and summates with the effect of the approach gradient in producing easily resolved, unstable equilibrium.

If the response tends to remove its own stimulus, or to produce stimuli facilitating its competitors, opposite results will be produced. Thus, when the subject is between two sources of avoidance without opportunity for lateral escape, turning away from one evil and toward

[15] If the subject is not limited to two responses, but instructed to make judgments of "equal" also, then there will actually be two discriminations involved: the difference between the stimulus of A greater than B and that of A equal to B, and the difference between the latter and A less than B. As Cartwright (1941b) has shown, the longest choice times will then appear at the points at which each of these discriminations is difficult. His theoretical interpretation of this phenomenon is couched in Lewinian terms (Cartwright, 1941a).

the other will tend to cause him to turn back even before he has gone far enough for the gradients to have much effect.

These effects are not limited to external stimulation in spatial situations. Proprioceptive stimulation facilitating the response producing it —as in the previously discussed example of psychological momentum— tends to produce unstable equilibrium. On the other hand, stable equilibrium is produced in postural reflexes by the fact that the response of leaning forward stretches the muscles down the rear of the leg and stimulates them to reflex contraction pulling the body back up.

Finally, in addition to changes in the stimulus situation, other factors such as refractory phase, fatigue, and experimental extinction, which weaken whatever response is occurring, tend to produce that vacillation and blocking which is characteristic of conflict situations.

Types of Incompatibility

Conflict occurs only when responses are incompatible. Thus far the discussion has, for the most part, dealt with responses, such as approach and avoidance, which are obviously mutually exclusive. In other cases, however, it is not always immediately apparent that the responses will be incompatible; they may be neutral or even mutually facilitating. Although the problem of incompatibility has not yet received thorough analysis, it seems probable that there are a number of different kinds. These may be sketched briefly.

Mechanical.—The most superficial type of incompatibility is that based on the physical structure of the body: for example, the flexion and extension of the arm. The characteristics of competition at this overt, mechanical level are that it involves fatiguing muscular tension and that the opposing responses subtract from each other, *pari pasu*, in a rough approximation of algebraic summation.

Neural.—In most cases overt mechanical incompatibility is paralleled by a more central neural incompatibility which Sherrington (1906) has called *reciprocal innervation*. Thus the spinal cord functions in such a way that if the muscles operating to flex a limb are reflexly excited to contract, those operating to extend it relax. This central resolution of competition prevents a wasteful physical cancellation of opposing muscular contractions. It is when this mechanism fails, so that competition is fought out on the mechanical level, that the individual most obviously manifests conflict.

Responses which are not obviously mechanically incompatible may be physiologically antagonistic through reciprocal innervation. Thus reflex flexion of one leg tends to inhibit the flexion of the contralateral one. Similarly, gripping hard with one hand tends to interfere somewhat with exerting the maximum grip with the other. In general, the more strongly the reflexes are excited the more likely they are not to be

neutral, but either facilitating or inhibiting. When reciprocal inhibition is uncomplicated by other mechanisms, responses summate algebraically.[16]

The problem of neural incompatibility is complicated by the fact that contractions of the same pair of muscles may be incompatible responses when mediated through one center and not when mediated through another. Thus the extensors relax when the flexors are excited by a spinal reflex, but both may contract at once if the impulses come from higher, "voluntary" centers.

Chemical.—A few internal secretions are known to have opposite effects on certain responses (Goodman and Gilman, 1941). Acetylcholine increases the frequency and amplitude of intestinal peristalsis, epinephrine reduces it. Epinephrine is released by fear and its persistence in the blood stream accounts for an interference with digestion which continues for a period after the fear stimulus has been withdrawn and direct sympathetic neural activity has ceased. It may be that chemical effects of this type are involved in antagonisms between certain drives, as, for example, a tendency for fear to interfere with hunger.

Perceptual.—Two responses may be incompatible because the performance of one removes the stimulus which elicits the other. In the simplest examples, the performance of the responses may depend upon two mechanically incompatible orientations of a sense organ, such as the eye. Reversible illusions, ambiguous figures, and limitations of the span of attention seem to involve more central types of incompatibility. The mechanism of these is not well understood, but it may be ventured that the competition between mutually exclusive central cue-producing responses is involved.

In some cases of sensory interference, for example, Heyman's law (1899), the summation is roughly algebraic; in others, such as reversible illusions, it seems to be all-or-none. Sometimes alternations occur, as in retinal rivalry. In peripheral examples, like the orientation of the eye, the kind of summation depends on the type of equilibrium of the competing cue-producing responses. A situation involving unstable equilibrium between antagonistic eye movements tends to produce all-or-none summation; stable equilibrium is likely to produce algebraic summation. Similar factors may be involved in central conflicts.

Acquired.—Responses which are originally compatible may acquire a certain amount of incompatibility. Very young children often manifest little conflict over expressing love and hate more or less simultaneously, and none at all over logical inconsistencies. By the time they become adults, either contrasting expressions of emotion or logically contradictory ideas may generate conflicts. Innately compatible responses seem to acquire incompatibility in situations in which responding with either

[16] Actually, of course, the ultimate units of nerve conduction obey the all-or-none law; progressive effects of facilitation or inhibition are produced by the activation of more and more units.

one or the other is rewarded, but responding with both is punished or extinguished. Since making both responses together may be punished in some situations but not in others, the same two responses may under some conditions be incompatible, and under others not. Acquired incompatibilities tend to reflect the culture patterns of the social group in which the individual has been reared. Unfortunately, acquired incompatibility has not yet been studied experimentally. A stimulus-response analysis suggests that it can be produced by several different mechanisms. These are diagrammed in Figure 7.

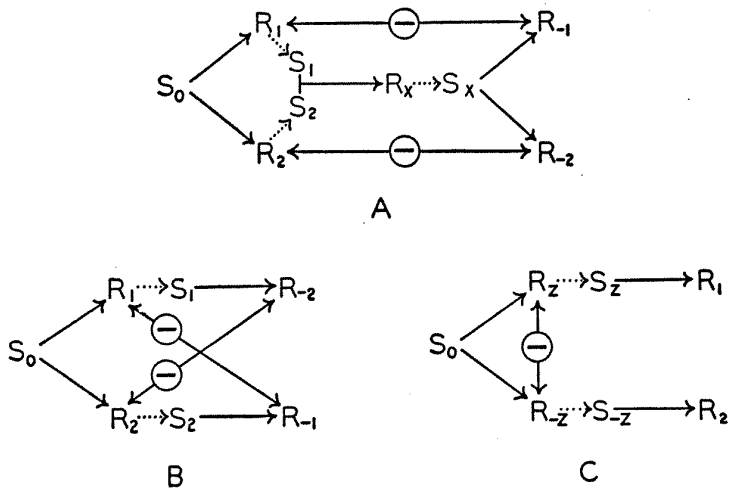

Figure 7. Types of Acquired Incompatibility

S_0 is the stimulus situation eliciting two responses R_1 and R_2, which originally were compatible. These responses produce the proprioceptive stimuli S_1 and S_2. In *A* the pattern of S_1 and S_2 appearing together elicits the anxiety response R_x, producing the anxiety stimulus S_x. This stimulus elicits the responses R_{-1} and R_{-2} incompatible with R_1 and R_2 respectively. In *B* the responses inhibiting R_1 and R_2 are attached directly to the stimuli produced by R_1 and R_2, respectively. In *C* the two original compatible responses R_1 and R_2 are dependent upon mutually incompatible cue-producing responses, R_z and R_{-z}. To the extent that these mediating responses are mutually exclusive, R_1 and R_2 will not appear simultaneously.

(a) Two responses, such as putting bread into the mouth with one hand and meat with the other, are originally compatible. Then the individual learns to respond with anxiety to the pattern produced by simultaneous stimulation from both responses. This anxiety motivates the subject not to perform both of the responses at once.

(b) Two responses are originally compatible, but the subject learns to react directly to the stimuli produced by each of them with a response incompatible with the other.

(c) Originally both of the responses are elicited directly by external cues and are compatible. Later both are elicited indirectly by internal cues from stimulus-producing responses which are incompatible with each other. Since the stimulus-producing responses are mutually exclusive, the responses elicited by them do not appear simultaneously.

Interference of Complex Habits

Sometimes habits interfere with each other at one stage of learning but not at another. When a person is first learning to drive, handling the car and carrying on a conversation interfere with each other; the experienced driver can do both at once. In such cases it seems plausible to assume that the difference in interference at various stages of learning is due to the fact that somewhat different responses are involved. The novice thinks out each move, giving himself cues by rehearsing directions he has received from the instructor. These verbal links are a source of incompatibility between talking to someone else and driving. Since the expert reacts directly without them, he is free to carry on a conversation. The progression is the opposite to that outlined in the discussion of the last, or (c) type of acquired incompatibility.

Studies of associative interference and retroactive inhibition (Melton and Irwin, 1940) demonstrate that practicing one habit tends to interfere with other habits involving different responses to similar stimuli. In the early stages of learning the amount of interference produced by a habit increases with practice; eventually, however, a point is reached where it decreases with further practice. Here again the stimulus-response elements involved in the two habits may overlap more in some stages of learning than in others. The way in which the range of response elements may vary during the different stages of learning has been studied by Beritov (1924). He observed that if dogs are trained to lift a paw to a stimulus which precedes shock, the conditioned response during early trials will be relatively generalized, involving movements of almost all parts of the body. As training proceeds the scope of the reaction gradually becomes more limited, until finally only the specific muscles essential to paw raising are involved. Girden's observations (1938) indicate that this narrowing may be produced by trial and error. Experiments on stimulus generalization (Pavlov, 1927) suggest a trend of initial widening, followed by gradual narrowing. In many habits a greater specificity may be produced by non-reinforcement of responses to irrelevant stimuli. Whenever the range of stimulus and response generalization becomes narrower with thorough practice, fewer different stimuli and responses are involved in an overlearned habit. Thus two such habits are less likely to involve units incompatible with each other.

Sometimes in a complex habit two or more responses are being learned at the same time but at different rates. If one of these facilitates while another interferes with some other habit, it is easy to see that the net effect will be different at different stages in learning. This is illustrated in Figure 8. An experiment by Jackson (1932) is an excellent example in point. He gave different groups of rats different amounts of training

in a maze of one pattern and then tested the rate at which they learned a different maze. He found positive transfer during certain stages of learning, and negative during others.

Similarly, Bunch (1939) has shown that complex habits may be mutually interfering at one stage of forgetting and facilitating at another. He explains this by assuming that components which interact differently are being forgotten at different rates.

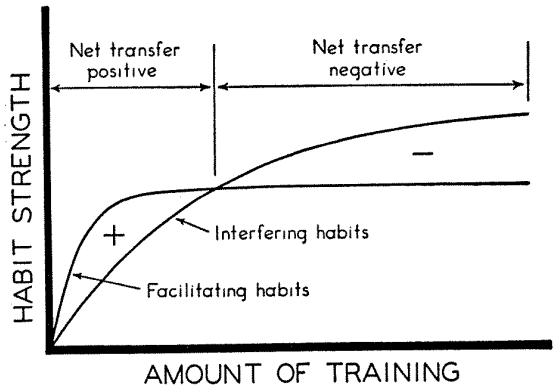

Figure 8. Reversal of Net Transfer Effect with Additional Training

This diagram represents the situation in which two different types of habit are being learned at two different rates in the same situation. One set of habits will facilitate correct behavior in subsequent tests in a new situation; the other will interfere. If the learning curve for the first set is rapid with a low asymptote while that for the second is slow with a high asymptote, the net effect of small amounts of training in the original situation will be positive transfer, and that of large amounts negative transfer.

Experiments on dynamogenesis have demonstrated that the way in which complex responses interact may also depend on their relative strengths. A typical experiment, Courts' (1939), tested the influence of requiring the subject to grip a dynamometer upon his performance in learning a list of nonsense syllables. It was found that the response of weakly gripping the dynamometer facilitated performance, while gripping strongly interfered with it. Similar results have been found for responses to sound and other types of distraction.

In some cases the different effects of distractions may partly be explained by physiological factors. For example, if each response is made up of a series of action units whose thresholds vary in a normal distribution, the cumulative curve will form an ogive. If the responses involved in the task which the subject is performing are moderately excited, while the muscles antagonistic to these responses are at a low level of excitation, a slight increase produced by dynamogenesis will be expected to add more to the responses in the task than to their antagonists. A much stronger general increase in excitation may raise the already excited

responses involved in the performance of the task to the flat portion of the ogive, where relatively little additional effect can be produced, while the reactions antagonistic to these responses are raised to the steep portions of the ogive, where many additional units are thrown into action so that the net result of further increases will be interference.

In many cases, it seems plausible to assume that psychological factors play an important role. The individual may have learned to compensate for distractions by exerting additional effort. If a weak distraction produces effort appropriate to a stronger one, the net result will be facilitation. If the distraction is strong enough, the conflicting responses which it elicits may override the effects of the habit of exerting additional effort.

Compromise Responses

One kind of compromise response has already been discussed: the lateral escape in a simple spatial situation of avoidance-avoidance conflict. The deduction of this response hinged on the proposition that each of the competing avoidances is composed of a whole hierarchy of habits. Responses of direct withdrawal from each of the stimuli are incompatible and tend to inhibit each other; responses of lateral escape are compatible and tend to summate. Similarly, many nonspatial responses are actually not simple but composed of a large number of subunits. Some of these may be elements which are present as parts of the overt, complete response. Others may be alternative modes of reaction which were originally used in earlier stages of trial-and-error learning, but later lost their dominance to other, more strongly rewarded reactions. Still others may always have been latent tendencies produced by the mechanism of response generalization. It seems reasonable to suppose that when two complex response hierarchies are in conflict, those elements which are not incompatible will tend to summate so that the one whose combined strength from both hierarchies is the greatest will tend to appear as a compromise response.

In an attempt to study this problem, Miller (1943) trained subjects to depress both of their hands to one stimulus and to depress the left hand and raise the right to another. Then both stimuli were given simultaneously. The apparatus was designed to measure the latency and force of the movements of each hand. He found that the depression on the left hand (i.e., the part of the patterns which was not incompatible) was stronger than the response of either depressing or raising the right, but that it was much weaker than that occurring on nonconflict trials. This apparent spread of the conflict to the compatible elements of each pattern suggests that each pattern was facilitated or mediated as a whole by a different central cue-producing response. To the extent that these were crucial, conflict between them would be expected to affect the whole pattern as a unit. It should be noted that, according to Freudian theory, displaced and other compromise responses are more likely to occur when

the conflict is not on a conscious level—i.e., when it is not mediated by verbal, or other cue-producing responses.

When a newly introduced reaction conflicts with the dominant response but is compatible with some weaker member of the hierarchy which was a part of earlier trial-and-error learning, the resultant reappearance of this response is called regression. Experimental evidence (Mowrer, 1940) indicates that such responses do reappear as compromise resultants of conflict situations.

In addition to the mechanisms just described, it seems likely that the conflict itself, as Miller and Stevenson (1936) have suggested, may produce strong stimulation. Thus, any response terminating the conflict will be rewarded by a reduction in the strength of this stimulation. In this way the subject may learn responses which take him out of the situation. That conflict can produce strong stimulation tends to be confirmed by Finger's (1941) finding that the force with which rats jump across a gap from the starting platform to the stimulus card is increased when the animals are placed in a discrimination conflict.

Spread of Conflict

Clinicians often observe that one situation seems to be the focus of a conflict which spreads to invade other areas of the patient's life. It has been shown that the generalization of responses from one stimulus to another can induce conflict in situations demanding fine discriminations. It can also induce an apparent spread of conflict. This is illustrated in a simple experiment which the author has performed for a class demonstration.

Hungry albino rats were trained to secure food in three different situations. The first was a flat board, two feet square, surrounded by celluloid walls, and placed on top of a table. In the center of the board was a food cup elevated by a small metal peg. The second was a smooth, long, fairly broad, elevated path leading to a similar food cup, and the third, also leading to a similar food cup, was a relatively short, narrow, elevated strip of quarter-inch wire screen. After the animals had learned to secure food in the three situations, the experimenter placed them on the flat board and just as they were commencing to eat gave them an electric shock through a grid of fine wires wrapped around the board. After a few trials of this kind the animals showed obvious conflict, remaining well away from the food cup, tentatively approaching and then hastily withdrawing, first from one side and then from another.

The animals also showed definite vacillation when tested in the other two situations in which they had never been shocked. The fear generalized on the basis of the similar food cups and created new conflicts in both of these situations. On the first trial the animals approached very near to the food cup, started to stand up to reach for the food, then vacillated back and forth several times and suddenly withdrew. Apparently the generalized fear and withdrawal was quite specific to reaching

up toward the cup. On successive trials the conflict behavior appeared at progressively earlier points in the path leading to the cup. The fear and withdrawal originally elicited by the stimulus of standing up and seeing the cup became conditioned to the other cues which had preceded that stimulus. In a description of phobias, Fenichel (1934, pp. 53–54) gives a description of human cases in which a similar enlargement of the area of conflict seems to be occurring by a process of progressively higher order conditioning.[17]

In a more formal experiment Miller (1935) has observed that avoidance, and hence conflict, can generalize from a device in which animals are fed when hungry to a somewhat similar device in which they drink when thirsty. He also observed that anticipatory goal responses can mediate a type of generalization which would ordinarily be described as foresightful. In all of these cases, of course, it is not the conflict itself which spreads; one or more of the competing tendencies responsible for the original conflict generalizes to new situations and creates new conflict there.

The experiments cited have shown that a simple approach situation can be changed to an approach-avoidance conflict by generalized fear. Similar generalization will also be expected to occur in more complex situations originally involving a choice between two goals. If avoidance generalizes to each of the goals, it will be expected to change the situation from an easily resolved approach-approach competition into a double approach-avoidance conflict. Thus, when the fears producing a severe conflict generalize, they tend to make all choices more difficult. Furthermore, it seems possible that the act of making a decision may produce stimuli which are relatively similar in different choice situations, so that after an individual has been severely punished for the immediate consequences of one decision, he may have anxiety about making others. These interpretations contrast with Janet's (1925) view that a severe conflict makes other choices harder by depleting the store of mental energy needed to make decisions.

Studies of experimental neuroses (see Chapter 12 by Liddell) have demonstrated that after an animal's behavior has been seriously disrupted by an attempt to force a discrimination between stimuli that are too similar, responses conditioned to other stimuli may also be disrupted. On the basis of generalization one would expect the habits involving stimuli most similar to those in the original conflict to be the ones most disrupted. But, can the effects of generalization account for all the disturbance observed, or must one also assume some more fundamental upset or damage? No one has yet aimed an experiment at deciding this issue.

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[17] From this description it seems probable that a more complicated mechanism may also be at work. Anxiety may be conditioned to the stimuli produced by certain anticipatory goal responses. As the drive motivating these anticipatory responses mounts, they generalize to more and more stimuli in the environment, carrying with them the anxiety which they mediate.

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