A STIMULUS-RESPONSE ANALYSIS OF
ANXIETY AND ITS ROLE AS A
REINFORCING AGENT.¹

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Within recent decades an important change has taken
place in the scientific view of anxiety (fear),² its genesis,
and its psychological significance. Writing in 1890, Wil-
liam James (6) stoutly supported the then current supposi-
tion that anxiety was an instinctive (‘idiopathic’) reaction
to certain objects or situations, which might or might not
represent real danger. To the extent that the instinctively
given, predetermined objects of anxiety were indeed dan-
gerous, anxiety reactions had biological utility and could
be accounted for as an evolutionary product of the struggle
for existence. On the other hand, there were, James as-
sumed, also anxiety reactions that were altogether sense-
less and which, conjecturally, came about through Na-
ture’s imperfect wisdom. But in all cases, an anxiety reac-
tion was regarded as phylogenetically fixed and unlearned.
The fact that children may show no fear of a given type of
object, e.g., live frogs, during the first year of life but may
later manifest such a reaction, James attributed to the ‘rip-
ening’ of the fear-of-live-frogs instinct; and the fact that
such fears, once they have ‘ripened,’ may also disappear
he explained on the assumption that all instincts, after put-
ing in an appearance and, as it were, placing themselves
at the individual’s disposal, tend to undergo a kind of
obliviscence or decay unless taken advantage of and made
‘habitual.’

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sity, March 13, 1939

² Psychoanalytic writers sometimes differentiate between anxiety
and fear on the grounds that fear has a consciously perceived object and anxiety
does not. Although this distinction may be useful for some purposes, these
two terms will be used in the present paper as strictly synonymous.
Some years later John B. Watson (11) demonstrated experimentally that, contrary to the Jamesian view, most human fears are specifically relatable to and dependent upon individual experience. Starting with the reaction of infants to loud sounds or loss of physical support, which he refused to call ‘instinctive’ but did not hesitate to regard as ‘unlearned’ or ‘reflexive,’ Watson was able to show, by means of Pavlov’s conditioning technique, that an indefinitely wide range of other stimuli, if associated with this reaction, could be made to acquire the capacity to elicit unmistakably fearful behavior. This was an important discovery, but it appears to have involved a basic fallacy. Watson overlooked the fact that ‘loud sounds’ are intrinsically painful, and he also overlooked the fact that ‘loss of physical support,’ although not painful in its own right, is almost certain to be followed by some form of stimulation (incident to the stopping of the body’s fall) that is painful. The so-called fearful reaction to loss of support—if not confused with an actual pain reaction—is, therefore, in all probability itself a learned (conditioned) reaction, which means that, according to Watson’s observations, human infants show no innate fear responses whatever, merely innate pain responses.

Freud seems to have seen the problem in this light from the outset and accordingly posited that all anxiety (fear) reactions are probably learned; his hypothesis, when recast in stimulus-response terminology, runs as follows. A so-called ‘traumatic’ (‘painful’) stimulus (arising either from external injury, of whatever kind, or from severe or- ganic need) impinges upon the organism and produces a more or less violent defence (striving) reaction. Furthermore, such a stimulus-response sequence is usually preceded or accompanied by originally ‘indifferent’ stimuli which, however, after one or more temporally contiguous associations with the traumatic stimulus, begin to be perceived as ‘danger signals,’ i.e., acquire the capacity to elicit

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3 Freud (3) has explicitly acknowledged the possibility of anxiety occurring, especially in birds and other wild animals, as an instinctive reaction; but he takes the position that in human beings, instinctive anxiety (not to be confused with ‘instinctual’ anxiety, i.e., fear of the intensity of one’s own organic impulses) is probably nonexistent or is at least inconsequential.
an ‘anxiety’ reaction. This latter reaction, which may or may not be grossly observable, has two outstanding characteristics: (i) it creates or, perhaps more accurately, consists of a state of heightened tension (or ‘attention’) and a more or less specific readiness for (expectation of) the impending traumatic stimulus; and (ii), by virtue of the fact that such a state of tension is itself a form of discomfort, it adaptively motivates the organism to escape from the danger situation, thereby lessening the intensity of the tension (anxiety) and also probably decreasing the chances of encountering the traumatic stimulus. In short, anxiety (fear) is the conditioned form of the pain reaction, which has the highly useful function of motivating and reinforcing behavior that tends to avoid or prevent the recurrence of the pain-producing (unconditioned) stimulus.

In the mentalistic terminology that he characteristically employs, Freud (3) has formulated this view of anxiety formation and its adaptational significance as follows:

“Now it is an important advance in self-protection when this traumatic situation of helplessness [discomfort] is not merely awaited but is foreseen, anticipated. Let us call the situation in which resides the cause of this anticipation the danger situation; it is in this latter that the signal of anxiety is given. What this means is: I anticipate that a situation of helplessness [discomfort] will come about, or the present situation reminds me of one of the traumatic experiences which I have previously undergone. Hence I will anticipate this trauma; I will act as if it were already present as long as there is still time to avert it. Anxiety, therefore, is the expectation of the trauma on the one hand, and on the other, an attenuated repetition of it” (pp. 149-150).

“Affective [anxiety] states are incorporated into the life of the psyche as precipitates of primal traumatic experiences, and are evoked in similar situations like memory symbols” (p. 23). “Anxiety is undeniably related to expectation; one feels anxiety lest something occur” (pp. 146-147).

According to views expressed elsewhere by Freud, expectation and anxiety lie along a continuum, with the former merging into the latter at the point at which it becomes uncomfortably intense, i.e., begins to take on motivational
properties in its own right. The preparatory, expectant character of anxiety is likely, however, to be obscured by the fact that danger situations sometimes arise and pass so quickly that they are over before the anxiety reaction—involving, as it does, not only an augmentation of neuromuscular readiness and tension but also a general mobilization of the physical energies needed to sustain strenuous action—has had an opportunity to occur. The result is that in situations in which danger is so highly transitory, as, for example, in near-accidents in motor traffic, anxiety is commonly experienced, somewhat paradoxically, after the danger is past and therefore gives the appearance of being indeed a useless, wasted reaction ([James]). It must not be overlooked, however, that situations of this kind are more or less anomalous. The fact that in a given situation the element of danger disappears before flight, for which the anxiety-preparedness is most appropriate, has had time to occur, does not, of course, mean that anxiety-preparedness in the face of danger is not in general a very adaptive reaction.

As early as 1903, Pavlov (10) expressed a point of view that bears a striking resemblance to the position taken by Freud in this connection. He said: “The importance of the remote signs (signals) of objects can be easily recognized in the movement reaction of the animal. By means of distant and even accidental characteristics of objects the animal seeks his food, avoids enemies, etc.” (p. 52). Again, a quarter of a century later, Pavlov (9) wrote as follows:

“It is pretty evident that under natural conditions the normal animal must respond not only to stimuli which themselves bring immediate benefit or harm, but also to other physical or chemical agencies—waves of sound, light, and the like—which in themselves only signal the approach of these stimuli; though it is not the sight and sound of the beast of prey which is in itself harmful to the smaller animal, but its teeth and claws” (p. 14).

4 Cf. the discussion of the ‘startle pattern’ by Landis and Hunt (5).
Although both Pavlov and Freud thus clearly recognize the biological utility of anticipatory reactions to danger signals, there is, however, an important difference in their viewpoints. Pavlov emphasizes the mechanism of simple stimulus substitution (conditioning). According to his hypothesis, a danger signal (the conditioned stimulus) comes to elicit essentially the *same* ‘movement reaction’ that has previously been produced by actual trauma (the unconditioned stimulus). It is true that the blink of the eyelids to a threatening visual stimulus is not greatly unlike the reaction made to direct corneal irritation. A dog may learn to flex its leg in response to a formerly neutral stimulus so as to simulate the flexion produced by an electric shock administered to its paw. And a small child may for a time make very much the same type of withdrawal reactions to the sight of a flame that it makes to actual contact with it. However, any attempt to establish this pattern of stimulus substitution as the prototype of all learning places severe restrictions on the limits of adaptive behavior: it implies that the only reactions that can become attached to formerly unrelated stimuli (*i.e.*, can be learned) are those which already occur more or less reflexly to some other type of stimulation.

According to the conception of anxiety proposed by Freud, on the other hand, a danger signal may come to produce any of an infinite variety of reactions that are wholly unlike the reaction that occurs to the actual trauma of which the signal is premonitory. Freud assumes that the first and most immediate response to a danger signal is not a complete, overt reaction, as Pavlov implies, but an implicit state of tension and augmented preparedness for action,\(^5\) which he calls ‘anxiety.’ This state of affairs, being itself a source of discomfort, may then motivate innumerable random acts, from which will be selected and fixated (by the law of effect) the behavior that most effectively reduces the anxiety. Anxiety is thus to be regarded as a motivating and reinforcing (fixating) agent, similar to hunger, thirst, sex, temperature deviations, and the many other forms of discomfort that harass living organisms,

\(^5\) *Cf.* the revised theory of conditioning proposed by Culler (2).
which is, however, presumably distinctive in that it is derived from (based upon anticipation of) these other, more basic forms of discomfort.6

By and large, behavior that reduces anxiety also operates to lessen the danger that it presages. An antelope that scents a panther is likely not only to feel less uneasy (anxious) if it moves out of the range of the odor of the panther but is also likely to be in fact somewhat safer. A primitive village that is threatened by marauding men or beasts sleeps better after it has surrounded itself with a deep moat or a sturdy stockade. And a modern mother is made emotionally more comfortable after her child has been properly vaccinated against a dreaded disease. This capacity to be made uncomfortable by the mere prospect of traumatic experiences, in advance of their actual occurrence (or recurrence), and to be motivated thereby to take realistic precautions against them, is unquestionably a tremendously important and useful psychological mechanism, and the fact that the forward-looking, anxiety-arousing propensity of the human mind is more highly developed than it is in lower animals probably accounts for many of man’s unique accomplishments. But it also accounts for some of his most conspicuous failures.

The ostrich has become a proverbial object of contempt and a symbol of stupidity because of its alleged tendency, when frightened, to put its head in the sand, thereby calming its emotional agitation but not in the slightest degree altering the danger situation in its objective aspects. Such relevant scientific inquiry as has been carried out indicates, however, that infra-human organisms are ordinarily more realistic in this respect than are human beings. For example, if a dog learns to avoid an electric shock by lifting its foreleg in response to a tone, it will give up this response entirely when it discovers that the tone is no longer followed by shock if the response is not made. Human beings, on the other hand, are notoriously prone to engage in all manner of magical, superstitious, and propitiatory acts, which undoubtedly relieve dread and uncertainty (at least

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6 Freud has never explicitly formulated this view in precisely these words, but it is clearly implied in various of his writings.
temporarily) but which have a highly questionable value in controlling real events. The remarkable persistence of such practices may be due, at least in part, to the fact that they are followed relatively promptly by anxiety-reduction, whereas their experienced futility at the reality level may come many hours or days or even months later. The persistence of certain forms of ‘unrealistic’ anxiety-reinforced behavior may also be due to the fact that in most societies there seem always to be some individuals who are able and ready to derive an easy living by fostering beliefs on the part of others in ‘unrealistic’ dangers. For the common man protection against such ‘dangers’ consists of whatever type of behavior the bogey-makers choose to say is ‘safe’ (and which furthers their own interests).

Yet other forms of ‘unrealistic’ anxiety-reinforced behavior are to be observed in the symptomatic acts of the psychoneuroses. According to Freud, anxiety is in fact ‘the fundamental phenomenon and the central problem of neurosis’ (3, p. in). He further says:

“Since we have reduced the development of anxiety to a response to situations of danger, we shall prefer to say that the symptoms are created in order to remove or rescue the ego from the situation of danger. ...... We can also say, in supplement to this, that the development of anxiety induces symptom formation—nay more, it is a sine qua non thereof, for if the ego did not forcibly arouse the pleasure-pain mechanism through the development of anxiety, it would not acquire the power to put a stop to the danger-threatening process elaborated in the id “ (3, pp. 112-113).

Willoughby (12), in a scholarly, well-documented paper, has previously stressed the similarity of magical rites (including religion) and neurotic symptoms and has shown

\[7\] Under some circumstances, e.g., when warriors are preparing for battle, malevolent incantations or similar anxiety-reducing magical procedures may, of course, be objectively efficacious, not, to be sure, in the supposed magical way, but in that they alter human conduct in crucial life situations (i.e., make the warriors bolder and better fighters).

\[8\] Cf. Hull’s concept of the ‘goal gradient’ (4).
that both types of behavior spring from the common propensity of human beings to deal with their anxieties unrealistically, i.e., by means which diminish emotional discomfort but do not adaptively alter external realities. This excellent study has, in the present writer’s opinion, only one important weakness: it takes as its point of departure what Freud has called his “first theory” of anxiety formation (1894), which he subsequently abandoned for the one outlined above. In brief, Freud’s earlier supposition was that anxiety arose whenever a strong organic drive or impulse was prevented from discharging through its accustomed motor outlets. According to this view, inhibition was the primary state, anxiety the resultant. In all his more recent writings, on the other hand, Freud takes the position, here also adopted, that anxiety (as a reaction to a “danger signal”) is primal and that inhibition, of anxiety-arousing, danger-producing impulses, is a consequence. Reaction mechanisms (magic, symptoms, etc.) that contribute to this end tend, for reasons already given, to be reinforced and perpetuated. Willoughby’s analysis is not of necessity predicated upon Freud’s original view of anxiety formation and would seem to gain rather than lose cogency if based instead upon his more recent formulations.

Magical and neurotic practices constitute a very perplexing and challenging problem from the point of view of traditional psychological theory; but, as Allport (1) has recently pointed out, so also do many other types of human activity that are commonly regarded as both rational and

9 One of Freud’s most fundamental discoveries, basic to the understanding of reaction-formation, repression, projection, and other neurotic mechanisms, is that organic impulses, even though they are not consciously experienced and identified, may function as ‘danger signals’ and thereby evoke anxiety. This relatively simple yet frequently misapprehended finding (Freud has himself contributed to the confusion by sometimes speaking as if anxiety is the ‘danger signal,’ instead of a reaction to it) can be readily translated into Pavlovian terminology by saying that an organic need, or drive, which has in the past led to overt behavior that was severely punished will tend upon its recurrence, even at low intensities, to elicit a conditioned pain (anxiety) reaction. Yet, as will be shown in a later paper on the so-called ‘experimental neurosis,’ Pavlov and his followers have largely ignored this possibility of internal, as well as external, stimuli acquiring ‘signal’ value, i.e., becoming ‘conditioned,’ and have consequently made apparent mysteries of some laboratory observations which, when viewed more broadly, seem completely intelligible.
normal. Allport rightly stresses the inadequacies of the conditioned-reflex concept as a comprehensive explanation of learning and personality development in general. He also justly criticizes the view that all human conduct is to be accounted for in terms of trial-and-error striving to eliminate immediately felt organic needs. The plain fact is that much of modern man’s most energetic behavior occurs when his organic needs are ostensibly well satisfied. In an attempt to account for this state of affairs, without, on the other hand, falling back on a forthright mentalistic type of approach, Allport elaborates the view, previously advanced by Woodworth, that habits themselves have an on-going character, independent of the motivation that originally brought them into being, and that this type of habit-momentum constitutes a form of self-sustained motivation. Allport calls this the principle of ‘functional autonomy’ and relies heavily upon it in developing his system of the ‘psychology of personality.’

In the estimation of the present writer, ‘functional autonomy’ is on a par with ‘perpetual motion.’ Its author clearly perceives an important psychological problem, but it seems unlikely that his is a scientifically tenable solution to it. The position here taken is that human beings (and also other living organs to varying degrees) can be motivated either by organic pressures (needs) that are currently present and felt or by the mere anticipation of such pressures and that those habits tend to be acquired and perpetuated (reinforced) which effect a reduction in either of these two types of motivation. This view rests upon and is but an extended application of the well-founded law of effect and involves no assumptions that are not empirically verifiable. It has the further advantage that it is consistent with common-sense impressions and practices and at the same time serves as a useful integrational device at the scientific level.

The present analysis of anxiety (anticipation, expectancy) and its role in shaping both ‘adaptive’ and ‘mal-adaptive’ behavior in human beings is also consistent with the growing tendency to eliminate the distinction between learning through ‘punishment’ and learning through ‘reward.’ The earlier view was that so-called punishment ‘stamped out’ habits and that reward ‘stamped’ them in. This distinction
now appears to have been spurious and to have depended upon a selectivity of emphasis or interest (7). If an individual is motivated by an internal discomfort or need (produced by his own metabolic processes), and if another individual provides the means of eliminating it, and if, in the process, the first individual acquires new behavior, this is called learning through ‘reward’. But if a second individual supplies the need (by inflicting or threatening to inflict some form of discomfort), and if the affected individual supplies the means of eliminating this discomfort (by flight, inactivity, propitiation, compliance, or the like), and if, in the process, this individual acquires new behavior, then this is called learning through ‘punishment.’ The truth of the matter seems to be that all learning presupposes (i) an increase of motivation (striving) and (ii) a decrease of motivation (success) and that the essential features of the process are much the same, regardless of the specific source of motivation or of the particular circumstances of its elimination.  

There is, however, one practical consideration to be taken into account. Although learning through ‘punishment’ does not seem to differ basically from learning through ‘reward,’ inter-personal relationships are likely to be affected very differently in the two cases. If the method of ‘reward’ is employed, inter-personal relationships are likely to be made more ‘positive’ (i.e., approach tendencies will be strengthened); whereas, if the method of ‘punishment’ is employed, inter-personal relationships are likely to be made more ‘negative’ (i.e., avoidance tendencies will be strengthened). From a purely social point of view, it is therefore preferable to employ the method of ‘reward,’ whenever this is possible; but ‘punishment’ may have to be resorted to if no organic needs are present to be

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10 According to this point of view, old habits are eliminated, not by being ‘stamped out’ or extracted, as it were, ‘by the roots,’ but by the functional superimposition of new, more powerful, antagonistic habits (7). Anxiety may thus be said to exercise an ‘inhibitory’ effect (see foregoing discussion of Freud’s ‘first theory’ of anxiety) upon established behavior trends mainly through its motivation and reinforcement of opposing behavior trends. In this way emphasis falls primarily upon the positive, habit-forming consequences of anxiety and only secondarily and indirectly upon its negative, inhibitory functions.
'rewarded' or if means of rewarding them are not available. Punishment (or the threat of punishment, i.e., anxiety) is particularly convenient in that it can be produced instantly; but this advantage is accompanied by disadvantages which cannot be safely disregarded (8).

Even the practical basis for distinguishing between learning through reward and through punishment just suggested becomes tenuous when one considers the type of situation in which one person withholds from another an expected reward. This, in one sense, is a form of 'punishment,' and yet its effectiveness is based upon the principle of 'reward.' This complicated state of affairs seems especially likely to arise in the parent-child relationship and has implications that have been but slightly explored in stimulus-response terms.

**SUMMARY**

In contrast to the older view, which held that anxiety (fear) was an instinctive reaction to phylogenetically predetermined objects or situations, the position here taken is that anxiety is a learned response, occurring to 'signals' (conditioned stimuli) that are premonitory of (i.e., have in the past been followed by) situations of injury or pain (unconditioned stimuli). Anxiety is thus basically anticipatory in nature and has great biological utility in that it adaptively motivates living organisms to deal with (prepare for or flee from) traumatic events in advance of their actual occurrence, thereby diminishing their harmful effects. However, experienced anxiety does not always vary in direct proportion to the objective danger in a given situation, with the result that living organisms, and human beings in particular, show tendencies to behave 'irrationally,' i.e., to have anxiety in situations that are not dangerous or to have no anxiety in situations that are dangerous. Such a 'dis-proportionality of affect' may come about for a variety of reasons, and the analysis of these reasons throws light upon such diverse phenomena as magic, superstition, social exploitation, and the psychoneuroses.

Moreover, by positing anxiety as a kind of connecting link between complete wellbeing and active organic discomfort
or injury, it is possible to reconcile the fact that much, perhaps most, of the day-to-day behavior of civilized human beings is not prompted by simultaneously active organic drives and the fact that the law of effect (principle of learning through motivation-reduction) is apparently one of the best-established of psychological principles. This is accomplished by assuming (i) that anxiety, i.e., mere anticipation of actual organic need or injury, may effectively motivate human beings and (ii) that reduction of anxiety may serve powerfully to reinforce behavior that brings about such a state of ‘relief or ‘security.’ Anxiety, although derived from more basic forms of motivation, is thus regarded as functioning in an essentially parallel manner as far as its role as an activating and reinforcing agent is concerned. This analysis is consistent with the common sense view in such matters and does not conflict with any known empirical fact. Finally, it has the advantage of being open to objective investigation and of giving rise to a host of problems that have scarcely been touched experimentally (8).

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