

# *The effects of aversive stimuli on speech*

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Aversive stimulation has long been considered significant in the cause, development, and maintenance of a wide range of speech disorders with emotional involvements. Speech pathologists have used various terms in referring to aversive stimulation: stress, penalty, disapproval, negative evaluation, etc. The emphasis on conditioning in interpreting the role of such stimuli has greatly increased since the time that Bluemel (1935) was criticized for explaining stuttering on the basis of Pavlov's findings (Bluemel, 1935; Blanton, 1936).

The purpose of this paper is to discuss, with regard to speech development, production, and disorders, the implications of various experimental findings on the negative effects of aversive stimulation and on the control and reduction of these effects. The major emphasis is upon clinically and educationally significant concepts rather than upon controversial theoretical issues.

Many behavioral data, particularly those of findings on aversive stimuli, that have helped to provide a functional analysis of complex behaviors, such as speech, are found in studies of organisms lacking such responses. For example, with a variety of behaviors, the application of major clinical principles, including operant procedures and counter-conditioning, were demonstrated in animal studies, and produced enlarged clinical insights for reducing the negative effects of aversive stimulation on humans. Likewise, speech behavior has many aspects that may be interpreted in terms of lower psychological processes, and in accordance with the law of parsimony (restated as



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Lloyd Morgan's Cannon), behavior that can be so explained, should be so explained (Chaplin and Krawiec, 1968).

Definitions of aversive stimulus, punishment, and extinction are appropriate here. An aversive stimulus refers to a stimulus that a subject will learn to escape or avoid (Logan and Wagner, 1965). Punishment refers to an aversive stimulus that is contingent upon a response (Church, 1963); all the findings on punishment discussed below were derived from studies in which punishment either accompanied or immediately followed the response. Extinction refers to a decrease of response strength with nonreinforcement (Kimble, 1961).

### **Classical and instrumental conditioning**

An aversive stimulus may elicit a response which includes not only an emotional reaction, but also a disruption of ongoing skilled behavior or the learning of skilled behavior (Ferster and Perrott, 1968). In classical conditioning if a previously neutral stimulus is paired with the aversive stimulus, independent of the subject's behavior, the above type of response may be conditioned by the neutral stimulus. The response to the previously neutral stimulus is then called a conditioned emotional response, for the previously neutral stimulus has then become what is called a conditioned aversive stimulus.

In speech behavior, the neutral stimulus may be a sound, word, idea, person, personal characteristic, situation, or any other factor or combination of such factors accompanying or immediately preceding the aversive stimulus. Brutton and Shoemaker (1967) have hypothesized that the initial disruption of speech fluency by conditioned emotional responses to such stimuli constitutes the onset of stuttering, because the speech disruption then creates its own aversive conditioning to additional stimuli. The stutterer's communicative act is further complicated by the processes of stimulus generalization and higher order conditioning, which add to the number of conditioned aversive situations which may cause aversive stimuli. Thus the stutterer may become increasingly subjected to conditioned anxiety, frustration, or other negative emotion that disrupts the fluency of his speech.

### **Abstract**

Four experimentally identified processes involved in the clinical reduction of the maladaptive effects of aversive stimuli on speech development, production, and disorders are discussed. These are: habituation, extinction, punishment-training, and counter-conditioning. The primary emphasis of the paper is upon clinically and educationally significant concepts rather than upon controversial and theoretical issues.

### **Resumé en français**

#### **Les effets des stimuli adverses sur le langage**

Il s'agit ici de quatre processus identifiés expérimentalement concernant l'étude clinique des effets de la maladaptation des stimuli adverses sur le développement, la production, et les désordres du langage. Ce sont: l'habituation, l'extinction, la punition et le contre conditionnement. Loin d'être une étude de controverse théorique, ce travail a plutôt un caractère clinique et éducationnel.

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Emotional reactions may also disrupt aspects of speech other than fluency, for a number of writers (Van Riper, 1963; Sheehan, 1958; Bluemel, 1957) have also referred to the etiological significance of emotion in various speech disorders. It is reasonable to hypothesize in such cases that generally disruptive emotion is learned in accordance with the principles of classical or emotional conditioning.

In addition to disrupting previously learned speech patterns, emotion conditioned aversively may also disrupt the process of learning normal speech patterns, as it can disrupt the development of other precise forms of behavior (Ferster and Perrott, 1968). Accumulating evidence on the importance of early childhood learning gives special emphasis to this phase of etiology of speech defects (Hunt, 1961).

Another effect of aversive conditioned emotion is to complicate both physiogenic and psychogenic speech disorders by superimposing additional speech disruption upon the previous disorder. Brutton and Shoemaker (1967) have pointed out that stuttering is aversive to listeners, and it therefore tends to evoke in them reactions which are aversive to the speaker. The same is often true of most speech disorders. However, defective speech creates situations aversive to the speaker when he has difficulty making himself understood; therefore, defective speech may be rendered more defective by being disrupted as a result of aversive conditioned emotion. An organic disorder, such as cerebral palsy or aphasia, may accordingly gain an important functional overlay of speech defectiveness.

Finally, an effect of aversive conditioned emotion may be the disruption of effective therapy. Anxiety and frustration may become conditioned to certain aspects of the clinical situation that the client has associated with failure. An aphasic, having experienced failure in treatment, utilizing certain stimulus materials, may thereafter experience emotion, conditioned to those stimuli, that impairs further learning. In more extreme instances, he may entirely reject a category of materials, the treatment, or even the clinician.

The question often arises: how can aversive conditioning be a significant factor in the cause and development of a severely crippling

speech disorder, despite the absence of severely aversive events in the case history? The answer is provided in the concept of temporal summation which maintains that the repetition of a stimulus may have the same effect as increasing the intensity within certain rates of presentation (Ferster and Perrott, 1968). In sheep, mild but highly repetitive presentations of shock, preceded by a signal, have caused severe, enduring experimental neurosis (Liddell, 1954). Brutton and Shoemaker (1967) have alluded to the role of summation in the etiology of stuttering.

So far classical conditioning has been discussed; however, another type of learning that may also adversely affect speech behavior is instrumental avoidance and escape conditioning. In avoidance conditioning a previously neutral stimulus becomes a cue to avoid an aversive stimulus that follows. In escape conditioning a previously neutral stimulus becomes a cue to escape the aversive stimulus that accompanies or follows too closely for avoidance. In either case the cue becomes a conditioned aversive stimulus that by itself elicits anxiety and also avoidance and escape responses that reduce the anxiety (Mednick, 1964).

The stuttering act has frequently been described as one involving conditioned avoidance (Sheehan, 1958; Johnson, 1956, Wischner, 1950), or avoidance and escape responses (Van Riper, 1963; Brutton and Shoemaker, 1967). Brutton and Shoemaker (1967) have set forth a two-process theory of the development of stuttering involving both instrumental avoidance and escape conditioning and classical conditioning. Both kinds of conditioning may also account for the development of other maladaptive behaviors in the speech of some "nervous," "self-conscious" individuals. Aversive speaking experiences may cause a speaker to become aversively conditioned to features in the speaking environment which later trigger both conditioned anxiety and instrumental avoidance and escape responses. The anxiety component may be manifested in various physiological reactions, including such familiar symptoms as tension, flushing, dryness of the oral cavity, and visceral reactions popularly described as "butterflies in the stomach." Instrumental responses may take the form of maladaptive movements popularly described as "nervous

symptoms" and "mannerisms" which may serve to reduce awareness of aversive stimuli and subsequent anxiety.

It is important to observe that anxiety does not necessarily disrupt speech. It may improve or impair skilled performance, depending on how the individual has learned to respond to anxiety (Mandler and Sarason, 1952). According to the hypothesis known as the Yerkes-Dodson Law, an increase in anxiety up to a certain optimum level for the individual improves performance, but an increase beyond that level impairs performance (Walker, 1967). Public speakers often experience this principle. The effect of a given level of anxiety on learned skills may depend upon how firmly the skills are established. Van Riper (1963), referring to the control of his own stuttering, said that he talked much better with than without fear. Bluemel (1957) indicated that stress does not disrupt maturely established speech patterns, but it does modify inadequately developed patterns. He attributed this difference to the fact that stuttering has its onset in childhood.

### **Response persistence**

The apparent persistence of responses involved in stuttering and other speech disorders is compatible with experimental findings on both conditioned anxiety and conditioned avoidance and escape responses. In view of the particular significance of these findings in speech pathology, they merit some special notice here.

Conditioned anxiety, even in mild forms, is difficult to extinguish; and severe anxiety may be extremely persistent (Wolpe, 1958). In Wolpe's (1958) study of cats subjected to a few powerful shocks and in Liddell's (1954) study of sheep subjected to frequent, mild shocks, the resulting anxiety and neurotic behavior showed no tendency toward extinction.

Conditioned avoidance responses are similarly persistent. Only a few training trials can produce extremely high resistance to extinction (Walker, 1967). Solomon and Wynne (1954) concluded that "traumatic" avoidance conditioning may be irreversible without therapy. Maier's (1949) studies of rats indicated that frustration in an "unsolvable" problem fixated punished responses selected by subjects.

The persistence of stuttering, conceptualized as punished avoidance and escape behavior, is also compatible with experimental findings. In a number of so-called "vicious circle" studies, punished avoidance and escape responses, as compared with unpunished responses, have shown increased resistance to extinction (Brown, (1969).

### **Suppression by punishment**

Despite findings such as those described, a frequent effect of punishment is the reduction of the punished response (Church, 1963). A number of recent studies have shown reduction of stuttering (Goldiamond, 1968; Martin, 1968) and disfluency (Brookshire, 1969; Brookshire and Evaslage, 1969) as a result of punishment. On the other hand, non-contingent aversive stimuli have been associated with increased disfluency in experimental situations (Brookshire, 1969).

Two of these studies have opened a promising new avenue of research in stuttering punishment. Brookshire (1969) found that response-contingent noise failed to reduce disfluencies in normal speakers after random presentation of noise during their oral reading. Yet the same punishment reduced disfluencies in a comparison group not previously subject to the random noise (Brookshire, 1969). Brookshire and Evaslage (1969) found that random noise increased disfluencies and a different aversive stimulus, the word "no" used as punishment, subsequently reduced disfluencies in the same group. These results supported Solomon's (1964) view that a response is suppressed by a punishment discriminatively different from the stimulus used to establish it, but it may not be suppressed by punishment with the same stimulus used to establish it. These vicious circle studies suggest that in the latter case the course of extinction may be prolonged by punishment (Brown, 1969).

Solomon's (1964) position, if established, could be a start in resolving the seeming contradiction between experimental findings that punishment reduces stuttering and the widely accepted view of many leading writers that punishment increases stuttering (Van Riper, 1963; Sheehan, 1958; Johnson, 1956). Punishment of stutter-

ing in the laboratory is discriminatively different from the kind of aversive stimuli that helped to establish stuttering in a natural environment; therefore, according to Solomon's (1964) hypothesis, such punishment should suppress stuttering. However, punishment of stuttering outside the laboratory or clinic probably involves the same kind of aversive social stimuli that helped establish it initially; and, according to Solomon's (1964) hypothesis, such punishment may be less effective as a suppressor.

The suppressive effect of weak punishment has been found to be entirely reversible. The probability of enduring response reduction by punishment is directly related to the intensity of the punishing stimulus. Sufficient intensity of the stimulus may result in total and irreversible elimination of the punished response (Azrin and Holz, 1966).

These findings are relevant to both speech development and speech rehabilitation. They suggest that the suppressive effect of punishment of speech on speech output should vary with the intensity of the punishing stimuli. Severe enough punishment of speech may have gross and lasting effects in reducing speech behavior. However, the motivations for speech are often compelling, and its punishment may result in severe approach-avoidance conflict (Sheehan, 1958).

With regard to therapy, the findings suggest that the suppressive effect of mild punishment of stuttering or other speech deviations in the clinic may be very temporary. However, Goldiamond (1968) has reported some successful carry-over of stuttering reduction which has involved punishment by delayed speech feedback. Further research is needed in developing techniques of punishment that are both humanly acceptable and clinically effective.

### **Nonreward**

When responses are repeatedly rewarded, they build up anticipation of reward. Withdrawal of reward, or nonreward, is then aversive (Amsel, 1958). A clinical procedure illustrating the use of nonreward of an inappropriate response as punishment of that response has been described by McReynolds (1970).

The aversiveness of nonreward is significant in speech development. Reward of speech, in the form of attention, interest, and responsiveness has been frequently and correctly stressed as essential in speech learning. Yet excessively consistent reward can ultimately develop its hazards. Children too long accustomed to instant, continual, and undivided attention or approval for speech may, when deprived of such reinforcement, respond with excessive frustration demonstrated in a manner not only highly aversive, but also utterly incomprehensible to their well-meaning parents. Such frustration may be severely punishing, and damaging to the child's speech, as in the case of a stuttering child described by Van Riper (1963); he also delineated procedures on how the speech clinician can assist parents in helping children to adapt to nonreward.

The disruption caused by nonreward is greatest when reward has been continuous. In the course of intermittent reward, the disruptive effects of nonreward tend to be adapted out. These contrasting effects may help explain why intermittent reward produces far more resistance to extinction than does continuous reward (Logan and Wagner, 1965). Consequently, intermittent reward procedures, because of their superior resistance to extinction, are more suitable for achieving carry-over in the advanced stages of clinical training (McReynolds, 1970).

### **Negative reinforcement**

The strengthening of a response by termination of an aversive stimulus is negative reinforcement (Ferster and Perrott, 1968). For example, if the termination of a stimulus fails to increase the frequency of desired vocalizations, under specified circumstances, the termination of the stimulus is by definition not negatively reinforcing. A description of one such clinical procedure is provided by McReynolds (1970), who relates how the frequency of a child's vocalizations were increased by terminating white noise at each vocalization.

Ferster and Perrott (1968) have suggested some possible hazards in the use of negative reinforcement. For example, in the same instance that the negatively reinforced response is strengthened,



other desirable responses may be weakened by punishment or disrupted by conditioned anxiety. Since the negatively reinforcing stimulus is aversive, it may have a punishing effect upon a response occurring immediately before or concurrently. Therefore, disruptive emotion may be evoked by conditioned aversive stimuli unintentionally paired with the aversive stimulus (Ferster and Perrott, 1968).

In the use of negative reinforcement, the clinician must exercise care that previously developed responses are not weakened by aversive stimuli intended for strengthening a new response. For example, if a child has recently developed a vocalization response, the clinician must avoid weakening this response by using negative reinforcement to develop more differentiated and refined vocalizations. Perhaps partly because negative reinforcement is more difficult to program effectively, positive reinforcement is much more frequently used (McReynolds, 1970).

### **Fixation and energizing effects**

It has long been recognized that fear can be both an inhibitor and an energizer; and in more recent years, it has been observed that conditioned fear is similar in these effects. In stuttering, inhibition often takes an extreme form in which the articulators appear to be fixated or frozen (Van Riper, 1963). When stuttering is viewed as behavior involving learned avoidance responses, the presence of such muscular fixations is not surprising. Hoffman (1966) has reported how, when the avoidance response of lever pressing is conditioned to a warning signal, subjects may hold the lever down between trials, even though such holding fails to prevent the punishing shock; some subjects freeze in their tracks at the signal and fail to execute the avoidance response effectively.

Like the vicious circle studies of punishment discussed above, such self-defeating behavior has noteworthy parallels with stuttering as in the case of the intensely self-punishing effect of stuttering fixations resulting from inhibition (Van Riper, 1963). In the latter, muscular fixations also interfere with effective avoidance behavior and maintain themselves despite punishment.

The energizing effect of conditioned fear, which is in startling contrast to the inhibitory effect, is well established (Mednick, 1964; Brown, Kalish, and Farber, 1951). This phenomenon appears to be reflected in much cluttering, stuttering, stage fright, and other forms of speech anxiety. Moore (1938) observed the energizing effect of an experimental aversive stimulus in both normal speakers and in stutterers. All subjects were shocked after each repeated hearing of a series of four nonsense syllables. In attempting, after hearing the first three syllables, to reproduce the fourth syllable and the time interval immediately preceding it, there was a tendency on the part of the subjects in both groups to hurry the utterance. It was concluded that in this experiment an effect opposed to inhibition was demonstrated.

### **Reducing the effects of aversive stimuli**

Depending upon the nature of aversive stimuli and upon the conditions of their presentation, four experimentally confirmed processes may be applied clinically in reducing their maladaptive effects; habituation (Martin, 1964), extinction (Rachman, 1967), punishment-training (Church, 1963), and counter-conditioning, also called "systematic desensitization" (Bandura, 1967). In clinical application, these processes may considerably overlap, and it is unlikely that their relative roles in many given instances of human behavior can be precisely determined. However, processes have usually been viewed as more or less distinct both in theory and in the laboratory.

**Habituation and extinction.** Habituation, or adaptation, refers to the reduction of an unlearned response with repeated stimulation (Harris, 1943). Some writers have considered habituation and extinction, defined above, to be identical processes (Seward and Seward, 1934; Humphrey, 1930); however, whether a given instance of response reduction is one of habituation or extinction may at times be uncertain. Johnson and others (1956) have regarded the use of repetition as a means for the reduction of stuttering in the same category as extinction, but Wingate (1966) has argued that such reduction involved habituation, not extinction.

Some findings on habituation are of particular interest to the speech clinician. Habituation to punishing stimuli is increased by the preliminary experience of the stimulus at low intensity and also by gradual increase in intensity of stimulation. Conversely, the opposite effect, sensitization, is more likely when the aversive stimulus is presented at high intensity at the outset and when the increase in intensity is abrupt (Soloman, 1964; Azrin and Holz, 1966; Humphrey, 1930; Walters and Rogers, 1963; Karsh, 1963; Kurtz and Pearl, 1960). It has been hypothesized that an experience of intense fear may predispose a subject to react later to aversive stimulation with increased fear, and that the experience may increase resistance to extinction of a conditioned fear (Kurtz and Pearl, 1960).

These findings underline the importance of successive approximations in habituating to aversive stimuli, as they are also compatible with clinical findings on the importance of gradualness in desensitization to conditioned aversive stimuli (Bachman, 1967). They suggest that differences in the responses of different speakers to aversive stimuli may partly result from differences in the relative intensities of previous aversive stimulation. The imperturbable speaker may have benefited by previous aversive experiences of gradually increasing intensity; whereas, the easily flustered and intimidated speaker may have become sensitized as a result of severe aversive stimulation too early in his development.

Although it is true that some maladaptive behavior is self-reinforcing, vis-a-vis the self-reinforcing character of stuttering (Van Riper, 1963; Sheehan, 1958; Wischner, 1950), conditioned anxiety responses are often eventually eliminated by extinction of the response alone. Wolpe (1958) regarded the failure of anxiety and other learned maladaptive responses to extinguish a feature to be a neurosis. Nelson (1966) found evidence that reduction of anxiety could be hastened by extinction alone by very gradually increasing exposures to the aversive stimuli. An example of this may be demonstrated in a public speaking course where very slight increases in heckling by the audience may be programmed for each student's performance, possibly resulting in considerable reduction

in the students' fear of being heckled. Van Riper (1963) has described such a procedure for desensitizing a beginning stutterer to gradually increasing levels of social stress.

An example of extinction resulting from an abrupt rather than gradual change may be provided by using the hypothetical instance of a young secretary who develops conditioned anxiety when it is necessary for her to talk to one of her superiors. She also develops a conditioned avoidance response of looking away in the same situation. Later, if the superior drops his abrasive manner, the girl's anxiety responses may eventually extinguish.

**Punishment-training.** In punishment-training both positive reinforcement and an aversive stimulus are contingent upon a response (Church, 1963). The suppressive effect of punishment has been shown to be reduced through punishment training with gradually increasing intensities of aversive stimuli. Logan and Wagner (1965) have suggested a hypothesis of "courage" according to which gradually increasing punishment may be used to train subjects to respond in the presence of aversive emotion.

The findings suggest that training may be programmed by the speech pathologist to reduce the suppressive effects of punishment. The penalty and frustration of speech failure is one of the severest burdens of the speech-handicapped person, particularly the stutterer. The clinician must often do more than provide a series of success experiences, important as they are, for the client. He must also strengthen and motivate the client to respond in the presence of aversive speaking experiences. This will be made possible by finding methods of adequately rewarding responses that acquire gradually increasing penalty.

**Counter-conditioning.** Punishment-training would appear to be in some respects a special form of counter-conditioning. In the latter, anxiety is reduced by the process of evoking adequately strong positive, anxiety-inhibiting responses in the presence of anxiety-arousing stimuli. Counter-conditioning often utilizes systematic desensitization, which involves gradually increasing intensities of exposure to conditioned aversive stimuli (Bandura, 1967; Rachman, 1967).

Controversy has arisen over the question of whether counter-conditioning, or extinction alone, is the effective factor in fear reduction (Rachman, 1967). Whatever the outcome of this theoretical issue, applications of the method have been demonstrated with a high rate of success for a variety of anxiety disorders including those associated with speech.

As first set forth by Wolpe (1958) in a fully developed exposition, counter-conditioning, or "reciprocal inhibition," to use his term, may occur either in the presence of the actual aversive stimuli in ordinary life situations or in a clinical setting in which aversive stimuli is evoked through imagination or hypnosis. An example of the first type of approach is the use of strongly assertive responses by insecure, reticent persons unable to cope with aggressive behavior in others. Wolpe (1958) found that the assertive responses inhibited anxiety and that the method, judiciously used, was extremely effective in a number of cases such as in the treatment of a stutterer who was instructed to use assertive responses in feared interpersonal situations. Both the patient's stuttering and his inability to cope with aggression were greatly reduced.

The second broad category of counter-conditioning developed by Wolpe (1958) utilizes imaginary aversive stimuli. It is for practical reasons much more frequently applied in therapy than the type described above. The patient is deeply relaxed, and is instructed to visualize the aversive stimuli as vividly as possible, but only until anxiety is experienced. An anxiety hierarchy, a list of feared situations arranged in order of their relative capacity to evoke fear in the client, determines the order of use of the imagined stimuli. As relaxation inhibits the anxiety aroused by visualizing a given situation on the list, the client progresses to the next higher and more fear-arousing situation. Under these circumstances, anxiety reduction has been found to carry over into real-life conditions outside the clinical setting.

Paul (1966) tested the application of this method to fear in public speaking. Of five matched groups of students, one received "systematic desensitization" (of the type described above); one received "insight therapy;" one, "attention-placebo treatment;"

and two, no treatment. There was far greater anxiety reduction in the desensitization group than in any other.

Wolpe (1958) reported a number of cases of "interpersonal anxiety" which were apparently cured by desensitization within the clinical setting. Although he gave treatment details for only two cases, including speaking situations in the anxiety hierarchy, he indicated that it is likely that a considerable proportion of the "interpersonal anxiety" cases involved speech anxieties.

Brutten and Shoemaker (1967) have described counter-conditioning approaches which utilize relaxation, eating responses, motor activity, and assertive responses for inhibiting anxiety responses in stuttering. Their methods, based upon their own clinical experience with stutterers, include techniques applicable within and outside the clinic. Similarly, Lanyon (1969) has detailed the successful treatment of a stutterer with "systematic desensitization," or counter-conditioning, which utilized relaxation and imagination.

An informal experiment in clinical technique, humorously described by Van Riper (1958) may be interpreted as an illustration of counter-conditioning. It was arranged that a young male stutterer, extremely disfluent, immature, and girl-shy, was to be kissed exuberantly by a vivacious girl for every three stuttered words he did not avoid or postpone. The treatment was permitted for only one day, but the boy's performance in therapy improved and he reported what appeared to be a permanent reduction in his fear of stuttering, because the kidding response had apparently inhibited his anxiety.

### **Conclusions and implications**

This paper discusses the implications, with regard to speech development, production, and disorders, of experimental findings on the maladaptive effects of aversive stimuli and on the control and reduction of these effects. Maladaptive emotional reactions to conditioned aversive stimuli may contribute to the development and maintenance of speech disorders by disrupting (1) established speech patterns, (2) the process of developing one or more of the various aspects of speech, (3) speech which is already defective, causing aggravation of the original disorder, and (4) the process of

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