"Aphasia Treatment: An Exercise in Stimulus Control"

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The task of the last two speakers and myself is to describe the application of the experimental analysis of behavior to the problems associated with evaluating the effectiveness, duration, magnitude, generality and interactions of variables involved in the treatment of aphasic individuals.

My presentation is organized in the following manner: First, I will describe the term stimulus control and its application to aphasia treatment. Secondly, I will describe the application of the technology of stimulus shaping to aphasia treatment. Thirdly, I will discuss the role of a number of stimulus factors involved in the measurement of interobserver reliability in the treatment setting.

The two previous speakers described some of the technology available to accomplish the task stated above. Specifically, the technology they described affords one the opportunity to investigate the components of treatment procedures, which is crucial if we are to be accountable and if we are to learn something about the recovery process. One phase of this investigation of treatment components is the application of the technology of stimulus control. Figure 1 shows the three-term contingency which serves as the framework for an analysis of stimulus control.

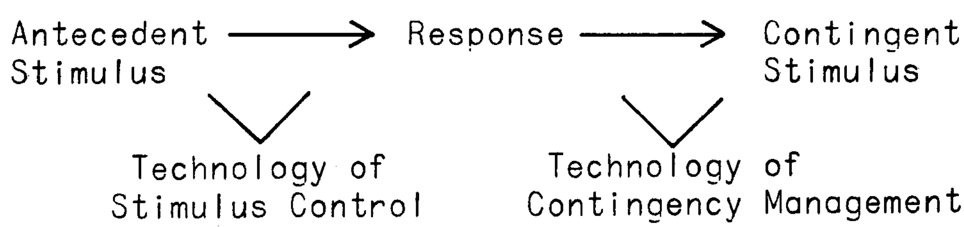

Figure 1. Three-term contingency

Stimulus control is the term used to describe the functional relationship between an antecedent stimulus and its control over the probability of the occurence of a response (Terrace, 1966). As the figure suggests, operant behavior is influenced by antecedent events as well as by consequences (Krasner, 1961). When an individual responds differentially to different stimuli, the individual has made a discrimination, and the response is then considered to be under stimulus control. A multitude of stimuli can function as discriminative or antecedent stimuli. The following are some examples of such stimuli that we commonly see in clinical settings.

Figure 2 depicts a commonly understood relationship and one often dealt with in treatment. The interest here is the control a picture generates over a variety of responses such as pointing, naming, writing by the patient. Similarly, different representations of the antecedent stimulus can control the same verbal response.

Sd → Response → Contingent Stimulus

Picture → Response → Reinforcement

Figure 2. Common stimulus-response-reinforcement relationship

Figure 3 suggests a relationship between a patient's response and its control over the examiner's scoring of the patient's response. The interest is in whether the patient's response is appropriately mapped by the examiner.

In Figure 4 the relationship we are interested in is the functional control the examiner's and patient's responses have over an observer's response.

Any and all of the antecedent stimuli presented in these figures can function as discriminitive stimuli. How one defines the functional relationship of interest determines which relationships are to be measured.

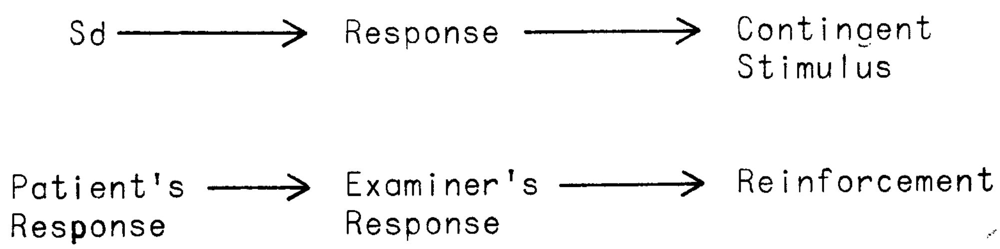

Figure 3. Control of examiner's scoring response by patient's response.

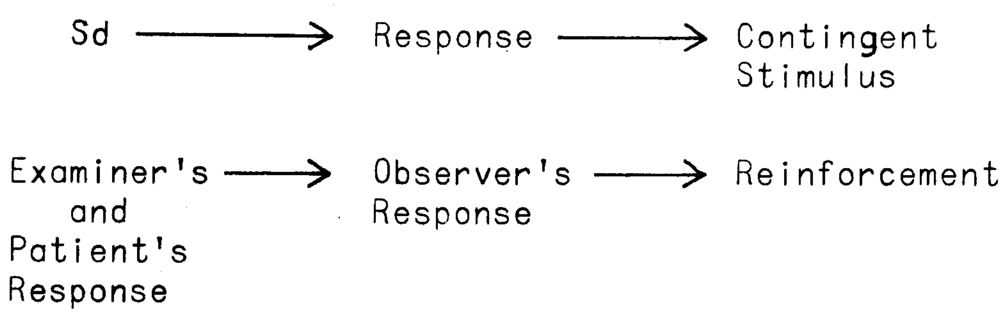

Figure 4. Control of an observer's response.

Sidman (1971) has described aphasia as a fracturing of stimulus control; that is, as a breakdown between antecedent stimuli and the aphasic person's response repertoire. For example, an aphasic individual may accurately point to a picture when named, but may be unable to name that same picture. In the first instance the stimulus-response relationship is intact, while in the second instance the stimulus-response relationship is fractured.

Viewing aphasia in such functional terms allows for the specification of treatment procedures in terms of an analysis of stimulus control. Such an analysis permits one to demonstrate that the treatment stimuli one is manipulating may or may not control the response being measured. To illustrate this analysis I'll present a few examples from the literature.

In 1976 I reported on an experimental treatment procedure that manipulated the duration of pauses within spoken messages (Salvatore, 1976). The procedure used the technique of stimulus shaping. That is, I systematically shaped the antecedent stimulus by decreasing the duration of relatively long pauses, until they approximated the duration of normal pauses. This systematic shaping permitted me to determine the most effective pause duration for a given subject.

Initially, pauses 4 sec in duration were inserted within spoken messages. Under this condition a high rate of correct responding was established. The duration of the pause was then gradually shortened to approximate the normal pause duration found in conversational speech. This systematic manipulation of pause duration permitted me to specify the pause duration at which the patient's performance deteriorated and furthermore, what duration was the most facilitating for the patient.

Thus, by systematically shaping the stimulus I was able to demonstrate the effects of specified pause durations on the patient's performance. Such stimulus shaping involves the establishment of performance in the presence of one stimulus. Then this same stimulus is gradually manipulated or shaped until the response comes under the control of a second stimulus. This is one example of an attempt to clarify the common clinical observation that reduced speech rate facilitates comprehension of spoken messages.

Another form of stimulus control operating in the study just reviewed was the effect that different examiners had on the performance of the patient. When a second examiner was introduced into the treatment session to test the generality of the effects of pauses, the patient's performance deteriorated at pause durations which had been successfully employed by the first examiner. To investigate the reason for this breakdown in performance, the reliability of the second examiner's pausing behavior was measured. The second examiner's pausing behavior was shown to be similar to the first examiner's. Then the examiners were manipulated in an ABAB design explained by the previous speakers. This procedure allowed me to compare the influence of each examiner on the patient's performance. In general, it was shown that the patient's behavior eventually came under successful control of both examiners. In this report the specific reasons for the initial decrement can only be hypothesized. We can say it was not the pause duration of each examiner. The recovery of the patient's performance with the new examiner suggests that the patient's performance was controlled by manipulation of pause duration regardless of the examiner.

During the treatment session it is necessary to insure that the patient is responding to the stimuli that the examiner has intended to be the relevant stimulus. Sidman and Willson-Morris (1974) reported a study relevant to aphasiologists which demonstrates that it is necessary to incorporate rigorous specification of stimulus control in clinical situations. Their normal subjects were presented a set of multiple-choice questions taken from Eisenson's (1954) paragraph reading tests. The subjects were given the questions without having read the relevant paragraphs. Since the subjects had not read the paragraphs, they had to respond to the multiple-choice questions based on stimuli found within the questions rather than from the test paragraphs. The authors reported "Of the 20 questions, 17 were answered correctly by at least two thirds of the subjects..." This high level of success was accomplished even though the subjects had never read the relevant paragraphs upon which the questions were based. As the authors stated, "...the presence of cues extraneous to the paragraphs precluded accurate identification of the controlling stimuli." To emphasize the point again, to correctly diagnose and treat patients requires specification of controlling stimuli.

Another example of stimulus shaping commonly used in the treatment of apraxic patients is Melodic Intonation Therapy (Sparks and Holland, 1976). Since the description of this treatment protocol is not clearly defined it is not possible to replicate the procedure. What I will present however, is an attempt to specify the components present in that procedure and offer a method for investigating the role of each of the components reported by Sparks and Holland.

The following study is an attempt to systematically investigate the suggested treatment variables presented in M.I.T. There are a number of variabl or components in the M.I.T. procedure. One is "gestural-tapping" and another is the spoken phrase, both to be imitated by the patient. There are also a number of manipulations of the spoken stimuli, i.e., increased duration of vowels and consonants, syllable stress, intoning, etc.

The general question then is, "what is the contribution of each of these components, and what are the possible combinations of these stimuli that leads to bringing the speech of the patient under control?" All of these antecedents may or may not play a role in generating the criterion performance (producing speech at a normal rate). By assessing the role(s) of these antecedents we may develop a more efficient treatment procedure and learn something about why it works.

To investigate these components Pat Holtzapple and I have begun a project that I will describe. Figure 5 shows in outline form the steps and the procedur as we view them now. Our overall approach is to engage in shaping the controlli antecedent beginning with the "gesturing-tap model" and to pair it with the verbal model, then remove the "tap" and leave the verbal model. We then propose to progress through the various verbal manipulations until the patient's speech comes under control. We have also suggested a number of back-up procedur to maintain a high level of success and to teach the patient the appropriate behaviors that will permit him/her to move successfully through the procedure.

PROCEDURAL STEPS

1. IMITATION OF TAPPING SEQUENCE MODEL
   A. PROMPT CONDITION:
      (1) MANUAL TAPPING
2. IMITATION OF TAPPING AND VERBAL SYLLABLE STRESS MODEL
   A. PROMPT CONDITION:
      (1) MANUAL TAPPING
      (2) UNISON VERBAL SYLLABLE STRESS MODEL
3. IMITATION OF VERBAL SYLLABLE STRESS MODEL
   A. PROMPT CONDITION
      (1) UNISON VERBAL SYLLABLE STRESS
4. SPONTANEOUS SENTENCE PRODUCTION

Figure 5. Steps in treatment program.

The treatment procedure just described is another example of stimulus shaping. That is, the patient's behavior is first brought under control of one stimulus, which is then paired with the second stimulus, until the second stimulus begins to control the patient's performance. New stimuli are successively introduced until they come to control the verbal behavior of the patient.

By presenting each stimulus one at a time we may be able to generate successful performance, while at the same time analyzing the value or contribution of any and all these hypothesized steps. Such procedures may help us to more competently talk about the disorder of apraxia and our ability to control such behavior.

If the technology just described is to be of clinical value, its application to the treatment of aphasic individuals must be established. A crucial variable in establishing the clinical relevance of this technology is the accuracy and reliability of recording clinical behavior by independent observers.

While I have not done an exhaustive search of the clinical aphasiology literature, my prevailing impression is that very few reports of aphasia treatment incorporate an analysis of reliability between independent observers. Kazdin (1977) reviews the diverse sources of artifacts, biases and complexities of assessment procedures that influence interpretation of interobserver agreement. He suggests that researchers should; (1) "...establish the ideal condition under which agreement can be assessed..." and (2) investigate the effects of deviations from these conditions in applied settings. Kazden argues that because of the sources of biases associated with interobserver agreement any estimate of agreement must be qualified by the specific condition of assessment.

Interobserver agreement and accuracy of scoring should be understood as target behaviors in their own right. These responses are a function of a variety of stimulus conditions. The following is an enumeration of some of the antecedent stimuli that affect interobserver agreement.

1. One situation in which the reliability of the observer is influenced is one in which the observer has knowledge that he/she is being monitored.
2. A second but similar variable is the scorer's knowledge of the standards that are being used to score behavior.
3. Another variable is observer drift. Observer drift suggests that observers may change their criteria for judging behavior over time. That is, it is commonly assumed that once an observer learns the scoring system, he will continue to apply the same definitions of behavior and record accurately.
4. A fourth source of variance is the complexity of the coding or scoring systems. The more complex the system, the greater the disparity in reliability.

An investigation of clinical treatment procedures must recognize the need for accurate scoring and for measurement of interobserver agreement. The variables noted in this paper are only some examples, and more should be considered. Scoring systems offered by Porch (1973) and Brookshire (1976) offer us a starting point.

Today I have attempted to show that we must be more definitive in our treatment designs. The specification of antecedent stimulus conditions and their functional relationships are crucial for the evaluation of our treatment procedures for aphasic individuals. While the task seems monumental, this pursuit will offer us the opportunity to learn more about the disorder of aphasia and related neurological speech and language deficits. An experimental analysis of the components of aphasia treatment is feasible and necessary if we are to demonstrate our effectiveness to others and, more importantly to, ourselves.

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