APPLICATION OF THE SYMBOLIC MATCH-TO-SAMPLE TASK IN LANGUAGE TRAINING

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INTRODUCTION

The operant conditioning literature defines principles and procedures such as those used in stimulus discrimination and generalization that have already been found to affect or control performance. By adapting and replicating these procedures with aphasic patients, the clinician can study the effects of different variables on learning and performance in aphasia. When operant procedures are applied, they can also be used to analyze aphasic deficits, such as the ability to recognize spoken versus written words. By determining which variables will have the greatest effect on learning and what deficits exist, the clinician can begin to structure a language remediation task sequence.

One area from experimental psychology which can be applied directly to language remediation in aphasia is the match-to-sample task. The operations in this task parallel those already used in many therapy tasks with aphasic patients. For example, an auditory recognition task commonly used in therapy is illustrated when the clinician says a word and the patient selects a picture that corresponds to the word. The clinician then gives informative feedback regarding the patient's choice. It is important to note that the patient is required to make a nonverbal response in choosing the matching item. He need only to touch or pick up the item of his choice. This simple way of responding helps to place little extra demands on the task. It also helps to insure that performance on the task will not be confounded by a complex response when it is likely that a verbal expression problem may coexist.

The basic operations in the match-to-sample task are: first, the sample stimulus and the array of comparison stimuli are presented; second, the patient responds by selecting the stimulus from the array that corresponds to the sample stimulus; third, informative feedback is given as to whether the correct choice was made.

The essential components of the task consist of the sample stimulus followed by a set of choice stimuli which contains a comparison stimulus that corresponds to the sample. On the basis of some rule or relationship, the patient responds by

choosing the correct one.

In actual application, the sample and choice stimuli can be anything from colors or shapes to linguistic stimuli. Although the sample and choice stimuli have a correspondence, they may vary widely in terms of their actual properties. For example, a very simple task may be matching color to color, while a more complex task would consist of spoken numbers matched to printed symbols. Another type of match-to-sample task is when the sample stimulus is a word and the choice stimuli are a set of pictures. This task is identical to the auditory recognition task previously described as a therapy task.

The sample stimulus as well as the comparison set of stimuli from which to choose may stimulate different modalities. They may also vary in other stimulus properties such as complexity or length. In the Leiter International Performance Scale, the sample cards are in the visual modality and the blocks placed to match them are also in the visual modality. Other match-to-sample tasks cross modalities. For example, the sample stimulus may be auditory with the comparison stimuli being printed words or pictures. The Peabody Picture Vocabulary Test uses the cross modality match from auditory to visual as a testing procedure.

When working on a language task, the stimulus would usually be a word or longer linguistic unit having some symbolic relationship to the correct choice. The auditory recognition task described above is called a symbolic cross-modality match-to-sample task. It is symbolic because linguistic units are used, and it is cross-modality because the match crosses from the auditory to the visual modality.

According to Schuell, Jenkins, and Jimenez-Pabon (1964). aphasia is a generalized language impairment that crosses all modalities. There may be complex interrelationships among modalities, and some modalities may be more involved than others. A necessary first step is to outline the input modalities (e.g., written, spoken, pictures, etc.) in which the patient has greater degrees of difficulty and those which are easier for him. By sampling the patient's performance systematically in a number of different modalities, the clinician can identify different levels of performance in auditory and visual (printed and pictorial) input modalities. For example, the clinician might present a set of tasks through the auditory modality, then he could present similar stimulus items in written and pictorial form. The number of correct responses made with each different type of stimulus can then be compared.

After outlining the aphasic patient's problem in terms of modalities that are easier or more difficult and in need of remediation, a task hierarchy can be constructed by ranking performance on the various tasks. The modalities in which

responding is easier may also be used as prompts to facilitate responding in the more difficult modalities or on more difficult tasks. For example, many aphasic patients have more difficulty with auditory stimuli and less difficulty with written or pictorial stimuli. When training auditory recognition, the written word may be added initially as a prompt and then faded out.

To summarize the introductory points, it has been suggested that the match-to-sample task is particularly useful in language testing and remediation for several reasons. First, the task provides the opportunity for crossing modalities between the sample and comparison stimuli. Second, the relationship between the stimuli can be symbolic, such as the verbal word and its related object or picture referent. Third, match-to-sample is an ideal procedure to train comprehension, since the motoric nonverbal response places minimal demands on an output response. Fourth, the procedure can be expanded to permit more complex learning and discrimination. Fifth, the length of stimulus units can be manipulated and cues can be added or faded.

PERTINENT VARIABLES

The match-to-sample task presents a useful framework for language testing and remediation. The task also involves a number of different variables the clinician may wish to consider. The variables that affect learning in the match-to-sample task are the same as those demonstrated to be important in stimulus discrimination learning. The stimulus discrimination procedure is also referred to as the establishment of stimulus control. Through the training procedure and consequences, the sample stimulus comes to control responding to the correct choice. In other words, the client learns to recognize the sample stimulus and its relationship with the correct choice by choosing a match and then receiving feedback.

Research on the match-to-sample task has indicated three basic variables that affect learning (Cumming and Berryman, 1965). One important variable is the relationship between the sample and comparison stimuli. In aphasia remediation, factors which determine the difficulty of the relationship are: (1) modalities in which sample and comparison stimuli are presented; (2) length of the stimuli; (3) complexity, or number of critical elements to be discriminated or learned; (4) the amount of abstraction in the stimulus relationships; (5) amount of redundancy; and (6) context in which stimuli are presented.

The second basic variable to be considered is the reinforcement or knowledge of results. The schedule or rate at which reinforcement is given will affect learning and transfer. Learning on a new task or set of items will be faster if consequences are immediate and given after each response. Retention of learning will be better if knowledge of results is given less

often after initial learning has taken place.

The third major variable affecting acquisition of learning in the match-to-sample task involves the temporal relations between the two stimulus events. A general rule is that increased time between the stimulus and the chance to respond or between response and reinforcement will make performance more difficult, but later retention will be better. For example, it has been shown that a delay between the response and reinforcement or knowledge of results affected performance by certain types of aphasics (Brookshire, 1971).

The time between the sample stimulus and the onset of the choice stimuli is also important to consider. In a simultaneous match-to-sample task, the sample is presented at the same time as the choice array. For example, a written or spoken word is presented and a picture array is shown at the same time. A variation of this task is delayed match-to-sample. The sample is presented first and then removed. After a set delay time, the comparison set of stimuli are presented and the patient may choose. The psychology literature indicates the important temporal relationship is the delay between when the sample stimulus is terminated and the comparison array is presented. Performance on the simultaneous match is usually better than on the delayed match. Further, performance is more difficult as the amount of delay time increases.

The match-to-sample task can be used to test the effects of such variables as temporal relations, reinforcement contingencies, and stimulus interrelationships. By varying the parameter in question systematically within the match-to-sample structure, the clinician can observe any corresponding effects on the performance of the aphasic patient. He can then determine if the parameter in question is one which affects performance. By testing different parameters, the clinician can outline those manipulations that facilitate responding and those that increase task difficulty.

The variables of interrelationships between the sample and choice stimuli offers a fruitful area for exploring relevant stimulus factors such as modality used or complexity of the stimulus. The Token Test (De Renzi and Vignolo, 1962) is an auditory to visual match-to-sample task which varies length and complexity of auditory stimuli. By presenting directions of varying length and complexity, the clinician can outline a patient's difficulties along these parameters. Clinicians have noted that some aphasic patients may respond better when the stimuli are presented in the visual modality rather than the auditory modality. The sample and choice stimuli may be presented in the same modality such as visual-visual or may cross modalities such as auditory-visual. The use of different modalities may have differential effects on performance.

By presenting different modalities and recording perfor-

mance systematically, the patient's responses can be demonstrated to be better in certain modes of presentation (e.g., written or pictured) than in others (e.g., auditory). Once the patient's communication skills have been measured in this way, the clinician will know which modalities are intact and which modalities show deficits that need remediation. In addition, the length and complexity of the stimulus units can be controlled and systematically increased within the modalities.

Implications for building a task structure in therapy can be seen if the clinician knows which modalities facilitate responding and which modalities are difficult. On a given task, the clinician can use a modality in which the patient does well as a prompt to facilitate responding in more involved modalities. The use of additional modalities to prompt a response and then fading the cue is an efficient therapy practice.

The parameter of temporal relations can also have an important influence on performance. For example, in delayed matching, performance becomes more difficult as the delay increases. The effect of the delay can be studied with the match-to-sample task to determine whether it is a variable powerful enough to affect performance. When delay is instituted, short term memory is involved. The task requires not only that the patient recognize the stimulus or word, but also that he retain it until the correct moment to respond. The patient must be able to "mediate" the delay. In everyday communication, the patient must recognize a message, often without having any visual cues, and then retain the message until it is appropriate to respond. For example, if the message is "bring the butter," he must recognize the message auditorily and remember it while he goes to the refrigerator and finds the item. He will have no visual cues to aid him until he sees the item.

The delayed match-to-sample task permits testing performance over delay time. During this delay time, distractions may be interjected, which make performance more difficult. A patient may be able to mediate virtually any length of delay by silently "rehearsing" during the delay. A distraction has the function of interrupting the rehearsal. Distractions may be externally produced by adding other stimuli or noninformative messages during the delay. Also, distractions may be "response produced" by requiring the patient to do some task during the delay.

The type of activity that is interpolated during the delay time may affect performance (Jarrard and Moise, 1971). If the interpolated activity or distraction is produced externally, it may function as a distractor or be "tuned out." Response produced distraction usually makes performance more difficult, and the more similar the distraction is to the task, the more interference will occur.

When distractions are introduced during the delay interval the patient must recognize the stimulus, then attend to some other stimulus or task, and finally recall the original stimulus item in order to respond. This is similar to the processing required in many everyday communication interactions. The patient hears a message, but before he can respond, some other distraction has intervened. If the intervening activity is similar to the task requirements, it may cause even more interference with performance on the match-to-sample task. On an auditory recognition task, the patient hears a word, but before the visual choices are shown, he hears some other verbal stimuli. Finally, when he is given the visual choices, the intervening verbal stimuli have interfered with his ability to make the correct response.

To increase response strength and retention, a progression from the simultaneous match to the delayed matching task may be used. Distractions interjected into the delay may place further demands on performance, much like everyday communication interactions.

SUMMARY

The match-to-sample task has been suggested as a useful structure for language testing and remediation. The task allows the clinician to outline the patient's comprehension abilities thoroughly and to note how they vary in a number of different conditions. A framework is provided for testing memory and recognition of symbolic stimuli. The creative clinician can use the task structure to explore and compare performance discrepancies systematically when available diagnostic measures do not meet his needs. The operant literature suggests different variables have been found to affect learning. Using predictions from the literature, the clinician can adapt the procedure for aphasic patients and measure the effects of the variables on their performance. If the variables suggested in the psychology literature are potent ones with aphasic patients, they should be incorporated into the treatment hierarchy.

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