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# Using A Performance-Based Assessment to Measure the Rate at Which Severely Retarded Subjects Learn to Communicate With Signs and Pictures

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# USING A PERFORMANCE-BASED ASSESSMENT TO MEASURE THE RATE AT WHICH SEVERELY RETARDED SUBJECTS LEARN TO COMMUNICATE WITH SIGNS AND PICTURES

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# CHAPTER I

# INTRODUCTION

## Statement of the Need

Severely/profoundly mentally retarded children and adults comprise approximately one tenth of one percent of the general population (Goldstein, 1978). This population of individuals functions at a "general developmental level of half or less than the level which would be expected on the basis of chronological age" (Justen, 1976). Examples of the behavioral deviations that result from this lack of developmental growth include: 1) attention deficits, 2) lack of bowel and bladder control, 3) self-injurious behavior, 4) hyperactivity, 5) self-stimulatory behavior, 6) lack of physical mobility, 7) aggression towards others, and 8) lack of communication skills (Abt Associates, 1974; Van Etten, Arkell, & Van Etten, 1980). The severely/profoundly (s/p) retarded individual's lack of communication skills is the focal point of this study.

It is estimated that 88% of this population have communication deficiencies that are so severe that communication beyond the one word utterance is not attained (Levine, 1979). Given that s/p retarded individuals frequently cannot use a verbal communication system to express needs, thoughts, and information, alternative communication systems have been developed. Currently, sign language and pictorial

representations are frequently being used as alternative communication systems with this population (Hollis and Carrier, 1979; Kiernan, 1978).

Both sign language systems and pictorial representation systems (picture systems) have been proposed as effective alternatives (Harris Vanderheiden, Brown, Reinen, MacKenzie, & Schiebel, 1977; Kleiner and Gast, 1981; Stremel-Campbell, Cantrell, & Halle, 1977), but how does a teacher or clinician determine which system to use with a given individual?

Sailor, Guess, Goetz, Schuler, Utley, & Baldwin (1980) and Nietupski and Hamre-Nietupski (1979) have proposed decision making models which involve assessing the sensory, motor, and cognitive capabilities of the individual and the behavioral requirements of the alternative communication systems. When both sets of data are gathered, the teacher chooses the system that is perceived to most closely match the individual's repertoire of skills. These assessment models will assist the teacher/clinician in discriminating between which systems the individual has the skills to use and which systems are beyond the individual's capabilities, but they will not identify which system the individual can use most efficiently. In order to objectively identify the system that is most useful to the individual, these analytical assessment models must be supplemented with a performance based assessment.

The aforementioned performance based assessment would be implemented after the teacher clinician has identified two or more systems which the individual has the potential to use. Given that two or more potentially useful systems have been identified, the teacher/clinician would conduct short-term performance based probes (i.e., single subject A-B quasi-experimental designs) to determine the rate at which the individual learns to communicate with each system. The data yielded from the probes would allow the teacher/clinician to base the selection of an alternative system on the individual's performance rather than a calculated guess.

## Statement of the Problem

The purpose of the study was to demonstrate how a performance based assessment can assist direct line teaching personnel in selecting appropriate alternative communication systems for non-verbal s/p retarded individuals and to gather data that compares two non-verbal communication systems; a sign communication system and a picture communication system.

In order to validate whether the subjects participating in the study could more readily use signs or pictures as communicative stimuli, it was necessary to select a set of persons, objects, actions, or relationships that the sign and picture stimuli described or represented. Since none of

the subjects possessed an extensive expressive vocabulary, it was necessary to identify a rationale for selecting one. A myriad of methods for selecting an initial lexicon for s/p retarded individuals are available (Fristoe and Lloyd, 1979; Miller, 1977; Sailor et al., 1980), but there are no empirical data that suggest that one method is more reliable or valid than another. While this is true for mentally retarded individuals, there are data which would define the parameters of an initial vocabulary for "normal" individuals (Miller, 1977). Data derived from normal language development studies indicates that the first words a child learns to use are nouns (Greer, Andersen, and Davis, 1976; Hallet, Sype, and Gates, 1976; Miller, 1977). Whether the s/p mentally retarded subjects participating in the study learned to use nouns before verbs was a question that was addressed in this investigation.

In order to determine if the subjects participating in this study were more responsive to using signs or pictures as an expressive communication system and if they learned to label objects (nouns) at a more efficient rate than actions (verbs), the following hypotheses were tested:

1. Severely retarded subjects will learn to point to pictures (black and white line drawings) that represent objects and actions at a more efficient rate than they will learn to shape their hands to form signs that represent objects and actions.

2. Severely retarded subjects will learn to point to pictures or form signs that represent objects (nouns) at a more efficient rate than they will learn to point to pictures or form signs that represent actions (verbs).

3. As a result of the procedures employed during the experimental phases of the study, the subjects will emit a higher percentage of correct responses during the post-tests than they will during the pretests.

## Definition of Terms

Communication. "Communication is used to refer to social interactions in which some information is exchanged, but participants do not necessarily share complex systems of grammatical or syntactic rules governing the interchange." (Sailor et al., 1980)

Communicative stimulus. A communicative stimulus is any observable behavior or object that is used to symbolize events, persons, places, objects, emotions, relationships, attributes, or ideas which comprise or are contained within a message that is transmitted or received.

Communication system. A communication system is a collection of communicative stimuli that share one or more common characteristics.

Picture communication system. A picture communication system is a communication system that uses graphic figures as communicative stimuli. The graphic figures can

range from being very reminiscent of the actual environmental referent to not at all reminiscent of the actual environmental referent.

Sign communication system. A sign communication system is a communication system that uses hand, arm, and/or body gestures as communicative stimuli. The gestures can range from being very reminiscent of the actual environmental referent to not at all reminiscent of the actual environmental referent.

Training trial. A training trial is an instructional sequence that includes the presentation of a discriminative stimulus, the elicitation of an observable response, and the delivery of a consequence.

Inter-trial interval. The inter-trial interval is a period of time that separates the offset and onset of two training trials (Donnellan-Walsh, 1976).

Potential reinforcer. A potential reinforcer is a stimulus that is assumed to be pleasant or desirable and likely to increase the frequency of the behavior that it follows.

# CHAPTER II

## REVIEW OF RELATED RESEARCH

In Chapter I, a two part assessment model for selecting an alternative communication system for s/p retarded individuals was proposed. The first component of the model is based on analytical assessment models proposed by Sailor et al., 1980 and Nietupski and Hamre-Nietupski, 1979. These models call for an assessment of the potential user's repertoire of skills and an assessment of the behavioral requirements and characteristics of available alternative systems. Data yielded from these type of assessments will allow the teacher/clinician to discriminate between systems which the individual has the potential to use and systems which are beyond the individual's competencies. The second component of the model is a performance based assessment that allows the teacher/clinician to make an empirically based decision as to which alternative system the individual uses most efficiently. This component of the model will be described and tested in Chapter III. Components of the aforementioned analytical models will be used in this chapter to identify the behavioral requirements and characteristics of sign and picture systems. Both of the systems will be evaluated in terms of input and output modes used, portability, potential communication audience, vocabulary, and information exchange capabilities.

Input and Output Modes

Input mode refers to the form in which the content of a message is received. Output mode refers to the form in which the content of a message is expressed (Sailor et al., 1980). Both sign and picture systems require the user to receive information visually and express information motorically. Since both systems use a visual input mode, the teacher/clinician must determine whether the potential user possesses the visual skills to use a sign or picture system. In order to determine whether an individual has the visual skills needed to use a sign or picture system, it is suggested that teaching personnel and/or an opthamologist evaluate the individual's capabilities in relationship to the following visual behaviors: 1) conjugated eye movement, 2) visual field, and 3) visual acuity (Sailor et al., 1980). Sailor et al. (1980) have identified methods which a teacher/clinician can use to assess these three classes of visual behavior if the services of an opthamologist are not available.

Although both sign and picture systems use visual stimuli as their primary input mode, speech is often paired with the visual stimuli. If speech is used as an input mode and the individual's auditory capabilities are in question, an assessment of the potential user's auditory skills must also be conducted. An audiologist can provide such an

assessment, but if this service is not accessible the teacher/clinician can evaluate the individual's auditory acuity with informal tests (Sailor et al., 1980).

While sign and picture systems use input modes that require similar sensory reception capabilities, the output mode used by these systems differs in complexity. Sign systems acquire the individual to make many complex motor responses, while picture systems typically require simple motor responses (e.g., touching, pointing). Because both systems require some type of motor response, the teacher/clinician must identify the motor responses available to the individual and determine whether the individual possesses the innate capacity to engage in or learn to engage in the motor behaviors required by either or both systems. Although each system requires the individual to possess some motoric capabilities, picture systems may be more useful to s/p retarded individuals since only a minimal degree of motor efficiency is required.

Portability

Portability refers to how readily a system can be carried from one environment to another. If the communication system allows the user to exchange information in any social or environmental context, then the system has a high degree of portability. If the information exchange process is limited to a few social or environmental contexts, then

the system has a low degree of portability. Sign systems are characterized by a high degree of portability, since the "tools" (i.e., arms, hands, and fingers) used to form communicative stimuli are part of the user's body (Nietupski and Hamre-Nietupski, 1979). The portability of picture systems varies, since the pictures need to be affixed to a display apparatus (e.g., lapboard, electronic board, notebook). Picture systems that utilize lapboards and electronic display boards typically limit the number of environments in which communication can occur. In contrast, pocket-size notebook displays can be carried anywhere. Although miniature displays make picture systems portable for some users, most displays limit the number of settings where communication can occur. In terms of portability, sign systems constitute a more functional communication system.

## Communication Audience

Communication audience refers to the population of individuals who can exchange information with an individual using an alternative communication system. Sign systems limit the communication audience, since only a small segment of our population uses sign language as a communication system (Guess, 1980; Nietupski and Hamre-Nietupski, 1979; Harris Vanderheiden, 1975). In contrast, picture systems typically provide the individual with a large communication

audience, since it is easy to affix a written word to the picture which denotes the meaning of the picture (Nicholas, 1978; Nietupski and Hamre-Nietupski, 1979). In relationship to potential communication audience, pictures used in conjunction with printed words constitute a more useful alternative system.

Vocabulary Capacity

The vocabulary capacity of a communication system refers to the quantity of meanings that the system is able to express. Standardized sign language systems such as American Sign Language (ASL) and Signing Exact English (SEE) allow the user to express a wide variety of meanings. SEE has an unlimited vocabulary capacity (Sailor et al., 1980) and ASL is considered to be a complete language (Wilbur, 1976). Well developed picture systems such as Blissymbols and Rebus symbols also allow the user to express a wide variety of meanings. The Bliss system contains over 400 pictures and the Rebus system is comprised of 818 pictorial representations (Hollis and Carrier, 1978). Given that standardized sign and picture systems possess large vocabulary capacities, it is conceivable that any alternative that uses pictures or signs has the potential to express a multitude of meanings. However, the use of non-standardized pictures or signs could reduce the size of the communication audience.

Information Exchange Capabilities

Communication by definition involves an exchange of information between two or more participants. The quality of an exchange is affected by three factors: 1) the user's ability to respond to information presented by others, 2) the user's ability to initiate an exchange, and 3) the time required to transmit a message. How each of these factors affects the information exchange process is dependent upon the motoric capabilities of the user and the characteristics of the system. This discussion will be limited to examining how sign and picture systems facilitate or inhibit the information exchange process.

Sign language systems allow the individual to both initiate an exchange and respond to the communicative attempts of others. Like the sign systems, picture systems also allow the user to initiate communication and respond to it, although the picture system user must gain access to the display apparatus before any information can be exchanged.

The time required to transmit a message will also affect the quality of the communicative exchange. In terms of transmission time, sign language is only limited by the user's motor skills. The time required to transmit a message with a picture system is dependent upon the type of display used and whether the display is readily available to the user. If the display allows the user to merely point to

or touch the communicative stimulus, then the message can be transmitted rapidly. If an electronic display is used, transmission time can be slow and the information exchange process may be segmented. The time required to transmit a message can also be delayed if the display is not readily available to the user. If the display is not immediately accessible to the user, then the receiver must wait for the message and spontaneous communication is inhibited. In terms of information exchange capabilities, sign language systems possess characteristics that allow the user to rapidly initiate an exchange and respond to the communication attempts of others. Although picture systems have the potential to serve the user in a similar manner, the user's ability to initiate an exchange can be inhibited and the time required to transmit a message can be delayed if an inefficient display is used.

This analysis of the input modes, output modes, portability, communication audience, vocabulary capacity, and information exchange capabilities of sign and picture systems (Table I), indicates that both alternatives possess characteristics that will facilitate functional communication in a myriad of social and environmental settings. Both systems also possess characteristics that may limit their use. Sign systems may inhibit communication, since the user is limited to exchanging information with the small population of individuals who use signs. Sign systems also

TABLE I

Comparison of Variables That Effect the Utility of Sign and Picture Systems

| Variables | Alternative System | |
|---|---|---|
| | Sign | Pictures |
| Input Mode | Simple to Complex Visual Stimuli | Simple to Complex Visual Stimuli |
| Output Mode | Simple to Complex Motor Movements | Simple Motor Movements |
| Portability | High Degree | Varying Degrees |
| Communication Audience | Limited | Extensive |
| Vocabulary Capacity | Large | Large |
| Allows Individual to Initiate and Respond | Two Way Communication Always Available | Depends on Availability of Display |
| Time Required to Transmit Message | Minimal | Varies from Minimal to Extensive |

require the user to possess sophisticated motor skills. Picture systems will not meet the complete communication needs of the individual if the display limits portability and/or transmission time. Despite these limitations, both systems will allow the non-vocal retarded individual to engage in meaningful dialogue with persons and within environments that are not accessible to non-communicative individuals.

Although the type of analytical assessment which has been applied to sign and picture systems in the preceding pages will allow the teacher/clinician to identify the communication systems which may be potentially useful to the individual, potential usefulness cannot serve as the sole criterion for selecting a system. In order for the teacher/clinician to identify the communication system which the individual can use most efficiently, the analytical data must be supplemented with empirical data. A performance based assessment that teaches the individual to form signs and point to pictures will yield such data. The following study employs this model to test three hypotheses:

1) Severely retarded subjects will learn to point to pictures (black and white line drawings) that represent objects and actions at a more efficient rate than they will learn to shape their hands to form signs that represent objects and actions.

2) Severely retarded subjects will learn to point to pictures or form signs that represent objects (nouns) at a more efficient rate than they will learn to point to pictures or form signs that represent actions (verbs).

3) As a result of the procedures employed during the experimental phases of the study, the subjects will emit a higher percentage of correct responses during the posttests than they will during the pretests.

# CHAPTER III

# METHODOLOGY

## Setting and Subjects

This study was conducted in a public school program for severely and profoundly mentally retarded individuals. The school is located in a suburb of a metropolitan area. Four of the students enrolled in the program served as subjects for this investigation.

The four subjects, two males and two females, were selected from a pool of twelve students. The following criteria were used in the selection of the subjects.

1. Responds to the verbal directive, "Look at me.".
2. Responds to the verbal directive, "Look here.", when paired with a pointing gesture.
3. Sits in a chair for a period of at least ten minutes.
4. Can independently assume a sitting and standing position.
5. Can chew solid food and drink liquids without difficulty.
6. Imitates motor movements when provided with a model.

It was judged important that the participants enter the study with the aforementioned skills so that the data collected during the investigation reflected the subjects'

ability to perform the tasks relevant to the study rather than the subjects' inability to cooperate with the testing and training activities.

The four students who served as subjects were considered to be severely mentally retarded according to their most recent psychological evaluations and multidisciplinary team reports. None of the subjects exhibited severe visual, auditory, or motor impairments. The average age of the subjects at the time of the study was 8 years 2 months with the range from 6 years 11 months to 9 years 4 months. Each of the subjects was involved in a formal communication training program at the time of the study. The subjects' repertoire of expressive communication skills are described below.

Subject 1: Jeff was 6 years 11 months at the time of the study. He did not use any type of communication system consistently, but he did demonstrate behaviors indicative of an intent to communicate. Jeff would occasionally verbalize the /b/ sound when asked if he wanted to obtain an object or initate an activity. On most occasions, Jeff used the sign for "candy" as a universal referent for objects he wanted to obtain or activities he wanted to initiate. His communication training program was aimed at increasing the frequency and appropriate use of the /b/ sound and other emerging vocalizations.

Subject 2: Cathy was 8 years 9 months at the time of the study. Cathy exhibited a variety of communicative behaviors. She was able to verbalize the names of objects, events, and persons, although she did not emit these verbalizations in the presence of appropriate environmental stimuli. Her communication training program was aimed at teaching her to use her repertoire of verbal responses in the presence of appropriate environmental stimuli.

Subject 3: Tim was 9 years 4 months at the time of the study. Tim did not use any type of communication system consistently, but he did demonstrate behaviors indicative of an intent to communicate. Tim used a combination of the /b/ sound and an approximation of the sign "eat" as a universal referent for any object he wanted to obtain or activity he wanted to initiate. He also identified his wants and needs by touching wanted objects and leading adults to locations where desired objects were available. His current communication training program was aimed at teaching him to use the signs for "eat" and "drink" expressively.

Subject 4: Tina was 7 years 9 months at the time of the study. Tina did not exhibit any verbal behavior. She was capable of imitating the signs for "eat", "baby", and "want", but she did not use the signs as a means for obtaining their environmental referents. Her primary means of communicating her wants was to grab or move toward objects

that she wanted to obtain. She infrequently used a pointing gesture as a means of communicating. Her communication training program was aimed at teaching her to use her repetoire of signs as a means of obtaining her wants and needs.

Experimental Design

In order to determine whether the four subjects participating in the study could learn to 1) point to pictures at a more efficient rate than form signs and 2) label objects at a more efficient rate than actions, four experimental conditions were formulated and tested. They are described below:

Experimental Condition 1 When the trainer presents an object, four line drawings, a model of the correct response, and the question "What is this?", the subject will point to the line drawing that describes the object presented by the trainer.

Experimental Condition 2 When the trainer prompts the subject to engage in an action and presents four line drawings, a model of the correct response, and the question "What are you doing?", the subject will point to the line drawing that describes the action the subject performed.

Experimental Condition 3 When the trainer presents an object, a model of the sign that describes the object, and the question "What is this?", the subject will form the sign that describes the object presented by the trainer.

Experimental Condition 4 When the trainer prompts the subject to engage in an action, presents a model of the sign that describes the action, and states the question "What are you doing?", the subject will form the sign that describes the action the subject performed.

The four experimental conditions were presented to the subjects in a test-train-test sequence. Four ten trial pretests were given to each subject on the first day of the study to determine the rate at which each subject could emit the four response defined in the experimental conditions (Table II). On days two through eleven, each subject was given ten opportunities per experimental condition per day to learn the four communicative responses. On day twelve of the study, each subject was given four ten trial posttests.

Table II

Experimental Design

| Subjects | Day(s) of Study | Experimental Conditions | Pretest -10- Trials | Training -100- Trials | Posttest -10- Trials |
|---|---|---|---|---|---|
| 1,2,3,4 | 1 | 1,2,3,4 | X | - | - |
| 1,2,3,4 | 2-11 | 1,2,3,4 | - | X | - |
| 1,2,3,4 | 12 | 1,2,3,4 | - | - | X |

Training Vocabulary

The training vocabular consisted of two object words, cookie and drink, and two action words, sit and stand. Three criteria were used to select each of the vocabulary words: 1) the word referred to an action/object that the subjects frequently encountered in their natural environment; 2) the word referred to an observable action/object; and 3) the word had face validity in regard to its placement in an initial expressive vocabulary for severely retarded subjects.

The words cookie, drink, sit, and stand met each of these criteria. The subjects encountered each of the four words and their referents in both their home and school environments. This was verified by observing the subjects in the school environment and by interviewing each subject's parent(s)/guardians.

Each of the vocabulary words refers to an observable object or action. Both of the object words referred to items that could be tasted, touched, and observed by most individuals. Both of the action words referred to body positions that could be observed and assumed by any able bodied individual. All of the subjects were observed to interact with the objects and engage in the actions referred to by the targeted vocabulary words.

Each of the vocabulary words had a high degree of face validity in regard to inclusion in an initial vocabulary for retarded subjects. In Fristoe and Lloyd's compilation of sign language lexicons used with persons who exhibit severe communication impairments, each of the words are referenced in at least seventy percent of the lexicons reviewed (1979). All four words are also listed in Walker's Revised Makaton Vocabulary (1980), a suggested initial vocabulary for severely retarded individuals.

Picture and Sign Stimuli

Each vocabulary word was paired with a picture stimulus (Figure 1) and a sign (Figure 2) stimulus. The picture stimuli consisted of the four black and white line drawings illustrated in Figure 1. The pictures presented to the subjects during the study were identical to those shown in Figure 1, with the exception that the pictures used during the test and training phases were mounted on 3" x 4" oak tag cards. All of the pictures were drawn by the author.

American Sign Language signs for cookie, drink, sit, and stand were used for the sign testing and training phases of the study (Figure 2). The signs for cookie and sit were adapted so that each sign only required the subjects to make a single formation with each hand. To form the sign for cookie, the subjects had to bring a "clawed hand" into

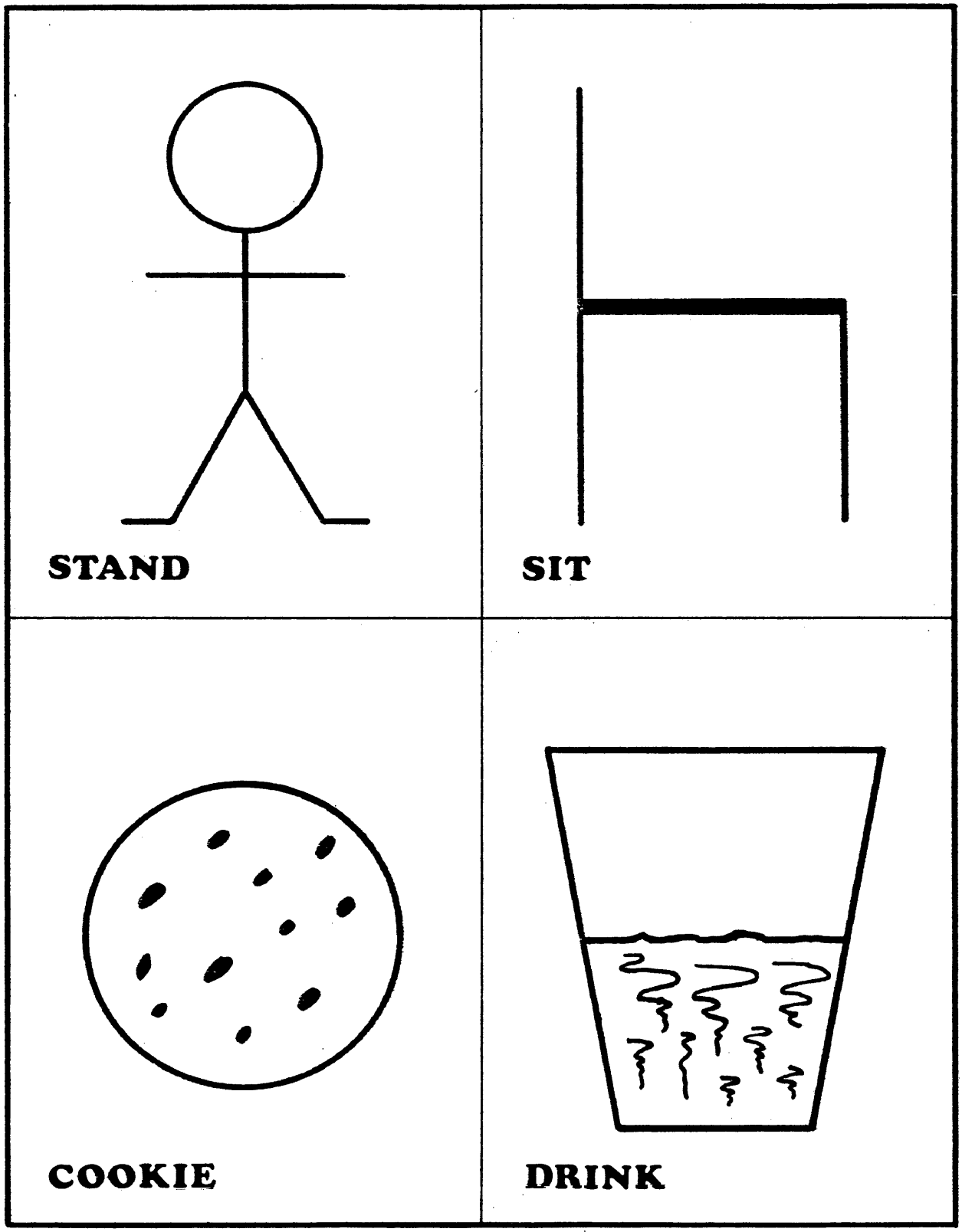


Figure 1: Four Picture Stimuli Used During Testing and Training Phases of the Study

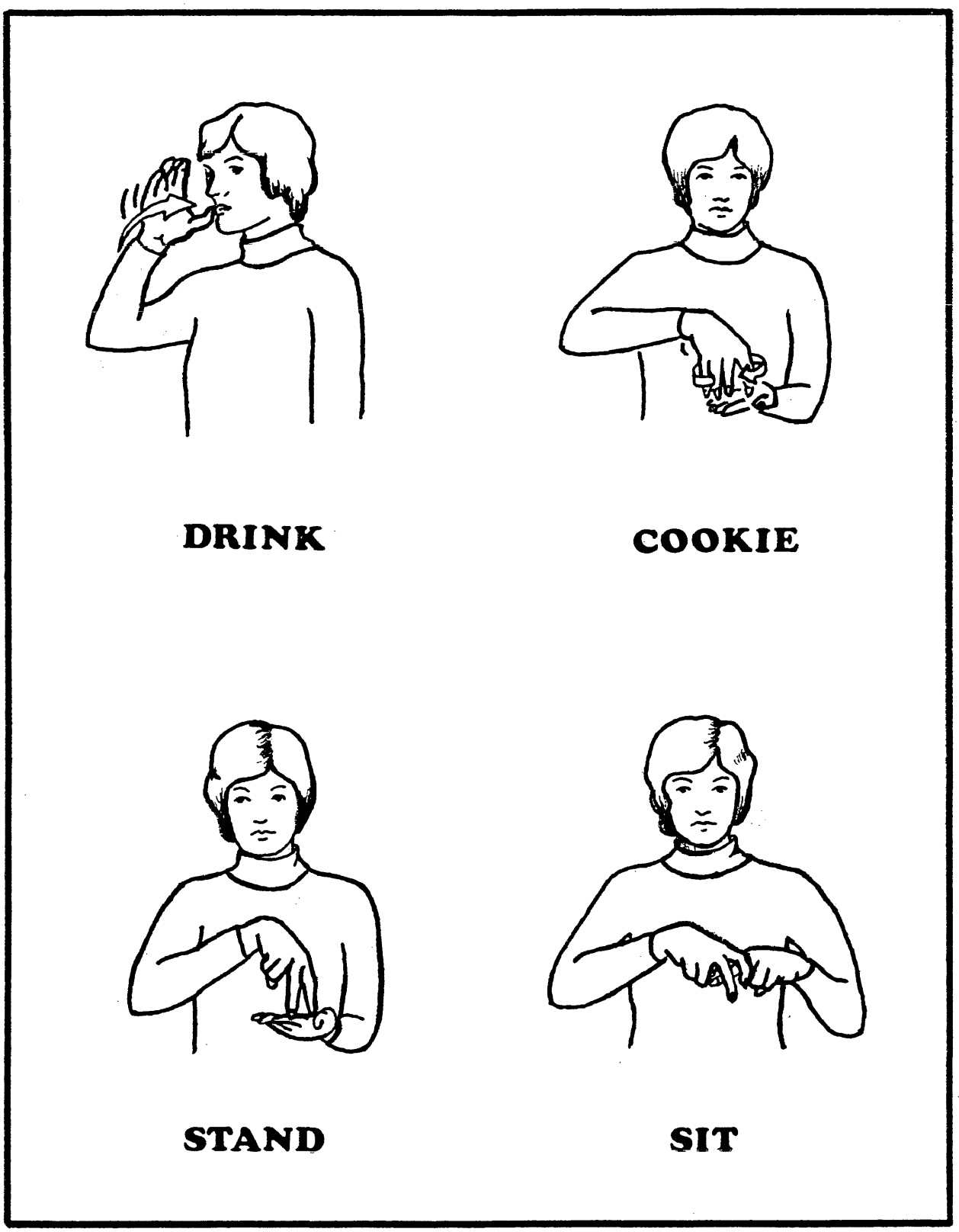


Figure 2: Four Sign Stimuli Used During Testing and Training Phases of the Study

contact with the extended palm of the second hand. The subjects were not required to twist the "clawed hand" as is illustrated in Figure 2. To form the sign for sit, the subjects had to lay the extended index and middle fingers of one hand on top of the extended index and middle fingers of the second hand. The subjects were not required to bend the fingers of the top hand over the fingers of the bottom hand as is illustrated in Figure 2. The signs for drink and stand were not adapted in any way.

Materials

All test and training sessions were conducted in an 8' x 10' x 7' room located in a classroom at a public school. The room contained a 2' x 2' desk, two chairs, a stopwatch, a three shelf cart, the four stimulus pictures, a video camera (during pretests and posttests only), and twelve potential reinforcers. The items selected for potential reinforcers were a parachute, a Fisher-Price windup radio, a bottle of liquid bubbles, a xylophone, a ball, a Fisher-Price shape sorter, a hand puppet, a chocolate chip cookie, a glass of water, a doll, a toy car, and a Slinky. The potential reinforcers, the data sheet, the stopwatch, and the stimulus pictures were positioned on the three shelf cart. With the exception of the video camera, all training materials as well as the number and type of potential reinforcers were identical during all phases of the study.

Trainer

The author served as the sole trainer during all phases of the study. It was recognized that the author's participation in the study introduced the variable of experimenter bias. To minimize the impact of this variable, all test session were video-taped and data reliability checks were made. An inter-rater reliability coefficient was computed to determine the degree of agreement which existed between the data taken by the trainer during the test sessions and the data taken by the rater observing video-tapes of the test sessions. The following formula was used to compute the reliability coefficient (RC):

$$RC = \frac{\text{Number of agreements}}{\text{Number of agreements + Number of disagreements}} \times 100$$

Communicative Stimuli-Vocabulary Word Combinations

Eight communicative stimulus-vocabulary word combinations (hereinafter referred to as stimulus-word combinations resulted from pairing the four vocabulary words with the sign and picture stimuli. Subjects were tested and trained using all eight combinations during the course of the study. Subjects 1 and 3 were given training aimed at teaching them to label cookie and sit with a sign and drink and stand with a picture (Table III). Subjects 2 and 4 were given training aimed at teaching them to label cookie and sit with a

TABLE III

Stimulus-Word Pairings and Order In Which Pairings Were Presented to the Subjects

| Subjects | Vocabulary Words | Order of Presentation | Communicative Stimulus |
|---|---|---|---|
| 1 | Cookie | First | Sign |
| | Drink | Second | Picture |
| | Sit | Third | Sign |
| | Stand | Fourth | Picture |
| 2 | Cookie | First | Picture |
| | Drink | Second | Sign |
| | Sit | Third | Picture |
| | Stand | Fourth | Sign |
| 3 | Stand | First | Picture |
| | Sit | Second | Sign |
| | Drink | Third | Picture |
| | Cookie | Fourth | Sign |
| 4 | Stand | First | Sign |
| | Sit | Second | Picture |
| | Drink | Third | Sign |
| | Cookie | Fourth | Picture |

picture and drink and stand with a sign. Each vocabulary word was paired with both types of communicative stimuli so that the data reflected the effect of the type of stimulus and type of word used rather than the effect of any single stimulus-word combination. Each subject was presented with all four experimental conditions, so that the data reflected the stimulus and word preferences of the group rather than the performance of each subject. Subjects 1 and 2 were presented with the vocabulary words in the following order: cookie, drink, sit, and stand. The order of presentation was reversed for subjects 3 and 4 to minimize any variance that might result from an order effect (Table III).

## Procedures

Each test and training phase was structured by a step-by-step presentation format. The presentation formats are described in Chapter III, Experimental Design. For a complete pretest/posttest procedures, see Appendix A.

## Assumptions and Delimitations

Four assumptions were made when the aforementioned procedures were devised and implemented. The first assumption made was that the training vocabulary used was comprised of semantic concepts appropriate to an initial vocabulary for severely retarded individuals. The second assumption made was that establishing objective response

definitions (i.e., Experimental conditions 1, 2, 3, and 4) and taking reliability checks would minimize errors in data collection. The third assumption made was that the instructional procedures employed during the test and experimental phases of the study represented appropriate instructional procedures for severely retarded individuals. The fourth assumption made was that the vocabulary words and communicative stimuli were paired and presented in a way that minimized bias toward any single stimulus-word combination.

Due to the size and characteristics of the experimental group, the findings of the study will be applicable only to the subjects who participated in the study. Furthermore, the findings of the study will be applicable only to the specific communicative stimuli and vocabulary words presented during the study.

# CHAPTER IV

## RESULTS

The purpose of this study was to test the following hypotheses:

1. Severely retarded subjects will learn to point to pictures (black and white line drawings) that represent objects and actions at a more efficient rate than they will learn to shape their hands to form signs that represent objects and actions.

2. Severely retarded subjects will learn to point to pictures or form signs that represent objects (nouns) at a more efficient rate than they will learn to point to pictures or form signs that represent actions (verbs).

3. As a result of the procedures employed during the experimental phases of the study, the subjects will emit a higher percentage of correct responses during the post-tests than they will during the pretests.

In order to determine whether each hypothesis could be accepted or rejected, an analysis of variance was performed.

### Inter-Rater Reliability

The data collected by the trainer during the actual pretests and posttests and the data collected by the rater from video-tapes of the pretests and posttests were in

agreement for 99.6 percent of the 320 test trials (see Chapter III for method of computation).

Statistical Analysis

A 2(picture vs. sign) x 2(noun vs. verb) x 2(pretest vs. posttest) analysis of variance was attempted, but due to statistical problems associated with the lack of performance in the sign presentation the effect of the communicative stimuli could not be statistically analyzed.

Visual inspection of the raw data revealed that there were instances where pictures were used to accurately represent nouns and verbs, while in no instance were signs used to accurately represent nouns or verbs. This disparity in performance suggests that the type of communicative stimulus presented was a significant factor. To analyze the effect of the noun vs. verb and pretest vs. posttest factors in the pictorial presentation, a 2 x 2 factorial analysis of variance within subjects was performed. As is shown in Table IV, the main effects of noun vs. verb ($F=12.02$, $p<.01$), pretest vs. posttest ($F=12.02$, $p<.01$), and the interaction between these factors ($F=7.14$, $p<.01$) were highly statistically significant. Further analysis of the interaction, Table V, revealed that learning was successful for the pictorial representation of nouns ($F=19.35$, $p<.001$), but not for the pictorial representation of verbs ($F<1$, NS).

TABLE IV

Results of Analysis of Variance for Noun vs. Verbs, Pretest vs. Posttest, and Their Interaction

| Sources of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Noun vs. Verb (A) | 38.82 | 1 | 38.82 | 12.03* |
| Pretest vs. Posttest (B) | 38.82 | 1 | 38.82 | 12.02* |
| A x B | 23.05 | 1 | 23.05 | 7.14* |
| Error | 38.75 | 12 | 3.23 | |
| Total | 139.44 | 15 | | |

*$p < .01$

TABLE V

Analysis of Variance
For Noun vs. Verb
Via Pictorial
Presentation

| Sources of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Noun (Pretest vs. Posttest) | 62.5 | 1 | 62.5 | 19.35* |
| Verb (Pretest vs. Posttest) | 1.12 | 1 | 1.12 | <1 |
| Error | 38.75 | 12 | 3.23 | |
| Total | 102.37 | 14 | | |

*p<.001

These analyses show that hypotheses 1, 2, and 3 were partially supported by the experimental results. Although the subjects did not learn to point to pictures that represented verbs at a more efficient rate than they learned to form signs of verbs, they did learn to point to pictures that represented nouns at a more efficient rate than they learned to form signs that represented nouns. Similarly, the subjects did not learn to form signs that represented nouns at a more efficient rate than they learned to form signs that represented verbs, although they did learn to label nouns with pictures at a more efficient rate than they learned to label verbs with pictures. In no instance were signs used to accurately label nouns or verbs.

# CHAPTER V

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## Summary

This study was undertaken to investigate the rate at which four severely retarded subjects learned to communicate with pictures and signs and to demonstrate how a performance based assessment could be used to assist in the selection of a communication system for non-verbal severely retarded individuals. To accomplish these goals, three hypotheses were formulated and tested. In order to test the hypotheses, each of the subjects who participated in the study were assigned to four experimental conditions. The four experimental conditions consisted of training session aimed at teaching the subjects to produce the following responses: label an object with a picture, label an action with a picture, label an object with a sign, and label an action with a sign. A test-teach-test assessment paradigm was used to determine the rate at which the subjects learned to produce each of the responses. A factorial analysis of variance was conducted to delineate the statistical significance of the data yielded from the testing procedures.

## Conclusions

The results of this study indicate justification for the following conclusions.

1. The findings of this study suggest that the development and acquisition of expressive communication skills in s/p retarded individuals may be dependent upon the relationship between the communicative stimulus and the message being expressed. The performance of the subjects participating in this study seems to provide justification for this premise. The analysis of the factors that were presented during this investigation revealed that the subjects learned to communicate most efficiently when they were taught to label objects with pictures. The subjects did not successfully learn to label actions with pictures or objects with signs. For the subjects participating in this study, neither the type of communicative stimuli presented nor the type of words presented proved to be the unitary factor that prompted the acquisition of communicative responses. Communicative responses were successfully learned only when the subjects were presented with a specific type of stimulus-word combination. For select groups of s/p retarded individuals, acquisition of communicative skills may be contingent upon the identification of stimulus-word combinations which are meaningful to the user.

2. This study used a performance-based assessment to compare the rate at which severely retarded subjects learned to use signs and pictures to label objects and actions. The data yielded from the assessment revealed that

the subjects learned to label objects with pictures at a more efficient rate than they learned to label objects or actions with signs and actions with pictures. The relationship between successful learning and training that paired pictures with objects was significant at the .001 level of confidence. The specific data yielded from this assessment was obtained in a public school classroom during twelve school days. The assessment used was comprised of testing and training procedures (see Chapter III) that are frequently used with s/p retarded individuals in an educational setting. The total time spent assessing each subject was less than one hour daily. All of the stimulus materials used in the assessment process were made from materials available in most school settings or borrowed from the subjects' classrooms. For the aforementioned reasons, it seems justified to conclude that the performance-based assessment used in this study may represent an efficient and effective tool for identifying useful communication systems for s/p retarded individuals.

## Recommendations

"The development of communication skills in severely/multiply handicapped persons represents one of the most technically difficult, challenging, and important problems in the design and delivery of effective educational services." (Guess, 1970.) A primary problem encountered

when attempting to develop communication skills in non-verbal severely handicapped individuals is the identification and selection of a communication system that allows the user to transmit and receive messages. Analytical assessment models have been proposed (Nietupski and Hamre-Nietupski, 1979; Sailor et al., 1980), that will assist the teacher/clinician in identifying potentially useful systems for severely handicapped individuals. These assessments do not yield data that allows the teacher/clinician to select the system which the individual can learn to use most efficiently. This imprecision in communication assessment lead to the development of the analytical-empirical assessment model that was described and tested in this study. The findings of this study seem to provide justification for the following recommendations as they pertain to the future direction of communication assessment and research.

1. It is recommended that the decision to instruct a non-verbal severely retarded individual to use a communication system be based on a comparative analysis of the behavioral requirements and characteristics of available alternative systems and the behavioral repetoire of the potential user as well as a performance-based assessment that compares the rate at which the individual learns to communicate with potentially useful systems.

2. It is recommended that further research be conducted to determine whether data yielded from an analytical-empirical assessment model enables teaching personnel to identify a communication system that is of long-term use to a s/p retarded individual.

3. It is recommended that further research be conducted to determine whether there are specific communication systems that have a higher probability of being successful with definable subgroups of the s/p retarded population than others.

4. It is recommended that further research be conducted to determine what effect the relationship between the communicative stimulus and the message expressed has on the acquisition of communicative responses in other subgroups of the s/p retarded population.

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# APPENDIX A

Experimental Condition 1 When the trainer presents an object, four line drawings, a model of the correct response, and the question "What is this?", the subject will point to the line drawing that describes the object presented by the trainer.

Pretest/Posttest Procedures:

1. The trainer and the subject are seated at a desk facing each other.

2. The trainer requires attending behavior.

3. The trainer presents a cookie/drink at the subject's midline. The cookie/drink is positioned 16 inches away from the subject.

4. The trainer presents the four stimulus pictures to the subject. The pictures are positioned 3 inches apart and 8 inches away from the subject. Two of the pictures are presented to the left of midline and two are positioned to the right of midline.

5. The trainer points to the cookie/drink momentarily.

6. The trainer points to the picture of cookie/drink and says "Cookie/Drink".

7. The trainer points to the cookie/drink and says "What is this?".

8. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

   a. Correct Response: The subject points to the picture of cookie/drink within 10 seconds.

      Consequence: The trainer says "Good try.".

   b. Incorrect Response: The subject points to another object or action picture.

      Consequence: The trainer says "Good try.".

c. No Response: The subject does not emit a task-related response within 10 seconds.

Consequence: The trainer proceeds to Step 9 after 10 seconds elapse.

9. The trainer scores the subject's response on the data sheet.

10. The trainer repeats steps 2 through 9 until ten opportunities have been given. The trainer randomly changes the position of the target picture each time a new opportunity is presented.

Experimental Procedures:

Steps 1, 2, 3, 4, 5, 6, 7, 9, and 10--Same as test procedures

8. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

a. Correct Response: The subject points to the picture of cookie/drink within 10 seconds.

Consequence: The trainers says "That's right, it's a cookie/drink, you get to choose something from the cart.". The trainer directs the subject to the cart and allows the subject to choose a desired object.

b. Incorrect Response: The subject touches another object or action picture.

Consequence: The trainer says "No, it's a cookie/drink." and manipulates the subject to touch the target picture.

c. No Response: The subject does not emit a task-related response within 10 seconds.

Consequence: The trainer says "It's a cookie/drink." and manipulates the subject to touch the target picture.

Experimental Condition 2 — When the trainer prompts the subject to engage in an action and presents four line drawings, a model of the correct response, and the question "What are you doing?", the subject will point to the line drawing that describes the action the subject performed.

Pretest/Posttest Procedures:

1. When the target word is stand, the trainer and the subject are seated at a desk facing each other.

   When the target word is sit, the trainer and the subject are standing at a desk facing each other.

2. The trainer requires attending behavior.

3. The trainer presents the four stimulus pictures to the subject. The pictures are positioned 3 inches apart and 8 inches away from the subject. Two of the pictures are presented to the left of midline and two are presented to the right of midline.

4. The trainer points to the picture of sit/stand and says "Sit/Stand". The trainer immediately models the named behavior and manipulates the subject to engage in the named behavior.

5. The trainer says "What are you doing?".

6. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

   a. Correct Response: The subject points to the picture of sit/stand within 10 seconds.

      Consequence: The trainer says "Good try.".

   b. Incorrect Response: The subject points to another object or action picture.

      Consequence: The trainer says "Good try.".

   c. No Response: The subject does not emit a task-related response within 10 seconds.

      Consequence: The trainer proceeds to Step 7 after 10 seconds elapse.

7. The trainer scores the subject's response on the data sheet.

8. The trainer repeats Steps 1 through 7 until ten opportunities have been given. The trainer randomly changes the position of the target picture each time a new opportunity is presented.

Experimental Procedures:

Steps 1, 2, 3, 4, 5, 7, and 8--Same as test procedures

6. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

| | | |
|---|---|---|
| a. | Correct Response: | The subject points to the picture of sit/stand within 10 seconds. |
| | Consequence: | The trainer says "That's right, you are sitting/standing, you get to choose something from the cart." The trainer directs the subject to the cart and allows the subject to choose a desired item. |
| b. | Incorrect Response: | The subject points to another object or action picture. |
| | Consequence: | The trainer says "No, you are sitting/standing." and manipulates the subject to point to the target picture. |
| c. | No Response: | The subject does not emit a task-related response within 10 seconds. |
| | Consequence: | The trainer says "You are sitting/standing." and manipulates the subject to point to the target picture. |

Experimental Condition 3 — When the trainer presents an object, a model of the sign that describes the object, and the question "What is this?", the subject will form the sign that describes the object presented by the trainer.

Pretest/Posttest Procedures:

1. The trainer and the subject are seated at a desk facing each other.

2. The trainer requires attending behavior.

3. The trainer presents a cookie/drink at the subject's midline. The cookie/drink is positioned 16 inches away from the subject.

4. The trainer points to the cookie/drink momentarily.

5. The trainer signs and says "Cookie/Drink".

6. The trainer points to the cookie/drink and says "What is this?".

7. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

   a. Correct Response: The subject forms the sign for cookie/drink within 10 seconds.

      Consequence: The trainer says "Good try.".

   b. Incorrect Response: The subject forms another object or action sign.

      Consequence: The trainer says "Good try.".

   c. No Response: The subject does not emit a task-related response within 10 seconds.

      Consequence: The trainer proceeds to Step 8 after 10 seconds elapse.

8. The trainer scores the subject's response on the data sheet.

9. The trainer repeats Steps 2 through 8 until ten opportunities have been given.

Experimental Procedures:

Steps 1, 2, 3, 4, 5, 6, 8, and 9--Same as test procedures

7. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

a. Correct Response: The subject forms the sign for cookie/drink within 10 seconds.

Consequence: The trainer says "That's right, it's a cookie/drink, you get to choose something from the cart." The trainer directs the subject to the cart and allows the subject to choose a desired item.

b. Incorrect Response: The subject forms another object or action sign.

Consequence: The trainer says "No, it's a cookie/drink." and manipulates the subject to form the target sign.

c. No Response: The subject does not emit a task-related response within 10 seconds.

Consequence: The trainer says "It's a cookie/drink." and manipulates the subject to form the target sign.

Experimental Condition 4 — When the trainer prompts the subject to engage in an action, presents a model of the sign that describes the action, and states the question "What are you doing?", the subject will form the sign that describes the action the subject performed.

Pretest/Posttest Procedures:

1. When the target word is stand, the trainer and the subject are seated at a desk facing each other.

   When the target word is sit, the trainer and the subject are standing at a desk facing each other.

2. The trainer requires attending behavior.

3. The trainer signs and says "Sit/Stand", immediately models the named behavior, and manipulates the subject to engage in the named behavior.

4. The trainer says "What are you doing?".

5. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

   a. Correct Response: The subject forms the sign for sit/stand.

      Consequence: The trainer says "Good try.".

   b. Incorrect Response: The subject forms another object or action sign.

      Consequence: The trainer says "Good try.".

   c. No Response: The subject does not emit a task-related response within 10 seconds.

      Consequence: The trainer proceeds to Step 6 after 10 seconds elapse.

6. The trainer scores the subject's response on the data sheet.

7. The trainer repeats Steps 1 through 6 until ten opportunities have been given.

Experimental Procedures:

Steps 1, 2, 3, 4, 6, and 7--Same as test procedures

5. The trainer waits 10 seconds for a response. The trainer consequences the subject's response as follows:

   a. Correct Response: The subject forms the sign for sit/stand.

      Consequence: The trainer says "That's right, you are sitting/standing, you get to choose something from the cart.". The trainer directs the subject to the cart and allows the subject to choose a desired item.

   b. Incorrect Response: The subject forms another object or action sign.

      Consequence: The trainer says "No, you are sitting/standing." and manipulates the subject to form the target sign.

| | | |
|---|---|---|
| c. | No Response: | The subject does not emit a task-related response within 10 seconds. |
| | Consequence: | The trainer says "You are sitting/standing." and manipulates the subject to form the target sign. |

In an effort to keep the subjects motivated to respond during the pretest and posttest phases of the study, the trainer allowed the subjects to select an object or edible from the cart containing potential reinforcers if the subjects were sitting in their chair during every third inter-trial phase. In between trials 3 and 4, 6 and 7, and 9 and 10, after the data sheet was scored, the trainer looked at the subject to see if the subject was sitting in his/her chair. If the subject was sitting, the trainer delivered verbal praise and directed the subject to choose a desired item from the cart.