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Evoking non-repertory verbal behavior across operant classes : the effects of motor echoic sign language training within the context of a motivating operation

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EVOKING NON-REPERTORY VERBAL BEHAVIOR ACROSS OPERANT CLASSES: THE EFFECTS OF MOTOR ECHOIC SIGN LANGUAGE TRAINING WITHIN THE CONTEXT OF A MOTIVATING OPERATION

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by

Karelix Alicea

2005

To: Interim Dean Mark Szuchman
College of Arts and Sciences

This thesis, written by Karelix Alicea, and entitled Evoking Non-Repertory Verbal Behavior Across Operant Classes: The Effects of Motor Echoic Sign Language Training within the Context of a Motivating Operation, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this thesis and recommend that it be approved.

Wendy Silverman

David Lubin

Jacob L. Gewirtz, Major Professor

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The thesis of Karelix Alicea is approved:

Interim Dean Mark Szuchman
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Florida International University, 2005

DEDICATION

I dedicate this thesis to my parents for having instilled in me the importance of a graduate education. The completion of this work would not have been possible without their endless love and support.

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I wish to thank the wonderful members of my committee, Wendy Silverman and David Lubin, for their support in the completion of this project. I would also like to thank my major professor and mentor, Jacob L. Gewirtz, for his incomparable wisdom and guidance.

ABSTRACT OF THE THESIS

EVOKING NON-REPERTORY VERBAL BEHAVIOR ACROSS OPERANT CLASSES: THE EFFECTS OF MOTOR ECHOIC SIGN LANGUAGE TRAINING WITHIN THE CONTEXT OF A MOTIVATING OPERATION

by

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Professor Jacob L. Gewirtz, Major Professor

The individual effects that echoic, mand, and sign language training procedures have on the acquisition of verbal behavior have been widely demonstrated, but more efficient treatment strategies are still needed. This study combined all three treatment strategies into one treatment intervention in order to investigate the joint effects they may have on verbal behavior. Six participants took part in the study. Intervention totaled 1 hour/day for 5 days/week until mastery criterion for motor echoic behavior was achieved. Although motor echoic behavior were solely targeted for acquisition, significant increases in spontaneous motor mands were noted in all treatment participants. Additionally, 4 treatment participants also demonstrated significant gains in vocal echoics and spontaneous vocal mands. No significant increases were noted for the control participant. Results suggest that the aforementioned procedure may provide more efficient results as a first-step to teaching a functional repertoire of verbal behavior to developmentally delayed children.

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Evoking Non-Repertory Verbal Behavior Across Operant Classes: The Effects of Motor Echoic Sign Language Training within the Context of a Motivating Operation

The prevalence of autism and other forms of pervasive developmental disorders (PDDs) has been steadily rising, creating a sense of urgency to improve upon the treatment strategies that are routinely employed to treat this population. There are three areas of development that may be impaired in a child who has been diagnosed with a form of PDD: social interaction, repetitive and stereotyped motor mannerisms, and language/communication. Nearly half of all children diagnosed with autism do not exhibit functional speech and require intensive behavioral interventions to acquire an effective system of communication (Williams & Greer, 1993). The vocalization rates of these children are so low as to contribute minimally to the acquisition of the muscle control required for the training of vocal echoic responses (i.e., vocal imitation) (Sundberg & Michael, 2001). Because linguists emphasize that the prime age range for language acquisition to take place is under 5 (e.g., James, 1990), and because professional interventions for children with developmental delays are usually sought between the ages of 2 and 3, finding time-efficient behavioral treatments for language acquisition is crucial. Many of the strategies and techniques currently employed in applied behavior analysis are inefficient with respect to the amount of time required for a vocal repertoire to be acquired. In exploring new options that may lead to more efficient treatment strategies, the present study is the first to combine motor echoic (physical imitation), sign language, and mand (demand) training to determine their combined effects on the acquisition of a vocal echoic repertoire. The present study also explored the effects that motor echoic training of manual signs had on behaviors other than vocal echoics, specifically spontaneous mands in the vocal and motor form.

Traditional language acquisition programs for developmentally delayed children have focused on targeting a child's repertoire of receptive and expressive-language skills under the assumption that once equipped with the meaning of words, the child will learn to use them in various ways without the need for further training. However, unlike typically developing children, many children who are developmentally delayed lack a functional language repertoire despite such intensive language training. (Sundberg & Michael, 2001). In his 1957 publication entitled *Verbal Behavior*, B.F. Skinner proposed a functional account of language, that he termed verbal behavior, which was influenced by the same operant conditioning principles that guided all other operant behaviors. Operant behavior is any behavior whose probability of occurrence is determined by the history of its consequences (Skinner, 1957).

Departing from the traditional linguistic model, Skinner identified seven verbal operants, two of which are of direct interest to this study: the echoic and the mand. The echoic is a verbal operant whose response form is controlled by a preceding verbal stimulus. Two critical characteristics of an echoic are the point-to-point correspondence between the preceding stimulus and the response, along with the proximal temporal relation between the two. For example, a mother says "mama" and a baby repeats "mama". A mand, on the other hand, is a type of verbal behavior whose response form is controlled by a Motivating Operation (MO) or Establishing Operation (EO), two terms which may be used interchangeably for the purposes of the present study. An EO is an environmental event that momentarily alters (by either increasing or decreasing) the effectiveness of a consequential stimulus to function as a reinforcer, thereby altering the likelihood of occurrence of the type of behavior that is typically a consequence of those events (Gewirtz, 1971; Bijou, 1995). A MO is a term that refers to a type of EO that specifically serves to increases the effectiveness of a consequential stimulus to function as a reinforcer. Common examples of such EOs/MOs are deprivation (a reduction in the availability of a reinforcer that increases its effectiveness), satiation (continued availability of a reinforcer that reduces its effectiveness), and aversive stimulation (a consequential stimulus effective as either a negative reinforcer or a positive punisher). A negative reinforcer is defined as a stimulus whose removal increases the responding that precedes it, while a punisher is defined as a stimulus that reduces the likelihood of responses that produce it (Catania, 1998). Unlike the other verbal operants that are reinforced nonspecifically through social interaction, a mand has an immediate benefit so far as it specifies its own reinforcer (Sundberg & Michael, 2001). For example, the mand response "I want a cookie" is reinforced upon the speaker's receipt of a cookie, while the mand response "I want juice" is reinforced upon the speaker's receipt of juice. Although mands may be emitted for missing items, for information, and to remove aversive stimuli, the present study solely focused on those emitted with the function of gaining socially mediated positive reinforcement, as noted in the aforementioned examples.

In realizing the need for new and improved treatment interventions that capitalize on Skinner's account of verbal behavior and its operants, an important first step is to review the literature pertaining to the treatment strategies that are routinely employed. The individualized contributions and weaknesses in building a verbal repertoire for the non-verbal child with developmental delays will be discussed for each of the treatment strategies.

Motor Echoic Training

Motor echoic training involves attempting to teach a child to provide a matching response (i.e., imitate), to a series of motor movements so that there is 1:1 correspondence between the behavior of the trainer and the child. Because typically developing children acquire many skills through the direct observation and imitation of another's actions (vicarious learning), building a motor echoic repertoire in a developmentally disabled child enables them to learn how to learn. Several research studies to date have investigated whether or not motor echoic behavior generalizes to vocal echoic behavior when only the former is targeted for acquisition (Garcia, Baer, &Firestone, 1971; Young, Krantz, McClannahan & Poulson, 1994). The motor echoic behaviors that are usually targeted either involve actions to be carried out with objects (e.g., banging a hammer, brushing hair, pushing a car) or gross and fine motor actions (e.g., raising hand, jumping, clapping). Although most studies to date have concluded there to be a lack of generalization between the topographical responses, significant improvements have been made when motor echoic responses (e.g., pushing a car) are systematically shaped into echoic responses that are simultaneously motor and vocal (e.g., pushing a car and saying "beep beep"). The downfall of this procedure is that systematic shaping is very labor intensive, must be carried out by a trained professional, skill acquisition can sometimes take several months, and the procedure ultimately fails to lead to a functional repertoire of verbal behaviors. Although sign language has been successfully taught to mentally handicapped individuals, to children diagnosed with autism, and to chimpanzees and gorillas, this specific motor topography is rarely employed in behavioral programming. The present study is the first in the behavioral literature to employ manual signs as the target motor echoic topography.

Vocal Echoic Training

Conventional approaches to targeting vocal echoic repertoires involve attempting to teach vocal imitation to children who cannot speak or imitate. Procedures usually consist of gradually shaping, or reinforcing successive approximations of vocal behavior from the production of any sound, to vowel sounds, to consonant-vowel combinations and so on, until a child can reliably emit words and phrases in imitation. This procedure is both time consuming and labor intensive, and non-verbal children can sometimes take several months just to get through the first step of the shaping process. Since the word imitated does not have direct correspondence with the reinforcer supplied (as it would in mand training) or any surrounding visual stimuli (as it would in tact training), the intervention fails to incorporate any defining environmental variables relevant to basic language function. A tact is another verbal operant defined by Skinner (1957) that constitutes a form of verbal behavior that is under the control of the non-verbal environment and that is reinforced with either generalized (e.g., saying "good job", smiling) or tangible reinforcers (e.g., providing access to a preferred toy).

Like motor echoic training, vocal echoic training lacks the ability to provide the learner with a functional repertoire of verbal behavior. This approach to teaching speech is based on the assumption that verbal behavior is acquired by imitating a model (Drash, High, & Tudor, 1999). Interestingly, when a functional analysis of language acquisition has been performed, results indicate that the mand is typically the first verbal operant to be learned (Skinner, 1957), and not the echoic as was once believed. As a result of such recent research findings, mand training is being emphasized as the ideal starting point for teaching language to non-verbal children.

Mand Training

Because mands specify a reinforcer, mand training procedures create therapeutic environments that are conducive to language acquisition (Drash, High & Tudor, 1999). Stafford, Sundberg and Braam (1988) found that mand reinforcement produced verbal behavior that was used more frequently and consistently than did non-mand reinforcement. Despite the clear advantages of using mand training over other treatment methods as a first-step to building a functional communicative repertoire in non-verbal children, conventional mand training procedures often have relinquished the fact that EOs play a critical role in the acquisition of this verbal operant. Although mands should ideally be targeted for acquisition within the context of an EO, trainers are instead known to erroneously incorporate the use of a discriminative stimulus (S^D) into the training trials. An S^D is a stimulus that signals the possibility that reinforcement could occur as a consequence to a target a response. For instance, a typical three-term contingency for conventional mand training often involves the antecedent presentation of an S^D (e.g., trainer asks "What do you want?" while holding up a cookie), a target response (e.g., child says "cookie"), and a consequential reinforcing stimulus (e.g., trainer presents a cookie to the child immediately following emission of the target response). Because the mand is specifically trained in the presence of the desired item and is preceded by an S^D, the child's tendency to make the same response in the absence of the item or the specific S^D is unlikely. It is therefore ideal for pure mands to be trained strictly under the control of an EO so that the response is free from stimulus control (Sundberg & Michael, 2001).

Augmentative and Alternative Communication

Because there is a readily available and large vocal community that can reinforce vocal behavior without special training, speech is the universally-desired method of communication. It is of major concern, however, that many children with developmental delays fail to acquire speech and require an additional focus on augmentative communication (Sundberg, 1993). Selecting a response form for a language-intervention program is a critical element of treatment designs for children who have trouble acquiring vocal language. Rather than basing a decision on empirical evidence in support of one system over another or on the individual child's abilities, response forms are frequently assigned based on a trainer's or a parent's personal preference (Sundberg, 1993). Learning to write, to use pointing systems and augmentative communication devices, to use the picture exchange communication system (PECS), or learning sign language are other communicative options for children who have trouble acquiring speech.

Sign Language vs. Speech

It is simpler to teach an individual to imitate a motor movement than to imitate a vocal sound due to physical prompting, shaping, and fading procedures that are almost impossible to implement with parts of the vocal system (Sundberg, 1993). Prompting is defined as presenting a stimulus that makes a response very likely to occur. In shaping, the gradual development of a new behavior is encouraged by repeatedly reinforcing minor improvements or steps toward that behavior. Fading involves the gradual removal of a prompt in order for independent responses to be emitted.

In addition to the fact that it is easier to teach, sign-language training has consistently been shown to improve sign usage along with vocal speech production. A study conducted by Kahn (1981) compared groups of developmentally-delayed children who received either sign-language training or speech training. The study produced results that were clearly favorable to training sign language. All four subjects in Kahn's sign-language group learned to sign, and some children even used combinations of signs to make multi-sign phrases. In comparison, only two of the children in his speech-training condition learned to say words, with only one child learning to combine words into phrases. Additionally, two of the four children in the sign-language group were noted to emit vocalizations concurrently or in place of signs. This automatic transfer between motor and vocal responses is an indication that sign language does not hinder vocal speech development as was once believed. On the contrary, research suggests that when signs are presented in a total communication format (using sign and speech combined), the acquisition of vocal behavior is likely to accelerate (Kahn, 1981). Developmentally-delayed children who undergo sign-language training in comparison to speech training have also been known to retain their communication skills for longer periods (Gaines, Leaper, Monahan & Weickgenant, 1988).

Topography-Based vs. Selection-Based Verbal Behavior

In topography-based verbal behaviors, the response form varies across verbal relations and the topography (what the behavior looks like) is observably different for each controlling variable. For example, the manual sign for "cookie" is different than the manual sign for "milk". In contrast, the response topography for selection-based verbal behavior remains the same across verbal relations and what varies instead is the stimulus selected. For instance, the behavior of pointing is the fixed topography, but what the individual points to (a picture of a cookie vs. a picture of a sandwich) is what changes across responses. Recent research has reliably concluded that topography-based methods of communication have more advantages over selection-based communicative systems (Sundberg, 1993).

Total communication procedures that simultaneously target sign language and vocal speech fall under the category of a topography-based communication system. This procedure has been used to successfully target spoken language development in children with autism since the 1970s (Fulwiler & Fouts, 1976; Salvin, Routh, Foster & Lovejoy, 1977). It is also well documented that the use of signs with this population of children has been successful in producing vocal speech when other selection-based communication systems had previously failed (Bonvillian & Nelson, 1976; Carr, 1979; Yoder & Layton, 1988). As detected by PET scans, sign language and speech are known to stimulate the same area of the brain. Thus, when the total communication method of training is employed, the area of the brain involved in speech production receives stimulation from two sources (signing and speaking) rather than stimulation from one source alone (signing or speaking) (Poizner, Klima & Bellugi, 1988). Data have also shown that when there exists a consistent and reinforcing verbal community, the development of sign language and speech parallel each other. Deaf children born to deaf parents who sign acquire similar verbal behavior as do hearing children born to speaking parents (Vernon & Koh, 1970). It has also been found that hearing children born to deaf parents communicate using phrases made up to two manual signs or more beginning at around 12-14 months of age. This is much earlier than most typically developing children can vocally emit 2-word phrases. Furthermore, it has been found that hearing children who are exposed to speech and sign language simultaneously will sign before they speak (Armstrong, Stokoe, & Wilcox, 1995).

One of the many advantages of sign language in comparison to other forms of alternative communication is that it is conceptually similar to speech and constitutes topography-based verbal behavior that has point-to-point correspondence with its response product. Additionally, sign language is free from environmental support. Selection-based verbal behavior, on the other hand, constitutes a response form that remains constant across controlling variables and requires the additional use of specialized mediums in order to communicate (e.g., specialized devices, computers, picture symbols) (Sundberg, 1993). While other forms of alternative communication require multiple behaviors in sequence (e.g., accessing the augmentative device, visually scanning, pointing), sign language involves only a single response and a single discrimination. Although individual responses must be shaped by a listener who has special training in sign language, a learner may already possess a strong echoic repertoire of behaviors that will facilitate skill acquisition. Additionally, manual signs are often iconic in nature, meaning that there exists a resemblance between the stimulus and the response. This may in itself provide a built-in prompt for the learner (Sundberg, 1993).

In comparison to all other forms of augmentative and alternative communication, only sign language has been proven consistently to improve speech. As best described by Sundberg (1993, p. 112), "If signs begin to evoke vocalizations, then signs can be used as a new type of prompt to evoke these vocalizations. This type of prompting may be more effective than typical echoic prompts which provide the response form, making it harder to transfer control to other types of verbal behavior." A child may also use signs to prompt his own vocalizations. That is, if a non-verbal stimulus can evoke a sign, and the child is able to emit a vocalization under the control of a sign, then vocalizations can be self-prompted (Sundberg, 1993).

Significance of the Present Study

The problem to be examined involves the difficulty in establishing verbal repertoires in developmentally-delayed nonverbal children, and the behavioral strategies and techniques currently employed by professionals to remedy this deficiency. The significant effects that echoic training, mand training, and sign language training procedures have on the acquisition of verbal behavior have been widely demonstrated when they are employed individually. It still remains, however, that each procedure does not work for every child and that more time efficient treatment strategies are still needed. For this reason, the goal of the present study was to combine all three treatment strategies (motor-echoic training, sign-language training, and mand training) into one treatment intervention in order to investigate the joint effects they might have on the acquisition of verbal behavior. Within the context of an EO, manual signs were trained with motor-echoic procedures. The primary purpose of this study was to determine the effects of the treatment intervention on the acquisition of vocal-echoic behaviors. A secondary purpose of this study was to determine the extent to which the same treatment allowed for increases in behaviors across additional response topographies and operant classes, specifically spontaneous motor mands, and spontaneous vocal mands.

Methodology

Participants

Six participants took part in the present study, 5 of whom received treatment and 1 of whom served as a control. All participants were non-verbal children between the ages of 2 and 3 with severe developmental delays. All children were recruited to participate in the present study based on the deficiency of their existing verbal repertoires and overall lack of skills across the following developmental areas: 1) lack of an established vocal echoic repertoire (inability to vocally imitate the sounds of another person), 2) lack of an established motor echoic repertoire (inability to physically imitate the actions of another person), and 3) lack of an established mand repertoire (inability to request desired items or activities). In addition, children were only considered for inclusion if they did not have severe impairments in fine motor functioning. Such a deficit was considered to possibly induce a scientific confound that may inhibit the acquisition of manual signs in comparison to participating children without significant fine motor delays.

Setting

All intervention visits took place in the child's home in the presence of the mother who was the caretaker of each participant. This served the advantage of having the children acquire skills within the immediate environment in which the EOs for mand responses occur most often without the need to target the skill for generalization. Also, the primary caretaker was present during all training sessions led by the investigator and was the primary trainer 3 days out of the week in the absence of the investigator, the children were directly taught to respond to the individuals within their natural environment. In contrast to other studies, a pre-existing repertoire of echoic behaviors was not necessary because all signs were independently shaped. It is also important to note that this intensive behavioral intervention was the first for all children involved in this study. No prior training in eye contact, instructional control, motor echoic behaviors, or behavior management had been targeted before. Any occurrences of maladaptive behaviors that are often associated with the commencement of an intensive treatment program were managed as they were exhibited. This is contrary to many other studies that have attempted similar goals with children, 1) whose behaviors had already come under the instructional control of the trainer, and/or 2) who were required to meet criteria for inclusion in the study, such as mastered eye contact, sitting, following instructions, and general motor echoic training, and/or 3) whose maladaptive behavior patterns had been extinguished prior to the commencement of the study (Tsiouri & Greer, 2003; Ross & Greer, 2003).

Research Design

An AB design was used for each treatment participant. The AB design is comprised of a baseline condition (A) and treatment condition (B), in which the effects of the independent treatment variable (motor-echoic sign-language training) was observed. Each participant served as his own control across conditions. To strengthen experimental control further, a cross-subject cross-treatment element was included in which the independent variable was introduced at different times to the different participants receiving treatments. Finally, control participant 6 remained in the baseline condition throughout the entire course of the study, thereby serving as an additional control for all treatment participants. The result is a non-standard, non-concurrent multiple baseline design in which 1-3 participants were serving as controls for other participants during all or some period of the study.

Procedures and Measures

Baseline and Control Procedures and Measures. Procedures and measures pertaining to the baseline condition (A) for all treatment participants were identical to the procedures and measures that the control participant was exposed to throughout the length of the study. In order to comply with routine ethical guidelines, control participant 6 will be exposed to treatment protocols upon the termination of the study.

The study began by completing a survey of each participant's three most preferred items and activities and assigning manual signs for each. There are three formational aspects of a manual sign that distinguish any one from another. The first is the location of a sign, or where on the body the sign is made. The second is the hand-shape, or the configuration, of the hands. The last is movement, or the action of the hands in forming the sign. A study on the motor functioning of children with autism who use sign language as their main form of communication found that the location aspect of a sign was consistently produced more accurately than either movement or hand-shape (Seal & Bonvillian, 1997). Taking the results of this study into consideration, the manual signs that were assigned to the preferred items and activities were often modified or simplified versions of real signs in American Sign Language (ASL).

Baseline measures were taken for each participant until data was stable across three visits. Baseline procedures consisted of initially exposing the subject to a period of deprivation from the three preferred items / activities. Deprivation has been defined as a reduction in the availability of a reinforcer in order to increase its effectiveness. Items were put away at the end of each visit, only to be made newly accessible during subsequent visits. At the beginning of each baseline visit, all preferred items were made visible but inaccessible to the child. Trials did not begin until the child was observed to display behaviors characteristic of the effects of an EO (e.g., looking, reaching, or pointing at any one item). If no such behaviors were exhibited independently, the investigator would hold two different preferred items up at a time within close proximity of the child for a period of 5 seconds, in the absence of any verbal stimuli, in order to evoke looking, reaching, and pointing behaviors. In commencement of the learning trial, the S^D "Do this" was presented followed by the total communication format of simultaneously signing and naming the preferred item. The children were given 5 seconds following the presentation of the S^D to respond. No prompting or shaping of the matching motor response was provided. After the 5-second period, the children received access to the desired item regardless of their response.

Data were collected for four different verbal operants: 1) vocal echoics (vocal imitation of the name of a preferred item or activity), 2) motor echoics (physical imitation of the manual sign representing a preferred item or activity), 3) spontaneous vocal mands (spontaneous vocalization in request of a preferred item or activity, and 4) spontaneous motor mands (spontaneous physical request of a preferred item or activity in the form of a manual sign). Spontaneous responses were defined as responses that occurred in the absence of the S^D and total communication format. Vocal echoic behaviors were measured on whether the child a) provided either a close approximation or an exact match of the target behavior within 5 seconds of the S^D, b) provided a sound other than the target behavior, or after 5 seconds following the S^D, or c) did not produce a vocalization following the S^D. Motor echoic responses were measured on whether the child a) exhibited either a close approximation or an exact match of the manual sign within 5 seconds of the S^D, b) provided a manual sign other than the target manual sign, or after 5 seconds following the S^D, or c) did not produce any manual sign following the S^D. Data for echoic behaviors was plotted according to percentage of accuracy. Both motor and vocal spontaneous mand responses were measured in terms of the frequency count exhibited by the child within each 1-hour visit. Only close word approximations (e.g., "coo-coo" for cookie) or exact target responses (e.g., "cookie" for cookie) were considered in the data collection for the frequency measure.

<u>Treatment Procedures and Measures.</u> Upon the completion of three consistent baseline measures, motor echoic training of manual signs began for two 1-hour visits per week by the investigator and three additional 1-hour training sessions by the parent in the absence of the investigator. Treatment intervention totaled 1 hour per day for 5 days per week until mastery criterion was achieved. Mastery criterion was defined as three consecutive treatment visits with a percentage of accuracy of 85% or higher.

Treatment procedures were identical to baseline procedures except for one major factor. After the presentation of the S^D, the participants were provided with immediate hand-over-hand physical assistance in providing a matching motor response, followed by immediate access to the desired item. Motor and vocal echoic responses were measured simultaneously within the 5-second period of time following the presentation of the S^D. For example, if a child produced the manual sign for TV in imitation of the investigator, but remained quiet while doing so, the motor echoic behavior (signing TV) was scored as a successful trial, while the vocal echoic behavior (saying "TV") was scored as an unsuccessful trial. Reinforcement (turning on the TV) would be presented immediately following the child's manual sign.

Prompting procedures were carried out in the most-to-least manner so that the investigator and parent gradually faded away the level of physical guidance required to complete the matching motor response. New preferred items and manual signs were systematically added to the target behavior list in the case that behaviors indicative of an EO for already established preferred items were not observed during a visit. Data were recorded on the same four verbal operants and in the same manner as was carried out during baseline visitations. Data were only recorded on the training sessions in which the investigator was present. Although data were being collected on four different categories of verbal operants, the only category that was directly targeted for skill acquisition was motor echoics. No other responses received prompting, shaping, or reinforcement. Whenever spontaneous mands were exhibited by the children, a motor echoic trial was commenced on the requested item or activity and echoic responses were directly reinforced instead. No direct measures of inter-observer reliability were taken in order to strictly focus on the consistency of behaviors within and across the individual participants.

Results

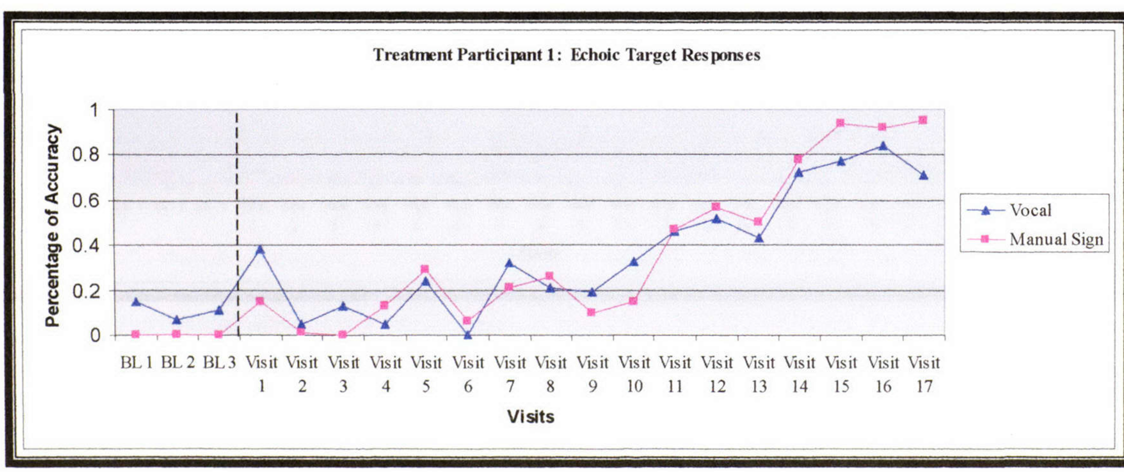
Echoic Responses

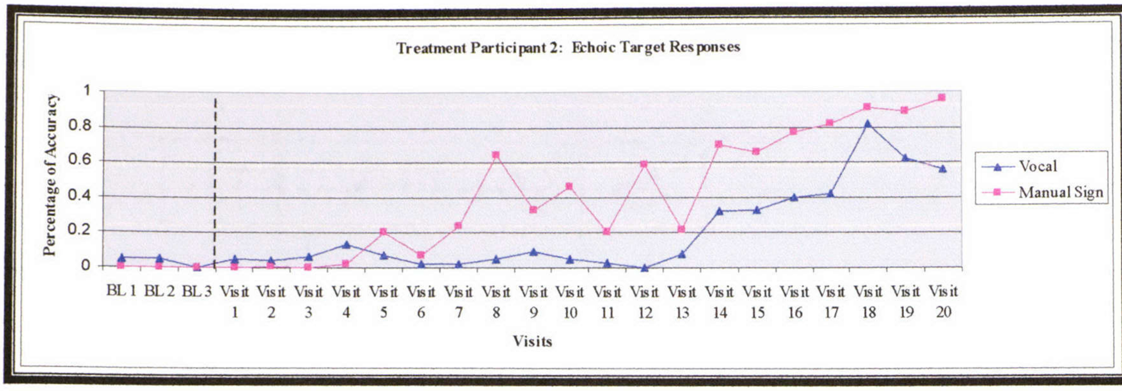
Data collection for echoic responses was divided into two separate response topographies: 1) motor echoic (manual signs), and 2) vocal echoic (spoken word or word approximation).

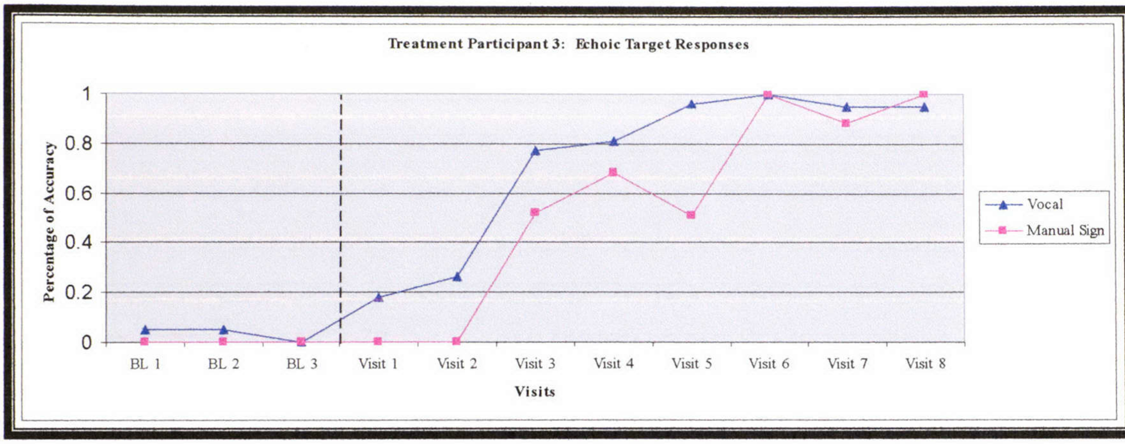
Motor Echoic Responses. All treatment participants demonstrated significant increases in motor echoic responding. Treatment participant 1 averaged 0% accuracy during baseline measures, and increased to 94% accuracy during the last 3 days of treatment. Mastery criterion was achieved in 17 treatment visits. Treatment participant 2 averaged 0% accuracy during baseline measures, and increased to 92% accuracy during the last 3 days of treatment. Mastery criterion was achieved in 20 treatment visits. Treatment participant 3 averaged 0% accuracy during baseline measures, and increased to 96% accuracy during the last 3 days of treatment. Mastery criterion was achieved in 8 treatment visits. Treatment participant 4 averaged 3% accuracy during baseline measures, and increased to 88% accuracy during the last 3 days of treatment. Mastery criterion was achieved in 18 treatment visits. Treatment participant 5 averaged 18%

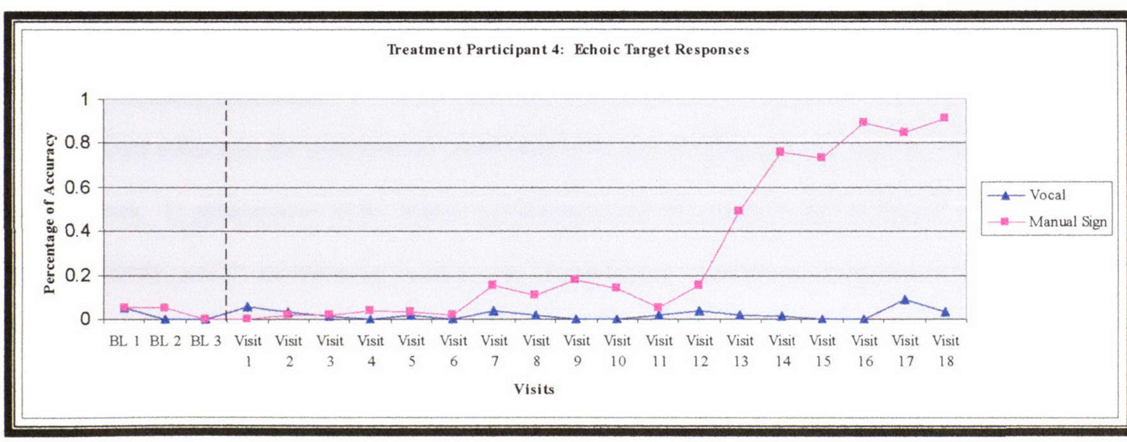
accuracy during baseline measures, and increased to 92% during the last 3 days of treatment. Mastery criterion was achieved in 12 treatment visits. Control participant 6 averaged 0% accuracy during the first three baseline measures, and showed an insignificant increase to 1% accuracy during the last three baseline visits. Mastery criterion was not achieved in the 18 total number of baseline visits.

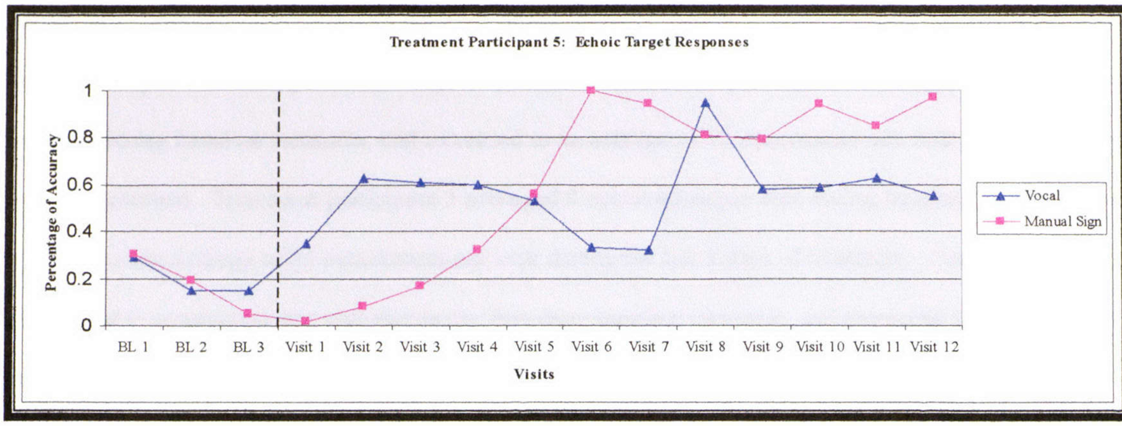
Vocal Echoic Responses. Vocal echoic responses showed significant improvement in 4 out of the 5 treatment participants, despite the fact that they were never targeted for skill acquisition. No significant gains were noted in the control participant. Treatment participant 1 averaged 11% accuracy during baseline measures, and increased to 77% accuracy during the last 3 days of treatment. Treatment participant 2 averaged 3% accuracy during baseline measures, and increased to 67% accuracy during the last 3 days of treatment. Treatment participant 3 averaged 3% accuracy during baseline measures, and increased to 97% accuracy during the last 3 days of treatment. Treatment participant 4 averaged 2% accuracy during baseline measures, and increased to 4% accuracy during the last 3 days of treatment. Treatment participant 5 averaged 20% accuracy during baseline measures, and increased to 59% accuracy during the last 3 days of treatment. Control participant 6 averaged 1% accuracy during the first three baseline measures, and showed an insignificant increase to 4% accuracy during the last three baseline visits. Graphical displays of treatment gains for all participants are displayed below:

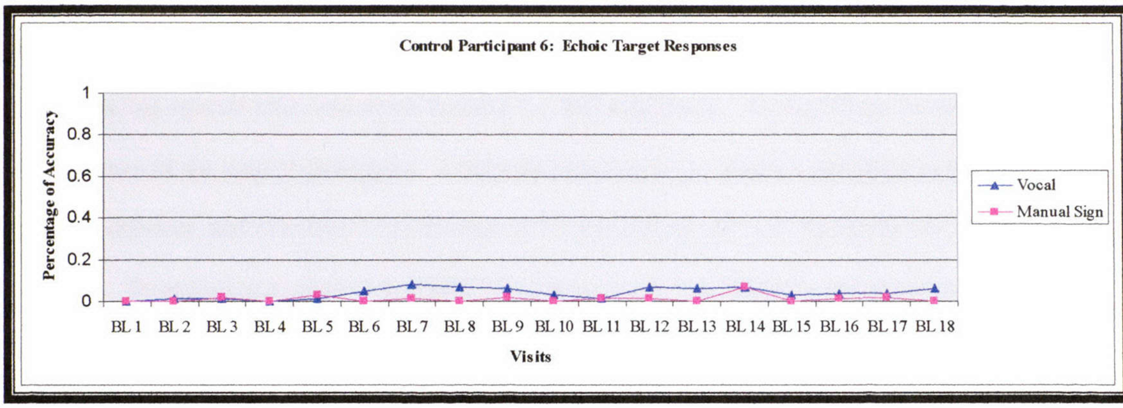



Treatment Participant 2: Echoic Target Responses
Percentage of Accuracy
1
0.8
0.6
0.4
0.2
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8 Visit 9 Visit 10 Visit 11 Visit 12 Visit 13 Visit 14 Visit 15 Visit 16 Visit 17 Visit 18 Visit 19 Visit 20
Visits
Vocal
Manual Sign


Treatment Participant 3: Echoic Target Responses
Percentage of Accuracy
1
0.8
0.6
0.4
0.2
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8
Visits
Vocal
Manual Sign


Treatment Participant 4: Echoic Target Responses
Percentage of Accuracy
1
0.8
0.6
0.4
0.2
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8 Visit 9 Visit 10 Visit 11 Visit 12 Visit 13 Visit 14 Visit 15 Visit 16 Visit 17 Visit 18
Visits
Vocal
Manual Sign



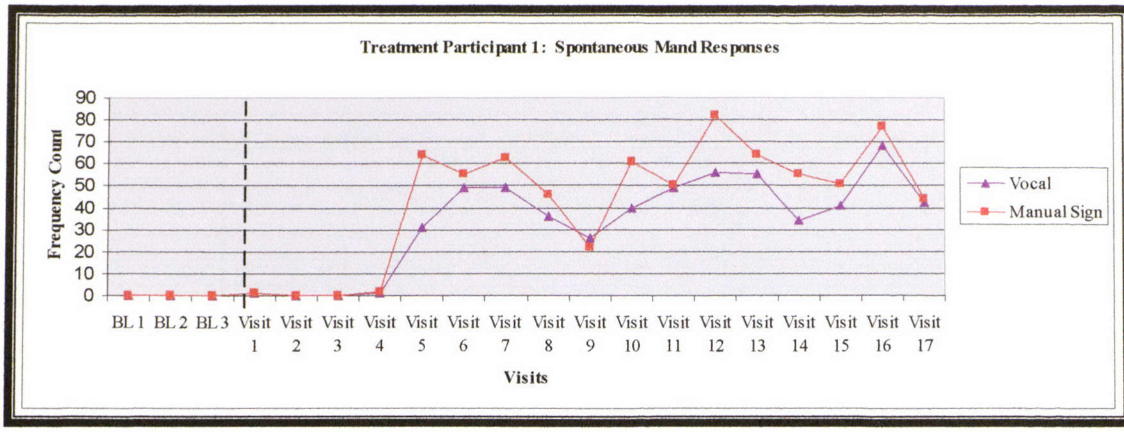


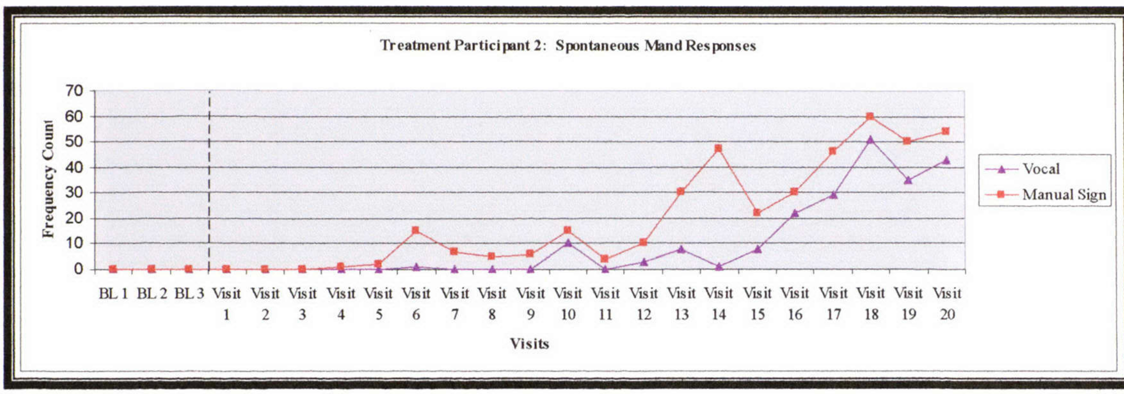
Spontaneous Mand Responses

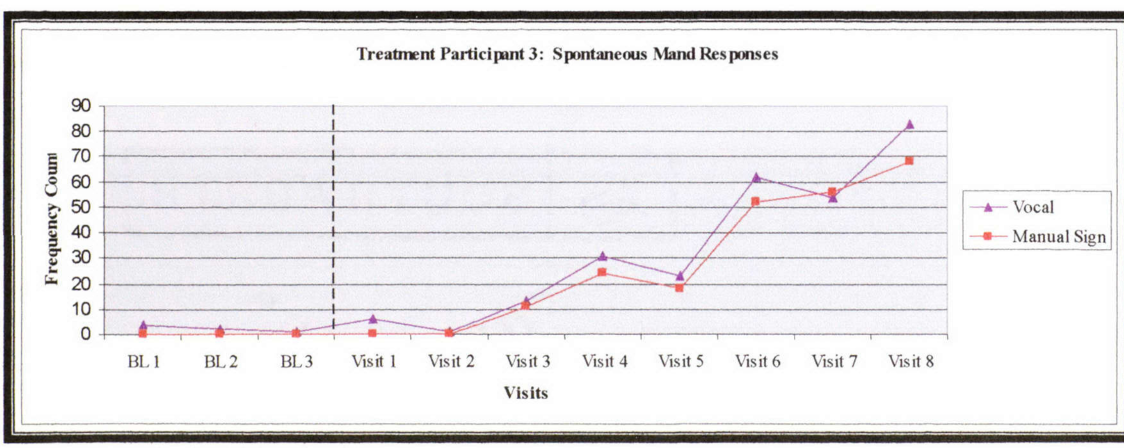
Data collection for spontaneous mand responses was divided into two separate response topographies: 1) spontaneous motor mands (spontaneous use of a manual sign in request of a preferred item or activity) and 2) spontaneous vocal mands (spontaneous vocalization in request of a preferred item or activity). It is important to restate that spontaneous mand responses were never targeted for skill acquisition in that responses were neither prompted, nor shaped, nor reinforced during the treatment phase.

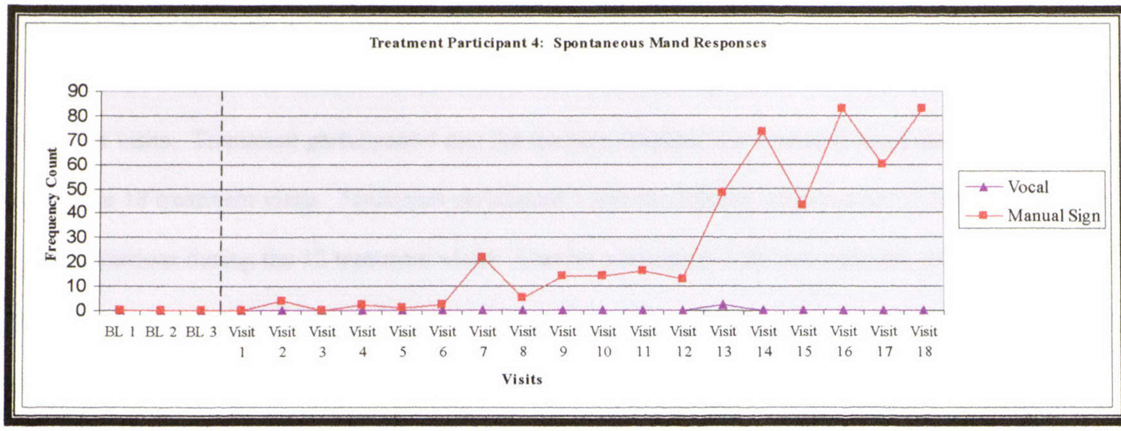
Spontaneous Motor Mand Responses. All treatment participants demonstrated significant increases in the spontaneous use of mands in the form of manual signs. No significant increases were noted in the responses of the control participant. Treatment participant 1 averaged 0 occurrences per visit during baseline measures, and increased to an average of 57 occurrences per visit during the last 3 days of treatment. Treatment participant 2 averaged 0 occurrences per visit during baseline measures, and increased to an average of 55 occurrences per visit during the last 3 days of treatment. Treatment participant 3 averaged 0 occurrences per visit during baseline measures, and increased to an average of 59 occurrences per visit during the last 3 days of treatment. Treatment participant 4 averaged 0 occurrences per visit during baseline measures, and increased to an average of 75 occurrences per visit during the last 3 days of treatment. Treatment participant 5 averaged 0 occurrences per visit during baseline measures, and increased to an average of 54 occurrences per visit during the last 3 days of treatment. Control participant 6 averaged 0 occurrences per visit during the first three baseline measures, and increased to an average of 3 occurrences per visit during the last three baseline measures.

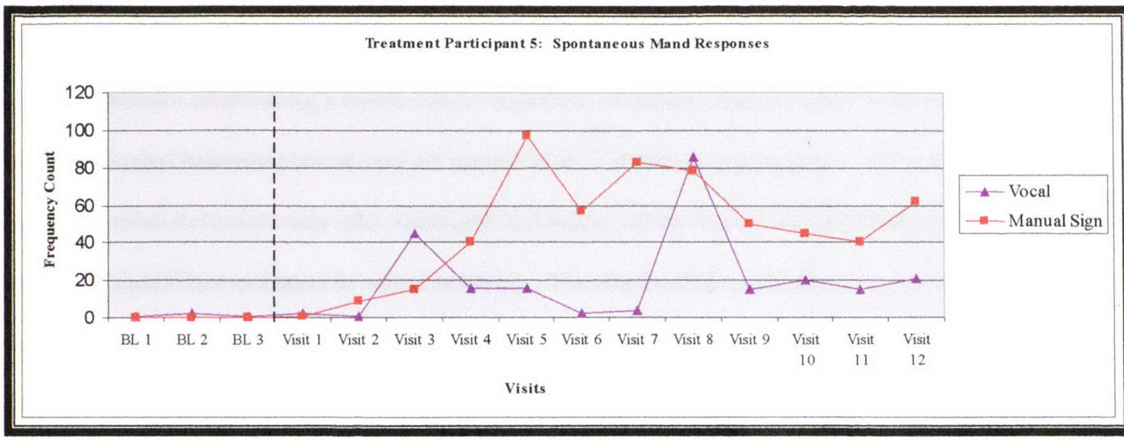
Spontaneous Vocal Mand Responses. Spontaneous vocal mands in the form of single word or word approximations showed significant improvement in 4 of the 5 treatment participants, despite the fact that this verbal operant class was never targeted for skill acquisition. No significant increase was noted in the responses of the control participant. Treatment participant 1 averaged 0 occurrences per visit during baseline measures, and increased to an average of 50 occurrences per visit during the last 3 days of treatment. Treatment participant 2 averaged 0 occurrences per visit during baseline measures, and increased to an average of 43 occurrences per visit during the last 3 days of treatment. Treatment participant 3 averaged 2 occurrences per visit during baseline measures, and increased to an average of 66 occurrences per visit during the last 3 days of treatment. Treatment participant 4 averaged 0 occurrences per visit during baseline measures, and remained at that same average number of occurrences per visit during the last 3 days of treatment. Treatment participant 5 averaged 1 occurrence per visit during baseline measures, and increased to an average of 35 occurrences per visit during the last 3 days of treatment. Control participant 6 averaged 0 occurrences per visit during the first three baseline measures, and increased to an average of 3 occurrences per visit during the last 3 days of baseline measure. Graphical displays of treatment gains for all participants are displayed below:

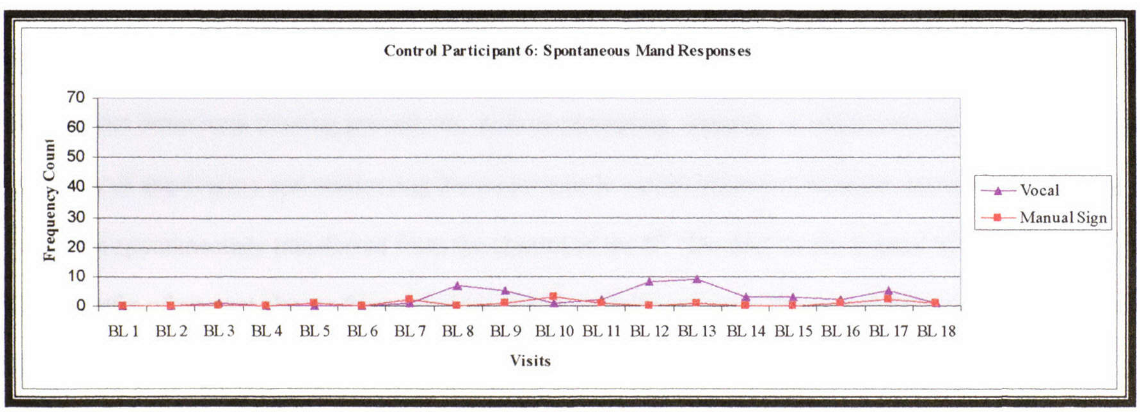

Treatment Participant 1: Spontaneous Mand Responses
Frequency Count
90
80
70
60
50
40
30
20
10
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8 Visit 9 Visit 10 Visit 11 Visit 12 Visit 13 Visit 14 Visit 15 Visit 16 Visit 17
Visits
Vocal
Manual Sign


Treatment Participant 2: Spontaneous Mand Responses
Frequency Count
70
60
50
40
30
20
10
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8 Visit 9 Visit 10 Visit 11 Visit 12 Visit 13 Visit 14 Visit 15 Visit 16 Visit 17 Visit 18 Visit 19 Visit 20
Visits
Vocal
Manual Sign


Treatment Participant 3: Spontaneous Mand Responses
Frequency Count
90
80
70
60
50
40
30
20
10
0
BL 1 BL 2 BL 3 Visit 1 Visit 2 Visit 3 Visit 4 Visit 5 Visit 6 Visit 7 Visit 8
Visits
Vocal
Manual Sign







Mastered Signs and Vocalizations

The criterion for having mastered a manual sign included motor echoic accuracy of 85% or better for three consecutive visits, in addition to the spontaneous use of that sign for two consecutive visits. The same mastery criterion was applied to target vocalizations. Treatment participant 1 met the mastery criterion for 14 manual signs and 12 vocalizations during the 17 treatment visits. Treatment participant 2 met the mastery criterion for 12 manual signs and 12 vocalizations during the 20 treatment visits. Treatment participant 3 met the mastery criterion for 12 manual signs and 17 vocalizations during the 8 treatment visits. Treatment participant 4 met the mastery criterion for 4 manual signs and 0 vocalizations during the 18 treatment visits. Treatment participant 5 met the mastery criterion for 11 manual signs and 10 vocalizations during the 12 treatment visits. Control participant 6 did not meet the mastery criterion for any manual signs or vocalizations during the 18 baseline visits. A complete listing of the mastered manual signs and vocal approximations has been provided for each participant in Tables 1-6 of the Appendix.

Discussion

Research Questions

Initially establishing a motor echoic repertoire of manual signs resulted in the increase of non-repertory verbal behaviors across operant classes in all 5 treatment participants. All treatment participants acquired verbal behaviors only after treatment had begun, while the control participant failed to master or show any significant increases in verbal behavior. The results of the present study clearly indicate that treatment gains can be directly attributed to the treatment intervention, ruling out the possibility that maturation or any other extraneous variable was responsible for the noted increases in responding.

Perhaps the most significant aspect of these results is that many of the responses (vocal echoics, spontaneous motor mands, and spontaneous vocal mands) were acquired without the direct implementation of any strict behavioral training procedures, such as prompting, shaping, or reinforcement. By creating a condition of deprivation and reinforcing the motor echoic verbal behaviors with the desired items, responses spontaneously transferred from the control of the S^D "Do this" to the control of the EO itself. This transfer of operant classes from echoic to mand operants increases the probability not only that the child will imitate during subsequent echoic trials, but also that the child will produce the manual sign spontaneously in the presence of similar EOs. These finding are congruent with past data that have clearly indicated that the mand is the type of verbal behavior most likely to be spontaneously emitted and most efficiently generalized because of the effects of the EOs under control (Sundberg & Michael, 2001).

Treatment participants 3 and 5 were, at times, noted to exhibit more spontaneous mand vocalizations than spontaneous mand signs, indicating they were no longer dependent on the motor topography for a vocal response to be emitted. This finding is in support of the Sundberg literature that explains how manual signs can allow an individual to self-prompt a vocalization (Sundberg, 1993). Furthermore, this finding implies that the self-prompt is also self-faded so that, following repeated trials, the motor topography no longer needs to precede the vocalization. Yet another astonishing finding of the present study is that treatment participants 1, 2, 3, and 5 began to emit spontaneous multi-word signs (e.g., "TV please", or "want juice") towards the end of their treatment visits that may or may not have been accompanied with respective vocalizations. Treatment participant 3 was the only treatment participant noted to consistently use spoken multi-word mand phrases (e.g., "want gum", "paper please", "color blue") without being accompanied by manual signs. These findings correspond to the previously mentioned study conducted by Kahn (1981) that found that a) children often made multi-sign phrases before they could vocally speak in multi-word phrases, and b) that some children used vocal speech in addition to and sometimes even in place of manual signs.

It is important to address the fact that the echoic behaviors of treatment participant 4 did not spontaneously transfer from motor to vocal topography, as it did for all other treatment subjects. Several papers have reported that when auditory and non-sign visual stimuli are presented simultaneously, some developmentally-delayed children selectively attend to visual stimuli alone (Lovaas & Schreibman, 1971; Lovaas, Schreibman, Koegel & Rehm, 1971). Other studies have found that some children with deficient imitative repertoires only learn to sign when speech and sign are presented together (Carr & Dores, 1981; Carr, Binkoff, Kologinsky & Eddy, 1978). These phenomena may serve to explain why vocal repertoires did not develop in the one treatment participant. Also, through the process of working with treatment participant 4, it became apparent to the investigator that the child was exhibiting behaviors consistent with a diagnosis of apraxia. Apraxia is a phonological disorder that is quite often comorbid with autism and other developmental delays. It impairs a child's volitional control over the movement of their mouth and vocal apparatus so that they are unable to accurately produce specific mouth-shapes or vocalizations despite desperate attempts to do so. Apraxia is often associated with other speech, language, cognitive, and sensory difficulties, which may also serve to explain why treatment participant 4 acquired the least amount of manual signs despite the fact that his treatment intervention was one of the longest in duration (Kirk, Gallagher, & Anastasiow, 2000).

However inconsistently and to a far lesser degree than the treatment participants, control participant 6 was noted to emit spontaneous target vocalizations, despite the fact that she did not undergo any treatment procedures. It is important to note that the baseline procedures of this study may resemble the stimulus-stimulus pairing procedure as has been outlined in recent literature. This procedure involves the temporal pairing of a neutral stimulus (e.g., a vocal sound) with a reinforcing stimulus (e.g., access to a preferred item). The stimulus-stimulus pairing procedure has been noted to condition vocal sounds as reinforcers, thereby increasing the target vocalization rates of children diagnosed with autism without the need for direct prompting, shaping, or reinforcement (Yoon & Bennett, 2000; Miguel, Carr & Michael, 2002). According to the literature, the effects of this procedure are temporary, vary significantly across individuals and never resulted in significant improvements in vocal repertoires (Yoon & Bennett, 2000; Miguel, Carr & Michael, 2002). Competing EOs, the subjects current emotional status, the number of pairings and different pairing histories are often thought to be responsible for such inconsistencies (Smith et al, 1996; Sundberg et al, 1996).

The stimulus-stimulus pairing procedure can be compared to the baseline protocols of the present study in that neutral stimuli (the S^D and total communication format) was temporally paired with a reinforcing stimulus (access to the preferred item that the experimenter signed and named). Contrary to the stimulus-stimulus pairing procedure, however, EOs were directly manipulated and the two stimuli that were paired had point-to-point correspondence. Hence, when a spontaneous target vocalization occurred, it was operationally defined as an untrained mand. There exists a common misunderstanding that the principle of reinforcement solely consists of direct and observable events. Data from this and other studies suggest that automatic reinforcement, which involves an increase in behavior that occurs as a result of an antecedent pairing of a neutral stimulus with an established form of reinforcement, may play an important role as an independent variable relevant to language acquisition (Skinner, 1957). This phenomenon is likely to be responsible for the slight and inconsistent increases in spontaneous vocal behaviors that were noted in the control participant.

Some similarities exist between the findings of the present study and those of some studies conducted in the past. One related study that focused on sign language training to target vocal speech found that regardless of the treatment group the children were assigned to, those with higher vocal imitation scores exhibited more spontaneous vocalizations (Yoder & Layton, 1988). This finding is congruent with the results of the present study in that spontaneous vocal mands increased as vocal echoic behaviors increased. Also in correlation with the present study, it has previously been found that noncompliant behaviors tend to occur with less frequency during mand training in comparison to training for other verbal operants (Sundberg & Michael, 2001).. Although the occurrence of maladaptive behavior patterns was not a formal aspect of this study, very few incidences occurred across participants and, with the exception of treatment participant 4, all were extinguished within the first four visits. In addition, all 5 treatment participants were noted to independently sit in their designated work area and emit spontaneous mand responses upon the investigator's entrance into their home. Control participant 6 was also noted to independently sit in her designated work area, make sustained eye contact, and display behaviors denoting positive affect (e.g., smiling, cuddling) with the investigator while waiting for trails to commence. The procedures utilized in the present study clearly produced ideal environmental conditions that were conducive to the acquisition of verbal behavior.

Limitations

The procedures outlined in the present study contained several limitations. First, an uneven ratio of treatment participants to control participants took part in the study. Having included an equal number of treatment and control participants throughout the study would have led to results that could have more vigorously been attributed to treatment protocols through a statistical analysis of the data.

A variable that is critical to skill acquisition is the number of behavioral training hours per week that is provided to a child. The in-home training sessions that were administered by the parents were not a formal aspect of this study, and data were not collected on days when parents conducted the treatment sessions. Although the children may not have learned as efficiently without this aspect of the study, its effects were never explicitly measured or evaluated. Future research may specifically compare the effects of this treatment approach with and without in-home treatment components. Future studies may also consider videotaping parent-led sessions for them to be scored by the investigators at a later date.

No skill maintenance or follow-up measures were taken. Future studies may consider extending the length of the research protocol to include this measure. Lastly, because the treatment protocol failed to produce consistent gains in the vocal behaviors of one treatment participant, future studies may pursue an understanding of the variables relevant to this inaccuracy.

<u>Summary</u>

The results of the current study are in many ways more powerful than those of previous experiments. Participants in the sign language group of the Kahn (1981) experiment depicted earlier developed 3 and 4 words after 27 and 33 months of intervention, respectively. Considering that the average length of intervention for the present study was 10 weeks, and that the mean number of mastered vocalizations was 9.5, the treatment subjects comparatively acquired more than twice the amount of vocal speech in less than half the time. This comparison supports the fact that the mand training treatment component was essential to the rapid acquisition of verbal behaviors. It is also important to note that all other studies that have attempted to increase vocal behaviors by targeting motor behaviors for acquisition have only achieved results with children who were previously trained for extensive periods (12 to 22 months) to exhibit a general imitative repertoire (Tsiouri & Greer, 2003; Ross & Greer, 2003). Again, because treatment gains in the present experiment were achieved without the need for such lengthy pre-treatment procedures with children who did not have general imitative repertoires, and because results were attained within an 8 to 13- week time period, using manual signs over non-sign motor responses within the context of an EO clearly provides enhanced, more efficient rates of skill acquisition.

In the past, several other studies have found that only children with autism that exhibited vocal echoic competency were able to learn both speech and sign when they were presented simultaneously (Carr & Dores, 1981; Carr, Binkoff, Kologinsky & Eddy, 1978). In the present study, however, no child exhibited a vocal echoic repertoire prior to the commencement of treatment, although 4 out of 5 children in the treatment group had at or near mastered levels of vocal echoic responding in addition to comparable rates of spontaneous vocal mands at the end of the study. In other findings, some children have been documented to only acquire two or three signs after receiving intensive training (Seal & Bonvillian, 1997). The average number of mastered signs in the present study was 10, with treatment participant 4 being the only treatment participant to master less than that number.

The results of the present study are also significant in that the participants' existing vocal repertoires were never considered in choosing their target signs and words. Many previous studies involving vocal echoic and stimulus-stimulus pairing procedures specifically targeted words that were currently in the participants' repertoire (i.e., sounds they can already produce), in order to avoid the possibility that a failure to respond to the procedure was due to any articulation deficits that are common among the developmentally delayed population. The current procedure only targeted and successfully evoked increases in non-repertory words and word approximations in 4 out of 5 of the treatment subjects. Also extremely noteworthy is the level of accuracy in the vocal approximations of the target words as spoken by the treatment participants (see Tables 1-6 in the Appendix). It often takes several months and very strict use of prompting, shaping and reinforcement procedures in the absence of this treatment intervention in order to produce comparable results with this population of children.

Recommendations

The training procedure employed in the present study is recommended as a new and improved first-step towards building a functional repertoire of verbal behaviors in non-verbal children. Echoics and mands may be simultaneously increased in order to create a verbal repertoire that functions across operant classes. Once the motor imitation of a manual sign is mastered, trainers can begin to require that a vocalization be paired with the sign in order to grant access to the desired item. By shaping and gradually reinforcing closer approximations to spoken words, vocal behavior and articulation may be additionally strengthened. Should a child present difficulties in producing a particular sign, it is recommended that modifications be made to facilitate their emission. An individual vocabulary of manual signs is often needed in order to include formational elements that are low in error rates and high in production frequencies for the individual child. One might also substitute a sign that is similar in meaning but easier to reproduce in order to promote a rapid and successful rate of skill acquisition (Seal & Bonvillian, 1997).

Many aberrant behaviors associated with the developmentally delayed population, such as aggression towards others, self-injury and general tantrum behaviors are often attributed to an individual's deficient repertoire of operant mands. For individuals who may show none or limited improvement in vocal language, the procedure outlined in this study may, in the very least, equip the individual with a topography-based verbal repertoire to serve as a communicative medium. The successful verbal interaction between the individual and a listener that results would not only provides an excellent opportunity to shape articulation, but would also elude the occurrence aberrant behaviors (Sundberg, 1993). One other possible benefit may be the facilitation of an individual's attentiveness to social gestures, a skill that could be the basis for building more advanced intraverbal and joint attention skills.

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APPENDIX

Mastered Signs and Vocalizations

Table 1: Treatment Participant 1

Target Sign	Vocal Approximation	Starting Date	Date Mastered
1. puzzle	puh-po	7/22/05	8/12/05
2. jump	ju-p / ump	7/22/05	8/19/05
3. TV	vee-vee	7/22/05	9/9/05
4. eat	e /eat	7/29/05	
5. milk		7/29/05	
6. tickles		8/12/05	9/9/05
7. back	ba	8/12/05	8/13/05
8. color	conor	8/12/05	9/30/05
9. water		8/19/05	9/10/05
10. ball	boh	8/19/05	9/2/05
11. cards		9/2/05	
12. chicken		9/3/05	
13. sing	see / seen	9/16/05	9/23/05
14. spider		9/16/05	9/23/05
15. bubbles	bubo	9/17/05	10/1/05
16. please	pee	9/23/05	10/1/05
17. kiss	ki	9/23/05	10/1/05
18. want	wa	9/24/05	10/1/05
19. flute		10/1/05	
20. book		10/1/05	
21. maraca		10/1/05	

Table 2: Treatment Participant 2

Target Sign	Vocal Approximation	Starting Date	Date Mastered
1. ball	ba	7/22/05	8/20/05
2. cup	dup	7/22/05	
3. cards	ard / ards	7/22/05	8/6/05
4. blanket	bankie	8/12/05	8/19/05
5. tickles		8/19/05	10/8/05
6. puzzle	pusso	8/19/05	9/30/05
7. jump	bump	8/20/05	10/7/05
8. sing	see	9/3/05	10/1/05
9. juice		9/3/05	
10. maraca		9/3/05	
11. milk		9/10/05	
12. color		9/10/05	9/17/05
13. baby	baby	9/17/05	10/1/05
14. bubbles	bubu	9/17/05	9/30/05
15. eat	eee	9/24/05	
16. please	pee	10/7/05	10/10/05
17. TV	beebee	10/7/05	10/10/05
18. book		10/8/05	

Table 3: Treatment Participant 3

Target Sign	Vocal Approximation	Starting Date	Date Mastered
1. color	conor	8/6/05	8/20/05
2. car	car	8/6/05	9/22/05
3. game	game	8/6/05	8/20/05
4. bubbles	bubbles	8/20/05	9/28/05
5. bunny	bunny	8/20/05	
6. gum	cum	9/3/05	9/9/05
7. cracker	cacker	9/3/05	
8. spoon	spoon	9/3/05	9/9/05
9. sing	seen	9/5/05	
10. water	wana	9/5/05	
11. letter	nener	9/5/05	9/10/05
12. paper	paper	9/10/05	9/17/05
13. new	new	9/24/05	
14. blue	bew	9/24/05	10/1/05
15. please	peace	9/24/05	10/1/05
16. green	geen	9/24/05	
17. want	wan	9/24/05	10/1/05
18. red		9/24/05	
19. ice cream		9/28/05	
20. book		9/28/05	

Table 4: Treatment Participant 4

Target Sign	Vocal Approximation	Starting Date	Date Mastered
1. radio		8/6/05	
2. star		8/6/05	
3. truck		8/6/05	
4. milk		8/12/05	
5. tummy		8/12/05	
7. bubbles		8/20/05	9/10/05
8. juice		8/20/05	10/8/05
9. chips		9/2/05	9/17/05
10. sing		9/3/05	9/10/05
11. TV		9/23/05	
12. chair		10/1/05	

Table 5: Treatment Participant 5

Target Signs	Vocal Approximation	Starting Date	Date Mastered
1. puzzle	zzle	8/5/05	8/13/05
2. book	boo	8/5/05	8/13/05
3. piano		8/5/05	8/13/05
4. bubbles	bu / ubu	8/13/05	9/30/05
5. up	uh	8/19/05	8/19/05
6. milk	ma	8/19/05	
7. cookie		8/19/05	9/2/05
8. blocks		8/20/05	9/24/05
9. car		9/3/05	9/24/05
10. color		9/3/05	9/24/05
11. again	a-de	9/22/05	
12. more	ma	9/22/05	9/30/05
13. want	wa	9/23/05	
14. all done	a-duh	9/23/05	9/30/05
15. help	he	9/24/05	
16. tickle		9/24/05	
17. cup		9/24/05	

Table 6: Control Participant 6

Target Sign	Vocal Approximation	Starting Date	Date Mastered
1. bubbles		9/16/05	
2. drum		9/16/05	
3. piano		9/16/05	
4. cookie		9/30/05	
5. juice		9/30/05	
6. maraca		9/30/05	
8. tickles		10/3/05	
9. flip		10/10/05	
10. ball		10/10/05	
11. book		10/12/05	