Increasing the Vocal Verbal Behavior of Children with Autism

Presented by

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Introduction

• The term vocal behavior is used specifically to refer to the production of auditory stimuli resulting from the movements of the muscles of the vocal apparatus, e.g., the sounds one makes.

• In treatment programs for children with autism we are interested in developing not just vocal responses because not all vocal responses constitute verbal behavior. Coughing and yawning produce vocalizations but in most cases they are not considered verbal.

• Vocal verbal behavior is the production of auditory stimuli that effectively control the behavior of a community of listeners resulting in reinforcement for the speaker (Skinner, 1957). Vocal verbal behavior is the production of the sounds and words of a verbal community.

• Non-vocal persons are individuals who fail to emit high rates of vocal verbal behavior.

• In the case of children with autism this issue is represented by individuals who produce very few speech sounds or words that correspond to those produced by other members of their verbal community.

• In more common terms, these are children with articulation problems or disorders.
• More precisely, for some children with autism the naturally occurring contingencies of reinforcement have failed to effectively control the movements of their vocal musculature.

• This does not mean that non-vocal persons do not emit verbal behavior (VB); they may exhibit other forms of VB (e.g., sign language, exchanging pictures, speech output devices, hitting, screaming, self-injury, etc.

• The purpose of this talk is to outline the evidence-based methods to increase the speech production of children with autism who emit few vocal verbal responses and who have generally failed to develop an echoic repertoire.

• Be reminded, that many of the children we will be discussing have weak verbal behavior repertoires (language) as well. In other words, their alternative forms of verbal behavior, e.g. manual sign, picture exchange, speech generating devices, are generally not accompanied by vocal verbal responses.

1. The term ______ is used specifically to refer to the production of auditory stimuli resulting from the movements of the muscles of the vocal apparatus, e.g., the sounds one makes.
   A. Vocal behavior
   B. Verbal behavior
   C. Manding
   D. Tacting

2. Non-vocal persons are individuals who fail to emit high rates of ______.
   A. Vocal Verbal behavior
   B. Vocal behavior
   C. Manding
   D. Tacting

3. A child who has many mands in the form of sign language, but emits limited vocal behavior would be considered _____.
   A. Non-verbal
   B. Vocal
   C. Non-vocal
   D. Verbal but not vocal
What is ABA?

- Several comparative studies have demonstrated the superiority of behavior analytic programs over other approaches to autism treatment. (Birnbrauer & Leach, 1993; Cohen, Amerine-Dickens, & Smith, 2006; Eikseth, Smith, Jahr, & Eldevik, 2002, 2007; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987; Remington et al., in press; Sallows & Graupner, 2005; Smith, Groen, & Wynne, 2000)

- In recent years many behavioral practitioners have been influenced by the conceptual and experimental support for inclusion of B.F. Skinner’s (1957) analysis of verbal behavior as a tool for guiding the teaching of language within the context of already existing applied behavior analytic (ABA) programs.

Basic Principles Of Behavior

- A large portion of human behavior is determined by the environmental arrangement of events or stimuli that appear before (antecedent) we behave and after (consequences) we behave.

- Skinner uncovered these principles through his early experimental work.

- Special names have been given to antecedents and consequences of behavior since different types of each affect behavior differently.

- These different types of stimuli which affect behavior have been called the “basic principles” of behavior.
Most of what we discuss about the treatment of autism will be guided by an understanding of the application of these basic principles of behavior.

We will discuss the procedures and methods that have been derived from the basic principles and empirically verified as effective in teaching children with autism.

Behavioral Analysis of Language

- Behavior analytic language based programs include B.F. Skinner’s analysis of verbal behavior.

- However, many behavioral programs for children with autism have not been influenced by Skinner’s (1957) analysis of verbal behavior and Sundberg and Michael (2001) state “…failure to make use of the technical concepts and principles that appear in B.F. Skinner’s (1957) Verbal Behavior seems inconsistent with the stated behavioral focus of many intervention programs.” (Discuss 5 Manuals)

- Nevertheless, there appears to be growing interest in adding the application of Skinner’s (1957) analysis of verbal behavior to ABA programs for children with autism.

- Workshops on the topic draw many participants. There is a growing body of research, parents and practitioners have developed well subscribed internet list servers devoted to discussions of teaching verbal behavior to children with autism and an increasing number of practitioners are relying on the approach.
Skinner’s Analysis of Verbal Behavior


- He defined verbal behavior as “behavior reinforced through the mediation of other persons” (p. 2).

- He also classified language based on function, not form.
  - Language is behavior and is learned like all other behavior resulting from the basic principles described above.
  - Different types of verbal behavior were categorized based on functions, or common controlling variables.
  - These categories, which are functionally independent, he called verbal operants.

**NONVERBAL BEHAVIOR**
Want Water -----walk to the refrigerator-----Get Water

**VERBAL BEHAVIOR**
Want Water----------say water--------Person Delivers
   sign Water          Water
   point to water
   whine
   exchange a picture
   kick someone
   scream
   write water

Saying Water is Behavior- Movement of Muscles of Vocal Apparatus that Produces Acoustic Stimulus.
4. Five of the basic principles of behavior are:
   A. Stimulus control, MO, reinforcement, extinction, and punishment
   B. Stimulus control, MO, positive reinforcement, extinction, and punishment
   C. Stimulus control, Mand, reinforcement, extinction, and punishment
   D. Stimulus control, reinforcement, extinction, and punishment

5. Skinner defined ________ as “behavior reinforced through the mediation of other persons”
   A. Vocal behavior
   B. Verbal behavior
   C. Manding
   D. Tacting

6. Skinner emphasized the importance of classifying language based on ________, not ________.
   A. Function, form
   B. Form, function
   C. Reinforcement, punishment
   D. Punishment, reinforcement

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Skinner’s (Nature’s) Verbal Behavior Categories

**Verbal Responses**

- **Mand (Requesting)**: Asking for reinforcers that you want. Saying shoe because you want a shoe.

- **Tact (Labeling)**: Naming or identifying objects, actions, events, etc. Saying “shoe” because you see a shoe.

- **Echoic (Vocal Imitation)**: Repeating what is heard. Saying “shoe” after someone else says “shoe.”

- **Intraverbal (“wh” Questions)**: Answering questions or having conversations where your words are controlled by other words. Saying “shoe” when someone else says “What do you wear on your feet?”

**Non-Verbal**

**Listener Responses**

- **Listener Behavior (Receptive)**: Motor responses to what someone says.
7. Mands, Tacts, Echoics, and Intraverbals are examples of:
A. Non-vocal responses  
B. Verbal Responses  
C. Non-Verbal Responses  
D. Listener Responses  

8. Listener behavior is a form of:
A. Manding  
B. Verbal Responding  
C. Non-Verbal Responding  
D. Tacting  

• Teaching vocal verbal behavior to nonvocal learners can be very difficult task. It requires a diverse teacher repertoire and a substantial understanding of the applications of Skinner’s analysis of VB. Procedures that have been shown to have at least some support include:

1. Stimulus-Stimulus Pairing (Automatic Reinforcement)  
2. Echoic Training  
3. Alternative Communication Methods: Manual Sign Language and PECS  
5. Shaping Vocal Productions. (Phonetic Transcription)  

During this talk I will discuss briefly numbers 1 and 2 above and will emphasize the role of alternative communication methods, time delay and differential reinforcement and shaping vocal productions.  
The use of phonetic transcriptions to determine successive approximations will be discussed.
Automatic Reinforcement: Theoretical Issues And Research Findings

- Automatic reinforcement is used to describe situations in which reinforcement of behavior occurs when it is not directly socially mediated but is, instead, the product of a response.
- Skinner referred to this type of overlooked source of reinforcement many times in his writings.
- He claimed that a lot of behavior that appears to produce limited social reinforcement might well be controlled by automatic reinforcement.
- In fact, he claims that much of the behavior of infants might well be under the control of automatic reinforcement.
- For example, he suggests that an infant’s movements that effectively change the environment, such as swatting at a mobile hung above the crib, might be automatically reinforced by the control over the non-verbal environment.
- Indeed, problem solving behavior might well be strengthened by those, “I did it,” moments.

Automatic Reinforcement: Theoretical Issues And Research Findings (Cont.)

- In addition, he suggested that many of the motivational problems related to public education could be solved by harnessing the power of automatic reinforcement through programmed instruction.
- Consequently, he suggested a substantial portion of human overt, as well as covert, behavior might well be strengthened merely by the changes they produce in the physical environment.
- This same process may well play an important role in the development of early language in infants.
- Psycholinguists, and others, have invented innate mechanisms (e.g., language acquisition device) to account for the development of language that seems to occur without being strengthened by programmed reinforcement.
- They are right, reinforcement is rarely deliberately programmed for most typical verbal behavior, but that fact has led to the ignoring of automatic reinforcement as a force in the development of language.
- For example; grammar, syntax, and early language sound production might well be the result of selection by automatic reinforcement.
- Verbal behavior stimulates the speaker in the same way that it stimulates a listener, this is a unique aspect of verbal behavior.
As Palmer (1996) points out, children become effective listeners before they become effective speakers. As such, sounds or words that have been paired with reinforcement might well strengthen the muscle movements necessary to produce them in young children. Infants may well babble more frequently the sounds that have been paired with socially mediated reinforcement. This process of automatic reinforcement will probably strengthen the vocal repertoire in general and prepare the young child to speak in words and sentences. These facts argue against an innate, universal system of grammar and construction of language by an acquisition device to account for what appears to be a “poverty of stimulus.” Some data, by Moerk (1989), demonstrated this fact when he reinterpreted Brown’s (1973) data to show the importance of subtle parental reinforcement in the development of language in young children. Another type of reinforcement might very likely occur as well.

Conformity and speaking like others receives substantial social reinforcement, while speaking differently often produces mild forms of social punishment. Consequently, the muscle movements that produce utterances that sound like others’ will be reinforced. The property of the stimulus that acts as the reinforcer is the parity between what is produced and what others have said. Young children will often comment on words pronounced incorrectly before they can produce them correctly themselves. For example, a young child learning to whistle will have her lip position and other movements reinforced if she produces a whistling sound similar to an admired peer. The dimension of parity acts as the reinforcer for this behavior. It is possible that listening to your own speaking may account for the development of many proper word forms (e.g., “runned” becoming “ran”), grammatical structure, and word order (syntax).
All of this is to say that the foundation for speaking intelligibly might well be the outcome of automatic reinforcement upon the vocal attempts by very young children. Several researchers have extended this analysis to the application of stimulus-stimulus pairing and the concept of automatic reinforcement to the development of vocalizations in children who fail to develop them typically. Since phonemes and syllable units are the building blocks of vocal verbal behavior, any attempts to increase their frequency and variety in young children who do not develop them typically might lead to a greater likelihood of developing vocal behavior. Sundberg et al. (1996) were the first to make use of the concept of automatic reinforcement to develop vocal responding in language delayed children. All children developed novel vocalizations without direct reinforcement after stimulus-stimulus pairing procedures were implemented.

A series of studies have occurred since 1996 with children with developmental disabilities and with low rate speech sound production and virtually absent vocal verbal behavior. The most recent is by Esch, Carr & Grow (2009) in JABA. For a current review of the literature on the topic see the Esch, et al. (2009) study. The reference section contains the references of the series of studies. In general the results have been mixed with some participants showing greater effects than others. A recent study by Esch, Esch & Love (2009) demonstrated some preliminary benefit to a direct reinforcement procedure using lag schedules of reinforcement that support speech variability. This study potentially suggests another procedure to increase vocal production in children with autism with very low vocal production.
Automatic Reinforcement Procedure (ARP, cont.)

The two-step process is as follows:

- **STEP 1.** The speech sounds and words heard by young children are frequently conditioned as reinforcers by correlation with parents’ positive reinforcers (e.g., food, caresses, smiles).

  - **STIMULUS** (speech sound) \(\rightarrow\) Paired \(\rightarrow\) **STIMULUS** (reinforcer)

- **STEP 2.** Subsequent production of these sounds by the child is strengthened by the product of his or her verbal behavior in the form of auditory stimuli. The closer the sound production is to matching the sounds that have been conditioned as reinforcers the greater the reinforcement (Schlinger, 1995; Sundberg, Michael, Partington, & Sundberg, 1996).

  - **SPEECH SOUND** PRODUCED \(\rightarrow\) **WHAT IS HEARD** ACTS AS A **REINFORCER**

9. Automatically reinforced behavior
   A. Is strengthened by socially mediated stimuli
   B. Is strengthened by the product of the response
   C. Is strengthened by tangible items
   D. Is not strengthened.

10. High frequency phoneme production by 10 month old children may be automatically reinforced because the response products act as a reinforcer through a history of correlation with
    A. Automatic reinforcement
    B. Negative reinforcement
    C. Nothing, they babble sounds that are developmentally appropriate
    D. Socially mediated reinforcement.

11. Conformity and speaking like others receives substantial ________, while speaking differently often produces mild forms of ________.
    A. social Reinforcement; social punishment
    B. social Punishment; social reinforcement
    C. Reinforcement; punishment
    D. Automatic Punishment; Automatic reinforcement
12. When a young child corrects themselves to say “ran” instead of “runned” what acts as a reinforcer to strengthen the ran response?
   A. The auditory stimulus they produce has been correlated with reinforcement
   B. The parity between the auditory response product and what the child has heard others say.
   C. The linguistic rules
   D. Nothing, they are supposed to say “ran”

13. As a result of a successful stimulus-stimulus pairing procedure
   A. The target speech sound (auditory stimulus) is conditioned as a reinforcer.
   B. The parity between what is produced and what others have said is reinforcing.
   C. You can teach a child to babble
   D. All of the above

14. What acts as a form of reinforcement for responses that are automatically reinforced.
   A. Meeting parity with what is said
   B. The auditory stimulus that is produced that has previously been correlated with reinforcement
   C. Socially mediated reinforcement
   D. All of the above
Clinical Practice

- In our clinical practice and research, we have used the stimulus-stimulus pairing procedure to develop novel vocalizations; following Miguel et al.’s (2002) suggestion, we have modified the process by simultaneously providing direct reinforcement to bring the target response under multiple echoic and motivational control.

- The higher frequency and variety of sounds produced through this process subsequently provides a large pool of vocalizations from which to select word approximations during mand and other verbal operant training. Moreover, the development of a generalized echoic repertoire allows for efficient transfer of stimulus control from the echoic stimulus to the MO during mand training.

Teaching Procedures

The following are procedures to follow when attempting to take advantage of automatic reinforcement generated by stimulus-stimulus pairing:

1. Choose sounds that have the highest frequency in the repertoire of the child or words that may be particularly easy for the learner. Initial position consonant-vowel combinations that are associated with the names of items that act as reinforcers may be useful. For example “buh” for a child who is reinforced by bubbles. Transfer to the mand may be facilitated when targets are chosen this way.

2. Present a sound three times with about a 1-second delay between presentations. If you hear any approximation or any sound after any of the presentations, deliver the reinforcer immediately. If there is no sound or approximation, then deliver the reinforcer after the third presentation anyway.

   “buh” – 1 sec – “buh” – 1 sec – “buh” – 1 sec REINFORCER
   *If “buh” is emitted at any point, deliver the reinforcer immediately*

3. Graph results.

Declan Video
Vince with Emily
Echoic Training

- Vocal imitation is an important skill in the development of vocal verbal behavior. Consequently, procedures have been developed to teach this skill. Using the terms of the verbal behavior approach this is called teaching the echoic repertoire.
- Echoic training methods are designed to increase the number and intelligibility of vocal responses.
- Echoic targets can be selected from the high frequency sounds the learner produces during free operant procedures.

Selecting targets for echoic training:
1. Developmentally easy sounds
2. High frequency sounds the learner produces during free operant procedures
3. Sounds and words associated with reinforcers and for reinforcers for which the child mands

REFERENCES
STIMULUS – STIMULUS PAIRING PROCEDURE


Echoic Teaching Procedure

1. Once echoic targets are selected, list on the probe data sheet echoic responses that will be taught first.
2. Begin the teaching procedure by having strong reinforcement available and visible to the learner to establish motivation for correct responding.
3. Present the echoic.
4. If the learner reaches parity, reinforce immediately.
5. If the learner does not reach parity, re-present the word 2-3 more times (based upon the learner).
6. At any point the learner reaches parity or a better response occurs, reinforce.
7. If the learner does not reach parity or give a better response following 2-3 echoic trials, drop to an easier echoic or motor imitation response and differentially reinforce.

Mattie Echoics

ECHOIC DATA SHEET

<table>
<thead>
<tr>
<th>Learner:</th>
<th>Date: 10/3/03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial</td>
<td>Target Sound/Word</td>
</tr>
<tr>
<td>1</td>
<td><em>m</em></td>
</tr>
<tr>
<td>2</td>
<td><em>b</em></td>
</tr>
<tr>
<td>3</td>
<td><em>n</em></td>
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<td>4</td>
<td><em>p</em></td>
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<td>5</td>
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<td>16</td>
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<td>17</td>
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<td>18</td>
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<td>19</td>
<td><em>h</em></td>
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<tr>
<td>20</td>
<td><em>n</em></td>
</tr>
</tbody>
</table>
15. Why is it important to teach an echoic repertoire?
   A. The echoic repertoire automatically leads to improved listener behavior.
   B. By teaching an echoic repertoire you can transfer stimulus control to other important functions of verbal behavior.
   C. Teaching an echoic repertoire is part of the ABLLS and VB-MAPP
   D. All of the above

16. When choosing sounds to teach as echoic responses consider
   A. Developmentally easy sounds
   B. High frequency sounds the learner produces during free operant procedures
   C. Sounds and words associated with reinforcers
   D. All of the above

Tarbox, Madrid, Aguilar, Jacobo & Schiff, 2009
REFERENCES
Research Studies that Support the Teaching of the Echoic Response to Increase Overall Vocal Responding


Kaufman Assessment And Teaching The Echoic Response

Assumptions:
1. Children who speak with limited consonant production and with motor coordination difficulties will have intelligibility problems.

2. Even though some of these sounds may appear in isolation they are not produced in combination with other sounds.

3. Many of these children simplify their production of words to compensate for these coordination difficulties (e.g. final consonant deletion, vowel neutralization).

4. As teachers we may be able to provide simplified forms of the word or word shells that are close to what the learner can produce.
5. By presenting these forms of the word during vocal imitation as successive approximations to the “adult form” of the word we may be able to shape the word production with limited learner frustration.

6. By requiring movement up the hierarchy of word shells to receive reinforcement, the learner may produce intelligible words within and across many syllable forms (e.g. CV, CVC, CVCV, VC).

Learners who are good candidates for the vocal teaching procedures have these behavioral characteristics (Kasper, Godwin, & Hulshof, 2002):

1. They have a limited ability to echo words and sounds and therefore much of their talking is unintelligible.

2. They do produce simple vowel and consonant sounds in isolation. If they cannot perform even these most basic skills, then investigation of medical issues and structural or muscle weakness problems should be investigated by appropriate professionals. However, this problem would not preclude the use of other behavioral procedures.

3. Limited phoneme repertoire.

4. Difficulty producing and sequencing sounds.

5. Limited response to echoic training as evidenced by limited vocalizations even after acquiring 15-25 signed mands.

6. Poor approximations that are resistant to change.
<table>
<thead>
<tr>
<th>KAUFMAN WORDS-BASIC KIT</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CVCV</strong></td>
<td>mama, papa, neigh neigh, moo moo</td>
</tr>
<tr>
<td><strong>VC</strong></td>
<td>on, up, out, in, eat, oat, arm, ant, eye</td>
</tr>
<tr>
<td><strong>CV</strong></td>
<td>day, two, me, tea, pea, dough, bay, bow</td>
</tr>
<tr>
<td><strong>VCV</strong></td>
<td>apple, obo, oh no, oh boy, okay</td>
</tr>
<tr>
<td><strong>CV1CV2</strong></td>
<td>mommy, puppy, daddy, baby, bubble, potato, people, banana, turtle</td>
</tr>
</tbody>
</table>

**KAUFMAN CARD EXAMPLE (CVCV)**

mama
mah-mah
mom-ah
mah-ah
mah
mm-ah
KAUFMAN CARD EXAMPLE (CV1CV2)

tomato
  tuh-maytō
  tuh-mahtō
  maytō
  mahtō
  maydō

Kaufman Teaching Procedures

1. Based upon the assessment, list on the probe data sheet the words or echoic responses from the category that will be taught first.

2. Begin the teaching procedure by having strong reinforcement available and visible to the learner to establish motivation for correct responding.

3. Present the word approximation at the level of the word that has achieved parity to insure success immediately.

4. Present the next higher word form immediately. If the learner quickly achieves parity (within one trial) then present the next form of the word without reinforcement to promote momentum.
4. If the learner does not meet parity continue to present this word approximation for 3-5 trials. The purpose of re-presenting the word is to give the learner several attempts to slip into parity and thereby receive reinforcement for doing so. If the learner does not meet parity during this process, present a sound, word, or motor movement that the learner will be successful at. If however, the learner reaches parity after several presentations, then reinforce the imitative response. Provide greater magnitudes of the reinforcer for parity responses that occur with fewer trials.

5. Consider using other antecedent variables to increase accuracy of the echoic response (e.g. a couple of easy motor movements, a couple of easy words with same syllable shape, backward chaining of parts of the word).

VIDEOS
Vincent-SET UP
Vincent
Declan

Kaufman Probe Data Sheet
Graph the weekly cumulative number of Kaufman words mastered as shown below:

![Graph showing cumulative number of words mastered over weeks](image)

Supporting Research

The Kaufman Speech Praxis Treatment Kit is widely disseminated as a treatment for the development of vocal imitation skills in children with autism and AOS, however, no empirical evidence currently exists to support its inclusion in a language training program for children with autism. Notwithstanding the lack of empirical support, the Kaufman method of teaching vocal imitation skills has shown promising results and therefore deserves experimental investigation. For example, it provides a method for evaluating a learners vocal imitation skills across a wide range of target sounds and words, a method for selecting targets based upon the assessment, and treatment methods that include the employment of phonological processes to simplify words so the child can learn successive approximations toward target words to achieve a “functional” vocabulary (Kaufman 1997). The purpose of this study was to compare an adaptation of the procedures recommended within the Kaufman method that include assessment, selection of targets and shaping through reinforcement of successive approximations toward the target word as compared to an echoic procedure that included reinforcement for correctly echoing the target response and extinction for echoing incorrect responses. The results indicate the superiority of the adapted Kaufman procedures.
Figure 1. Cumulative number of Kaufman and Echoic words mastered per week for Vincent

Figure 2. Cumulative number of Kaufman and Echoic words mastered per week for Max

Sweeney-Kerwin, E. J. (2005)
Figure 3. Cumulative number of words mastered in Kaufman and Echoic conditions and average trials to criterion per condition for Vincent.

Figure 4. Cumulative number of words mastered in Kaufman and Echoic conditions and average trials to criterion per condition for Max.
REFERENCES

Very Limited Research that Supports the Use of The Kaufman Praxis Treatment for Children to Improve Vocal Responding


17. The Kaufman Praxis Treatment for Children kit should be used for children who…..
   A. Have intelligibility problems.
   B. Emit some sounds in isolation, but do not produce the sounds in combination with other sounds.
   C. Simplify their production of words (e.g. final consonant deletion, vowel neutralization).
   D. All of the above

   A. The use of the Kaufman targets led to higher frequency of words mastered, with fewer teaching trials required to meet criterion.
   B. The use of echoic training led to higher frequency of words mastered, with fewer teaching trials required to meet criterion.
   C. The use of echoic training led to higher frequency of words mastered, but with more teaching trials required to meet criterion.
   D. The use of the Kaufman kit led to higher frequency of words mastered, with fewer teaching trials required to meet criterion.
Why Teach Manual Sign Language

- Manual sign language is an alternative communication system that can be taught to learners with autism.

- There is sufficient empirical support to conclude that sign language can be an effective form of alternative communication.

- There are several studies that support the use of manual sign manding to produce a functional communication (see Millar, Light, & Schlosser, 2006, Schlosser & Wendt, 2008a).

- Schlosser and Wendt (2008a) in their review chapter write:
  The available body of research on manual sign and gestures for children with autism reveals strong intervention effectiveness scores for symbol acquisition and production, as well as related outcomes such as speech comprehension and speech production. These results suggest that the use of manual signing gestures is a very effective communication option for children with autism. (p.370)

- While there is not an extensive body of literature on the benefits of using sign language to increase vocal productions, the controlled research that is available suggests that the use of manual sign language may support an increase in vocal productions for learners with autism, especially when a total communication training approach is utilized.

- Millar et al., 2006, reviewed controlled studies between 1975 and 2003 with persons with developmental disabilities and autism that purported to demonstrate that alternative forms of communication produced improved vocal production.

- Only studies that met rigorous experimental standards were included as effective treatment methods.

- They found only 6 studies that were sufficiently rigorous to include in their report.

- Of these 6 studies only 1 study found PECS to be effective in increasing vocal production. Charlop-Christy, et al, 2002.

- All the other 5 studies were manual sign language research papers.
Schlosser & Wendt (2008b) conducted a review of the literature searching for well controlled studies with only persons with autism demonstrating improvements in speech production with alternative communication methods.

Their findings were as follows:

1. There are eight (8) methodologically rigorous studies that evaluated the vocal production with alternative communication methods.
2. Of these only two (2) studies showed high PNDs for vocal production.
4. In Tincani (2004) when sign was compared to PECS manual sign language demonstrated superiority over PECS in both subject’s vocal productions.
5. The other eight (8) studies include 1 SGD study showing some benefit and the other seven (7) were PECS studies showing limited or no benefit related to vocal production in children with autism.
6. A dissertation (Anderson, 2002) comparing manual sign language to PECS found that in all participants who showed improvements in speech production manual sign language was robustly more effective.
7. A recent meta-analysis of all PECS research reported “small to negative” findings related to speech production. (Flippin, Reszka, & Watson, 2010)

- On the next few slides is a study our clinic conducted recently and published related to speech production and application of manual sign.

- In this study the learner was vocal in that she had a strong echoic repertoire but failed to acquire and maintain vocalizations in mainly the tact repertoire.

- When sign was added to her repertoire a substantial improvement in the frequency of vocal productions occurred as displayed on the data sets on the next few slides.
19. A review of the literature suggests that sign language is a(n) _____, and may _____ for some children with autism.
   A. Ineffective communication method, decrease vocal production
   B. Very effective communication method, increase vocal productions
   C. Very effective communication method, decrease vocal production
   D. Ineffective communication method, increase vocal productions

20. Studies by Tincani (2004) and Anderson (2002) compared PECS and manual sign training. What were the major findings related to vocal production?
   A. Both produced substantial levels of vocal productions in children with autism.
   B. Both produced substantial levels of vocal productions in children with autism, but sign language demonstrated superiority
   C. Both produced substantial levels of vocal productions in children with autism, but PECS demonstrated superiority
   D. PECS produced substantially higher frequency of vocal production in children with autism

Clinical data


- **Abstract**
  - Total communication (TC) involves the use of manual signs with their corresponding spoken words simultaneously; and research indicates that TC facilitates vocal responding by children with autism. However, most of this previous research was conducted 20 years ago and did not consider vocal responding in relation to verbal behavior functions (Skinner, 1957). The present study used an alternating treatment design to compare the effects of TC vs. vocal-alone (VA) training on the vocal tact responses of a child with autism. Results indicated that the child produced nearly four times as many vocal tact responses during TC training than during VA training in less than half the number of teaching trials. The use of manual sign training is considered in relation to its advantages for supporting the production of vocal responses.
Figure 1. Cumulative number of vocal tacts acquired in the total communication condition and vocal-alone condition per session.

Carbone, V. J. (2006)

Figure 2. The mean number of trials to criterion for vocal tacts in the total communication condition and vocal-alone condition.

Carbone, V. J. (2006)
21. A study by Carbone, Lewis, Sweeney-Kerwin, Dixon, Louden, and Quinn (2006). Compared two approaches for teaching VB functions: Total communication vs. vocal-alone. What were their findings?

A. TC led to higher frequency of vocal tact responses, taught in fewer teaching trials when compared to vocal-alone

B. Vocal-alone led to higher frequency of vocal tact responses, taught in fewer teaching trials when compared to TC

C. Vocal-alone led to higher frequency of vocal tact responses, taught, but required more teaching trials when compared to TC

D. TC led to higher frequency of vocal tact responses, but required more teaching trials when compared to vocal-alone

References


Why Teach Manding First

- For children whose language develops typically, mands:
  1. are often the first form of verbal behavior emitted (Bijou & Baer, 1965; Skinner, 1957),
  2. are often acquired without specific instruction (Sundberg & Partington, 1998), and
  3. are the type of verbal behavior most likely to be spontaneously emitted (Sundberg, 2004).

- Sundberg (2004) refers to the mand as a “dominating type of verbal behavior” (p. 211). Consideration of one’s own daily verbal behavior seems to suggest that a large percentage is mands.

- Many children with autism are either unable to mand or develop defective mand repertoires (Sundberg & Partington, 1998; Sundberg 2004).

- Therefore, manding (social/communication initiation) is considered to be one of the most important skills for children with autism to learn as soon as possible (NRC, 2001).

- Further, the mand response produces strong reinforcement and therefore any sounds that are produced when emitting a mand with sign or picture symbol methods of alternative communication will receive strong reinforcement.

By definition, children with autism:

- engage in aberrant behaviors which interfere with their learning,
- they fail to develop functional communication, and
- they fail to develop appropriate social responses.

- These core deficits can often be addressed through mand training. Various reports (Mirenda, 2003; Charlop-Christy, Carpenter, Le Blanc, & Kellet, 2002; Durand & Carr, 1991; Shafer, 1994; Drash, High, & Tudor, 1999; Koegel, et al., 1998) have indicated that mand training immediately benefits persons with developmental disabilities in the following ways:
  1. Manding reduces problem behavior.
  2. Manding increases social initiations.
  3. Manding increases overall communication attempts.
  4. Since the mand is the only verbal response that directly benefits the speaker it may be the most easily acquired initially and with the greatest functional value to the language disordered child.
  5. Sign mand training using total communication training may produce an increase in vocal productions.
22. The core deficits of autism can be addressed by teaching which repertoire?
A. Tact  
B. Echoic  
C. Mand  
D. Intraverbal

How to Teach The Mand

• Skinner (1957) defined the mand as “a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (pp 35-36).

• In other words, verbal responses that specify and declare a person’s motivation are called mands.

• Mands are commonly called requests.

• Manding is essentially asking for what you want.
• Examples
  • Saying water because you want water
  • Signing cookie because you want a cookie
  • Exchanging a picture of a ball because you want a ball
  • Whining and grabbing because you want a movie

• Controlling Variables:

<table>
<thead>
<tr>
<th>Antecedent</th>
<th>Behavior</th>
<th>Consequence</th>
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<tbody>
<tr>
<td>Motivation (MO)</td>
<td>Verbal Behavior</td>
<td>Specific reinforcement</td>
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<tr>
<td>Want water</td>
<td>Say “water”</td>
<td>Other person delivers water</td>
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<tr>
<td>Want a cookie</td>
<td>Sign “cookie”</td>
<td>Other person gives you a cookie</td>
</tr>
<tr>
<td>Want a ball</td>
<td>Exchange picture of a ball</td>
<td>Other person gives you a ball</td>
</tr>
<tr>
<td>Want a movie</td>
<td>Whine and grab</td>
<td>Other person puts in the movie</td>
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In the field of behavior analysis, motivation is described as motivating operations (Laraway, S., Snycherski, S, Michael, J., & Poling, A., 2003).

This means that effective mand training requires an instructor to arrange motivating operations so that items and activities that may not ordinarily be desirable to children with autism acquire reinforcing value.

The instructor must then be prepared, at the precise moment that the child shows an interest in an item or activity, to prompt the response, thereby giving the child the verbal behavior necessary to obtain the item or activity.

An instructor must capture and contrive as many opportunities per day to teach mands and set a goal of hundreds of mands per day across many reinforcers, teachers, and settings for early learners.

It is critical to begin by prompting mands in order to teach the child that it is easy to get things with verbal behavior and to prevent discouraging the child from communicating by requiring difficult responses at first.
How To Teach The Sign Mand (cont.)

- Get the best quality response with the least amount of prompting.
- Practice teaching mands so that you are skilled in how and when to reinforce, what approximations to accept, what level of prompt to provide, and how to fade the prompts as quickly as possible.
- Consistency in methods across trainers is essential, and numerous trials are necessary to promote generalization.
- An orderly and progressive curriculum must be in place.
- The practical steps to teaching mands, once the MO has been established, include stimulus control transfer procedures. The quick transfer procedure for teaching the mand, as recommended by Sundberg and Partington (1998), includes the following steps:

Stimulus Control Transfer Procedures

- Sign Manding
  - Physical Prompt
  - Gestural Prompt
  - Echoic Prompt
  - Item
  - FADE ALL TO MO + Audience

VIDEOS of Sign Manding

Ian
Katy Case Study
Katy Manding
Katy- Good Vocalization Video
James Case Study
Sophia
References


Procedures to Increase Vocal Productions

• Some learners do not produce vocalizations during sign mand training.

MATTIE VIDEOS OF SIGN MANDING WITHOUT VOCAL PRODUCTION
Mattie First Signs 0:00:58

PROCEDURES TO ADD TO SIGN LANGUAGE TRAINING TO INCREASE VOCAL VERBAL BEHAVIOR

• The literature indicates that there are other procedures that may be used alone or along with alternative communication to increase vocal production:


  • Carbone, et al., (in press) specifically demonstrated that sign mand training along with time delay and echoic prompting procedures increased vocal production and led to some adult form mand responses.

  • The echoic prompting procedure used by Carbone, et al., was similar to the method implemented by Drash, High & Tudor (1999) to increase echoic responses within the context of mand training.


A large percentage of children with autism do not develop vocal responses as their primary method of communication. There is evidence to suggest that sign language training may increase the vocal responding of some children with autism (Mirenda, 2003; Tincani 2004, Schlosser & Wendt, 2008). Many of the children who develop vocalizations do so simultaneous with signing when manding (requesting). Clinical experience has shown that there exists a subset of children with autism who do not vocalize even after extensive mand (request) training. For these children additional interventions may be needed to increase vocalizations.

This experiment included three learners with autism ages 5 and 6 years old. All three learners had developed a small sign-mand repertoire but demonstrated low rate vocalizations and almost no vocal responses during manding. After establishing the baseline rate of vocalizations during manding, a treatment package of reinforcer delay, presentation of an echoic stimulus, and differential reinforcement was implemented within the context of a multiple baseline design across learners. The results of this experiment included the substantial increase in vocal responses simultaneous with the sign mand in all three participants following implementation of the treatment package. In some cases, the vocalizations began to approximate the name of the item or activity being requested with the sign. It appears that in some children with autism sign mand training may not be sufficient to produce vocalizations however, implementation of additional procedures may lead to increases in vocal responding.
**Tony Word Approximations**

“wahwah” for water,

“buu” for book,

“reahl” and “eahl” for cereal,

“ve” and “oove” for movie,

“puh” & “buhbul” for puzzle,

“cahn” & “ahnd” for candy
Ralph Word Approximations

- puh” for puzzle
- “boh” and “bloh” for block
- “ta” and “ain” for train
- “pa” for turn page
- “cht” for pretzel”

References


NEXT STEP
Procedure # 5
Shaping

- When manual sign language and or time delay, differential reinforcement and echoic method produce increased vocal production it may still be necessary to shape the response to more closely approximate the adult form of the word.

- Cooper, Heron, & Heward (2007) describe a teaching procedure called shaping, which can be used to teach novel behaviors. Shaping involves differentially reinforcing successive approximations to a terminal behavior. This means that the practitioner must deliver reinforcement for all responses that share predetermined dimensions of the terminal behavior (i.e., are closer approximations to the terminal behavior) while withholding reinforcement for all responses that do not contain those dimensions.

- A recent report by Newman, Reinecke & Ramos, (2009) demonstrated that a shaping procedure can be an effective method to improve vocal productions of children with autism.

Transcription

- Transcription of the vocal productions during the shaping process can provide a standard on which to determine the sequence of successive approximations toward the adult form.

- Much of the theory about, rationale for, and procedures for transcription can be found in the linguistic literature related to the teaching of individuals with language disorders (e.g., apraxia) or individuals learning a second language.

- A transcript is defined as “an intentional representation of data translated from one medium to another as a necessary and convenient analytic strategy” (Müller & Damico, 2002, p. 301).

- The process of transcription involves 2 main components:
  - A listener who can accurately hear what is spoken
  - A notation system by which to record that which is heard (e.g., The International Phonetic Alphabet (IPA))
• There are also various reasons within the behavior analytic literature to consider using transcription when teaching language.

• Direct and repeated measures of behavior serve as the data for analyzing the relationship between independent and dependent variables (Skinner, 1938, 1953). In this case, the vocal productions and their transcriptions provide a way to objectively measure the vocal product of the learner’s verbal behavior.

• Second, a precise record of speech productions can serve as a method for determining incremental response requirements toward the adult form of the word during the shaping process.

• By identifying the adult form of the word as the terminal behavior and various combinations of speech sounds as successive approximations to that terminal behavior, the process of shaping can be applied to the development of vocal productions.

• Transcription of vocal productions allows the clinician to assess successive approximations to the adult form of the word. This permits the clinician to determine the next step, or the next successive approximation, that will be reinforced as a part of the shaping process.

• Visual display and analysis of data related to improvements of vocal productions based on transcriptive measurements provide a guide for making data-based decisions throughout the shaping process (Fuchs, Deno, & Mirkin, 1982).
## Methods for Transcription

- Based on the reasons identified in both the linguistic and behavior analytic research, we have selected transcription of vocal productions as the dependent measure for vocal training programs.

What follows are examples of the phonetic transcripive alphabet we have designed, as well as a system for classifying vocal productions along a continuum from speech sounds to the adult form of the word.

### Modified Phonetic Transcription

<table>
<thead>
<tr>
<th>Transcribe</th>
<th>Example</th>
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<td>Vowels:</td>
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| Consonants: |         |
| p          | pork   |
| b          | bug    |
| t          | to     |
| d          | dog    |
| k          | king   |
| g          | go     |
| m          | mad    |
| n          | name   |
| v          | vote   |
| ng         | ring   |
| f          | for    |
| th-         | thing |
| th+         | them |
| s          | say    |
| z          | zoo    |
| sh         | ship   |
| zh         | beige  |
| h          | hen    |
| ch         | chew   |
| j          | join   |
| w          | win    |
| y          | yet    |
| r          | row    |
| l          | let    |

[Data Sheets](#)
## Transcribing Vocalizations During Sign Manding

### Differential Reinforcement of Vocalizations

<table>
<thead>
<tr>
<th>Reinforcer</th>
<th>Prompt Level</th>
<th>Vocal Response during Initial</th>
<th>Vocal Response after Time Delay</th>
<th>Vocal Response after Echoic Trials</th>
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### Sign Manding with Time Delay, Echoic Prompting and Differential Reinforcement of Vocalizations

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<td>10.</td>
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</table>
Vocal Production Classification System

To determine progress toward production of the adult form of the word we have developed a classification procedure based upon the transcriptive record from each mand session.

1. Transcribe vocal responding using the phonetic transcriptive alphabet during mand training.

2. Classify transcriptions of vocal responses according to the following categories:

   - **Speech Sounds** → Any vocal production that contains at least one phoneme or any combination of phonemes (not found in the adult form of the word) independent of the relevant controlling variables
• Word Approximations ➔ Any vocal production with at least 2 phonemes included in an adult form of an American English word and emitted more than once throughout the session under the control of relevant variables

• Intelligible Word ➔ Any word that effectively controls the behavior of an unfamiliar listener without contextual cues but does not include all phonemes of adult form under the controls of relevant variables

• Adult Form ➔ Any word that contains all the phonemes of the adult form under the control of relevant variables

2 Graphs

(developed by V. Carbone, T. Kasper, L. O’Brien, M. Janecky, & G. Zecchin)

Speech Sound and Word Approximation

Figure 1. Percentage of Initial Sign Mand Attempts Accompanied by Vocalizations Across Vocal Response Categories: Speech Sounds and Word Approximations
23. A study by Carbone, Sweeney-Kerwin, Attanasio, and Kasper (in press) demonstrated that vocal productions could be increased through implementation of sign mand training and
   A. Time delay, echoic prompting, and differential reinforcement
   B. Time delay and reinforcement
   C. Gestural prompting, echoic prompting, and differential reinforcement
   D. Echoic prompting and prompt fading

24. Which procedure involves differentially reinforcing successive approximations to a terminal behavior?
   A. Prompting
   B. Fading
   C. Shaping
   D. All of the above

25. What type of measurement method can increase the effectiveness of teaching vocal productions.
   A. Partial interval recording
   B. Phonetic transcription of vocal responses
   C. Momentary time sampling
   D. All of the above
26. Transcription of vocal productions allows the clinician to...

A. Determine the next vocal production, or the next successive approximation, to reinforce as a part of the shaping process.
B. Record accurate data
C. Contrive more opportunities for mand
D. Prompt vocal mands

CASE STUDY – Shaping Vocalizations

What follows is a case study in shaping vocal productions using manual sign training, time delay, differential reinforcement, echoic prompting, transcription during mand training and shaping procedures. The procedures are as follows:

- Conduct mand training using manual sign language
- Conduct mand training using time delay, echoic prompts, and differential reinforcement to improve vocal productions
- Transcribe vocal productions to make daily decisions on which vocal productions to reinforce
- Graph data based on the transcribed vocal productions
Participant

- The participant for this study was Matthew (Matty), a 7-1 year-old male who had been diagnosed with autism in December, 2003.

- Matty began receiving intensive one-on-one services at the Carbone Clinic in June of 2004.

- When services began, Matty had no vocal or alternative manding, vocal imitation, tact, or intraverbal repertoires; he had weak motor imitation, receptive, and visual performance repertoires.

- Across his first 4 clinic sessions, when an Assessment of Basic Language and Learning Skills (ABLLS) was conducted, Matty emitted an average of approximately 505 speech sounds per 3 hour session, with an average variety of 20 different speech sounds per session; most of these occurred during highly reinforcing activities (e.g., while dancing, while watching movies, etc.).

  First Vocs 4a Video - PLAYING WITH MAGGIE
  First Vocs 4b Video – SINGING WITH MAGGIE

- When instruction began, Matty was taught to mand using manual sign language. Note that initially sign training produced no increase in vocal production.

  No Vocs 1 - EARLY SIGNS - NO VOCALIZATIONS

- Even after several months of sign mand training there was almost no increase in vocal production.

  No Vocs 2 - LOTS OF SIGNS, STILL NO VOCALIZATIONS

- After he developed a strong manual sign mand repertoire, instructional procedures that included time delay and echoic prompting were implemented to increase the frequency of vocalizations that were produced while manding.

- Use of a time delay, echoic prompting and differential reinforcement did lead to an increase in the production of vocalizations while manding.

  Voc 3 – SHOWS TIME DELAY IN FIRST COUPLE OF TRIALS - MARBLE TRIAL

- This procedure did not have any effect on improving the quality of those vocalizations. Therefore, a vocal mand shaping procedure was developed and implemented to target the improvement of Matty’s vocalizations emitted while manding.
Vocal Productions Correlated with Time Delay and Echoic Prompting
No Improvement in the Quality of Vocal Productions

Procedures – Vocal Mand Shaping Protocol

- While previous procedures supported the development of some vocalizations, limited progress and improvement was noted.

- Therefore vocal shaping procedures were used to target the improvement of vocal productions emitted while manding for all sign mands for which Matty previously met criteria for mastery.

- In other words, these procedures were used to target improved vocal productions for all mands that were strong, meaning that they were consistently emitted under the control of the presence of the item or the MO.
Establishing a Baseline

1. For each sign mand, Matty’s baseline vocal production was established by transcribing the vocal productions that accompanied the first 5 sign mand attempts for a given item.

2. From those transcriptions, it was determined which vocal production was emitted most consistently. This was the baseline measure against which future comparisons were made. If Matty emitted a different vocal production during each of the 5 trials, then the one that most closely approximated the adult form of the vocal mand was selected. This was the baseline measure against which future comparisons were made.

3. A daily updated list of Matty’s best vocal production for each mand was maintained.

Baseline Transcriptions for Mand Training to Improve Vocalizations

**Directions:** Choose mand(s) that have been mastered through the Sign Discrimination Program. Transcribe the vocal response that accompanies the initial sign mand attempt for each reinforcer. Record the date for each trial and the date the baseline was completed for each reinforcer. Highlight the most consistent vocal response. If different vocal responses are emitted on each trial, highlight the response that most closely approximates the adult form. The highlighted vocal response will be the initial baseline measure against which future comparisons of improvement will be made.

**Learner:** Matthew G.

<table>
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<th>Reinforcer</th>
<th>Trial #1</th>
<th>Trial #2</th>
<th>Trial #3</th>
<th>Trial #4</th>
<th>Trial #5</th>
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**Key:**

- **N/A:** No vocalization emitted with the sign during baseline
- **Highlighted:** Baseline in process (no data currently)
- **Highlighted Response:** Initial baseline measure (future comparisons of improvement will be compared to the initial baseline)

**Table 1. Baseline transcriptions for mand training to improve vocal productions (A-G).**
Teaching Procedures

1. A variety of reinforcers were available but out of sight; approximately 5 reinforcers were presented at a time, clearly spread out around the instructor where Matthew could see them.

2. The instructor waited for Matthew to declare motivation for an item (e.g., looking at or reaching for an item).

3. When Matthew emitted the sign mand,
   - If he simultaneously emitted a vocal production that was an improvement over the baseline measure, the instructor immediately delivered the reinforcer.
   - If he simultaneously emitted a vocal production that was NOT an improvement over the baseline measure, or if there was no vocal response emitted, the instructor implemented a 5-second time delay.

   During this 5-second time delay:
   • If a sign mand was emitted with a simultaneous vocal production that was an improvement over baseline, the instructor immediately delivered the reinforcer.
   • If no additional vocal response was emitted during the 5-second time delay or a sign mand was emitted with a simultaneous vocal production that was NOT an improvement over baseline, the instructor began running up to five echoic trials (i.e., modeling the sign while providing an echoic prompt of the adult form of the vocal mand).
     - If, during any one of these echoic trials, Matthew emitted a sign mand with a simultaneous vocal production that was an improvement over baseline, the instructor immediately delivered the reinforcer.
     - If, after 5 echoic trials, Matthew had not emitted a sign mand with a simultaneous vocal production that was an improvement over the baseline measure, the instructor delivered a smaller amount of the reinforcer (differential reinforcement).
Data Collection

• Trial by trial data with transcriptions for all mands were collected.

• All vocal productions emitted on initial sign mand attempts (i.e., unprompted vocal productions) were scored across the 4 vocal response categories:
  – Speech Sounds
  – Word Approximations
  – Intelligible Words
  – Adult Form

Airplane - /pa/
Ball - /baw/
Balloon - /boow/
Block - /bwoolik/
Boat - /buuh/
Book - /book/
Bubbles - /buhbuhw/
Cake - /ka/
Candy - /kah Indie/
Car - /car/
Chip - /chip/
Cookie - /kunke/
Cracker - /krakker/
Crayon - /krebyihn/
Doodle - /dooduul/
Duck - /gihie/
Fish - /fish/
Gear - /ger/
Goop - /goop/
Ice - /icing/
Juice - /jooks/
Jump - /juhmp/

Key - /ke/
Magnet - /mahnch/
Marble - /babuhbuh/
Movie - /moowev/
Music - /myoozih/
Paint - /patuh/
Piggy - /phige/
Popcorn - /pohkorn/
Pretzel - /prutzual/
Puzzle - /putzual/
Rice - /wah/
Shooter - /shusheer/
Slinky - /ihke/
Soda - /stoduh/
Spin - /phn/
Squeeze - /wwe/
Swing - /swih/
Thunder - /thumuh/
Tickle - /tiikwul/
Train - /tra/
Wagon - /wahwih/
Water - /wahhter/
Resetting the Baseline Measure

1. At the end of each session, the instructor reviewed the transcriptions of Matty’s vocal productions that accompanied initial sign mand attempts (i.e., unprompted vocal productions, not those following echoic prompts). If any unprompted vocal production was better than the previous baseline measure, this improved response was set as the new baseline measure against which future comparisons of improvement were made.

2. The list of Matty’s best vocal productions (i.e., baseline measures) was updated daily.
Vocal Mand Daily Baseline Measure

Before Session

Transcriptions below are based upon 4/11/08 mand data


After Session

Improvements based on 4/14/08 session:

- book - /bo/
- candy - /kandi/
- move - /move/
- popcorn - /pop/
- pretzel - /preizel/
- puzzle - /puzel/

Video of Vocal Shaping Procedures

On the next slide are the transcriptions of the sounds produced during the shaping process in the video you will be watching.
Sound Transcription During Manding

REINFORCER

1. Cookie- kuhkeh ➔ TIME DELAY ➔ kuhkeh ➔ PROMPT ➔ kuhkeh ➔ PROMPT ➔ kuhkeh
2. Cookie- kuhkeh ➔ TIME DELAY ➔ kuhkeh ➔ PROMPT ➔ kooke
3. Jump- juhp ➔ TIME DELAY ➔ juhp ➔ PROMPT ➔ juhp ➔ PROMPT ➔ juhp
4. Jump- juhp ➔ TIME DELAY ➔ juhp ➔ PROMPT ➔ juhp ➔ PROMPT ➔ juhp
5. Jump- juhp
6. Puzzle- puhzoo ➔ TIME DELAY ➔ puhzoo ➔ PROMPT ➔ puhzoo ➔ PROMPT ➔ puhzoo ➔ PROMPT ➔ puhzoo ➔ PROMPT ➔ puhzool
7. Pretzel- prehtzoo ➔ TIME DELAY ➔ prehtzoo ➔ PROMPT ➔ prehtzoo ➔ PROMPT ➔ prehtzoo ➔ PROMPT ➔ prehtzoo ➔ PROMPT ➔ prehtzool
8. Movie- mooee ➔ TIME DELAY ➔ mooee ➔ PROMPT ➔ mooee ➔ PROMPT ➔ mooee ➔ PROMPT ➔ mooee
9. Book- buuk ➔ TIME DELAY ➔ buuk
10. Chip- Chihph ➔ TIME DELAY ➔ chihph
11. Chip- Chihph

Steps in Shaping Vocal Productions

- On the next slide is a demonstration of the incremental changes of four (4) words that progressed from speech sounds or word approximation to adult form or intelligible word.
### Findings

- Manual sign mand training led to the development of a functional mand repertoire for Matty but limited vocal production.

- Time delay and differential reinforcement resulted in an increase in the frequency of vocal productions that Matty emitted while sign manding.

- Manual sign mand training incorporating the use of time delay and differential reinforcement did not, however, lead to the development of adult form vocalizations.

- Improving Matty’s vocal productions from speech sounds to intelligible or adult form words required precise shaping of his vocal verbal behavior.

- As was previously discussed, shaping involves differentially reinforcing successive approximations to a terminal behavior.
By transcribing Matthew’s vocal productions, instructors were able to more precisely measure the response products of Matthew’s vocal verbal behavior.

Then, by using the transcriptions to set baseline measures, instructors were able to make more consistent and objective decisions about which vocal productions should be differentially reinforced throughout the shaping process. This allowed the instructors to move forward with the shaping process in a systematic way.

OUTCOMES

The data suggest that, at least for this learner with autism, these procedures have been effective in shaping vocal productions since:

- The percentage of initial mand attempts accompanied by vocal productions categorized as speech sounds steadily decreased and were replaced by more sophisticated vocal productions. [Graph]
- The percentage of initial mand attempts accompanied by adult form vocal productions steadily increased. [Graph 2]
- The cumulative number of sign mands, for which Matthew emitted the adult form vocal mand on the initial mand attempt, increased from 2 to 17. (NEXT SLIDE) [1]
- Matthew’s consistency in meeting or exceeding daily baseline measures continued to improve, even as the daily baselines were updated to more closely approximate the adult form of the vocal mand.

Speech Sound and Word Approximation

![Graph 1: Percentage of Initial Sign Mand Attempts Accompanied by Vocalizations Across Vocal Response Categories: Speech Sounds and Word Approximations](image)

Figure 1. Percentage of Initial Sign Mand Attempts Accompanied by Vocalizations Across Vocal Response Categories: Speech Sounds and Word Approximations
Intelligible Word and Adult Form

Figure 2. Percentage of Initial Sign Mand Attempts Accompanied by Vocalizations Across Vocal Response Categories: Intelligible Word and Adult Form

Figure 3. Cumulative Number of Adult-Form Mands by Session.
Conclusions

- The data from this case study provide some initial support to suggest that transcription can be used to establish precise criteria for differential reinforcement. These criteria can then be used as guidelines for precisely shaping the vocal productions of learners with autism in the context of mand training that incorporates the use of manual sign language, time delay, echoic prompting, and differential reinforcement.

- The vocal shaping procedure described was only implemented during mand training, however probes were conducted to demonstrate Matty’s vocal productions while tacting.

Tact video

- These probes suggest that, although vocal productions while tacting were not specifically targeted for improvement, there seems to have been some carry over across verbal operants.

PETER CASE STUDY

27. The data from a case study from the Carbone Clinic suggest that, at least for this learner with autism, these procedures have been effective in shaping vocal productions since:

A. The percentage of initial mand attempts accompanied by vocal productions categorized as speech sounds steadily decreased and were replaced by more sophisticated vocal productions.

B. The percentage of initial mand attempts accompanied by adult form vocal productions steadily increased.

C. The cumulative number of sign mands, for which Matthew emitted the adult form vocal mand on the initial mand attempt, increased from 2 to 17.

D. All of the above