

Improving the Speech Production of Children with Autism

Emily J. Sweeney-Kerwin
Gina Zecchin-Tirri
Vincent J. Carbone
Marietta Janeckey
Danielle D. Murraray
Kelly McCarthy

Carbone Clinic
Valley Cottage, NY
www.dr-carbone.net

- Many children diagnosed with autism and other developmental disabilities often fail to develop a functional verbal repertoire. It has been reported that 50% of people who are diagnosed with autism have not developed any type of vocal speech. (Rutter 1978.)
- One of the most important skills in the development of a vocal verbal repertoire is a child's ability to vocally imitate sounds or words (echoic behavior). Echoic behavior is defined as a verbal operant with, ".....point to point correspondence between the sound of the stimulus and the sound of the response." (Skinner 1957)
- Skinner (1957) states that "When some echoic behavior has been acquired, the acquisition of a new unit is simplified." Skinner (1957) points out that in formal education, the echoic repertoire allows the teacher to bring echoic responses under new forms stimulus control. For example, teaching young children to name things is easier for the teacher after an echoic repertoire has already been established. Furthermore, it has been suggested (Carroll & Hesse 1987) that an established echoic repertoire can aid in the development of other language repertoires.

- Although the importance of the echoic repertoire has been well established, it remains perhaps one of the most difficult repertoires to teach in children who fail to acquire it through typical means. Drash, High and Tudor (1999) report, “One of the most challenging tasks in establishing functional verbal repertoires in autistic and other language delayed children is teaching vocal imitation to children who have no speech and no ability to imitate.”
- While the importance of an echoic repertoire is widely acknowledged, the behavioral research on teaching an effective echoic repertoire remains limited. Many early behavioral language training programs (Drash & Leibowitz 1973; Guess, Sailor & Bear 1976; Kent, 1974 Lovaas, 1977) focused on teaching vocal behavior mainly through shaping sound approximations in words and sentences.
- Lovaas, Koegel, Simmons and Long (1973) demonstrated that using a shaping procedure to teach vocal imitation produced an increase in vocal speech production in children with developmental disabilities. Similarly, Sloane, Johnston and Harris (1968) found that shaping vocal imitations increased the vocal speech in children diagnosed with autism.

- Eikseth and NSSERT (2003) demonstrated that teaching a group of words which contained target misarticulated sounds using a vocal imitation program produced mastery of the target sounds in novel words in children diagnosed with phonological disorder.
- Many behavioral language training programs have made use of behavioral procedures such as shaping, reinforcement, prompting, time delay and chaining procedures to increase vocal imitation skills. (Lovaas, 1981;2003, Maurice, Green and Luce, 1996, Leaf & McEachin, 1999)
- A variety of non-behavioral approaches have been developed, and used to improve the articulation skills in people diagnosed with apraxia of speech (AOS). Nancy Kaufman (1997) defines AOS as, "... a motor-speech programming disorder resulting in difficulty coordinating the oral-motor movements necessary to produce and combine phonemes (consonants & vowels) to form syllables, words, phrases and sentences." (Kaufman, p. 1)

- Most of these types of treatments for children with AOS have been designed to improve their vocal imitation skills within and across sound categories. Some of the techniques that have been used are integral stimulation, articulatory placement cueing, PROMPT therapy and repeated practice (Wambaugh 2002).
- There is minimal empirical evidence for most approaches to AOS (Wambaugh 2002) and virtually no empirical research related to the treatment of children with the combined diagnosis of apraxia and autism.
- The Kaufman method is another approach to teaching vocal imitation in children who have AOS. It is a method based on how children attempt first words. The Kaufman method (1997) is a set of techniques that involves reinforcement of successive approximations, and employs phonological processes to simplify words to teach successive approximations to the adult form of the word.

- 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.

Method

Participant and Setting

- There were two (2) participants in this study. Max was a three (3) year old boy diagnosed with autism and moderate disabilities with a developing language repertoire. Vincent was a four (4) year old boy diagnosed with autism and delays due to a premature delivery with a slow developing language repertoire.
- Both participants had hearing within the normal range and did not present with any oral-motor organic problems which would preclude them from producing speech sounds.
- The experiment was conducted in a private educational setting that Max attended four (4) days a week for about 12 hours and Vincent attended five (5) days a week for 15 hours.

Method

Speech Target Selection

- Each learners' articulation was evaluated using a modified Kaufman Speech Praxis Treatment Assessment – Basic Level. (1997)
- Using this assessment, word categories where articulation broke down were identified. Individual words from the categories were selected as targets for the intervention. The words were then randomly assigned to one (1) of the two (2) experimental conditions, Kaufman or Echoic. Each group of words contained the same syllable shape.
- Based on the modified assessment, Max's articulation broke down in the CV1CV2 – Simple Bisyllabic section. Vincent's articulation broke down in the CVCVCV – Simple Polysyllabic section.
- Treatment on a group of words was discontinued after all words in either group met criteria. For Max, criteria was met on all words which received the Kaufman protocol so a second and third group was added into treatment.

- For Max, words targeted to receive training using the modified Kaufman protocol were: *muddy, potty, panda, marble, and handle*. Words targeted for the echoic protocol were: *dirty, tuna, dino, mona, and paddy*.
- After criteria was met on the first group of words, a second and a third group of words were selected based upon the original modified assessment. Each group of words were randomly assigned to one (1) of the two (2) experimental conditions, Kaufman or Echoic. For the second group of words Max's articulation broke down in the C1V1C2V2 + CVC section. For the third group of words, Max's articulation broke down at in the CVCVCV – Polysyllabic section.
- The second group of words to receive treatment for Max using the Kaufman protocol were: *bottle top, pony ride, paddle boat, honey pot and muddy boot*. Words targeted for the echoic protocol were: *bunny hop, panda bear, tummy hurt, teddy bear and dirty hat*. The third group of words to receive treatment using the Kaufman protocol were: *potato, petunia, Ohio and animal*. Words targeted for the echoic protocol were: *tomato, domino, Idaho and bandana*.
- For Vincent, words targeted to receive training using the modified Kaufman protocol were: *tomato, piano, bandana, Indian and Ohio*. Words targeted for the echoic protocol were: *potato, petunia, domino, tornado and Idaho*.

Response Definition, Data Recording and Reliability.

- The dependent variable was defined as the number of correctly articulated words that met mastery criteria of three (3) consecutive daily cold probes.
- A correct response was defined as the learner correctly echoing the adult form of the word presented by the instructor within three (3) seconds of the presentation of the echoic stimulus.
- Responses were considered incorrect if the participant did not achieve parity of the adult form of the target word presented or if the response occurred after three (3) seconds of the presentation of the echoic stimulus.
- Cold probes were conducted at the beginning of every session before any teaching occurred. During the probes for all words in each of the two treatment conditions, the instructor presented the adult form of the target word and recorded a “yes” for correct responding and a “no” for incorrect responding.

- During the cold probes, reinforcers were not delivered regardless of the accuracy of the participants response.
- The participant's instructor was the primary data collector. With a data sheet attached to a clipboard the instructor coded each vocal imitation as correct or incorrect. Additional instructors were trained to record data simultaneously but independently for the purposes of assessing inter-observer agreement (IOA).
- An agreement occurred when both recorders coded the observed response as either correct or incorrect and a disagreement occurred when the recorders did not agree on the accuracy of the response observed. The inter-observer agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100.
- Inter-observer agreement was 80% for all of the sessions for which reliability was assessed. Inter-observer agreement was assessed for about 15% of the sessions.

Experimental Design

- An alternating treatment design across words was used to evaluate which training procedure, Kaufman or Echoic was more effective as a treatment to improve articulation. (Barlow & Hayes 1979)

Baseline

- For Vincent eight (8), words were targeted for treatment based upon the assessment and for Max ten (10) words were targeted for treatment based upon the assessment. The words selected for each learner were randomly assigned to one of the two treatment conditions with both conditions having an equal number of target words.
- During baseline, daily cold probes were taken on all words targeted for treatment.
- Baseline occurred for five (5) sessions.

Treatment

- To ensure randomization, the words “Kaufman” and “Echoic” were printed on equal number of pieces of paper and combined. At the beginning of each experimental session, one (1) word group was drawn at random to be used as the first group presented for that session.

Echoic Protocol

- Each treatment session began with a cold probe for each word by presenting the adult form. No reinforcement was given during the probe if parity occurred.
- Teaching trials began with the instructor holding up a promise reinforcer. The instructor presented an echoic stimulus (target word). If parity occurred, a reinforcer was delivered.
- If parity did not occur, the echoic stimulus was presented again. For Vincent, if parity did not occur after five (5) presentations, the instructor would present an easy motor imitation for him to imitate and would then deliver a reinforcer. For Max, if parity did not occur after five (5) presentations, the instructor would present an easy, mastered word for him to echo and would then deliver a reinforcer.
- Two (2) teaching trials for each word occurred during a session.

Kaufman Protocol

- Each treatment session began with a cold probe for each word by presenting the adult form. No reinforcement was given during the probe if parity occurred.
- Each targeted word was broken down into word shells in a hierarchy from simple to complex. For example, the target word “panda” was broken down into “pa-uh”, “pa-duh”, “pan-duh”, “panda”.
- Teaching trails began with the instructor holding up a promise reinforcer. The instructor presented the lowest word shell as an echoic stimulus. If parity occurred, the instructor would immediately move up to the next word shell and present that shell as an echoic stimulus. If parity continued, the instructor would continue to move up the shell until the adult form was echoed.
- If parity did not occur, the instructor would present that word shell as an echoic stimulus again to the learner. The instructor would present the word shell up to five (5) times before dropping down to an easier skill. For Vincent, if parity was not reached on the lowest word shell, the instructor would present an easy motor imitation for him to imitate and then reinforcement would be delivered. For Max, if he did not receive parity at the lowest word shell, the instructor presented an easy known word and would then deliver reinforcement.

Results

- Vincent met criteria on one (1) word in the Kaufman group after four (4) weeks of treatment. Max met criteria on one (1) word in the Kaufman group after two (2) weeks.
- Vincent met criteria on one (1) word in the echoic group after six (6) weeks. Max met criteria on one (1) word in the echoic group after 14 weeks.
- As shown in Figure 1, Vincent met criteria on all four (4) words that under went treatment using the Kaufman protocol and met criteria on one (1) of words that under went treatment using the echoic protocol.
- The data displayed in Figures 3 represent the average number of trials to criterion. Vincent achieved parity for each target word in an average of 22 teaching trials using the Kaufman protocol and about 88 trials using the echoic protocol.
- These results show that Vincent met criteria on four times as many words in the Kaufman condition as in the echoic condition in a quarter of the number of trials.

- As shown in Figure 2, Max met criteria on all 14 words that under went treatment using the Kaufman protocol and met criteria on six (6) of the words that under went treatment using the echoic protocol.
- Figure 4 presents Max's data for average number of trials to criterion. The average number of trials to criteria using the Kaufman Protocol were eight (8) and the average number of trials to criteria using the Echoic Protocol were 18.
- These data show that Max achieved parity more than two times the number of adult forms of target words in less than the number of teaching trials.

Discussion

- The results of this study demonstrated that using the Kaufman protocol is superior to the echoic protocol with these participants related to the improvement of articulation.
- Baseline data suggested that both participants could not articulate any of the words targeted for treatment prior to implementation of these procedures.
- Through the use of reinforcement of successive sound approximations using a sound simplification system, both learners were met criteria faster, in fewer trails than using a treatment that did not take into account a phonological process to simplify words and reinforcement of successive approximations.

- For Max probes were conducted to determine if the improved articulation achieved as echoic responses would transfer to tact responses. Following achievement of mastery criterion for each target word in the Kaufman and echoic conditions Max was taught to tact pictures each target word. Probes for correct articulation of the tact responses were then conducted.
- The results of these probes demonstrated that there were better results in transferring the words from echoic control to tact control when words were taught using the Kaufman protocol rather than the echoic protocol.

Implications

- The implications for improving articulation in children with autism and other developmental disabilities may be as follows:
- The findings of this study provide the practitioner with a method to assess and treat the articulation deficits of children with autism even when they do not have extensive training in the analysis and treatment of individuals with phonological disorders.

- By using the Kaufman Speech and Language Praxis Kit (1997) as an assessment the selection of targets for vocal imitation training is simplified and based upon information related to an individual's current level of performance.
- The treatment protocol can be used by people within the field of ABA to assess and treat children who present with poor articulation patterns.

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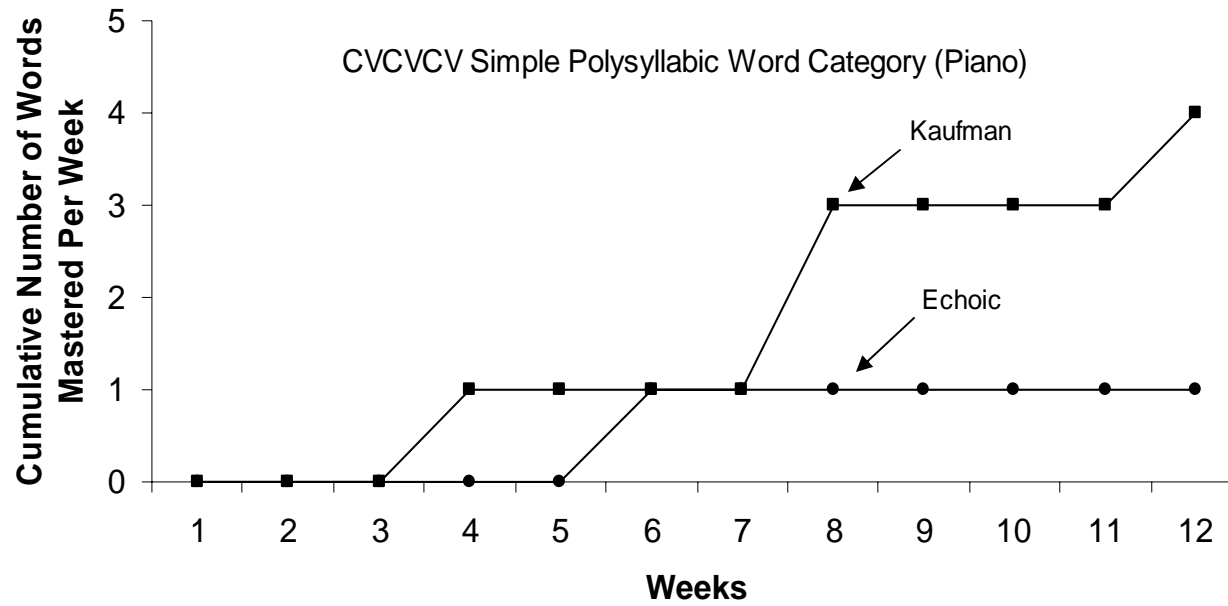


Figure 1. Cumulative number of Kaufman and Echoic words mastered per week for Vincent

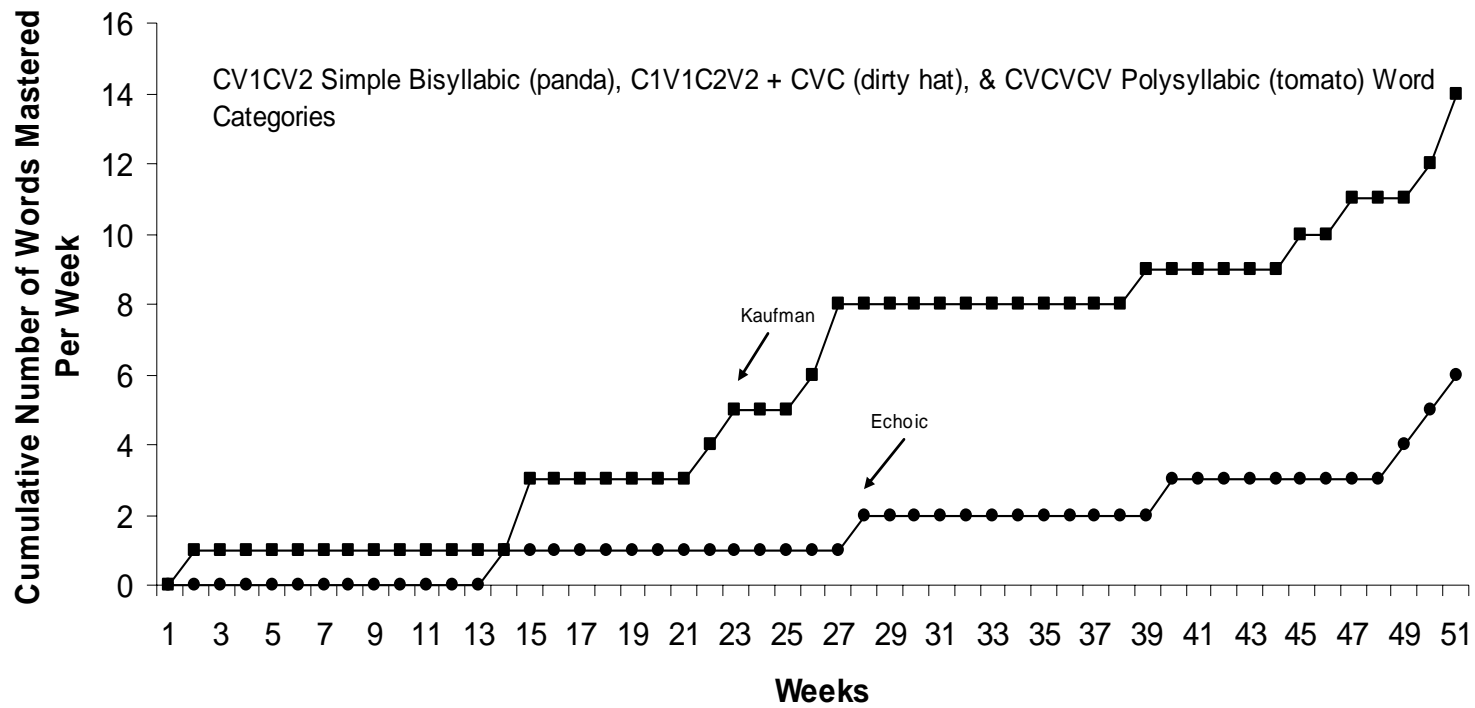


Figure 2. Cumulative number of Kaufman and Echoic words mastered per week for Max

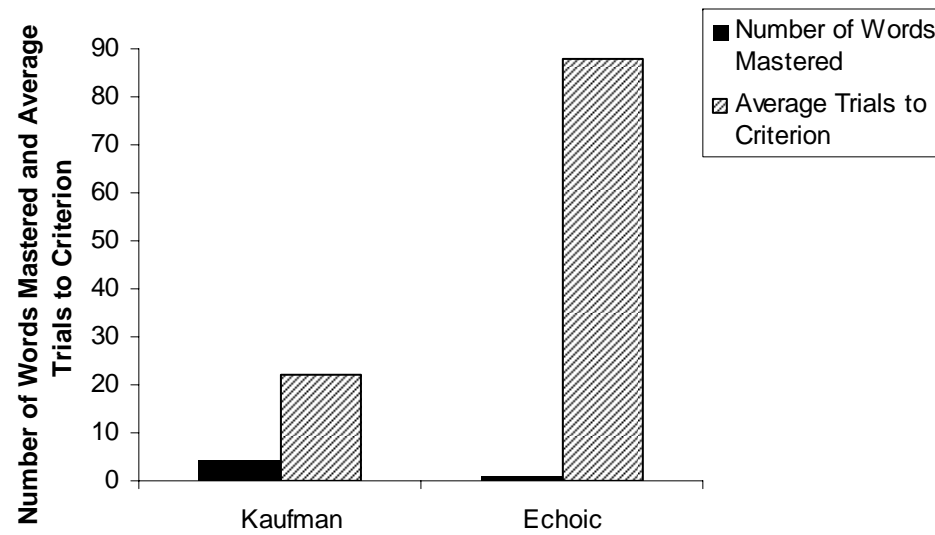


Figure 3. Cumulative number of words mastered in Kaufman and Echoic conditions and average trials to criterion per condition for Vincent.

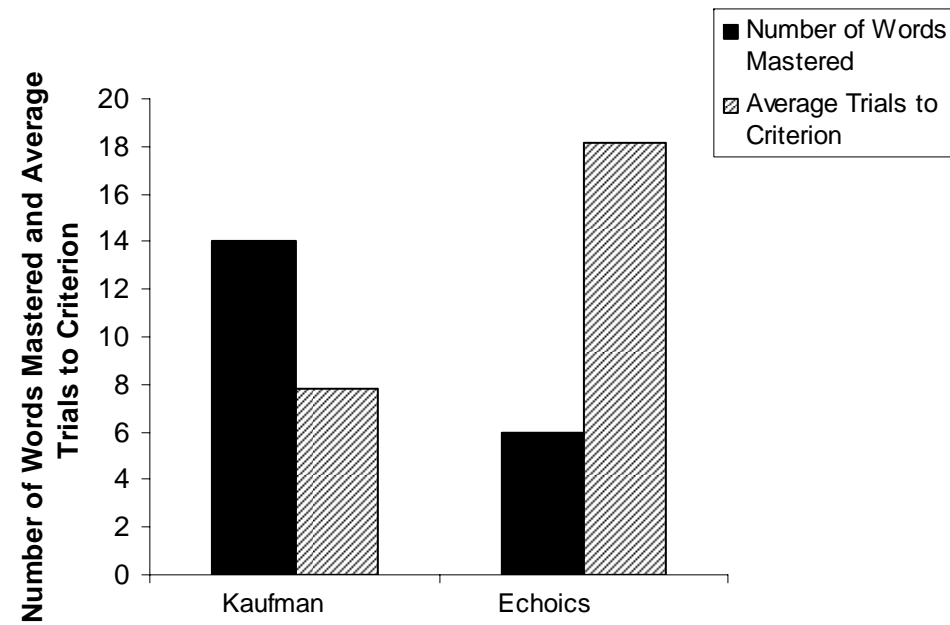


Figure 4. Cumulative number of words mastered in Kaufman and Echoic conditions and average trials to criterion per condition for Max.