Speech Production and ABA: Using a Conceptual Analysis of Phonetic Hand Cues to Shape Speech Production

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Disclosures

- Financial
  - I do not have financial relationships relevant to the content of this presentation.

- Nonfinancial
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Abstract

Phonetic hand cueing systems are commonly used by speech-language pathologists and promoted in commercially available products (Carahaly, 2012; Kaufman, 2007; Strode, 1994, and others), however; research on the effectiveness of these systems for improving articulation is limited (Hall and Jordan, 1992, Jordan 1988, Klick, 1985, Stelton & Graves 1985). This series of studies examines the effect of the systematic use of phonetic hand cues as a stimulus control transfer procedure and compares the relative effectiveness of phonetic hand cue procedures to other commonly used differential reinforcement procedures. Study results reveal rapid acquisition of hand cues, and improved articulation at the syllable, and word level as well as use of hand cues to improve intelligibility in natural settings. Reduction of speech sound errors on formal testing further confirms results. Use of hand cues as part of an ABA or school program from target selection to generalization of improved articulation across the verbal operants will be presented and illustrated via video examples. Results confirm previous case study findings that phonetic hand cues may be an effective intervention in promoting speech production skills in children with autism with limited vocal repertoires.

Keywords: Autism, echoic, verbal vocal behavior, sign language

Introduction

- Improving speech intelligibility in children with autism with limited vocal repertoires is the focus of many early intensive behavior programs.
- Treatment strategies from the fields of Speech-Language Pathology and Applied Behavior Analysis have been implemented to attempt to develop and shape vocal repertoires in children with autism.

Introduction

- Speech-Language Pathologists (SLPs) often employ a medical model to diagnose a specific speech sound production disorder
- Through a careful case history, assessment of repertoires and characteristics of errors, the SLP makes a diagnosis which often infers etiology of the disorder
- In theory, the diagnosis would then guide the SLP in selecting the most effective treatment based on research of treatments utilized for that particular diagnosis
- Targets are carefully selected (typical development, motor complexity, stimulability, etc.)
- SLPs often provide intervention with less intensity than Behavior Analysts (BAs) which may results in fewer training trials and increased time to assess treatment effects

Introduction

- Behavior Analysts (BAs) collect detailed inventories of existing echoic repertoires and the conditions under which those repertoires are occasioned and reinforced (including verbal operants)
- BAs analyze the Discriminative Stimuli that occasion a response, the Establishing Operations that influence the value of a reinforcer and rate of a response, and the consequences that increase or decrease the likelihood of that response occurring in the future under similar conditions
- A conceptual analysis is employed
- Current research is consulted and treatment designed and implemented with careful measurement of progress and manipulation of variables to maximize progress, however; speech-language literature is not often consulted.
- BAs are often able to implement many training trials with tight integrity controls thereby allowing a quicker analysis of effectiveness of a procedure

Introduction

Typical Development of Vocal Verbal Skills

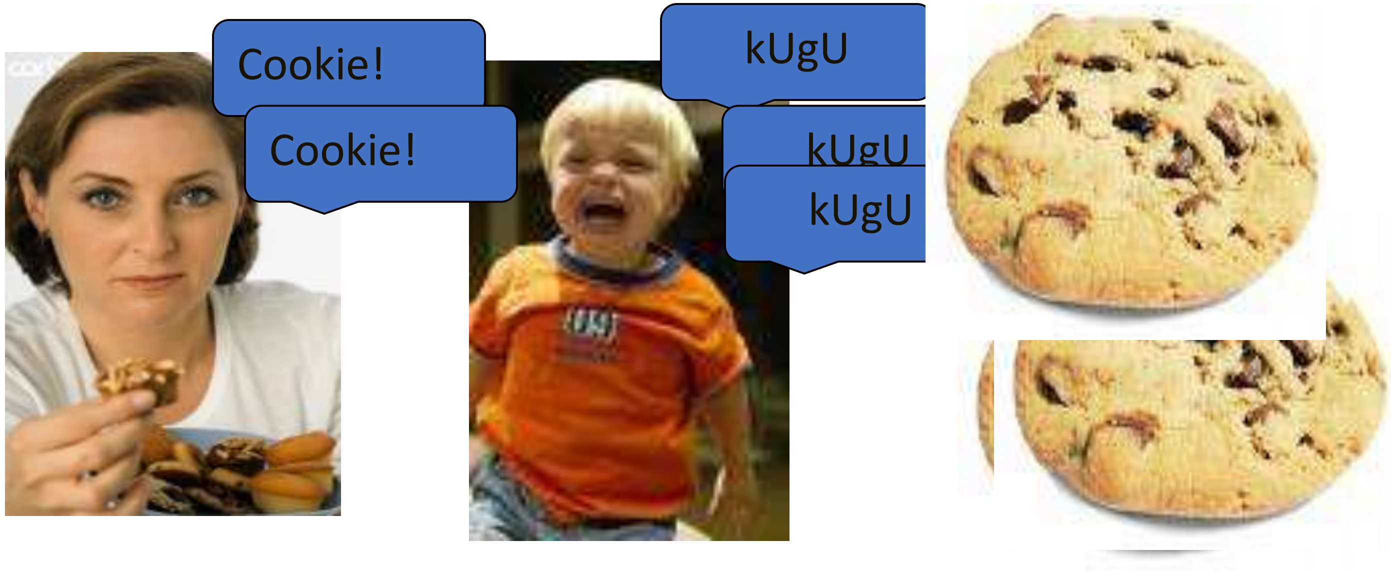
- Socially-Mediated Positive Reinforcement→

  Attention, Items

- Automatic Reinforcement→ Sounds/Words heard while receiving reinforcement are more likely to be produced
- Parity → Automatic shaping of vocalizations to match those of significant others "outcome monitoring"
- Physiologic Variables →Children with intact neurology and anatomy are set up to develop sounds in a predictable progression

Shaping Speech Production

Antecedent→Behavior→Consequence



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Yum Yum
cookies

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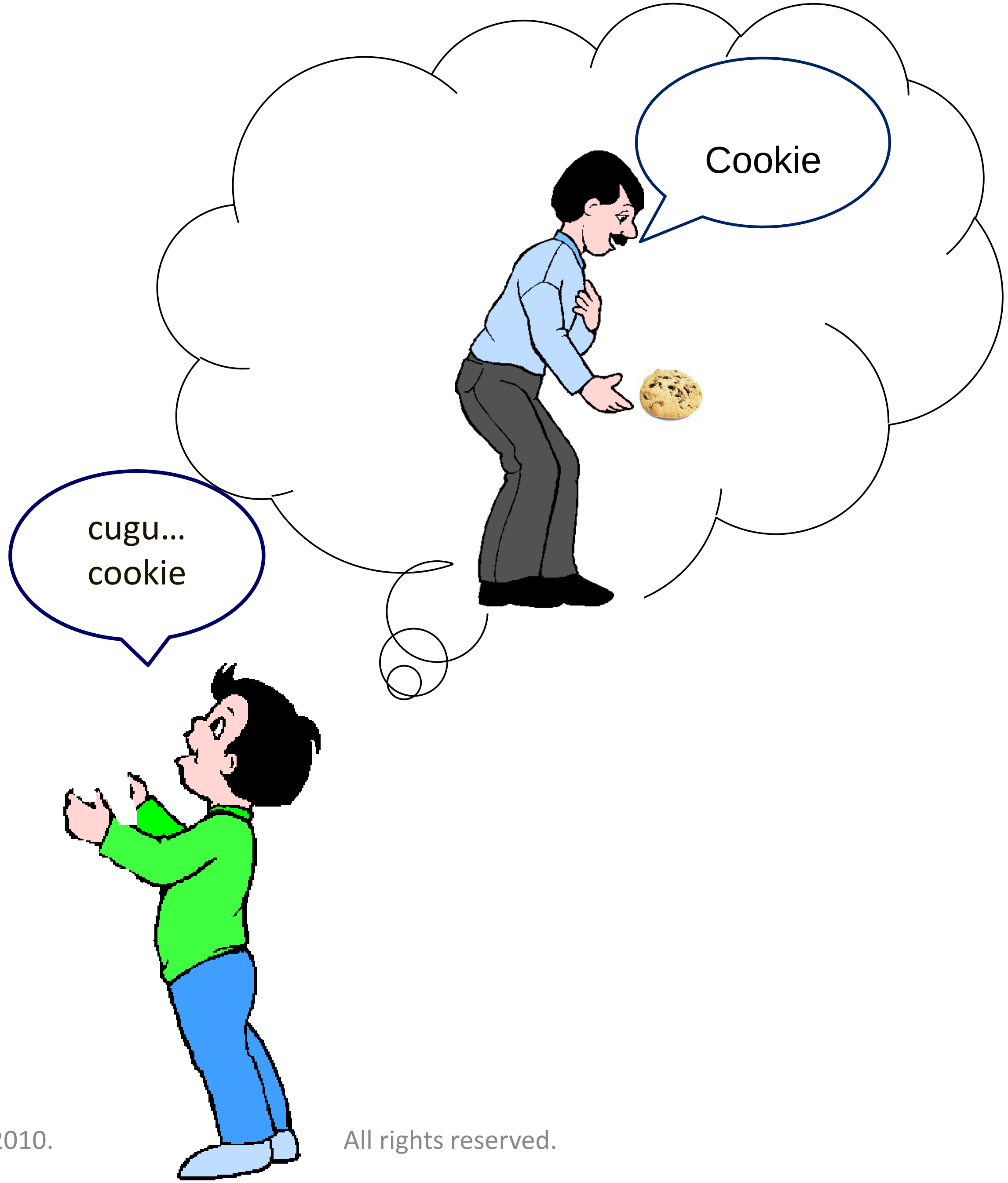
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Introduction

Typical Development of Vocal Verbal Skills

- Parity: "Automatic" shaping of verbal responses toward parity (to match) the vocalizations of others in your environment (the verbal community) which is mediated by the speaker's repertoire as listener.

Palmer, D, (1996). The Role of automatic reinforcement in the establishment of parity. *Journal of the Experimental Analysis of Behavior*. 65(1): 289–290.

Introduction

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Introduction

Childhood Apraxia of Speech

- Some children with a diagnosis of autism demonstrate characteristics of childhood apraxia of speech (CAS).
- *According to the American Speech-Language-Hearing Association (ASHA), the* core impairment in CAS in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody:
    - inconsistent errors
    - lengthened and disrupted coarticulatory transitions between sounds and syllables

Literature Review

Literature Review
Motor Programming Approaches

- Motor programming approaches, which may also be termed *articulatory* or *phonetic* approaches are often used to remediate childhood apraxia of speech by SLPs and include integral stimulation (Strand& Debertine, 2000; Strand& Skinder, 1999) as well as a number of commercially available intervention programs (e.g., Dauer, Irwin, & Schippits, 1996; Kaufman, 1995; Kirkpatrick, Stohr, & Kimbrough, 1990; Strode & Chamberlain, 1993; Williams & Stephens, 2004).

Literature Review

Motor Programming Approaches

- According to motor learning theory, a generalized motor program (GMP) is an abstract movement pattern that specifies relative timing and relative force of muscle contractions. (Schmidt, 1975; Schmidt & Lee, 2005).
- “recognition schema” that encodes the relations among the initial conditions, the sensory consequences of the movement, and the outcome of the movement
- Before “recognition schema” can be used to judge the accuracy of the movement, the system must first learn which sensory consequences are to be considered “correct.”

Literature Review
Motor Programming Approaches

- Some GMPs provide clear reference of correctness, while other references of correctness are not directly interpretable to the learner but depend on feedback from an instructor (e.g. golf v. somersault skydiving)
- In such cases, the learner must calibrate the expected sensory consequences with an externally provided reference of correctness, so that the internal error signal may serve to correct errors on future trials without external feedback.

Literature Review

Phonetic Hand Cues

- Phonetic or phonemic hand cuing systems are systems of hand gestures which are modeled by the instructor and are paired with the production of a sound.
- In general, the instructor’s hand is held near his/her face and the hand movement is modeled by the instructor at the moment that the sound is produced by the instructor and again when the sound is produced by the learner.
- In theory, some hand cues mimic aspects of the speech sound and provide additional visual cues which in application may improve speech sound production

Literature Review

Phonetic Hand Cues

- Among the interventions that utilize phonetic hand cues, efficacy research has been reported only for the integral stimulation approach (Strand & Debertine, 2000; Strand & Skinder, 1999).
- Phonetic hand cuing systems are often included in treatment packages designed for treatment of childhood apraxia of speech in commonly available speech-language products (Carahaly, 2012; Kaufman, 2007; Strode, 1994),
- However; research on effectiveness of phonetic hand cuing systems is limited (Hall and Jordan, 1992, Jordan 1988, Klick, 1985, Shelton & Garves 1985).

Literature Review

Cued Speech

- Perrier et. al. (1986) found that Cued Speech improved spoken language acquisition when combined with manual communication in young deaf children.
- Cued Speech can support speech and articulation skills by "reinforcing the pattern of phonemes within a word or phrase….motoric reminder and trigger of speech production"
- Jaffe (1986) advocated for the use of the manually signed alphabet to improve speech production in the treatment of apraxia.


Cued Speech for American English

Sign Language Alphabet
Aa Bb Cc Dd Ee Ff Gg
Hh Ii Jj Kk Ll Mm Nn
Oo Pp Qq Rr Ss Tt
Uu Vv Ww Xx Yy Zz

Literature Review
Signed Target Phonemes

- In a single subject study, a 5-year-old-boy with developmental apraxia of speech received therapy from two different clinicians.
- The clinicians working with John charted and compared therapy sessions in which STP was used to facilitate correct production, versus session in which it was not used.

Literature Review
Signed Target Phonemes

- Clinician A incorporated signed target phonemes into traditional therapy while Clinician B used a traditional auditory/visual approach instructing the child to "watch me, do what I do."
- The target phoneme was initial /s/ in CVC combinations.
- In the initial steps, John reached criterion more quickly in few sessions using signed phonemes. At the end of the school year, John exhibited 80% accuracy of production of initial /s/ in spontaneous speech.

Literature Review

Adaptive Cuing Technique

- One study by Klick (1985) used an Adaptive Cuing Technique (ACT)
- ACT reflects the shapes of the oral cavity and movements required during speech production.
- Patterns of articulatory movement and manner of production of sounds are made visible by motions of the hand.
- In cuing place of production, the trajectory of the tongue, rather than its static placement is represented.

Literature Review
Adaptive Cuing Technique

- Finger movements signal specific speech sounds. The fingers are held in configurations loosely based on those of the manual alphabet but correspond to phonemes in the word.
- A study of a 5;6 year old girl found that after 3 months of treatment, her oral communication skills improved. She progressed from 2 to 4 true words to several carrier phrases and 12 single words were produced functionally.
- Within 6 months she began producing novel utterances. As treatment progressed, she became less reliant on ACT and it's use was reduced.

Literature Review

Summary

- Efficacy research has been reported for the integral stimulation approach (Strand & Debertine, 2000; Strand & Skinder, 1999) which utilizes gestural cues as part of a treatment package.

- Others (Hall and Jordan, 1992; Jordan 1988; Klick, 1985) demonstrated that use of instructor executed hand cues improved speech production as an antecedent prompt or simultaneous prompt as part of a treatment package. One study demonstrated the superiority of vocal training with hand cues to vocal training only. (Shelton & Garves, 1985).

- Subjects were not required to execute hand cues simultaneously with sound production in these studies.

Literature Review

- In theory, some hand cues mimic aspects of the speech sound and provide additional visual cues which in application may improve speech sound production.

- Additional research provides evidence of the “motoric integration of speech and manual systems” which demonstrated changes in the magnitude of speech movements during pointing, finger tapping, grasping, and hand movements (Esteve-Gibert & Prieto, 2013; Rusiewicz, et al., 2013; Rusiewicz, et al., 2014; Parrell, et al., 2014; and Gentilucci et al., 2001.)

- Roberge, et al. (1996) found that gestural cues performed by subjects resulted in change in magnitude of vowels while instructor-modeled cues did not.

Literature Review

Requiring Vocal & Sign Language

- There is a strong body of literature supporting the use of sign language to increase speech production (Schlosser & Wend, 2008a; Barerra, et. al, 1980; Barrera, Sulzer-Azaroff, 1983; Barrett & Sisson, 1987; Carbone et. al., 2006; Conaghan et. al., 1992; Kouri, T.A., 1988; Linton & Singh, 1984; Sisson & Barrett, 1984; Tincani, 2004) especially when combined with time delay procedures (Carbone, et. al., 2010).
- In this research, Sign language is taught as a response form rather than used as a prompt.

Literature Review

Requiring Vocal & Sign Language

- Sisson and Barret (1984) compared requiring echoic or echoic and mimetic (sign) responses to teach minimally verbal individuals with cognitive impairment to sequence words.
- These authors demonstrated the superiority of providing and requiring vocal plus signed stimuli in establishing sequences of words.

Literature Review

Requiring Vocal & Sign Language

- Similarly, Sundberg (1993) noted that sign language may improve articulation
- He noted that if signs begin to evoke specific vocalizations, they may be more effective than echoic prompts in transfer of stimulus control
- Acquisition of motor sequences for signs may be matched with vocalizations
- This sign-vocalization prompt can be used by the learner to self-prompt his own vocalizations

Literature Review
Requiring Vocal & Sign Language

- Tincani (2004) also offers this explanation to account for superiority of sign compared to PECS in the development of vocal responses
- He noted that learners signed the tact (and/or looked at the sign produced) and then emitted the vocal response
- Carbone (2006) in his study comparing the effects of TC vs. vocal-alone (VA) training on the vocal tact responses noted that anecdotally, use of signs as prompts for vocalization seemed to be confirmed by the behavior of the study participant

Literature Review

Motor Learning Theory, Deaf Education

- In promoting speech reception and speech production in deaf children, discriminative stimuli (Cued Speech) are used to occasion specific phonemes as the deaf individual lacks physiology for monitoring vocal verbal productions.
- Similarly, children with autism with limited speech production skills may lack the physiology and learner history for an echoic prompt to exert stimulus control over an echoic production.

Literature Review

Motor Learning Theory, Deaf Education

- In addition, parity may not function as a reinforcer due to limited learner history
- Thus, children with autism and severe speech production issues, much like deaf children, may benefit from discriminative stimuli and carefully executed reinforcement contingencies in order to consistently produce and generalize phonemes.
- Learner production of a phonetic hand cue may serve as a discriminative stimulus to evoke the correct phoneme.

Phonetic Hand Cues Discriminative Stimuli

- BAs might conceptualize a PHC as a discriminative stimulus that evokes production of specific phoneme (GMP) due to a history of reinforcement.
- As such, it could be used to transfer stimulus control to the stimuli that should ultimately control the response (echoic, M0-mand, tact, etc.)
- As such, the exact topography of the hand cue would be less critical as long as the hand cue/phoneme differs from other hand cue/phonemes and can be produced by the learner.

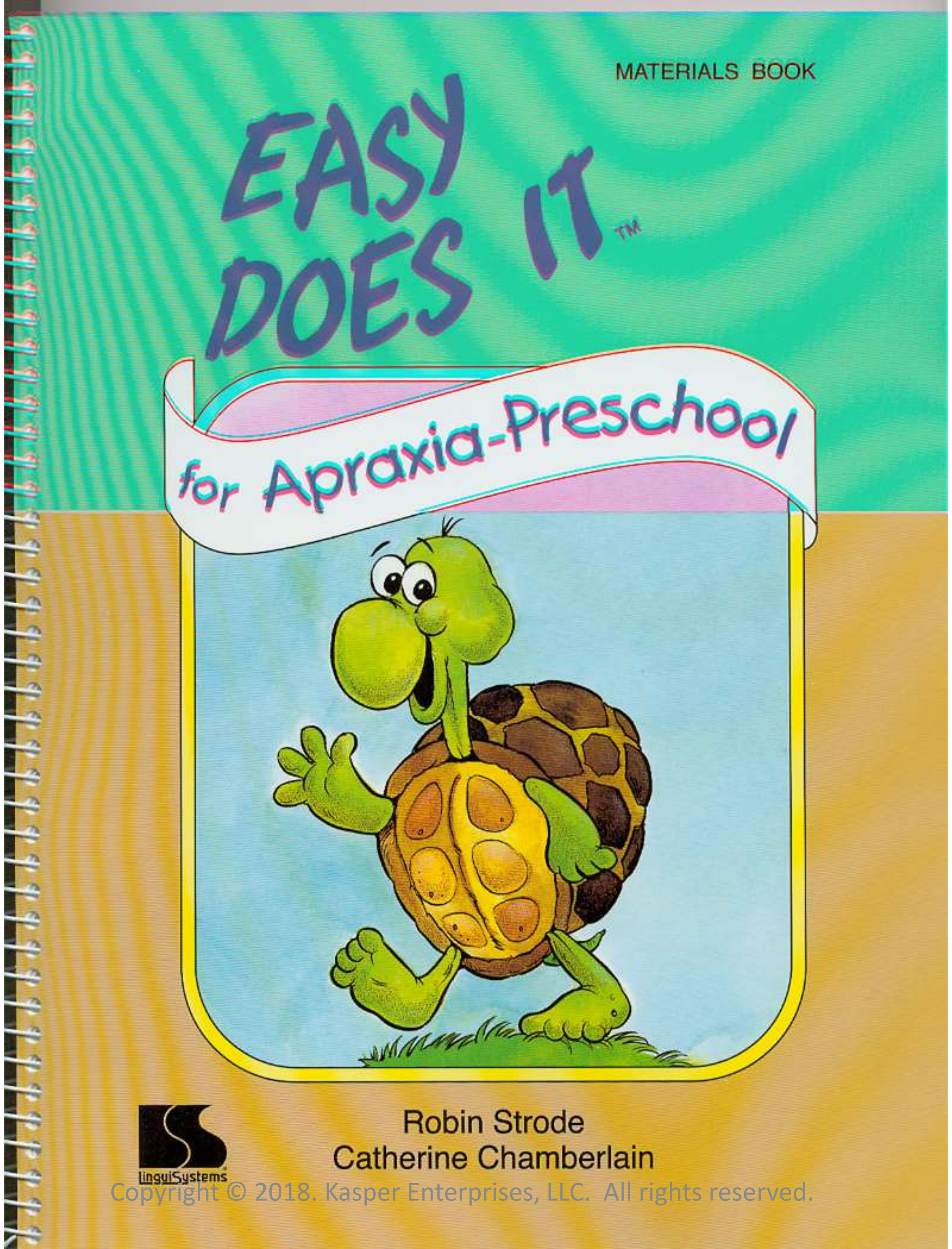
Phonetic Hand Cues as Discriminative Stimuli

- If the learner is taught to emit the hand cue with production of the phoneme, this might serve as a self-prompt or self-instruction for production of the correct phoneme in novel syllables or words.

Clinical Work

Clinical Work

- In 2000, the author routinely using hand cues with students with autism who also demonstrated characteristics of apraxia of speech as a speech-language consultant to a Lovaas replication sight.
- Clinically, children receiving direct intervention began making substantial gains in speech production relative to their progress with echoic only programming and teams requested instruction in the hand cuing system.
- Using the work of Robin Strode and Catherine Chamberlain as a guide, the author developed a set of hand cues for specific phonemes that various clinics began employing with children who could produce some sounds, but were experiencing difficulty sequencing sounds to form syllables, words, and longer utterances.


MATERIALS BOOK
EASY DOES IT™
for Apraxia-Preschool
Robin Strode
Catherine Chamberlain
LinguiSystems

Criteria for Hand Cues

- Modified or invented according to the following criteria:
  - Simple hand shapes
  - Easy to imitate or prompt
  - Each cue is topographically different from any other
  - Near the face to promote attention to mouth movement
  - Sustained sounds included a sustained movement with onset and offset corresponding to vocal onset and offset

HAND CUES

"p" as in "pop" "b" as in "boy" "m" as in "man"

"t" as in "top" "d" as in "dog" "n" as in "no"

"k" as in "kite" "g" as in "go" "ng" as in "sing"

"f" as in "fox" "v" as is "vase" "h" as in "hat"

HAND CUES


"w" as in "win"


"l" as in "lake"


"y" as in "yes"


"r" as in "rat"


"s" as in "sit"


"z" as in "zoo"


"sh" as in "ship"


"zh" as in pleasure


"ch" as in chop


"j" as in "jump"


"th" as in ""thin"


"th" as in "that"

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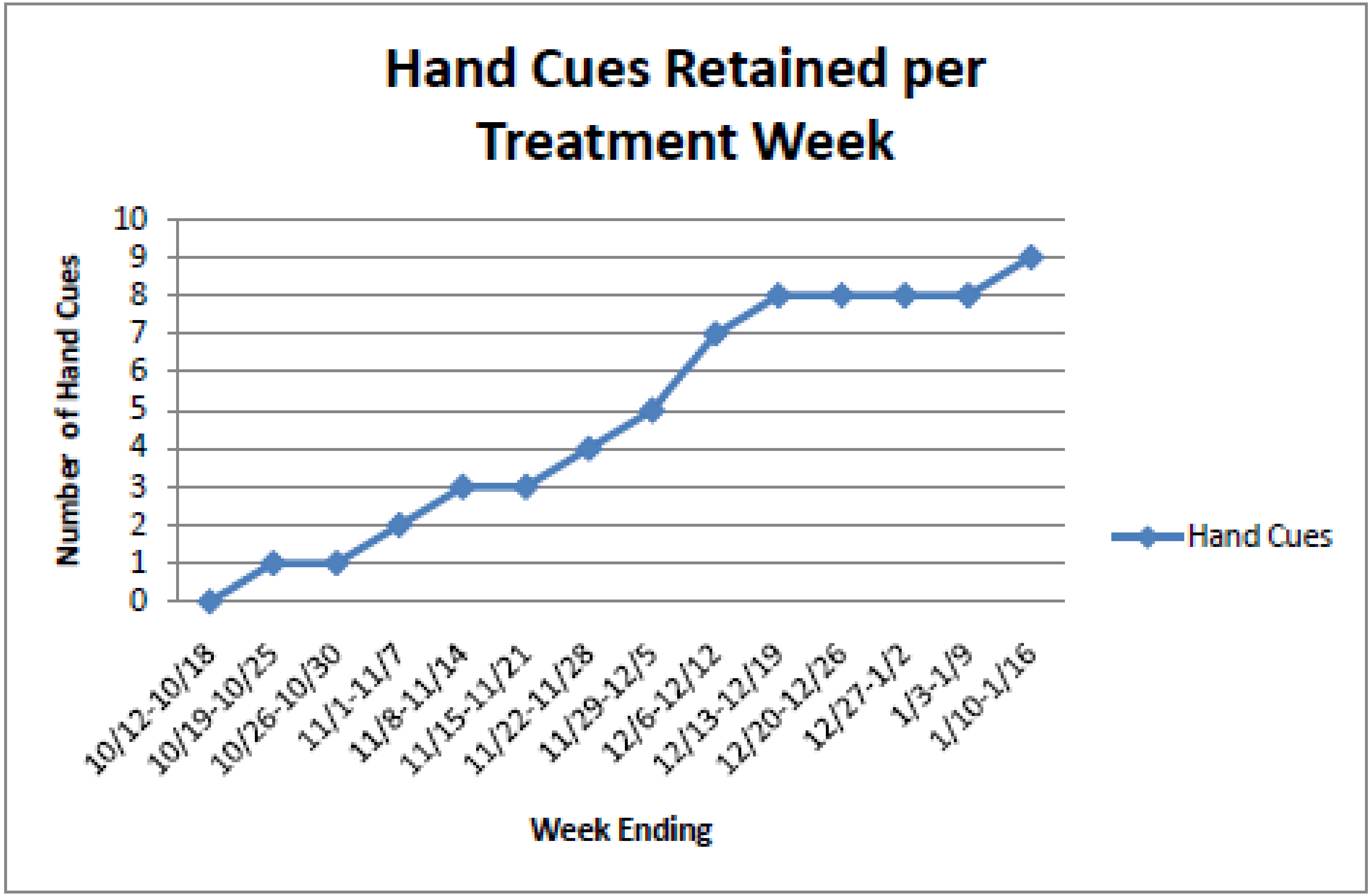
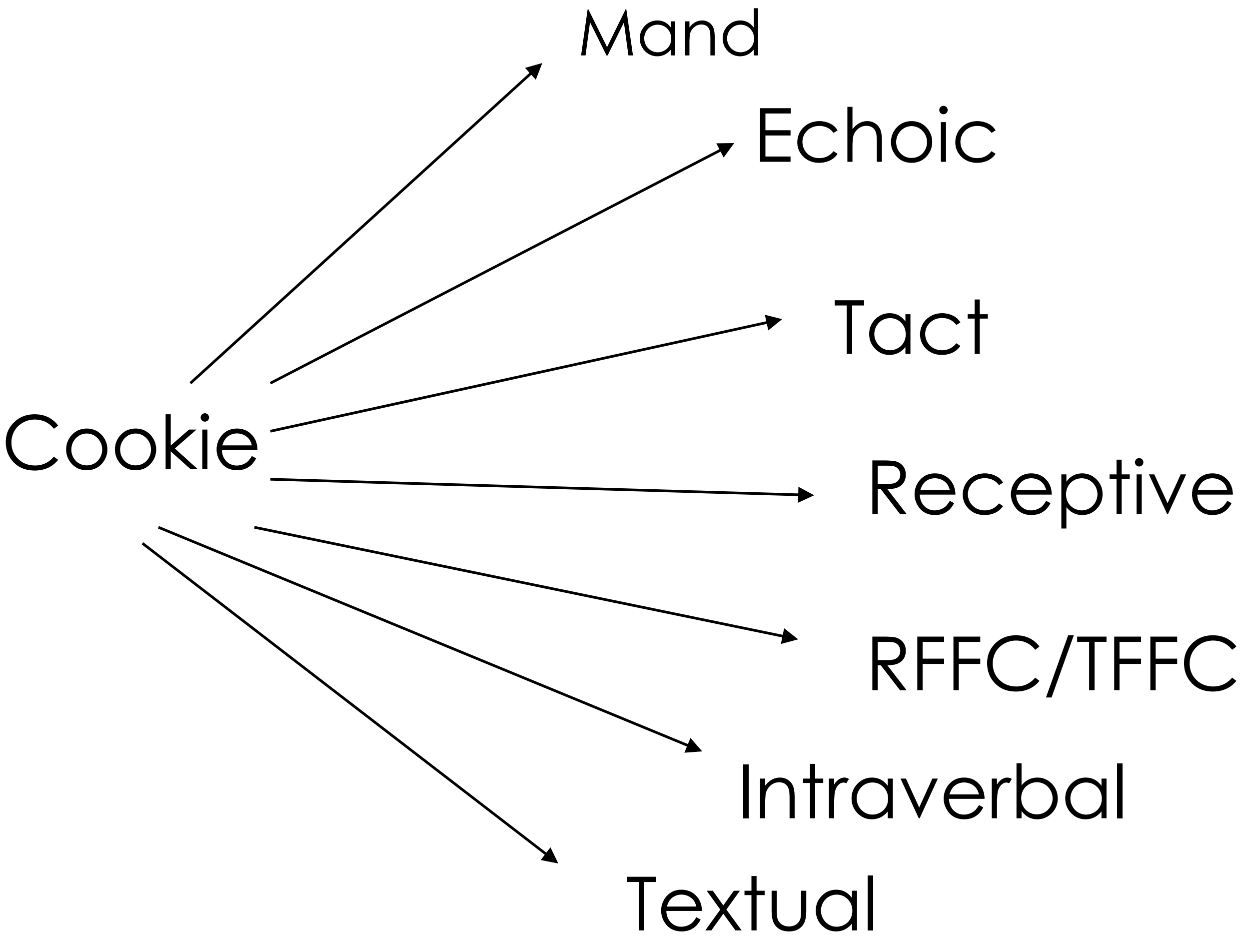


Hand Cues Retained per Treatment Week
Number of Hand Cues
10
9
8
7
6
5
4
3
2
1
0
10/12-10/18
10/19-10/25
10/26-10/30
11/1-11/7
11/8-11/14
11/15-11/21
11/22-11/28
11/29-12/5
12/6-12/12
12/13-12/19
12/20-12/26
12/27-1/2
1/3-1/9
1/10-1/16
Week Ending
Hand Cues

Teach All the "Meanings"



Controlled Research

Controlled Research

This series of studies examines the effectiveness of PHC as a stimulus control transfer procedure to improve articulatory precision. In the initial study, the subject was taught to imitate both the vocal model and hand cue. Results revealed rapid acquisition of 20 hand cues, steady acquisition of 248 single words, and a reduction in errors on the *Hodson Assessment of Phonological Targets Third Edition* from 131 to 73 errors over a 3 month period. Results of two additional studies compared the relative effectiveness of three treatment conditions: Echoic trials in which Hand Cues were Taught (HCT-modeled by instructor and executed by subject), Hand Cues were used as an antecedent prompt (HC-executed by instructor only) and Echoic trials only (E). Results confirm previous case study findings that PHCs may be an effective intervention in promoting speech production skills in children with autism with limited vocal repertoires and provide valuable information regarding treatment procedures and subject selection.

Purpose

1. Evaluate the effectiveness of PHCs executed by the instructor and/or the subject as discriminative stimuli for correct phoneme production to facilitate accurate production in isolation, word and syllable shape level

2. Evaluate whether PHCs executed by the learner could assist in transfer of stimulus control to the stimuli that should ultimately control the response (echoic, MO-mand, non-verbal stimuli-tact, etc.)

Moreover, the exact topography of the hand cue may be less critical as long as the hand cue/phoneme topographically differs from other hand cues/phonemes

Introduction and Literature Review

The current set of studies seeks to:

- Extend the research on PHCs and establish the efficacy of this technique separate from a treatment package
- Utilize a system of simple phonetic hand cues which differ from each other (topography-based)
- Compare echoic treatment conditions in which Hand cues are executed by instructor and subject (Hand Cue Taught –HCT), executed by instructor only (Hand Cue-HC), and not utilized (Echoic-E)
- Employ conceptually systematic, behaviorally analytic and technically precise procedures

STUDY 1:
Subject-Executed Hand Cues (HCT)

Method – Participant and Setting

- 6 year old female, GM, diagnosed with Autism by a qualified medical professional
- Diagnosis of Severe Phonological Disorder by independent Speech-Language Pathologist
- Diagnosis of Childhood Apraxia of Speech
- Attends public school for 20 hours per week, abbreviated school day
- Receives 25-30 hours per week of ABA intervention in her home five days a week
- Referred to The Center due to minimal gains in speech production given school-based intervention and private speech-language therapy

Method – Participant and Setting

- GM’s language skills were assessed 7/1/2015 via The Assessment of Basic Language and Learning Skills-Revised (Partington, 2006)

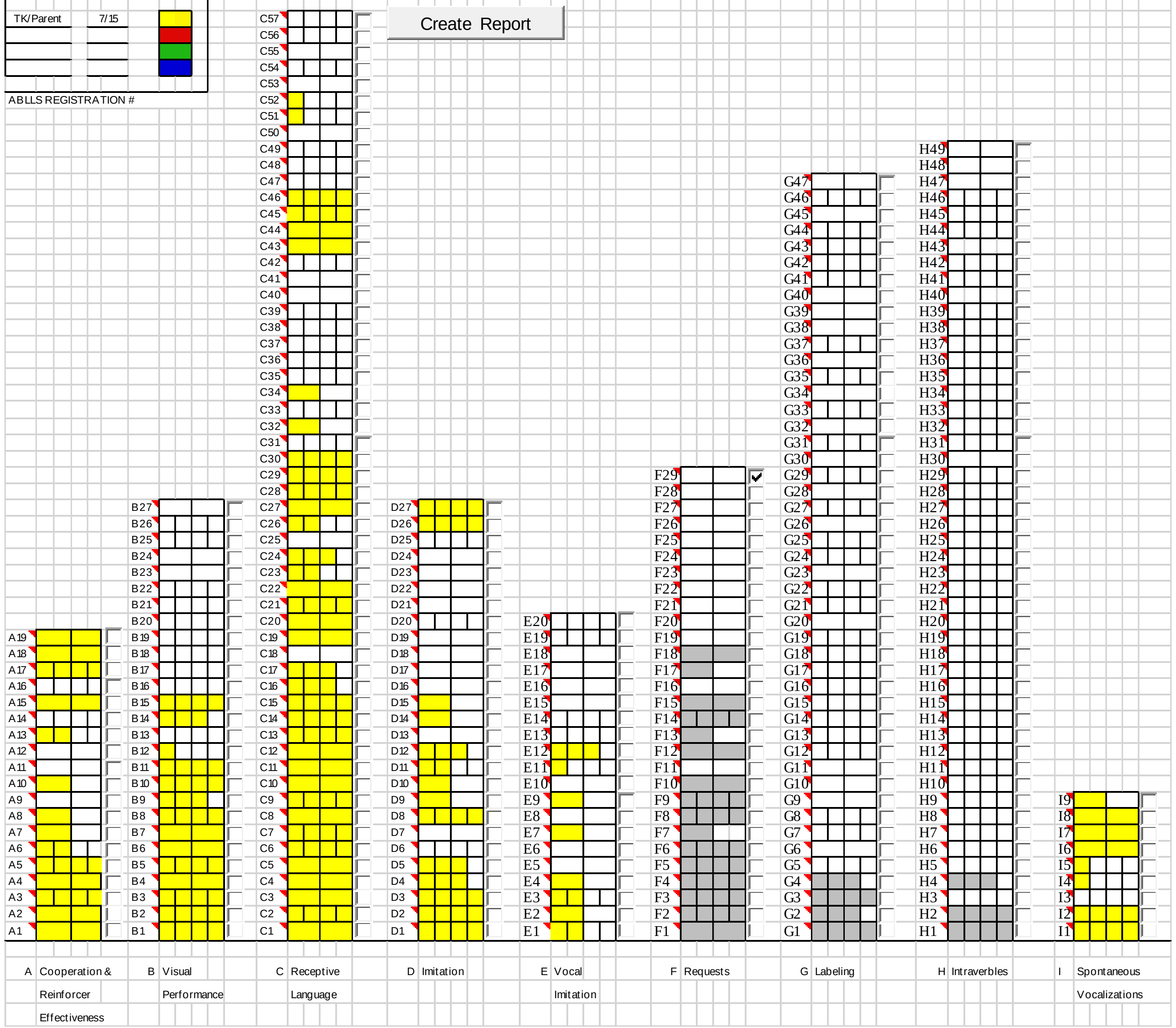
- GM’s echoic, tact, and intraverbal skills were severely delayed while her visual performance and receptive language skills were relative strengths

- Scoring of mand, tact, and intraverbal repertoires was modified to include responses with topographies intelligible only to her mother indicated in grey

Assessment of Basic Language and Learning Skills
Skills Tracking System

Student:	GM	
Assessor	Date	Color Code
TK/Parent	7/15	

ABLLS REGISTRATION #



Method – Participant and Setting

<u>Results of the ABLLS-R revealed the following:</u>

- Echoic Repertoire: Attempted to imitate almost any word, however; topographies were dissimilar to targets and consisted primarily of Consonant-Vowel (CV) productions. She consistently approximated 15 words

- Free Operant Babbling/Attempts: Phonemes /p,b,m,n,t,d,k,g/ with neutral vowels (not able to produce under echoic control)

- Mand Repertoire: GM utilized vocalizations and gestures as her primary method of communication in the home. She was intelligible only to her mother. In the school environment, she was provided with an iPad with a communication app (PROLOQUO). She did not utilize PROLOQUO for manding

Method – Participant and Setting

Results of the ABLLS-R revealed the following:

- Tact Repertoire : No functional tacting repertoire
- Intraverbal Repertoire : CV approximations for two animal sounds
- Independent evaluation by her school speech-language pathologist (6/3/2015 and 9/10/2015) utilizing the Hodson Assessment of Phonological Patterns-Third Edition (HAPP-3) revealed 135 and 131 errors respectively with a severity rating of “Severe”
- Minimal gains in speech production noted for three years

Method: Participant and Setting

- All learner training for the two initial phases of treatment occurred in the home of the client.
- Training for HCT isolated phonemes and HCT word targets occurred in the dining room.
- Materials included a table with chairs, prompt cards for the instructors, and various therapy materials.
- The room was relatively free of distractions.

Method – Stimuli and Apparatus

- Calibration training for assessment of correct phoneme production was conducted during weekly supervisory meetings
- Each tutor was observed during 20-25% of teaching sessions
- Inter-observer agreement for cold probe data scoring was 95%
- Treatment integrity was also assessed weekly
- Teacher errors were noted infrequently
- If errors were observed, instruction via behavioral skills training model was utilized until 100% proficiency was demonstrated

Method – Stimuli and Apparatus

Independent Variable:

- Phonetic Hand Cue (HCT) transfer procedure

Dependent Variables:

- Cumulative number of HCT in isolation
- Cumulative number of HCT target words mastered as echoics utilizing HCT as stimulus control transfer procedure
- Reduction in errors on formal testing as documented by third party

Method – Stimuli and Apparatus

- A simple phonetic hand cuing system modified by one of the authors (Kasper, 1995) from the work of Strode (1994) was utilized.
- Strode's phonetic hand cuing system was simplified to allow for ease of acquisition for children with autism who might also exhibit motor deficits.
- HCT targets consisted of phonemes that the learner could produce in isolation as an echoic, but could not produce at the syllable or word level: /n,t,d/
- Echoic word targets consisted of words that contained the target phonemes from the HCT condition but were produced in error by the learner.
- A group of four individuals (4 instructors) received training in procedures for implementing the independent variables, documenting the responses by the subject, and recording the responses on a specified form.
- Training consisted of a behavioral skills training model with practice via role play until each instructor performed the task with 100% accuracy.

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HAND CUES

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HAND CUES

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“sh” as in “ship” “zh” as in pleasure “ch” as in chop

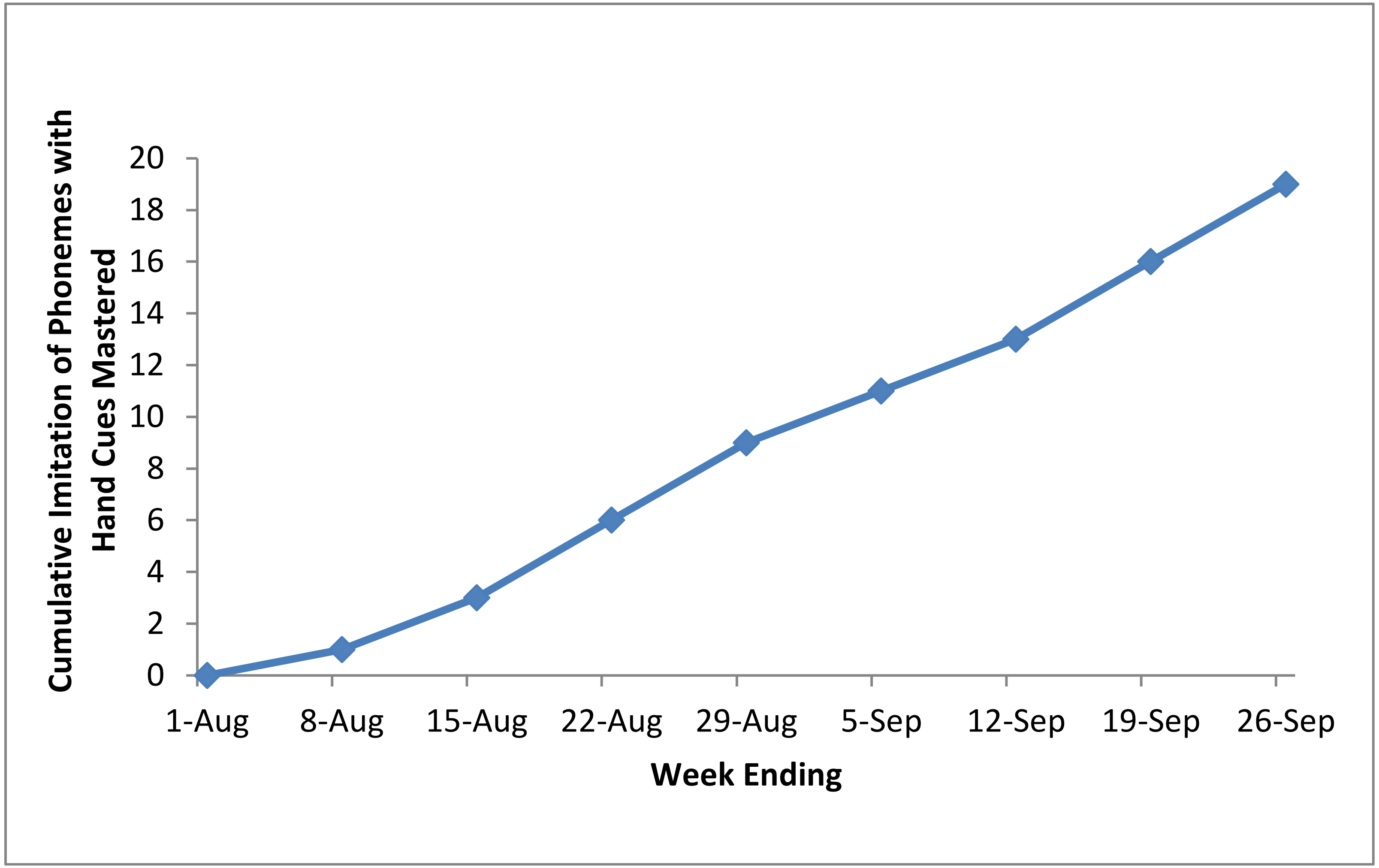
“j” as in “jump” “th” as in “'thin” “th” as in “that”

Experimental Procedure
HCT Instruction – Isolated Phoneme Pre-Session Probe

- Prior to each HCT in isolation teaching session, a HCT cold probe was conducted.
- The subject was presented with the verbal discriminative stimulus “copy me” or other similar verbal S^D and subsequent model of the hand cue and echoic for the target HCT to be taught (initial probe).
- A response was scored as correct when the subject correctly imitated the HC with accurate phoneme within 3 seconds (HCT).
- All other responses were scored as incorrect.
- Mastery criteria of three consecutive correct pre-session probes were utilized.

Experimental Procedure – HCT Instruction-Isolated Phoneme

- Errorless teaching procedures utilizing zero second delay, presentation of the verbal discriminative stimulus “copy me” or similar verbal S^D , and model of the HC (mimetic) and phoneme were employed.
- Physical prompting for the HC (if needed) was used and then a constant time delay fade procedure of 3 seconds was employed.
- Prompt fade or transfer trials were conducted immediately following each prompted trial.
- Correct responses were followed by reinforcement.
- Errors were corrected by re-presenting the stimulus and returning to the zero second time delay prompt followed by the prompt fade procedures described.
- If the learner did not reach parity with use of the HC/echoic model, the procedure was repeated two additional trials and if parity was not met, the instructor simply continued with teaching of other targets.
- Teaching trials were conducted as part of the child’s ABA instruction. Target and distracter trials (mastered skills across the verbal operants) were randomly alternated.



Cumulative Imitation of Phonemes with Hand Cues Mastered by Week Ending

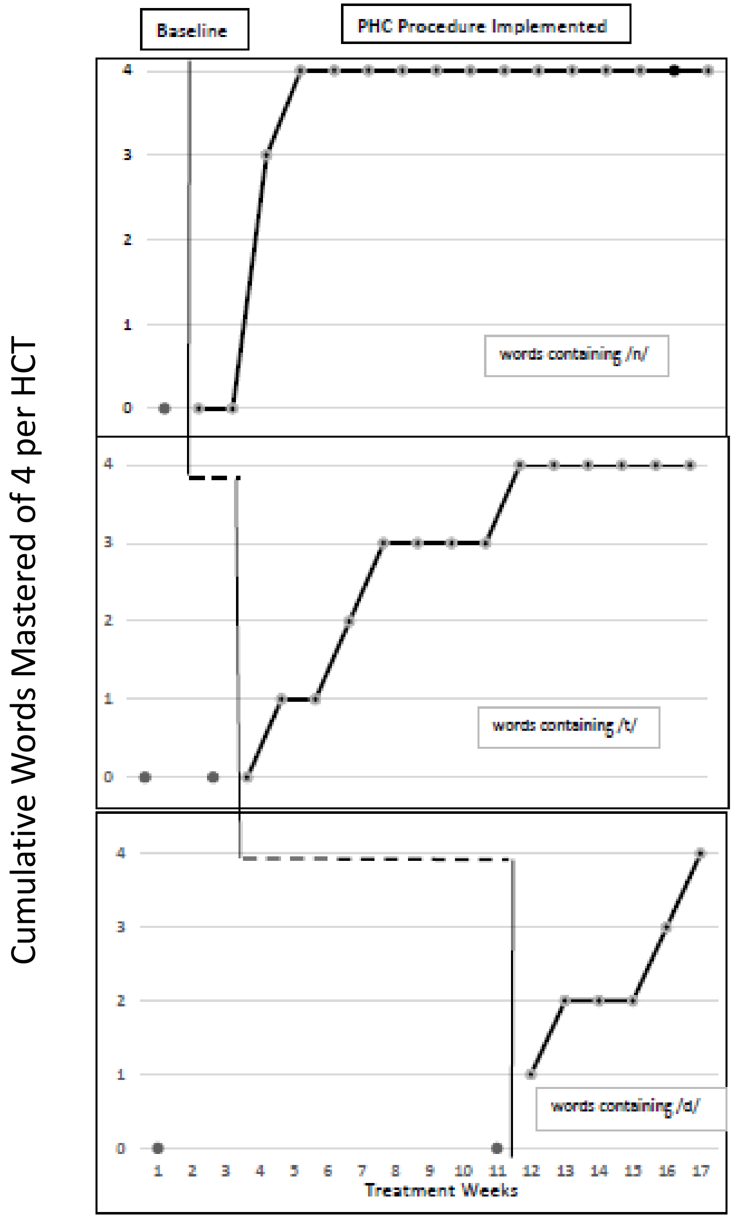
Experimental Procedure – HCT Word Level

- A multiple probe design across words containing HCT /n, t, d/ was utilized.
- All HCT word targets for the hand cues targeted /n, t, d/ were probed prior to implementation of HCT instruction, (baseline) and probed prior to introduction of a new training set of HCT words (discontinuous baseline)
- Teaching procedures were conducted in a similar manner as for HCT for isolated phonemes with the HC demonstrated at the moment the phoneme was produced in the word.
- If the learner did not reach parity with use of the HC/word model, the procedure was repeated two additional trials and if parity was not met, the instructor modeled the HC with phoneme in isolation, the subject imitated, teaching continued.

- A functional relationship was demonstrated by the multiple probe design as improvement in articulation of the target HCT words occurred only when the HCT was implemented.

- Thus, HCT appears to be an effective procedure to improve articulation, but the relative effectiveness or efficiency is not compared to any other procedure.

- In the absence of a comparison condition in which the HC was used as a prompt, but not required as a response, the hypothesis that the HCT provides more effective transfer of stimulus control cannot be tested.



Cumulative number of words containing /n, t, d/ mastered using HCT transfer procedure

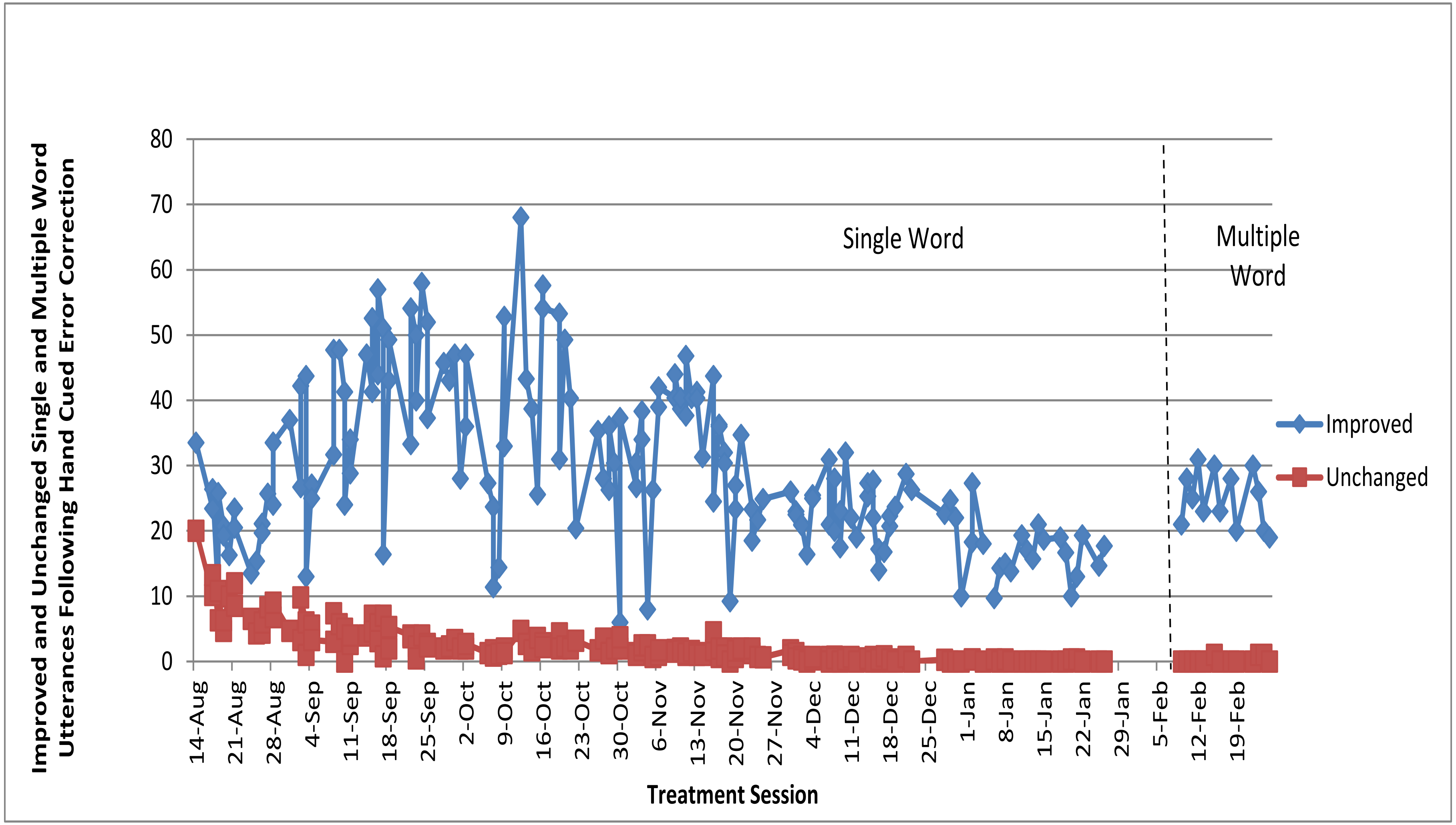
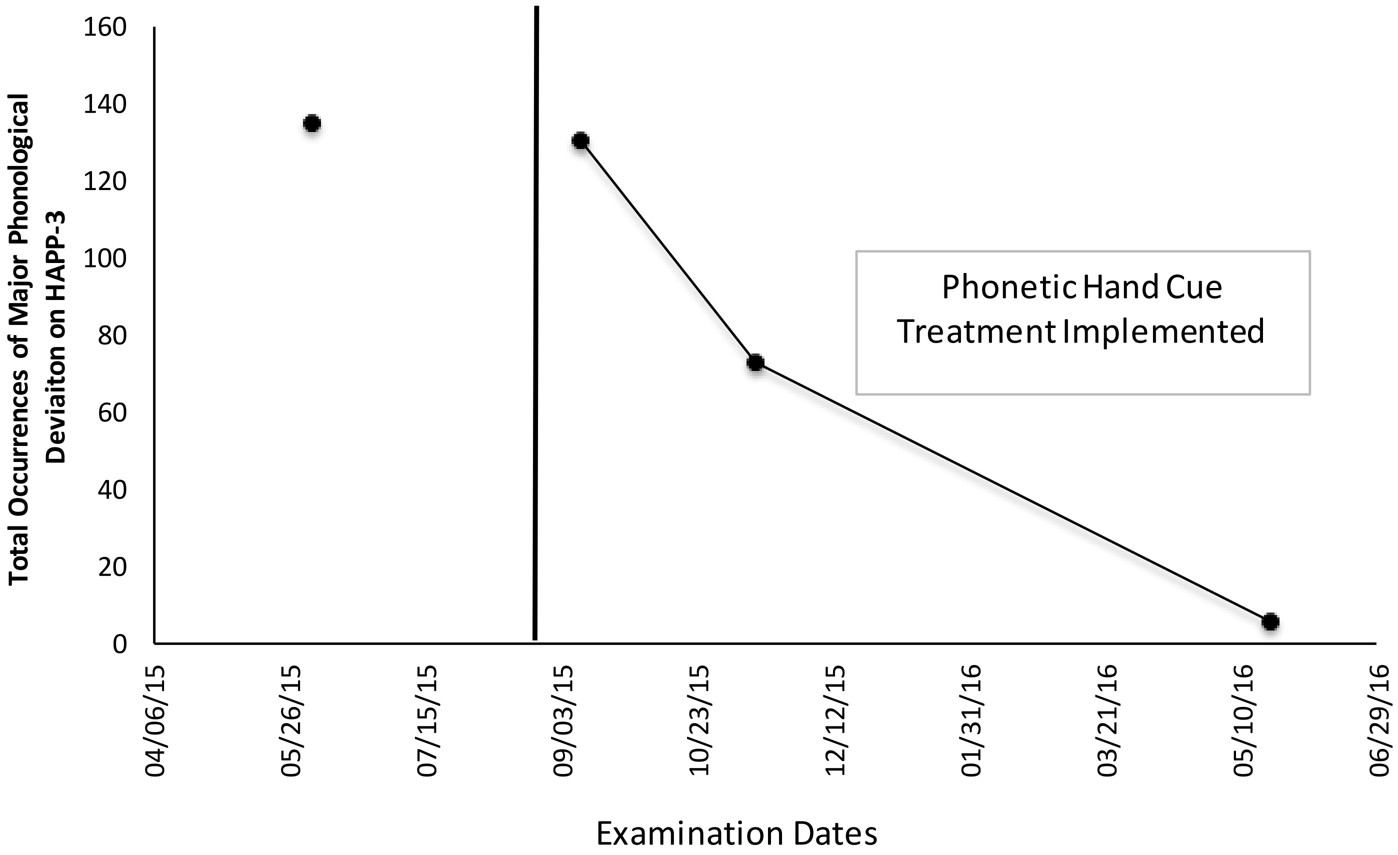


Figure 3. Number of Single Word and Multiple Word Utterances that Improved or Were Unchanged Following Error Correction Utilizing Hand Cues



Total Occurrences of Major Phonological Deviations on The Hodson Assessment of Phonological Patterns -Third Edition by Examination Dates

STUDY 2:
Comparison of Conditions:
Hand Cue Taught (HCT)
Hand Cue(HC)
Echoic (E)

THE CENTER FOR AUTISM TREATMENT

VOWEL HAND CUES

"e" as in "eat"

"oo" as in "shoe"

"i" as in "hit"

"u" as in "put"

"eh" as in "pet"

"a" (eh-ee) as in "bay"

"o" (oh-oo) as in "toe"

VOWEL HAND CUES

'uh" as in up

"aw" as in "saw"

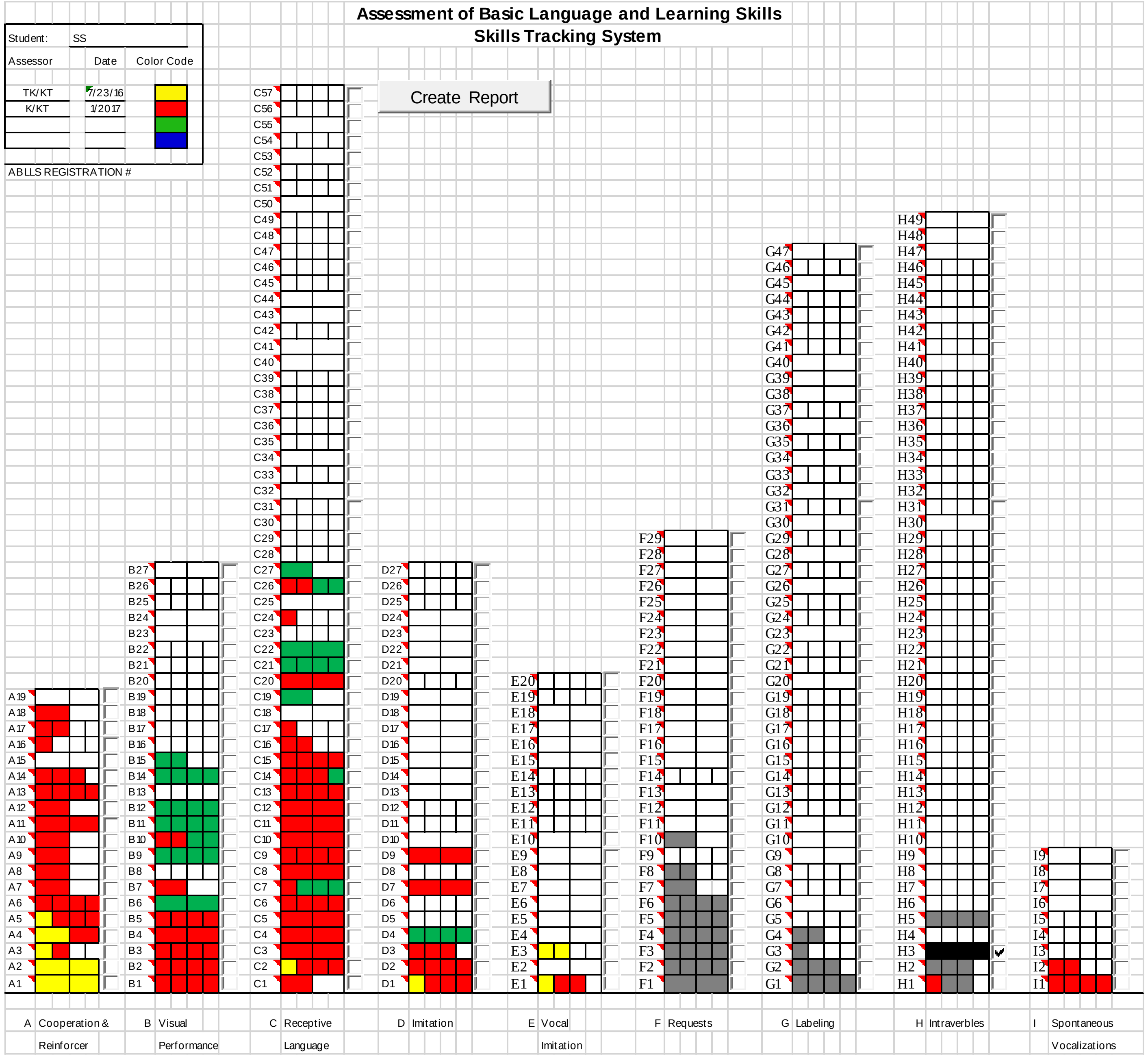
"a" as in "hat"

"ah" as in "hot"

Developed by T. Kasper & L. Slim-Topdjian 2018

Method – Participant and Setting

- A 6 year old male, SS, diagnosed with Autism by a qualified medical professional
- Diagnosis of Childhood Apraxia of Speech
- Twin with history of prematurity and feeding disorder
- Attends public school with full time aide for abbreviated school day for a total of 17.5 hours per week
- Receives 25 hours weekly of ABA intervention in his home five days a week
- Minimal gains in speech production prior to transfer to The Center, given school-based intervention, private speech-language therapy, and previous ABA therapy
- Referred by different ABA provider to The Center for Autism Treatment
- SS' language skills were assessed 7/20/2017 via The Assessment of Basic Language and Learning Skills-Revised (ABLLS-R, Partington, 2006)
- SS' echoic, tact, and intraverbal skills were severely delayed while her visual performance and receptive language skills were relative strengths
- Scoring of mand, tact, and intraverbal repertoires was modified to include responses executed on his communication app



Mand, Tact and Intraverbal sections as executed via PROLOQUO indicated in grey

Method – Participant and Setting

Results of the ABLLS-R revealed the following:

- Echoic Repertoire: Attempted to imitate words, however; topographies were dissimilar to targets and consisted primarily of Consonant (C) productions; Prior to initiation of the study, he consistently imitated 19 phonemes and produced 3 words across mand, tact, and intraverbal: in, on, and go.
- SS's echoic repertoire was further assessed via *The Kaufman Speech Praxis Test for Children (1995).* Results revealed raw score of 12 for Part 2 (Simple Phonemic/Syllabic Level) which resulted in percentile rank and standard score below norms and a Diagnostic Rating of 1.0 Verbal Apraxia (Executive).

Method – Participant and Setting

Results of the ABLLS-R revealed the following:

- Mand Repertoire: SS utilized contact gestures and problem behavior as his primary method of communication in the home. In the school environment and during previous ABA therapy he was provided with an iPad with a communication app. Parents did not utilize the communication app for manding as SS would damage devices if left unattended.
- Tact Repertoire : No functional vocal tacting repertoire
- Intraverbal Repertoire : CV approximations for three animal sounds
- Minimal gains in speech production noted for three years

Method – Participant and Setting

- Sessions were conducted in SS living room with instructor-controlled access to toys and activities
- Sessions were conducted at a table, 2 chairs
- A second experimenter, a BCBA, was present at 20-25% of sessions
- Parent or Grandmother was present at every session
- All probe sessions and 25-30% of teaching sessions were videotaped
- Each training session was divided into 1 probe and 6 treatment blocks
- Experimental conditions: HCT, HC, and E were randomized to blocks according to the requirements of an alternating treatment design (Neuman, 1985) with use of a random number generator.

Method – Stimuli and Apparatus

- Training procedures for three instructors were consistent with those used for Study 1 (HCT).
- Target sets included: CV, VC, and CVCV with the same consonant and vowel, and CVCV with different consonants and the same vowel.
- Each Target set consisted of 2 consonants and 1 vowel that were observed in the learner's repertoire but were not emitted consistently during the initial probes. Consonants and vowels were randomly assigned to the three conditions.
- Phonemes consisted of those that the learner could produce as an echoic with 80% or greater accuracy but could not sequence within syllable shapes with 50% or greater accuracy at the time of the initial probe.

Method – Stimuli and Apparatus

SS' target sets consisted of:

1. CV combinations:
   - /gʌ/ /nʌ/, /ti/ /pi/, /mu/ /bu/
2. VC Combinations:
   - / ʌg/ /ʌn/, /it/ /ip/. /um//ub/
3. C1VC1V/C2VC2V Combinations:
   - /gʌgʌ/ /nʌnʌ/, /titi/ /pipi/, /mumu/ /bubu/
4. C1VC2V/C2VC1V Combinations:
   - /gʌnʌ/ /nʌgʌ/, /tipi/ /piti/, /mubu/ /bumu/

Measurements

Independent Variables:

- HCT: Hand Cue/Vocalization modeled by instructor, and hand cue/vocalizations required as response
- HC: Hand Cue/Vocalization modeled by instructor, echoic response required
- E: Echoic: Vocalizations modeled by instructor and required as response

Dependent Variables:

- Cumulative number of syllable targets (CV, VC, C1V1C1V1, C1V1C2V1) mastered for each independent variable across syllable shapes as measured by session probe data
- Discontinuous Baseline Probes of all targets as pure echoics

Experimental Procedure – Pre-Teaching

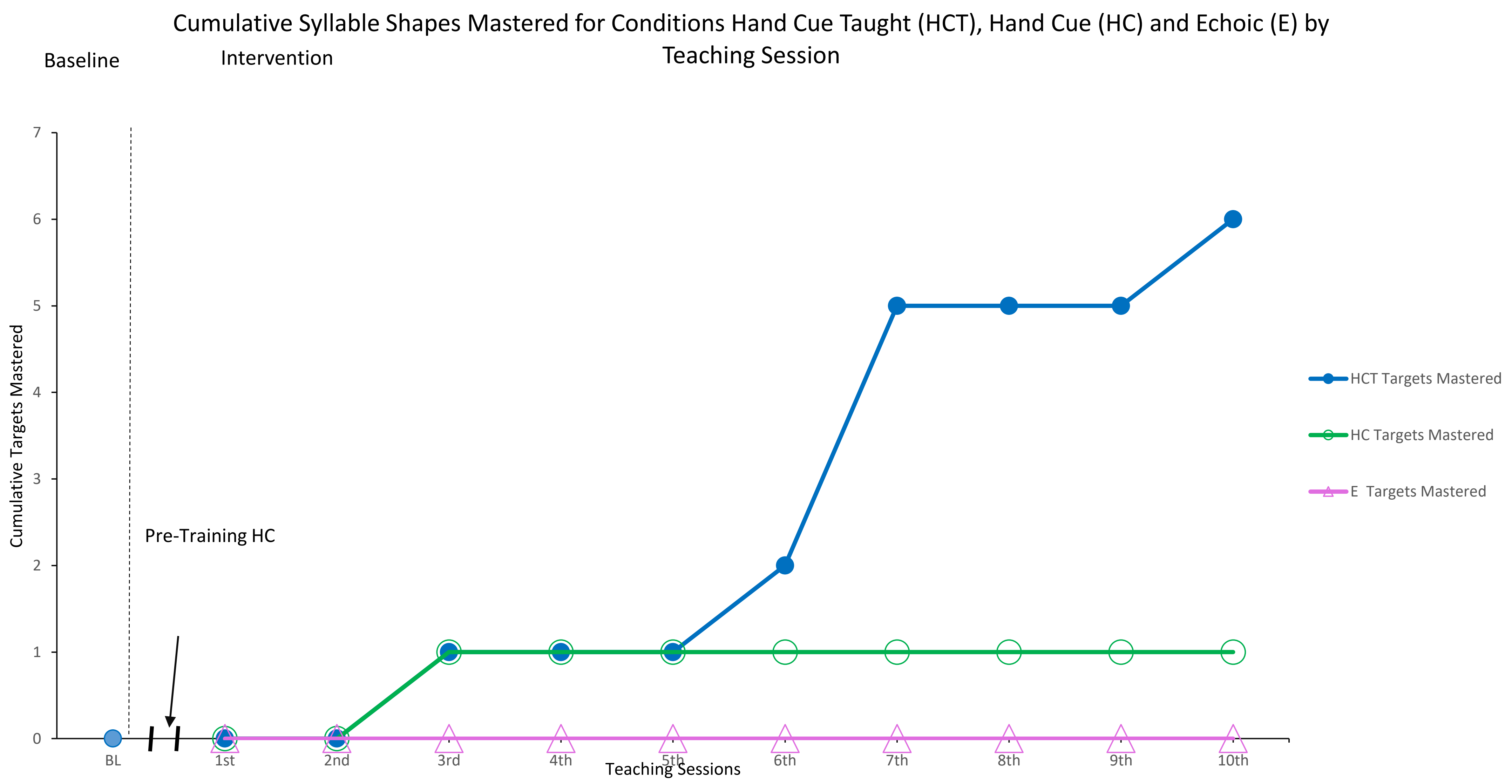
- Materials, setting, pre-session probes, and instruction in HCT at the isolated phoneme level were identical to those for Study 1 (HCT).
- SS was taught to execute the HC with echoic trial (HCT). Trials were conducted on the other phoneme targets for the study to ensure commensurate training opportunities for all phonemes in the pre-training phase.
- Manual guidance using errorless teaching with a 0 second TD was utilized if the learner incorrectly produced or did not produce Hand Cue with Phoneme (HCT) on session cold probe. Manual prompts were faded on subsequent trials.
- Mastery criteria of three consecutive correct pre-session probe as specified in Study 1 (HCT) were utilized.

Experimental Procedure – HCT Instruction Syllable Shape Levels

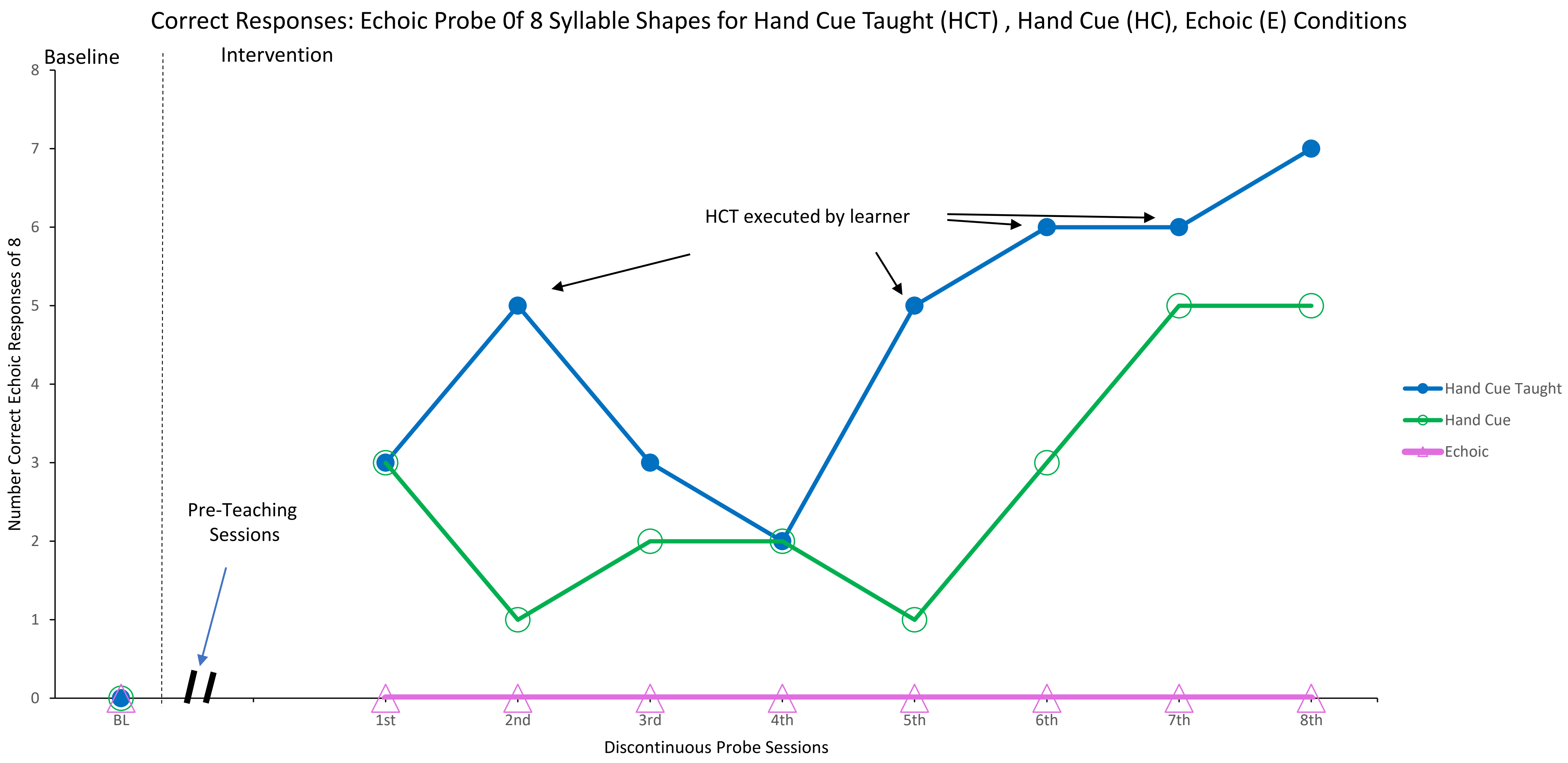
- A template was used to signal each condition.
- The designated antecedent prompt (HCT, HC, or E) was delivered. Physical prompting for the HCT (if needed) used, then a constant TD fade procedure of 3 seconds
- Prompt fade or transfer trials conducted immediately following each prompted trial
- Correct responses were followed by reinforcement
- Errors were corrected by re-presenting the stimulus and returning to the 0 second TD prompt followed by the prompt fade procedures described
- If the learner did not reach parity with use of the HCT/syllable shape model, the procedure was repeated two additional trials and if parity was not met, the instructor modeled the HC with phoneme in isolation and after the child responded, teaching of other targets continued
- Target and distracter trials were randomly alternated
- Distracters consisted of any mastered skills across the verbal operants
- An equal number of Treatment blocks were conducted for all conditions HCT/HC/E

Experimental Procedure –Syllable Shape Level

- *Syllable Shape Pre-Session Probe*:
  Targets for instruction were presented as HCT, HC, or E . Instructor presented the designated template (blank, outline of hands, solid hands) and blocking of hand movements if needed (HC, E). Instructor presented the verbal S^D “copy me” or other similar verbal S^D, followed immediately by presentation of the Hand Cue and Echoic prompt (HC and HCT) or Echoic prompt (E).
    - This initial probe response served as a measure of learning
- *Correct Response*:
  Accurate imitation of the syllable shape within 3 seconds (E, HC).
  Accurate imitation of the syllable/execution of acceptable topography of HC (HCT)
- *Incorrect Response*:
  All other responses – incorrect/incomplete/absent
- *Mastery Criterion*:
  3 consecutive correct pre-session “cold” probes



Cumulative Syllable Shapes Mastered for Conditions Hand Cue Taught (HCT), Hand Cue (HC) and Echoic (E) by Teaching Session
Baseline
Intervention
Pre-Training HC
Cumulative Targets Mastered
0
1
2
3
4
5
6
7
BL
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
Teaching Sessions
HCT Targets Mastered
HC Targets Mastered
E Targets Mastered


Correct Responses: Echoic Probe 0f 8 Syllable Shapes for Hand Cue Taught (HCT) , Hand Cue (HC), Echoic (E) Conditions
Baseline
Intervention
HCT executed by learner
Pre-Teaching Sessions
Number Correct Echoic Responses of 8
Discontinuous Probe Sessions
0
1
2
3
4
5
6
7
8
BL
1st
2nd
3rd
4th
5th
6th
7th
8th
Hand Cue Taught
Hand Cue
Echoic

STUDY 3:
Comparison of Conditions:
Hand Cue Taught (HCT)
Hand Cue(HC)
Echoic (E)

Method – Participant and Setting

- A 4.7 year old girl, diagnosed with Autism by a qualified medical professional.
- Attends a half day preschool integration program three times a week with an BCBA instructor
- Receives 30 hour-week ABA intervention in her home five days a week.
- Emerging vocal-verbal repertoire
- Engages in high rates of vocal stereotypic behaviors
- Poor eye contact
- Mands for preferred items (i.e., food, toys, actions like go/jump/hug/carry me): Limited repertoire and unintelligible to unfamiliar listeners.
- Tacts familiar items in her home play room setting (i.e., farm animals, trampoline, swing, doll, ball, etc.)
- Engages in simple intraverbal responses involving simple preschool songs, "AB__", "12__", "up & ___", "clap your ___".

Method – Participant and Setting

- The GFTA-2 was administered to assess speech sound accuracy and quality. Lilly earned a standard score of 73 (within 2 standard deviation below the mean) and percentile rank of 8 on the GFTA-2.
- Articulation errors consisted of vowel distortions, sound additions, sound omission, and substitution errors
- Phonological errors consisted of:
  - Fronting (i.e., "tup” for “cup”)
  - Gliding (i.e., “yewow” for “yellow”)
  - Vowelization (i.e., /apo/ for “apple”)
  - Reduplication
  - Cluster reduction (i.e., “wim” for “swim”)
  - Weak syllable deletion (i.e., “nana” for “banana”)
  - Final consonant deletion
  - Coalescence (i.e., /pu/ for /spun/)
- Minimal gains in her speech and language repertoire per parental and BCBA reports

Method – Participant and Setting

- The Early Echoic Skills Assessment (EESA; Esch, 2008), from the VB-MAPP, was administered on October 19, 2017, to assess each Lilly's speech sound repertoire:

- Learner received a score of 33/100 on the "The Early Echoic Skills Assessment (EESA; Esch, 2008), and had a limited vocal-verbal repertoire during the experimental conditions:

    - Group 1: Simple and reduplicated syllables 15/25 – Vowels, no diphthongs, some early consonants
    - Group 2: 2-syllable combinations 15/30 – Early consonants, 2-syllable combinations
    - Group 3: 3-syllable combinations 3/30 – Early consonants, emerging 3-syllable combinations
    - Group 4: Prosody – spoken phrases 0/10 – No imitation of prosodic features (Syllable stress)
    - Group 5: Prosody – other contexts 0/5 – No pitch, loudness, vowel duration imitations

- EESA scores fell in the Level 1 with emerging sounds and syllable shapes in Level 2, which indicate the need for vocal repertoire shaping procedures (not discounting signing)

Method – Participant and Setting

Inclusion Criteria:

- Vowel Duration in Isolation: 0.5 sec Criterion for mastery of the Vowel
- Vowel and Consonant Accuracy at the Sound Level, in Isolation
- Motor Movement necessary for the HCT (Approximations described per learner reflecting the learner’s motor ability in their repertoire)

Method – Participant and Setting

- Sessions were conducted in learner's playroom area, in the basement, with free access to toys and activities
- Sessions were conducted at a table, 2 chairs, leaner facing the lead experimenter
- A second experimenter, a BCBA, was present at every session and sitting behind Lilly for prompting when discriminative stimulus was presented per condition
- Mother was present at every session
- Every session was videotaped using a Samsung Video Camera
- All videotaping was approved by parents and reviewed at every session
- Experimental conditions: HCT, HC, and E were randomized within each block according to the requirements of an Adapted Alternating Treatment Design (AATD) (Sindelar, Rosenberg, & Wilson, 1985) with use of a random number sequence generator

Method – Stimulus and Apparatus

- The lead experimenter presented the auditory stimulus and the PHC per conditions
- Target sets included: CV, VC, C1VC1V/C2VC2V, C1VC2V/C2VC1V combinations that were not in the learner's repertoire and were nonsensical/unfamiliar to the English language
- Each Target set/condition consisted of 2 consonants and 1 vowel that were observed in the learner's repertoire but were emitted inconsistently and with decreased accuracy
- Learner able to produce an echoic response for a phoneme with 50% or greater accuracy but cannot sequence with the one-syllable word CV or VC production, or 2-syllable word CVCV combination with 50% or greater accuracy

Method – Stimulus and Apparatus

The learner's target sets consisted of:

1. CV combinations:
   - /ta/, /za/, /di/,/fi/, /nu/, /mu/
2. VC Combinations:
   - /at/, /az/, /id/,/if/, /un/, /um/
3. C1VC1V/C2VC2V Combinations:
   - /tata/, /zaza/, /didi/, /fifi/
4. C1VC2V/C2VC1V Combinations:
   - /taza/, /zata/, /difi/, /fidi/, /numu/, /munu/

Method – Stimulus and Apparatus

- A template was used for each condition used to signal the response requirement for each intervention condition for the target set
- PHCs for target consonants and vowels, for HCT & HC conditions, selected
- A simple PHC system developed by the authors (Kasper and Slim-Topdjian, 2016) was utilized for vowels
- Kasper's (2014) phonetic hand cuing system was used for the target consonants in HCT and HC conditions

Measurements

A. **Independent Variables:**

The Phonetic Hand Cue transfer procedure under which the auditory stimuli were presented

1. HCT
   - Target set stimuli: /t/, /z/, /a/
2. HC
   - Target set stimuli: /d/, /f/, /i/
3. E
   - Target set stimuli: /n/, /m/, /u/

B. **Dependent Variables :**

1. Percent correct of syllable shape targets per condition (CV, VC, C1VC1V/C2VC2V & C1VC1V/C2VC2V combinations)
2. Cumulative number of syllable targets (CV, VC, C1V1C1V1, C1V1C2V1) mastered for each independent variable across syllable shapes as measured by session probe data

C. **Interobserver Agreement (IOA):** weekly and was 95% acc.

Experimental Procedure – Design

- Multiple Probe Design Across Targets
- Adapted Alternating Treatments Design (AATD) (Sindelar, Rosenberg, & Wilson, 1985)
- Two to Four experimental blocks were conducted per session day, 3-5x/week, in the child's home, in a quiet room where learner received home intervention
- Each block lasted 5 min. or until the randomized target set was completed
- Differential reinforcement procedure implemented with preference assessment conducted prior to each session to ensure motivational operations were present
- Programmed consequences for target and distractors: Token board following a VR1 schedule per learner's level & verbal praise
- Materials: any items necessary for NET including food items, a wide variety of toys, and activities
- Target trials were randomly alternated
- Distracters consisted of listener responding tasks

Experimental Procedure – Pre-Teaching HCT Motor Movement

- Materials, setting, pre-session probes, and instruction in HCT at the isolated phoneme level were similar to those for Study 2 (HCT)
- Learner was taught to execute the HC with echoic trial (HCT). Trials were conducted on the other phoneme targets for the study to ensure commensurate training opportunities for all phonemes in the pre-training phase
- Manual guidance using errorless teaching with a 0 second TD was utilized if the learner incorrectly produced or did not produce Hand Cue with Phoneme (HCT), on session cold probe, for targets /t/, /z/, /a/
- Manual prompts were faded on subsequent trials
- Mastery criteria of three consecutive correct pre-session probe as specified in Study 2 (HCT) were utilized

Experimental Procedure – HCT Instruction Syllable Shape Levels

- A template was used to signal each condition.
- The designated antecedent prompt (HCT, HC, or E) was delivered. Physical prompting for the HCT (if needed) used, then a constant TD fade procedure of 3 seconds
- Prompt fade or transfer trials conducted immediately following each prompted trial
- Correct responses were followed by reinforcement
- Errors were corrected by re-presenting the stimulus and returning to the 0 second TD prompt followed by the prompt fade procedures described
- If the learner did not reach parity with use of the HCT/syllable shape model, the procedure was repeated two additional trials and if parity was not met, the instructor modeled the HC with phoneme in isolation and after the child responded, teaching of other targets continued
- Target and distracter trials were randomly alternated
- Distracters consisted of any mastered skills across the verbal operants
- An equal number of Treatment blocks were conducted for all conditions HCT/HC/E

Experimental Procedure –Syllable Shape Level

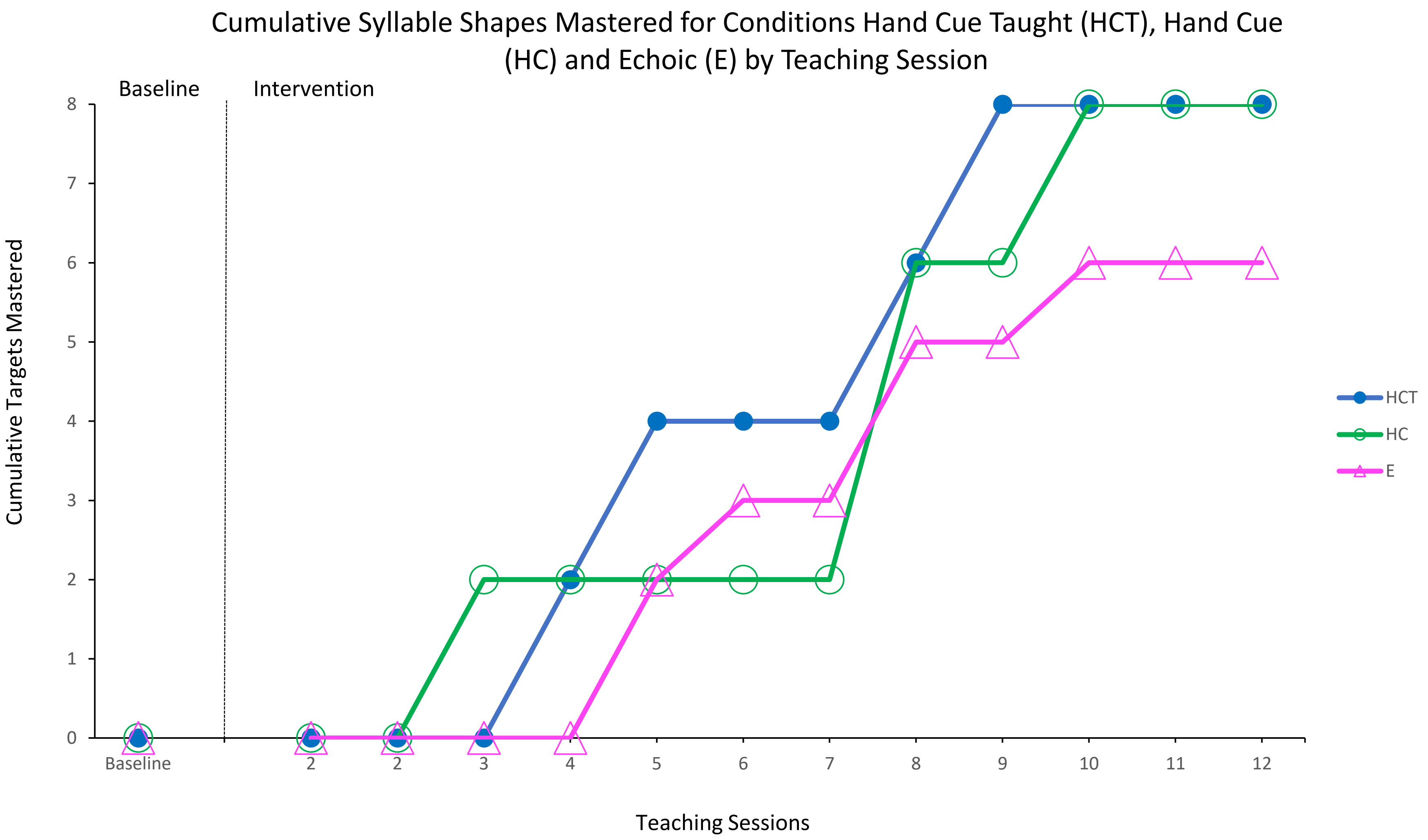
- *Syllable Shape Pre-Session Probe*:
  Targets for instruction were presented as E, HC, or HCT. Instructor presented the designated template (blank, outline of hands, solid hands) and blocking of hand movements if needed. Instructor presented the verbal S^D “together/you do” or other similar verbal S^D, followed immediately by presentation of the Echoic prompt (E), Hand Cue and Echoic prompt (HC and HCT)
    - This initial probe response served as a measure of learning
- *Correct Response*:
  Accurate imitation of the syllable shape within 3 seconds (E, HC). Accurate imitation of the syllable/execution of acceptable topography of HC (HCT)
- *Incorrect Response*:
  All other responses – incorrect/incomplete/absent
- *Mastery Criterion*:
  3 consecutive correct pre-session “cold” probes

Results – Cumulative Targets Mastered Per Condition

HCT Condition:
- Effective in establishing stimulus control
- Rapid, steady response acquisition
- All targets mastered

HC Condition:
- Effective in establishing stimulus control
- Moderate response acquisition
- All targets mastered

Echoic Model Alone Condition:
- Less effective in establishing stimulus control
- Slow response acquisition
- Not all targets mastered

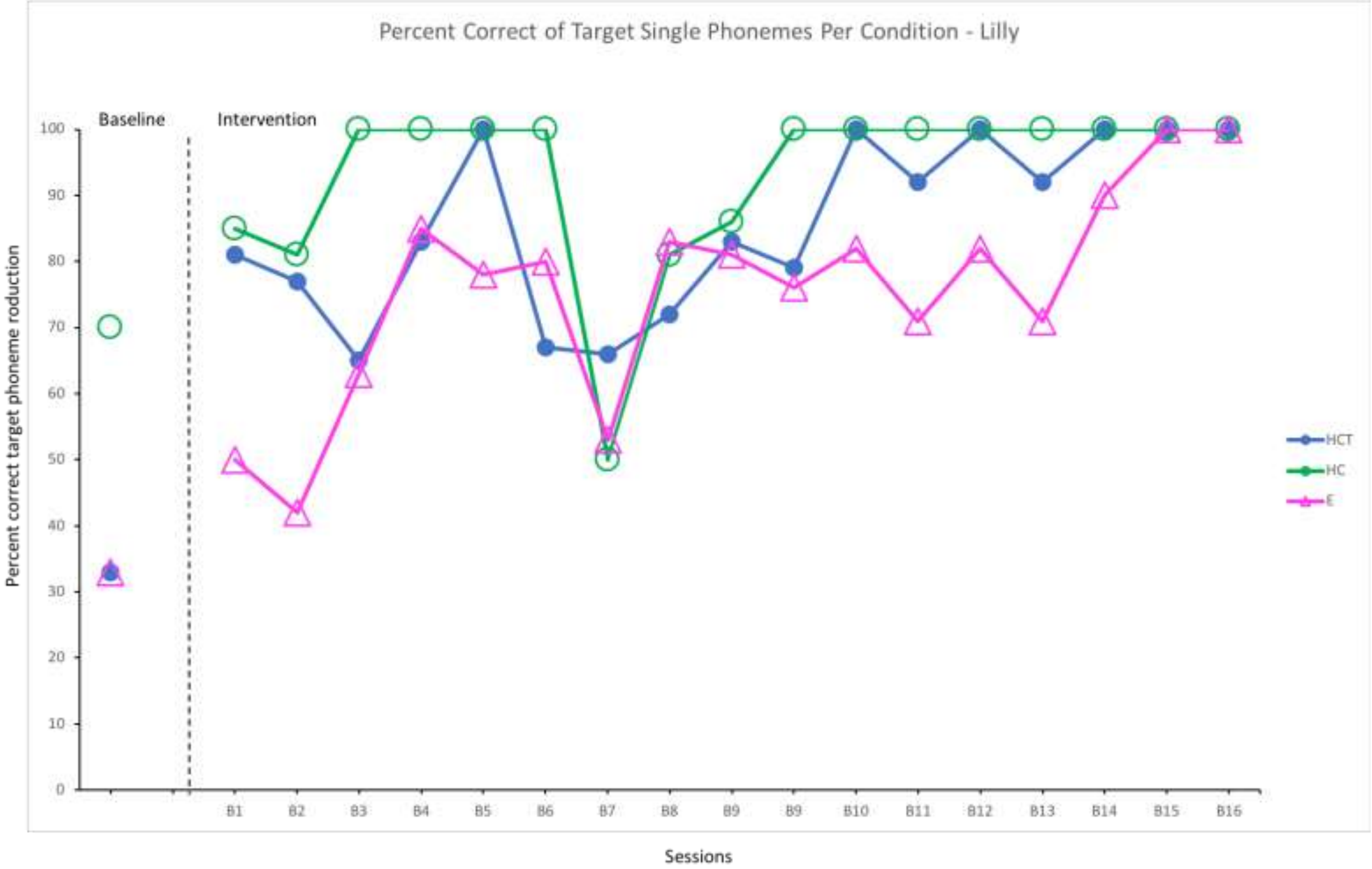


Results – Phoneme Level /t,z,a,d,f,I,n,u,m,v/

HCT Condition:
- Effective in establishing stimulus control
- Moderate, steady response acquisition

HC Condition:
- Effective in establishing stimulus control
- Rapid response acquisition
- Consist performance

Echoic Model Alone Condition:
- Less effective in establishing of stimulus control
- Slow response acquisition



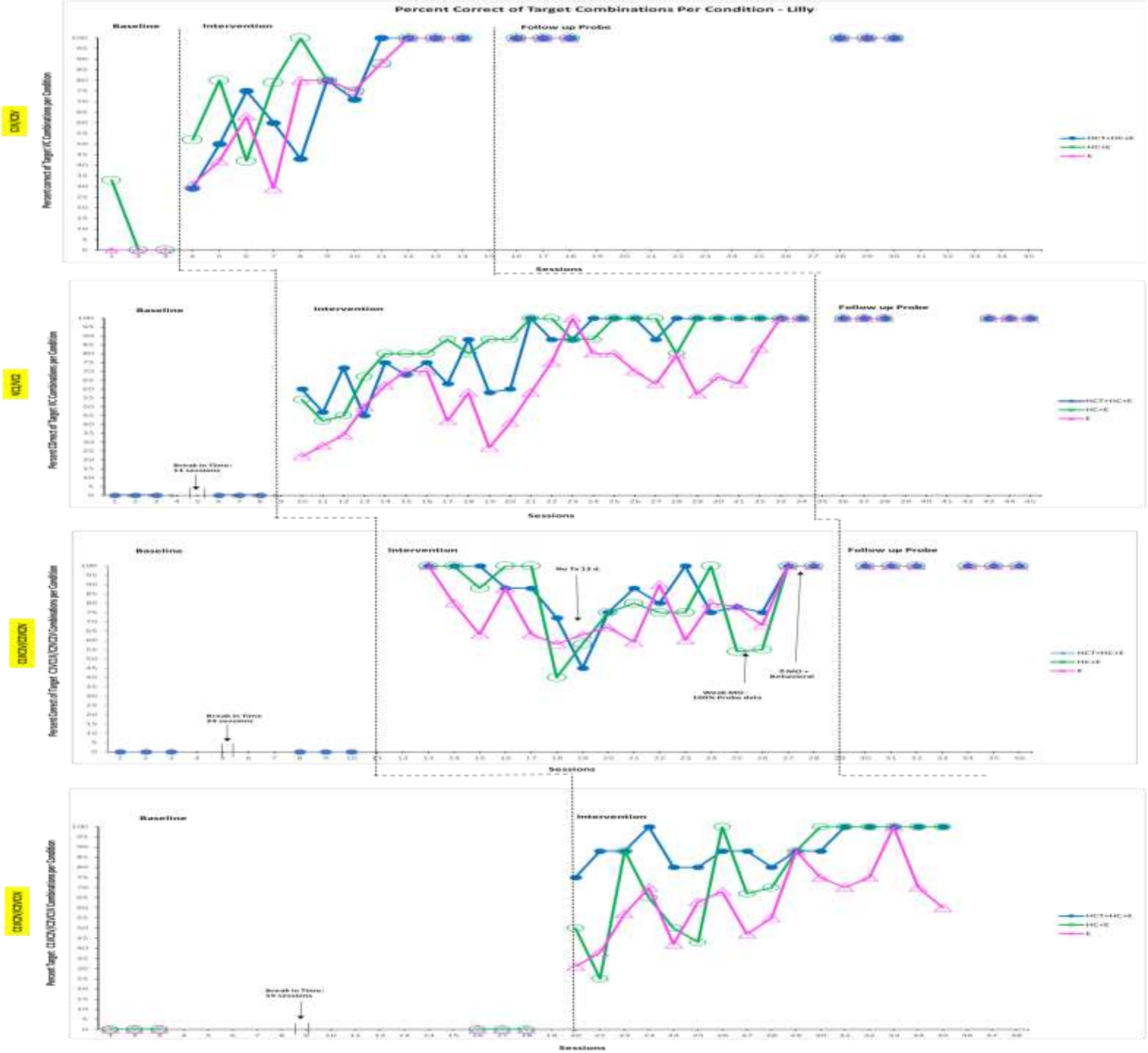
Results – Percent Correct

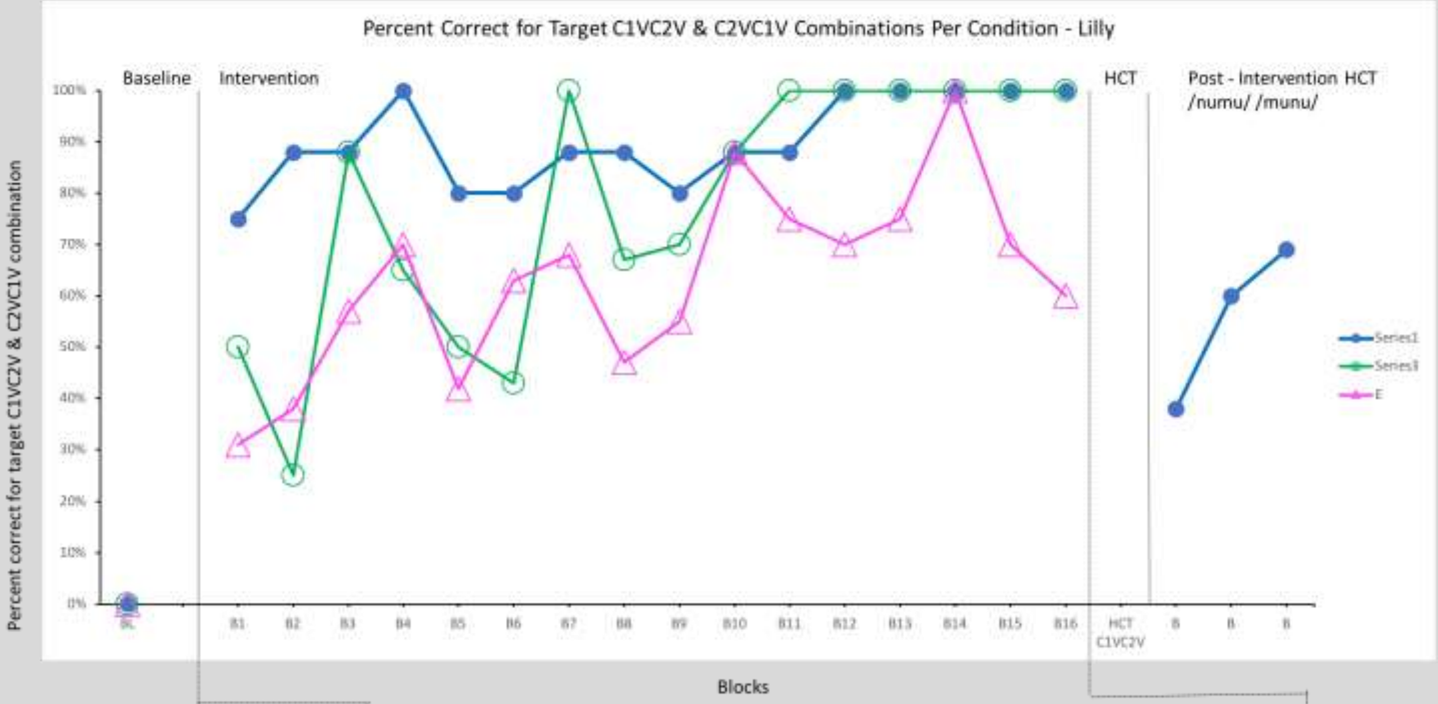
HCT Condition:
- Effective stimulus control procedure
- Steady increase in response acquisition for CV, VC, C1VC2V
- Variability in response for C1VC1V

HC Condition:
- Effective stimulus control procedure CV, VC, C1VC2V
- Most Rapid response acquisition
- Most Consistent performance
- Variability in response for C1VC1V

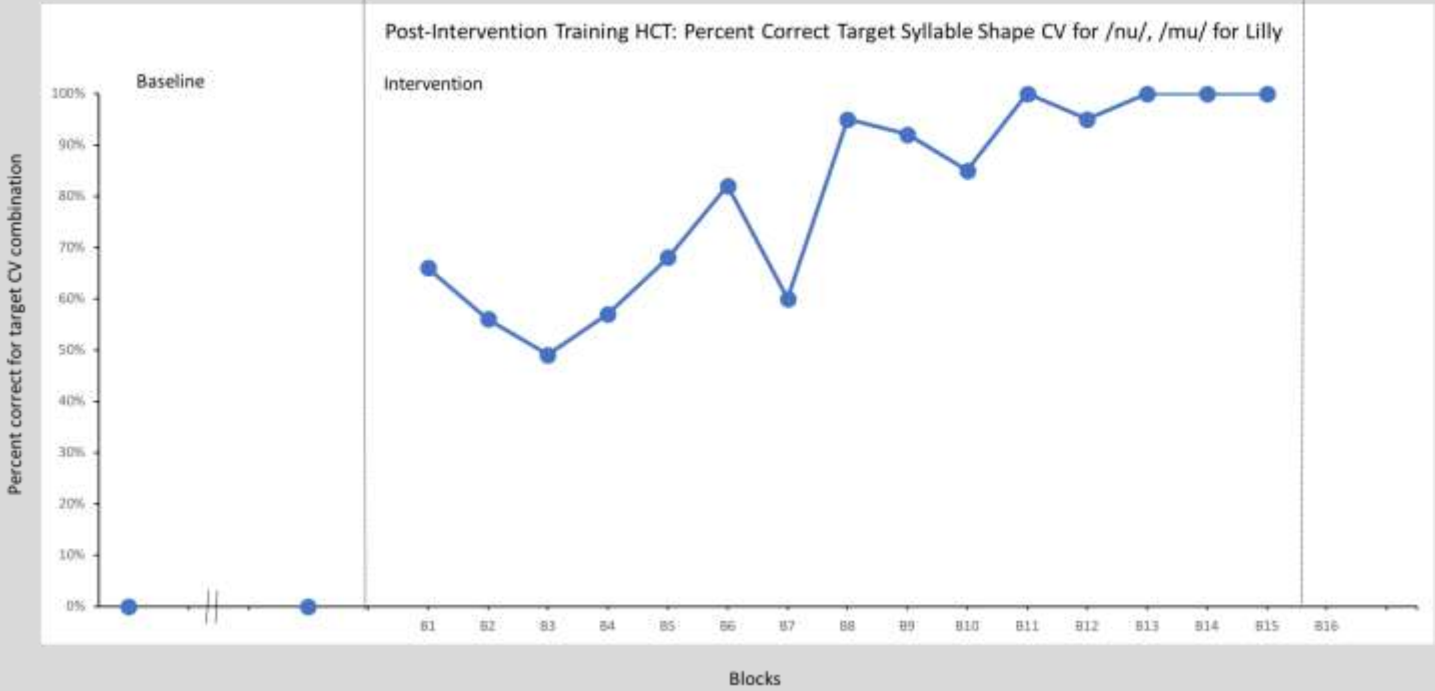
Echoic Model Alone Condition:
- Variable response acquisition trend
- Slow response acquisition
- Least effective stimulus control procedure (Lower overall performance)

*DRO procedure to reduce vocal stereotypy initiated at session 5





Percent Correct for Target C1VC2V & C2VC1V Combinations Per Condition - Lilly
Baseline
Intervention
HCT
Post - Intervention HCT
/numu/ /munu/
Percent correct for target C1VC2V & C2VC1V combination
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
BL
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
HCT C1VC2V
B
B
B
Series1
Series3
E
Blocks



Post-Intervention Training HCT: Percent Correct Target Syllable Shape CV for /nu/, /mu/ for Lilly
Baseline
Intervention
Percent correct for target CV combination
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
Blocks

EESA – Re-assessment February 13, 2018

- Lilly received a score of 51/100 (↑18) on the “The Early Echoic Skills Assessment (EESA; Esch, 2008), ~4 months post intervention. Significant Improvement noted in Groups 1-3:
  - ✓ Group 1: Simple and reduplicated syllables 17/25 (↑2)
  - ✓ Group 2: 2-syllable combinations 17.5/30 (↑2.5)
  - ✓ Group 3: 3-syllable combinations 16.5/30 (↑13.5)
  - Group 4: Prosody – spoken phrases 0/10
  - Group 5: Prosody – other contexts 0/5
- Parents and BCBA reports indicated improved & increased speech sound production & accuracy:
  - Accuracy sound production and syllable shape
  - Speech intelligibility
  - Spontaneous speech production – Manding frequency

Conclusions

- Results confirm previous case study findings that PHCs may be an effective intervention in promoting speech production skills in children with limited vocal repertoires and extends that research to children with autism
- Improvements in word and syllable shape productions when PHCs were utilized were demonstrated by multiple probe designs and adapted alternating treatment designs
- HCT resulted in steady increases in response trends whereas E condition alone to resulted in more variable, slow response acquisition or lack of response acquisition for all three learners
- For Lilly, rapid acquisition rates for HC and HCT procedures yield support for HCT and HC as effective stimulus control transfer procedures for phoneme and syllable shape levels
- Anecdotal reports from parent and BCBA in support of improved overall speech production: sound accuracy, syllable shape, speech intelligibility, mand frequency

Considerations

- Percent correct data, probe data, and discontinuous probes of all targets provided valuable information:
  - Rate of acquisition
  - Trend analysis: steady vs. variable
  - Consistency
  - Response class generalization without direct instruction

Discussion – Study Results

1. HCT and HC effective in establishing stimulus control to improve articulatory precision in isolation, word, and syllable shape level

    - HCT and HC more effective than echoic trials alone

2. HCT may be a more effective stimulus control transfer procedure as evidenced by independent self-prompting of correct phoneme production observed during discontinuous baseline probe

Observation and Anecdotal Report:

Independent use of hand cues observed in natural and structured settings

Discussion – Study Results

- Extend literature on subject-executed signs to the hand cues as a topography–based cue to evoke vocal verbal productions and promote improved speech precision (Barret & Sisson, 1994; Sundberg, 1993; Tincani, 2004; Carbone, 2006, 2010)

- Establish PHCs as an effective intervention in promoting speech production skills, independent of a treatment package

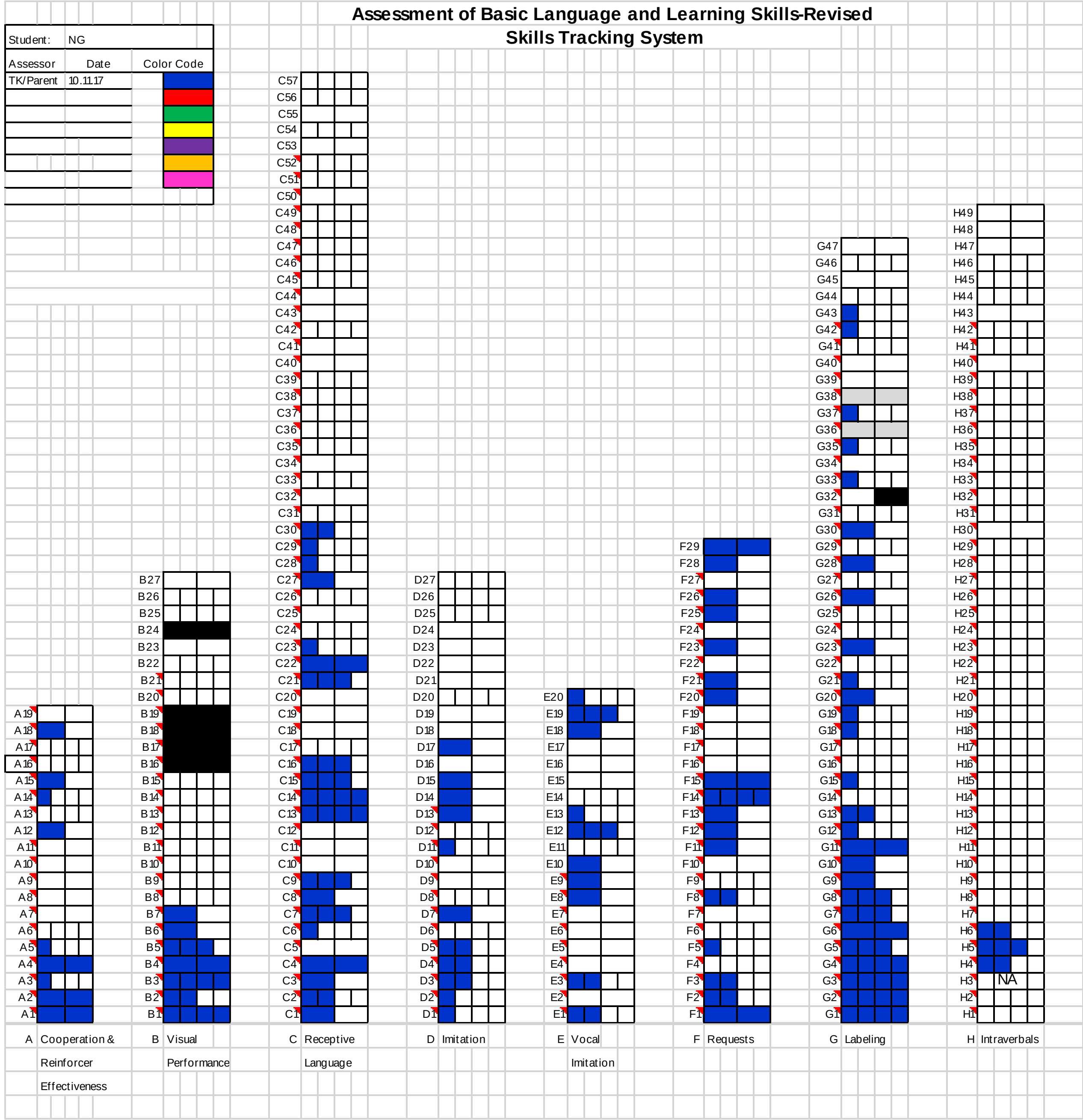
Limitations

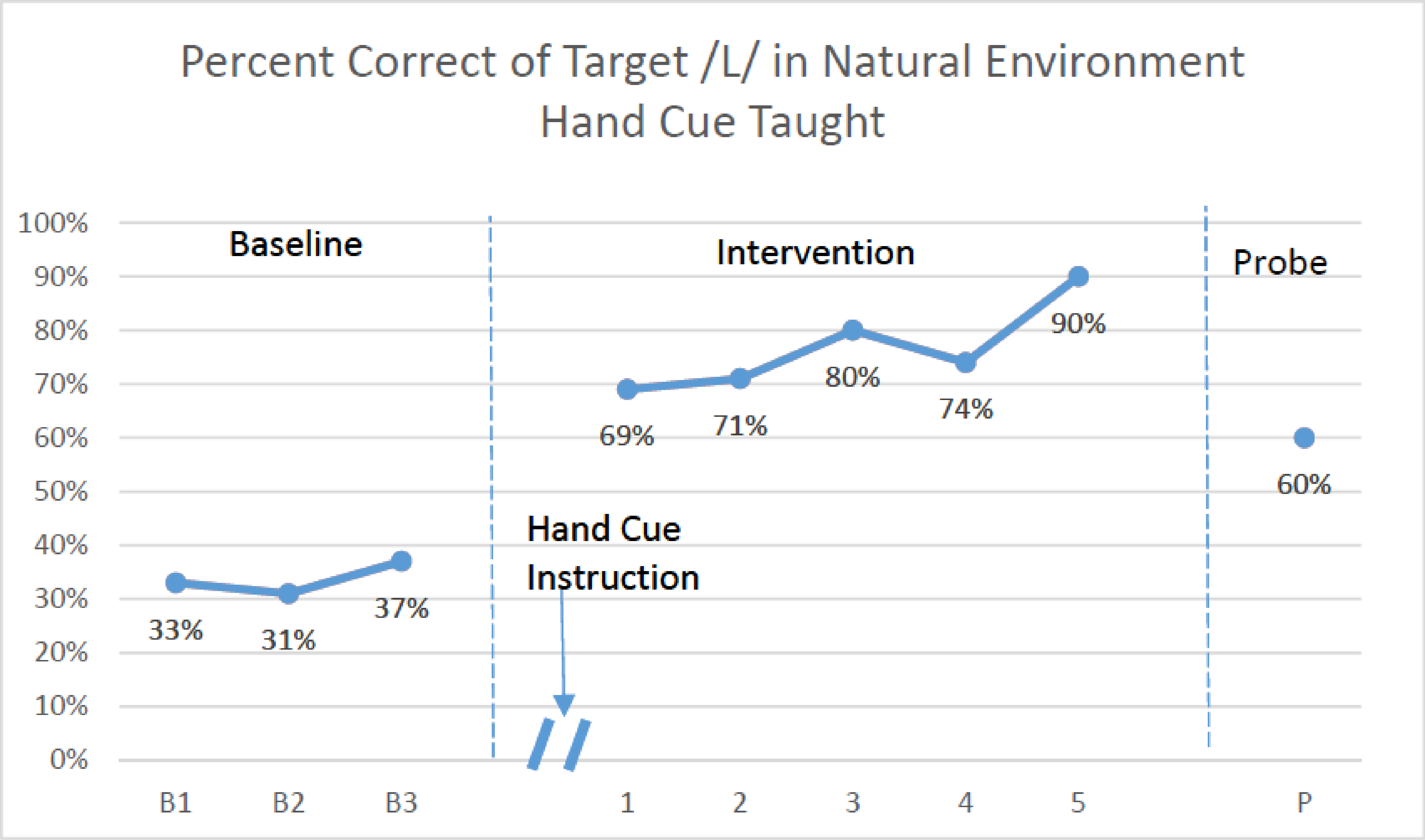
- Sampling Method:
  - Small sample – number of participants
  - Convenience sample
- Small Target Set per Condition
- Possible Confound Variable:
  - Concurrent mand/echoic training in other environments
- Could a quick controlled assessment indicate good candidates?

NG

- 4 year, 8 month old male
- Diagnosis of autism
- Diagnosis of Speech Sound Disorder with functional nasal emissions
- Intelligibility rated at less than 80% to unfamiliar listener with MLU (morphemes) 3.2
- Significant problem behavior in structured teaching settings
- Multiple articulation errors
- Limited response to traditional speech-language therapy
- Multiple different cuing systems used by SLPs
- 10 ITT sessions to meet 90% accuracy across two sessions
- Implemented hand cues in NE only with contrived opportunities

Assessment of Basic Language and Learning Skills-Revised
Skills Tracking System




Percent Correct of Target /L/ in Natural Environment
Hand Cue Taught
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Baseline
Intervention
Probe
33%
31%
37%
69%
71%
80%
74%
90%
60%
Hand Cue
Instruction
B1
B2
B3
1
2
3
4
5
P

Future Research

- Evaluate learner prerequisite skills that may yield most successful outcomes when using HCT v. HC
- Formally measure self-prompting under extinction conditions (e.g. self-correction)
- Formally measure correct phoneme production under extinction conditions (e.g. blocking)
- Replication
- Assess whether topographical similarities of the PHCs to the shape/movement of the oral mechanism influences relative effectiveness
- Assess the effectiveness of PHCs relative to target complexity
- Examine strategic implementation of PHC for error productions only, which would reduce HCT response effort
- Current studies included learners who failed to make progress with echoic methods alone. Assess relative efficiency of Hand Cues as an initial method of instruction

Implications

- Clinically, many children with autism demonstrate speech sound production issues
- Failure to acquire echoic responses limits a child's language repertoire and further development of more advanced language skills
- Methods for identifying effective echoic training early on is highly critical
- There is a need for additional research on effectiveness of echoic training is in both the fields of SLP and ABA
- Collaborative research is essential to identify efficacious and effective procedures to improve echoic repertoires in children with autism

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References

American Speech-Language-Hearing Association. (2007a). *Childhood apraxia of speech [Technical report].* Available from www.asha.org/policy.

Arntzen, E. & Almas, I. (2002) Effects of mand-tact versus tact-only training on the acquisition of tacts. *Journal of Applied Behavior Analysis*, 35, 419-422.

Barrera, R. D., & Sulzer-Azaroff, B. (1983). An alternating treatment comparison of oral and total communications training programs with echolalic autistic children. *Journal of Applied Behavior Analysis,* 16(4), 379-394. doi:10.1901/jaba.1983.16-379

Bashir, A., Grahamjones, F., & Bostwick, R. (2008). A touch-cue method of therapy for developmental verbal apraxia. *Seminars in Speech and Language* 5(2), 127-137.

Brady, D. O., & Smouse, A. (1992) A simultaneous comparison of three methods for language training with an autistic child: An experimental case analysis*. Journal of Autism and Childhood Schizophrenia*, 8, 271-279.

Carahaly, L. (2012). *The Speech-EZ® Apraxia Program.* Gilbert, AZ: Author.

Carr, E. (1979) Teaching autistic children to use sign language: Some research issues. *Journal of autism and Developmental Disorders*, 9, 345-359.

References

Carr, E. & Dores, P. (1981) Speech vs. Sign comprehension in autistic children; Analysis and prediction. *Journal of Experimental Child Psychology*, 37, 587-597.

Carroll, R. J. & Hesse, B. E. (1987). The effect of alternating mand and tact training on the acquisition of tacts. *The Analysis of Verbal Behavio*r, 5, 55-65.

Carbone, V. J.; Lewis, L.; Sweeney-Kerwin, E.; Dixon, J.; Louden, R.; & Quinn, S. (2006). A comparison of two approaches for teaching VB functions: total communication vs. vocal-alone. *The Journal of Speech-Language Pathology and Applied Behavior Analysis,1*(3), 181-192. http://dx.doi.org/10.1037/h0100199

Carr, E. (1979) Teaching autistic children to use sign language: Some research issues. *Journal of Autism and Developmental Disorders,* 9, 345-359.

Casey, L. O. (1978) Development of communicative behavior in autistic children: A parent program using manual signs. *Journal of Autism and Childhood Schizophrenia*, 8, 45-59.

Cooper, J., Heron, T., & Heard, W. (1987). *Applied Behavior Analysis*. Columbia, OH: Merrill.

Dauer, K. E., Irwin, S. S., & Schippits, S. R. (1996). *Becoming verbal and intelligible*. Austin, TX: Pro-Ed. Davis.

Esteve-Gibert, N., & Prieto, P. (2013). Prosodic structure shapes the temporal realization of intonation and manual gesture movements. *Journal of Speech, Language, and Hearing Research,* 56, 850–864.

References

Fulwiler, R. & Fouts, R. (1976) Acquisition of American Sign Language by a non- communicating Autistic Child, *Journal of Autism and Childhood Schizophreni*a, 6, 43-50.

Gentilucci, M., Benuzzi, F., Gangitano, M., & Grimaldi, S. (2001). Grasp with hand and mouth: Kinematic study on healthy subjects. *The Journal of Neurophysiology*, 86, 1685–1699.

Hall, G., & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. T*he Analysis of Verbal Behavior*, 41-50.

Hall, P. K. (2000a). A letter to the parent(s) of a child with developmental apraxia of speech. Part I: Speech characteristics of the disorder. *Language, Speech, and Hearing Services in Schools*, 31, 169-172.

Hall, P. K. (2000b). A letter to the parent(s) of a child with developmental apraxia of speech. Part IV: Treatment of DAS. *Language, Speech, and Hearing Services in Schools*, 31, 179-181.

Hall. P. K., Jordan, L., & Robin, D. (1993*). Developmental apraxia of speech: Theory and clinical practice.* Austin, TX: PRO-ED.

Helfrich-Miller, K. (1994). "A clinical perspective: melodic intonation therapy for developmental apraxia," *Clinics in Communication Disorders*, 4(3).

References

Hall, G., & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. *The Analysis of Verbal Behavior,* 41-50.

Hall, P. K., Jordan, L. S., & Robin, D. A. (1993). *Developmental Apraxia of Speech*. Austin, TX: Pro-Ed.

Helfrich-Miller, K. (1994). "A clinical perspective: melodic intonation therapy for developmental apraxia," *Clinics in Communication Disorders*, 4(3).

Hodson (2003). *HAPP-3: Hodson Assessment of Phonological Patterns–Third Edition.* TX: Pro-Ed.

Helfrich-Miller, K. (1994). "A clinical perspective: melodic intonation therapy for developmental apraxia," *Clinics in Communication Disorders*, 4(3).

Kaufman, N. (1995). *Kaufman Speech Praxis Test for Children*. Detroit, MI: Wayne State University Press

Kaufman, N. (2012). *Kaufman Speech to Language Protocol*. Gaylord, Michigan: Northern Speech Services.

References

King, J., Seunghee, H., & Vaughn, T. Effectiveness of hand cues in the treatment of children with suspected childhood Apraxia of Speech. Poster session presented at Department of Audiology & Speech Pathology, University of Tennessee-Knoxville.

Kirkpatrick, J., Stohr, P.; Kimbrough, D. (1990). *Moving Across Syllables Training Articulatory Sound Sequences* TX; Pro-Ed.

Klick, S. L. (1985). Adapted cuing technique for use in treatment of dyspraxia. *Language, Speech, and Hearing Services in Schools*, 16, 256–259.

Konstantareas, M. (1984) Sign language as a communication prosthesis with language impaired children. *Journal of Autism and Developmental Disorders.* 14, 9-25.

Konstanantareas, M., Webster, C., & Oxman, J. (1979). Manual language acquisition and its influence on other areas of functioning in four autistic and autistic-like children. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 20,337-350.

References

Konstantareas, M. (1984) Sign language as a communication prosthesis with language impaired children. *Journal of Autism and Developmental Disorders*. 14, 9-25.

Konstanantareas, M., Webster, C., & Oxman, J. (1979). Manual language acquisition and its influence on other areas of functioning in four autistic and autistic-like children. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 20,337-350.

Layton, T. (1988) Language training with autistic children using four different modes of presentation. *Journal of Communication Disorders*, 21, 333-350.

Maas, E., Robin, T., Austermann, S., Freedman, S., Wulf, G., Ballard, K., & Schmidt, R. (2008). Principles of Motor Learning in Treatment of Motor Speech Disorders, *American Journal of Speech-Language Pathology*, Vol. 17, pp. 277–298.

Michael, J. (1993). *Concepts and Principles of Behavior Analysis*. Kalamazoo, MI: Association for Behavior Analysis.

Miltenberger, R. (2000). *Behavior Modification Principles and Procedures (Second Edition*). Belmont, CA: Wadsworth/Thomas Learning.

References

Murray, E., McCabe, P., & Ballard, K. J. (2014). A systematic review of treatment outcomes for children with childhood Apraxia of Speech. *American Journal of Speech-Language Pathology, 23(3),* 486. doi:10.1044/2014_ajslp-13-0035

Neuman, S. (1985). Alternating treatment designs. In S. Neuman & S. McCormick (Eds.),*Single Subject Experimental Research: Applications for Literacy* (pp. 64-83). Newark, DE: International Reading Association.

Nicholls, G. H., & Mcgill, D. L. (1982). Cued Speech and the reception of spoken language. *Journal of Speech Language and Hearing Research*, 25(2), 262. doi:10.1044/jshr.2502.262

Palmer, D, (1996). The role of automatic reinforcement in the establishment of parity. *Journal of the Experimental Analysis of Behavior*. 65(1): 289–290.

Pannbacker, M. (1998).“Management strategies for developmental apraxia of speech: a review of the literature,” *Journal of Communication Disorders*, 21.

References

Parrell, B., Goldstein, L., Lee, S., & Byrd, D. (2014). Spatiotemporal coupling between speech and manual motor actions. *Journal of Phonetics*, 42, 1–11.

Partington, J. W. (2006). *Assessment of Basic Language and Learning Skills-Revised* (ABLLS-R). Pleasant Hill, CA: Behavior Analysts, Inc.

Partington, J.W., Sundberg, M.L., Newhouse, L., & Spengler, S.M. (1994). Overcoming an autistic child's failure to acquire tact repertoire. *Journal of Applied Behavior Analysis,* 27, 733-734.

Perrier, O., Bochner-Wuidar, A., Everarts, B., & Michiels, J., (1986) "The Combination of Cued Speech and Signed French to Improve Spoken Language Acquisition by Young Deaf Children." in B. Tervoort (Ed.) *Signs of Life: Proceedings of the Second European Congress on Sign Language Re-search* (pp. 194-199) Amsterdam. Reprinted in the Cued Speech Journal, 4, 1990.

Perrier, O. (1987) "The Psycholinguistic Integration of Signed French and Cued Speech: How can Speech Components be Triggered?" Paper presented at the Symposium on Oral Skills and Total Communication, Gent, Belgium. (Reprinted in the Cued Speech Journal, 4, 1990).

References

Rusiewicz, H. L., Shaiman, S., Iverson, J. M., & Szuminsky, N. (2013). Effects of prosody and position on the timing of deictic gestures. *Journal of Speech, Language, and Hearing Research,* 56, 458–470.

Rusiewicz, H. L., Shaiman, S., Iverson, J. M., & Szuminsky, N. (2014). Effects of perturbation and prosody on the coordination of speech and gesture. *Speech Communication*, 57, 283–300.

Sisson, L. A., & Barrett, R. P. (1984). An alternating treatments comparison of oral and total communication training with minimally verbal retarded children. *Journal of Applied Behavior Analysis, 17(4*), 559-566. doi:10.1901/jaba.1984.17-559

Skinner, B. F. (1957). *Verbal Behavior*. Englewood Cliffs, NJ: Prentice Hall.

Square, P. (1994). Treatment approaches for developmental apraxia of speech, *Clinics in Communication Disorders*, 4 (3).

Shelton, I.S. & Garves M. M. (1985). Use of visual techniques in therapy for developmental apraxia of speech. *Language, Speech, and Hearing Services in Schools. April 1985, 16, 119-121.*

References

Strand, E. A. & Debertine, P. (2000). The efficacy of integral stimulation intervention with developmental apraxia of speech. *Journal of Medical Speech-Language Pathology*, 8, 295-300.

Strand, E. A., & Skinder, A. (1999). Treatment of developmental apraxia of speech: Integral stimulation methods. In A. Caruso & E. Strand (Eds.), *Clinical management of motor speech disorders in children* (pp. 109-148). New York, NY: Thieme.

Strode, R., & Chamberlain, C. (1994). *Easy does it for apraxia: Preschool.* E. Moline, IL: Linguisystems.

Sundberg, C. and Sundberg, M. (1990) Comparing topography-based verbal behavior with Stimulus selection-based verbal behavior, *The Analysis of Verbal Behavior*, 8, 31-41.

Sundberg, M. (1993). Selecting a Response Form for Nonverbal Persons: Facilitated Communication, Pointing Systems, or Sign Language? *The Analysis of Verbal Behavior* (11), pp. 99-116.

Sundberg, M. Endicott, K. & Eigenheer, P. (200). Using Intraverbal Prompts to Establish Tacts for Children with Autism. *The Analysis of Verbal Behavior*, 89-104.

References

Terrace, H. (1963). Discrimination learning with and without errors. *Journal of the Experimental Analysis of Behavior, 6,* 1-27.

Tincani, M. (2004). Comparing the Picture Exchange Communication System and Sign Language Instruction for Children with Autism. *Focus on Autism and Other Developmental Disabilities,* 19(3), 152-163.

Touchette, P. E. (1968). The effects of graduated stimulus change on the acquisition of a simple discrimination in severely retarded boys. *Journal of the Experimental Analysis of Behavior,* 11, 39-48.

Touchette, P. E. & Howard, J. (1984). Errorless learning: Reinforcement contingencies and stimulus control transfer in delayed prompting. *Journal of Applied Behavior Analysis,* 17, 175-181.

Williams, P., & Stephens, H. (2004). *Nuffield Dyspraxia Programme–Third edition.* Windsor, England: The Miracle Factory.