Generalized Selection-Based Auditory Matching and the Emergence of the Listener Component of Naming

JeanneMarie Speckman-Collins, Hye-Suk Lee Park & R. Douglas Greer

Abstract

We tested the effects of teaching an auditory match to sample repertoire on the emergence of the listener half of the verbal developmental cusp of Naming for 2-preschool students with language-based disabilities. The study was conducted in a special education CABAS® preschool. Neither of the students had selection or discrimination responses, the listener component of Naming, following mastery of match to sample programs for two-dimensional visual stimuli while hearing the tact as they matched. We taught the students to match same sounds and same words using BIGMac® buttons, and then tested the effects of mastery of these skills on the emergence of the listener component of Naming. A time-lagged multiple probe design across students was employed to determine if there was a functional relation between the acquisition of auditory matching and the emergence of the listener component of naming. The results showed that for these two students, the acquisition of an auditory matching repertoire was functionally related to the emergence of the listener component of Naming. We also report data on the participants' echoic responses to stimuli as well as emergent tact responses (the speaker component of Naming).
Keywords: Observational learning, naming, contingency learning, & emotional and behavioral disorders.

The productivity of human language is an area of interest for many who research language development (Skinner, 1957; Chomsky, 1959; Pinker, 1999; Horne and Lowe 1998; Hayes, Barnes-Holmes & Roche 2001, Greer and Yuan, 2003, Speckman-Collins and Greer 2005, Lee-Park 2005.) Some linguists account for novel language production in terms of a lexicon, lexical rules and an infinite number of combinations available to a speaker (Pinker, 1999; Jackendoff, 2002.) Horne and Lowe's (1998) theory on Naming provides an operant explanation of productive verbal behavior. Naming is "a circular relationship between classes of objects and events and the responses they occasion" (Horne & Lowe, 1998, p.5.) According to the theory of Naming, speakers listen to their own speech. This orients the speaker back to the item of which they are speaking. This can be a particular item or a class of items in general. If the item or items then evoke a tact response from the speaker, the cycle may begin again. The individual can then" hold the object in consciousness" (Horne & Lowe, 1998, p.6) for as long as the cycle continues. Once an individual has an orienting response towards an item, or a listener response, an echoic response may occur. Once a listener and echoic response are in place, the conditions then exist for the corresponding tact response (Horne & Lowe, 1998.) Once the listener response, the echoic response and the tact are in place, the Naming cycle is complete. Horne and Lowe (1998) claimed that Naming is the basic unit of verbal behavior, upon which all complexities of human language are founded.

One experiment that tested the Naming theory showed that only 1 out of 5 children tacted items after being taught an echoic response not in the presence of the item and a listener response, but 5 out of 5 children tacted items after being taught a listener response and an echoic response in the presence of the item (Horne & Lowe, 1998). In other experiments, acquisition of Naming led to the emergence of discrimination responses to those stimuli (Horne & Lowe, 1998) and teaching a tact response resulted in correct "sorting behavior" (Horne & Lowe, 1998) while teaching only a listener response did not (Horne & Lowe, 1998). Another study showed that Naming in two to four year old children resulted in the

establishment of arbitrary stimulus classes and that match to sample training resulted in categorization responses (Lowe, Horne, Harris & Randle, 2002).

The emergence of Naming has been functionally linked to multiple exemplar instruction (Greer, Stolfi, Chavez-Brown and Rivera-Valdes, 2005.) When individuals are exposed to a variety of exemplars across different situational contexts, responses and the sources of stimulus control over them are refined. "Contextual dimensions of the training tasks must vary… while reinforcement is maintained so that relevant features of the task can be discriminated." (Hayes, et.al., 2001 p.26). In multiple exemplar instruction, many exemplars and non- exemplars are presented and responding to a particular stimulus is differentially reinforced (Fields, Reeve, Matneja, Varelas, Dalanich, Ditzer & Shamoun, 2002). Using many within class exemplars during discrimination training has been shown to increase the likelihood of perceptual class formation (Fields et. al , 2002; Brown, Brown & Poulson, 1995; Gena, Krantz, McClannahan & Poulson, 1996), relational frame formation (Hayes & Barnes, 1997; Steel & Hayes, 1991; O'Hora, Roche, Barnes-Holmes & Smeets, 2002) and transformation of stimulus function across functionally independent operants (Greer, Yuan & Gautreax, 2003). Multiple exemplar instruction for transformation of stimulus function involved rotating instruction across different response forms and functions for purposes of establishing joint stimulus control across those responses.

Greer et. al. (2005) and later Fiorile and Greer (2006) found that multiple exemplar instruction that rapidly juxtaposed match to sample while hearing the tact, point to responses while hearing the tact, and tact responses for the same two-dimensional stimuli induced Naming in young children with disabilities. More recently, Feliciano (2006) found that multiple exemplar instruction that closely rotated only match to sample and selection or point responses to the same stimuli led to the emergence of the listener component of Naming in children with disabilities ranging in age from 3 to 7 years. For some students, full Naming emerged as a result of the instruction. Gilic (2004) looked at the prevalence of Naming in typically developing children and found that most of the typically developing two-year-olds she studied did not have a Naming repertoire, but that MEI induced a full Naming repertoire in those typically developing two-year- olds.

The importance of a Naming repertoire cannot be underestimated for children with language based disabilities as well as for children who lack certain verbal experiences. For these students, acquisition of one operant could lead to as many as three more listener and speaker operants (selection, tact, multiply controlled responses) and later, the acquisition of similar joint stimulus control among text and spoken words may lead to many more relations necessary for success in school (Greer & Keohane, 2005.) Multiple exemplar instruction has been shown to be an effective tactic to induce both full Naming and the listener component of Naming in children for whom the repertoires were not present. It is important to test for more procedures that may also be successful in inducing these important repertoires. In the present study we tested the effect of mastery of selection based auditory matching on the emergence of the listener component of naming.

Auditory Matching

Vause (1998) and Vause, Martin and Yu (2000) taught children to match first sounds, then words and investigated performance on these tasks as a predictor of performance on the Assessment of Basic Learning Abilities (ABLA) (Kerr, et al. 1977.) The results showed strong correlations. Marion (2003) looked at the relation between the ABLA, two auditory matching tasks and the emission of mands, tacts and echoics. The results showed that children who passed the auditory matching tests had more success with mand, tact and echoic responses. Chavez-Brown (2005) tested the effects of an auditory matching procedure with increasing levels of complexity on the echoic behavior of preschoolers. Students were required to press Big Mac® buttons that produced sounds that were identical to the sounds produced by the experimenter's buttons. The experimenter had a sample button and two comparisons set up in front of the student. The experimenter, sitting across from the student, pressed all three buttons (two produced the

same sound or word and the other was different.) The student then had to press the button that produced the sound or word that matched the sample sound or word. The student progressed through levels of instruction including sound vs. no sound, sound vs. white noise, sound vs. sound, non-word vs. word, word vs. word and finally, novel word vs. novel word (generalized auditory matching.) The results showed that the acquisition of an auditory matching repertoire resulted in increased partial and/or full echoic responses for all participants.

For the current experiment, we tested the effects of the same auditory matching procedure (AM) employed by Chavez-Brown (2005) on the acquisition of the listener component of Naming for three preschoolers with disabilities. We also investigated the effects of AM on the acquisition of the speaker component of Naming and the emission of full echoic responses by participants.

Method

Participants

Student S was a three year five month- old female with a diagnosis of autism. She was a pre-listener as well as a pre-speaker. According to the results of Preschool Language Scale- Fourth Edition (PLS-4) (Zimmerman, Steiner, and Pond, 2002), her auditory comprehension age equivalent was 1.3 years and her expressive communication age equivalent was 11 months. She did not demonstrate reliable eye contact or imitation of teachers' actions. Student S pointed or gestured to mand desired items. She did have a generalized echoic repertoire, however she had been observed to produce true words or parrot. She did not have a generalized matching repertoire, however she had mastered matching some directly taught sets of objects and pictures.

Student D was a four year eight month-old female with diagnoses of autism and cerebral palsy. She was a listener/ early speaker. According to the results of PLS-4, her auditory comprehension age equivalent was 1.11 years and her expressive communication age equivalent was 1.9 years. Participant D had a generalized echoic repertoire but did exhibit difficulties in the articulation of certain phonemes (e.g., /r/, /l/, etc.) and some combination of phonemes (e.g., /dl/). She had mands and tacts with autoclitics in her repertoire, but demonstrated limited generalized vocal verbal skills, or she did not mand or tact "spontaneously" across environments.

Setting

The present study was conducted in a CABAS® preschool (a publicly funded private school in a suburb of a large metropolitan city). Behavior analysis was applied to all aspects of instruction as well as for measurement of all of the students' responses to instruction received in the school. The ratio of student to teacher was 1:1. The experimental and pre- experimental probes, as well as instruction in matching picture sets were conducted in the classrooms of the participants. Instructions for auditory matching were conducted in a small therapy room. The sessions began as soon as the experimenter sat at a child size table across from the participant.

Data Collection

Data were collected on data forms with a pencil. The experimenters recorded pluses (+) following participant correct responses and minuses (-) following participant incorrect responses. After 20 instructional trials, learn units, were presented, the pluses were summed and plotted on a graph.

Dependent Variables

Emergent selection or point responses as listener component of Naming. During probe sessions for untaught selection or point responses, the experimenter placed two pictures, a positive and a negative exemplar, on the table in front of the participant. The experimenter provided the vocal direction "Point to ___". The participant had three seconds to point to or touch the correct picture. If they did, it was considered a correct response and the experimenters recorded a plus (+). If the student pointed to the

wrong picture, did nothing or pointed to the picture after the three seconds allowed latency had elapsed, it was considered an incorrect response and the experimenter recorded a minus (-). There was no feedback given to the participants for correct or incorrect responses during probe sessions.

Echoic responses. During probe sessions for echoic responses, the experimenter presented a picture to the participant and tacted the picture. The participant had three seconds to echo the tact with direct phonetic correspondence. If they did, it was considered a correct response and the experimenters recorded a plus (+). If the student emitted the wrong phonetic structure, said something completely different, or did not vocalize, it was considered an incorrect response and the experimenter recorded a minus (-). There was no feedback given to the participants for correct or incorrect responses during probe sessions.

Emergent tact responses as the speaker component of Naming. During probe sessions for emergent tact responses, the experimenter presented a picture to the participant. The participant had three seconds to vocally tact the picture, or produce the correct name of the picture that had been used by the experimenter during match training. If they did emit the tact response, it was considered a correct response and the experimenters recorded a plus (+). If the student emitted the wrong tact or vocalized nothing, it was considered an incorrect response and the experimenter recorded a minus (-). It is important to note that because we were targeting the emergence of a Naming repertoire for the participants, approximations of tacts were accepted as correct for this measure whereas approximations were not accepted as correct for echoic responses, where the structure or form of the vocalization was the behavior of interest. There was no feedback given to the participants for correct or incorrect responses during probe sessions.

Independent Variable.

An auditory matching instructional sequence was the independent variable for this study. During this procedure, two buttons, one for a target sound or word and the other for the foil, negative exemplar sound or negative exemplar word (depending on the instructional phase), were placed in front of the participants and one sample button was placed in front of the experimenter who was across the table. First, the instructor pressed her sample button and then the two comparison buttons one at a time. She then pressed the sample again. The participants were then required to press the comparison button which matched the experimenter's sample sound or word given the experimenter's vocal direction "Your turn." The latency of responding was 5 seconds. Each instructional session consisted of 20 learn units and the preset criteria for acquisition of the target skill was 90% accuracy for two consecutive sessions.

Materials.

The experimenters used BIGMac® buttons in order to teach the auditory matching responses. The buttons were red and were 15 centimeters in diameter. The buttons were equipped with audio recorders onto which sounds or voices were recorded. Once the buttons were in the "on" mode, pressing them lightly produced the previously recorded sound.

Picture stimuli were used for the Naming and echoic probes. The pictures were approximately 10 centimeters square and were either actual photographs or drawn exemplars.

Experimental Design and Procedure

We employed a time-lagged multiple probe design across participant. For Student D, we conducted initial Naming probes and next implemented the Auditory Matching procedure. Once she met criterion on the sounds vs. no sounds phase, we conducted another set of Naming probes. At the same time, we conducted initial Naming probes for Student S. A full description of the procedure is presented in this section.

Auditory matching instruction was conducted in five phases; matching environmental sounds in the presence of no sound, matching five different environmental sounds in the presence of sounds, matching five different words in the presence non-sense words, matching five different words in the presence of words, and matching five different pairs of words which had similar phonetic structures. Post-probes with sets of stimuli were conducted after the participants met criteria during instructional phases. Prior to each probe phase, instruction on matching pictures which were the target stimuli was conducted for two sessions in order to ensure that the participants had opportunity to hear the words for the pictures before selection responses with the pictures were probed. Probes were conducted in 20- trial sessions and no consequences were delivered during the probes. The sequence of the probes across target behaviors was first tacts, then pointing to pictures or selection responses and lastly echoics. Probes for untaught speaker behaviors (tacts and echoics) were conducted to determine if there was increase of correct tact responses as the participant moved toward finer discrimination of auditory stimuli.

Pre-experimental and subsequent probes. Four sets of pictures were presented in order to probe for the following responses: selection or "point to" responses, tact responses and echoic responses. Sets 1 and 2 were each composed of a picture of a mode of transportation, a type of flower, a breed of dog, and a community helper. Sets 3 and 4 were randomly chosen regardless of categories. The four sets of stimuli are shown in Table 1.

Table 1: *4 Sets of Pictures Used during Probe Sessions for Listener Component Naming*

Set	Stimuli (Multiple Exemplars of Pictures of Following Items)
Set 1	A Firefighter, A Tulip, A Poodle, and A Jeep
Set 2	A Painter, A Daisy, A Beagle, and A Truck
Set 3	A Jar, A Pan, A bib, and A Carrot
Set 4	A Bell, A Peacock, A Mouse (a part of computer), and A Camera

Pre-experimental matching instruction with Set 1. The participants received instruction on matching pictures of Set 1 which was one of four sets presented during the pre-experimental probes. The instruction was delivered in 20 learn unit sessions and the criterion for the acquisition of the target skill was 90% of correct responding for two consecutive sessions. Two comparisons, a positive and a negative exemplar, were presented on a table and the participants were required to match a given sample to one of the comparisons with the experimenter's vocal direction, "Match ___." During this phase, the participants had opportunities to hear words for the pictures which they matched.

Post matching probes with Set 1. After the participants met criteria during matching instruction with the set, probes were conducted again. The target behaviors were pointing to the pictures, tacting pictures and echoing the instructors' tact of the pictures. 20 trials were presented for each response class. The format of the probes for each behavior remained same as in pre-experimental probes. Candidates who did not show untaught pointing behavior with the set were chosen for participants for this study.

Sound vs. no sound. During this phase, the participants were required to match identical sounds in the presence of no sound (foil). Criterion for mastery of this phase and all phases that followed was 90% across 2 consecutive sessions.

Post sound vs. no sound probes. Probes for Set 1 were conducted after the participants mastered discriminating five different sounds from no sound. If the listener component of Naming emerged, or if the participant emitted 80% of untaught point responses, a Naming probe was conducted with a novel set to test if the participant showed untaught pointing after match to sample instruction with the new stimuli.

Sounds vs. sounds. During this phase, the participants were required to match five different sounds in the presence of other sounds. The list of sounds used during this phase is presented in Table 2.

Table 2: *Auditory Stimuli Used during Instruction on Generalized Auditory Matching*

Phase	Exemplars	Non-Exemplars
Sounds *vs*. Non-Sounds	Laugh, Siren of Fire Engine, Cow Mooing, Sound of A Grasshopper, A Dog Barking	Non-Sound
Five Different Sounds	Laugh, Siren of Fire Engine, Cow Mooing, Sound of A Grasshopper, A Dog Barking	
Five Words *vs.* Non-Sense Words	Make, Low, Pot, Time, and Cup	Afe and Ipe
Five Words	Make, Low, Pot, Time, and Cup	
Five Sets of Words with Similar Phonetic Structures	Cop, Late, Make, Poppy, Soon	Pop, Bait, Mate, Potty, Moon

Post sounds vs. sounds probes. Probes were again conducted after the participants mastered matching to sample for five different sounds. If the listener component of Naming emerged, or if the participant emitted 80% of untaught point responses, a Naming probe was conducted with a novel set to test if the participant showed untaught pointing after to match to sample instruction with the new stimuli.

Words vs. nonsense words. During this phase, the participants were taught to match five words in the presence of nonsense. The words and non-sense words are shown at Table 2.

Post words vs. nonsense words probe. Probes were again conducted after the participants mastered matching five different words in the with nonsense words as foils. A probe was conducted with original sets and another probe was conducted with a novel set to test if pointing emerged with the novel stimuli.

Words vs. words. During this phase, the participants were taught to match five different words in the presence of words. The words are shown at Table 2.

Post words vs. words probe. All probes were conducted after the participants mastered matching words with words as negative exemplars.

Matching words with similar phonetic structures. The participants received instruction on matching five words in the presence of words which had similar phonetic structures. The words are shown at Table 2.

Post matching words with similar phonetic structures probe. Probes were again conducted after the participants mastered discriminating five different pairs of words which had similar phonetic structures.

Interobserver Agreement

Interobserver agreement (IOA) was assessed by having a second observer record occurrences of target behaviors simultaneously and independently. IOA was calculated by dividing the number of responses in agreement by the number of agreements plus the number of disagreements and multiplying by 100% (Cooper, Heron, & Heward, 1987). For Participant D, IOA was conducted during 14 % of the instructional sessions for auditory matching and 73 % of all probe sessions for selection responses, tacts and echoics.. The mean of IOA for the training sessions was 99 % with a range from 95 % to 100 % and 99% with a range from 90 % to 100 % for the probe sessions. For Participant S, IOA was conducted

during 34 % of the instructional sessions for auditory matching and 96% of the probe sessions for selection responses, tacts and echoics. The IOA for the training sessions was 100 % and for the probe sessions there was a mean IOA of 99% with a range from 85% to 100 %.

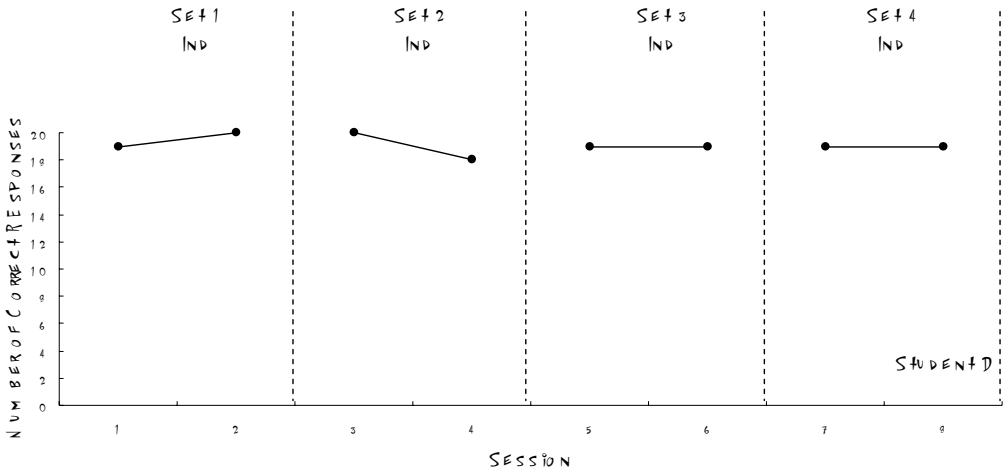

Figure 1. Number of correct responses during instruction on matching sets of pictures for Participants D and S.

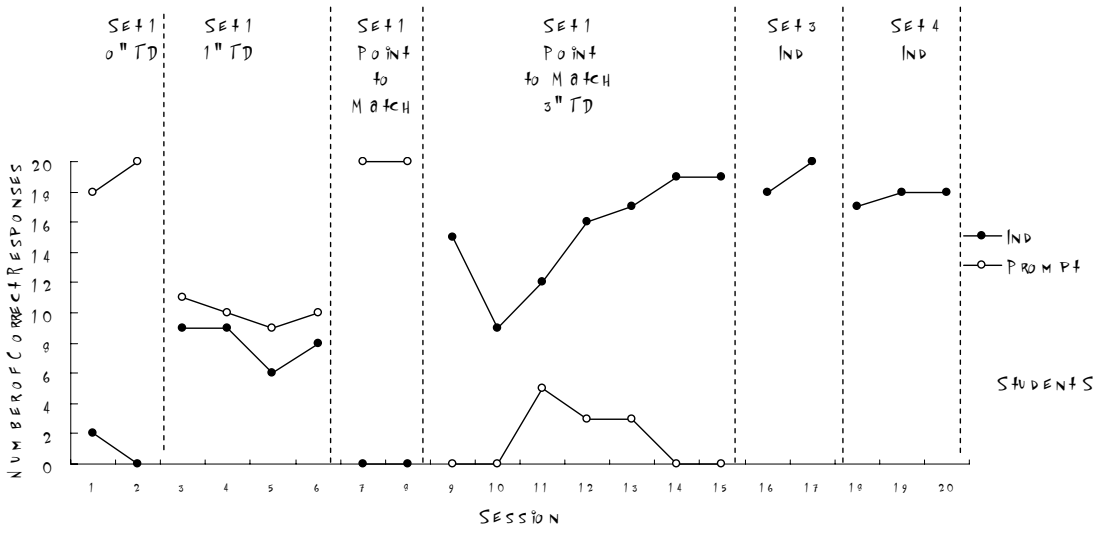

Figure 2. Number of correct responses during instruction on auditory matching for Participants D and S.

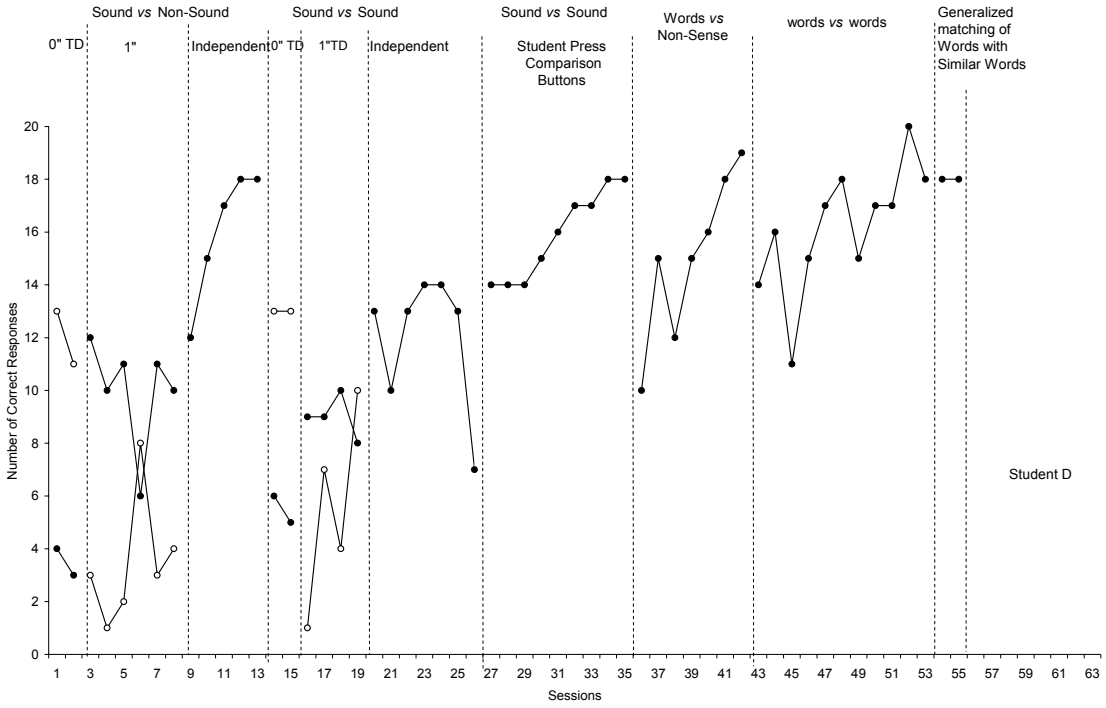

Figure 3. Number of correct responses during pre-experimental and post-experimental probes for untaught selection responses across the participants S and D.

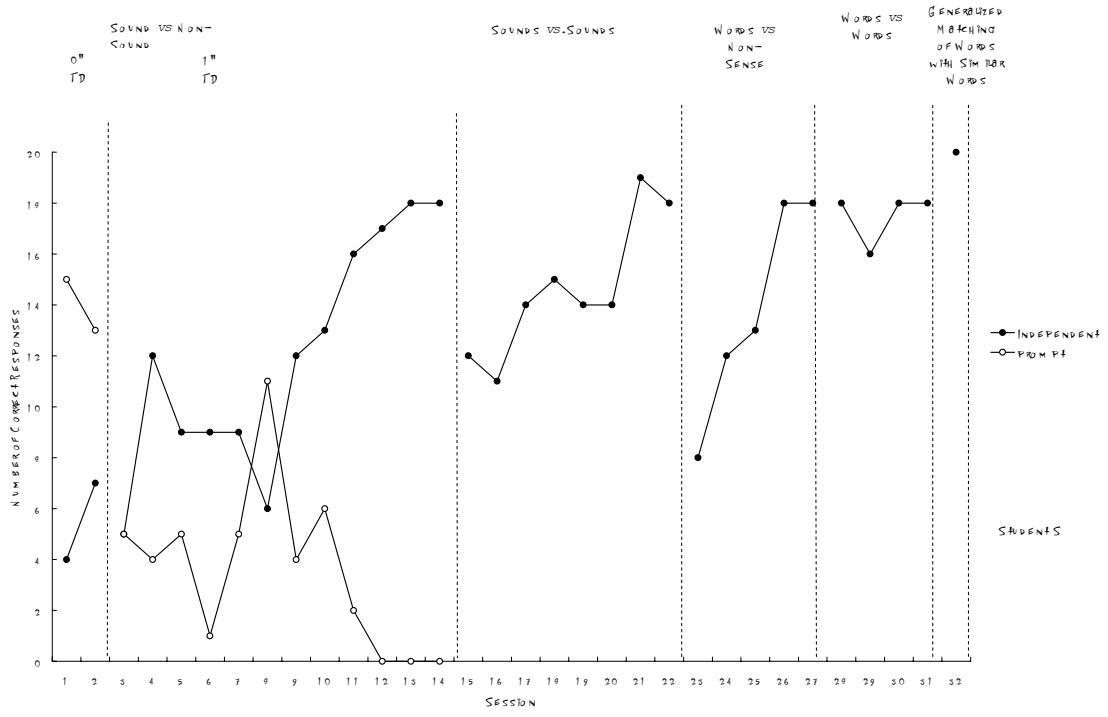

Figure 4. Number of correct responses during pre-experimental and post-experimental probes for untaught tacts across the participants S and D.

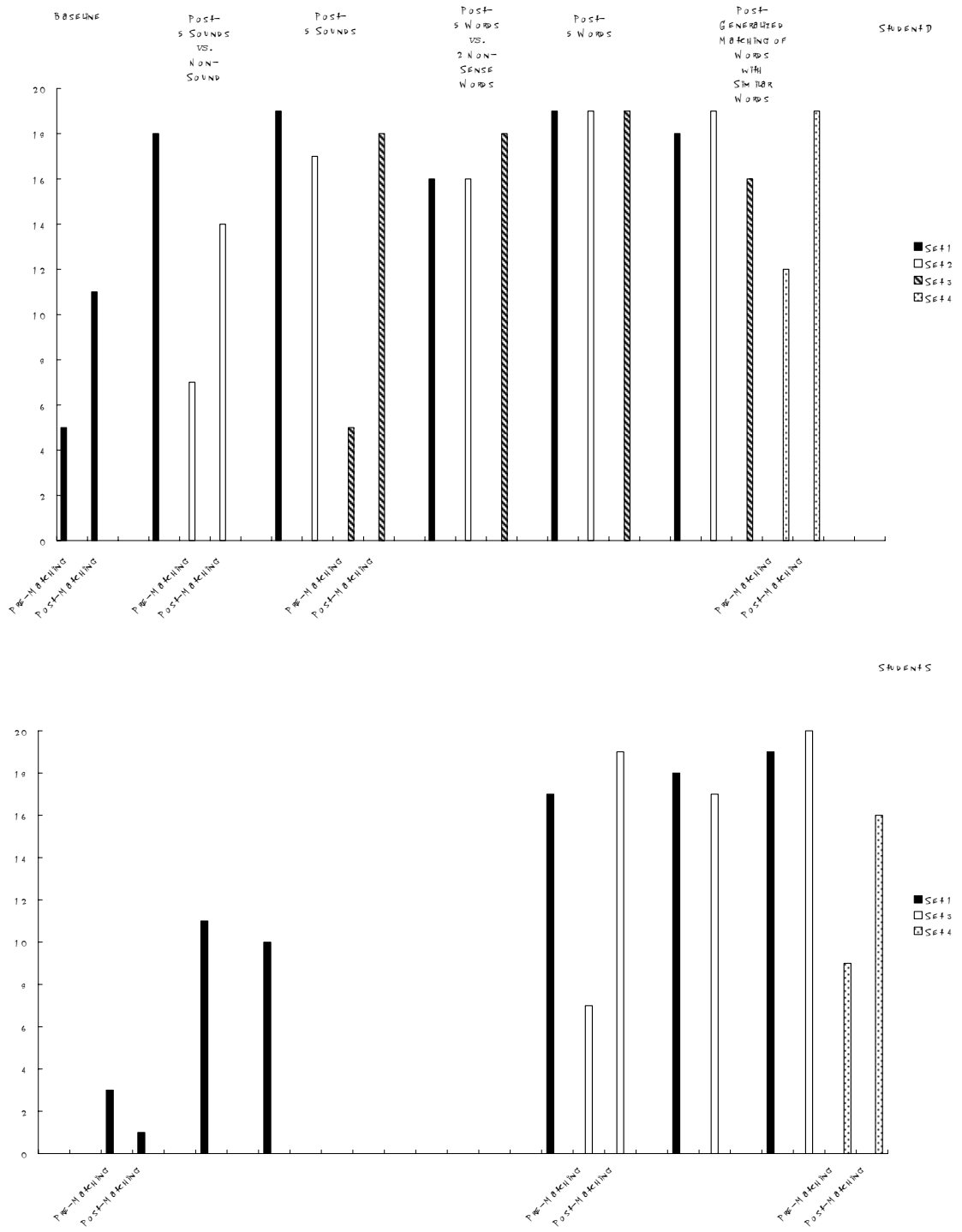

Figure 5. Number of correct responses during pre-experimental and post-experimental probes for accurate echoic responses across the participants S and D.

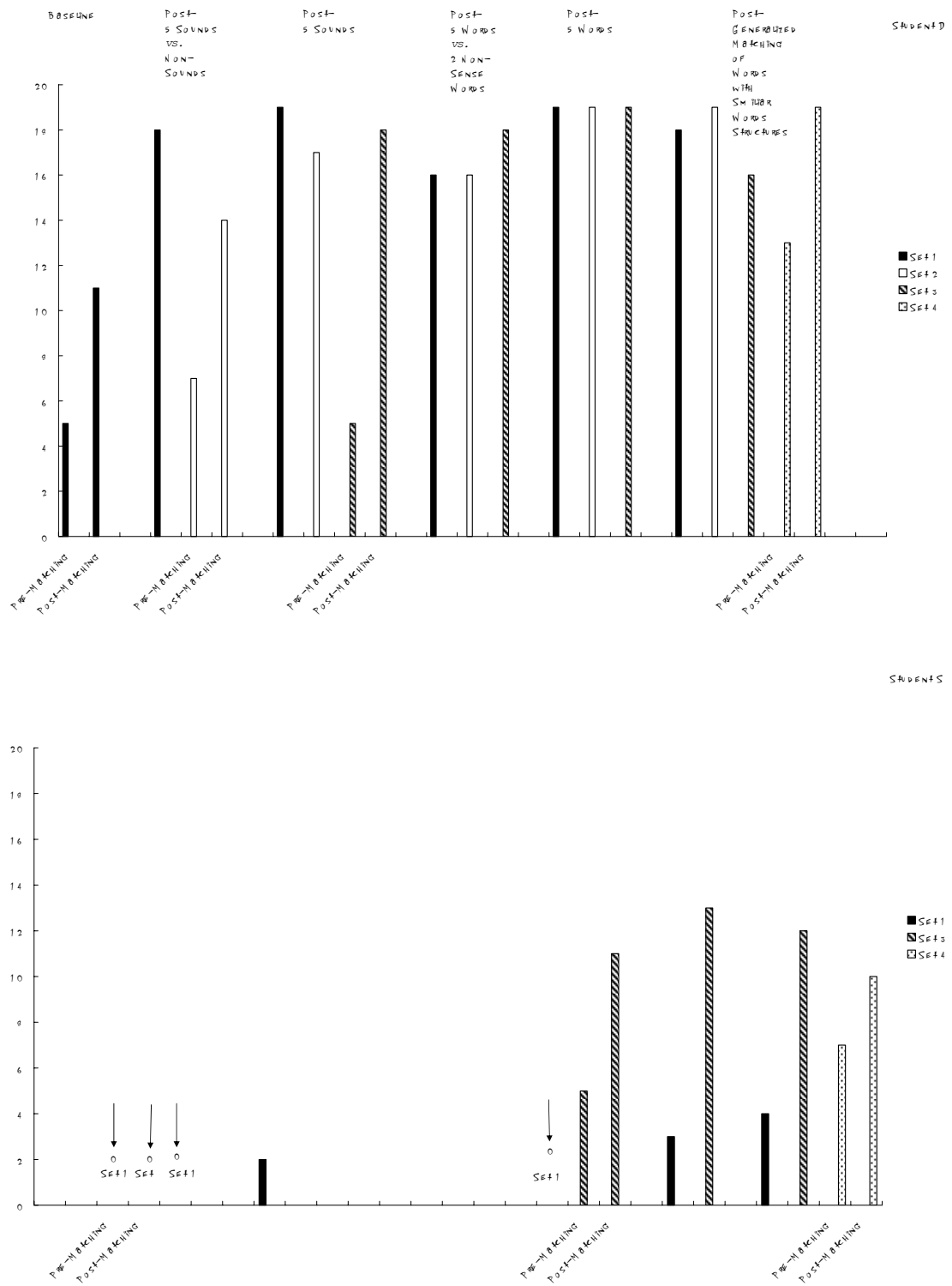

Figure 6. Weekly percentage of correct responses and weekly number of short-term objectives met during vocal mand and tact instructions for Participant S.

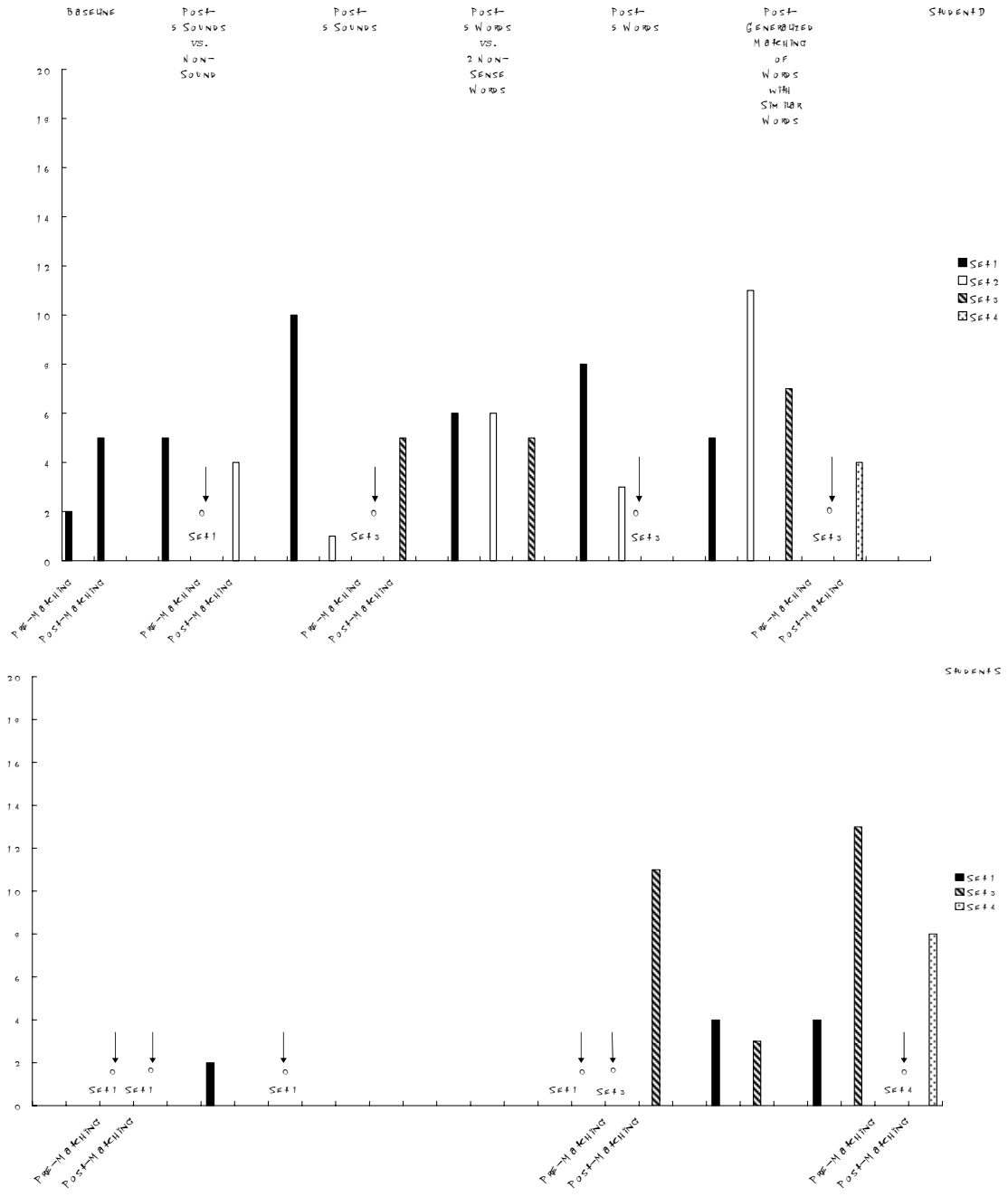

Figure 7. Number of correct responses during pre-and post-probes for untaught tact responses for Students D and S.

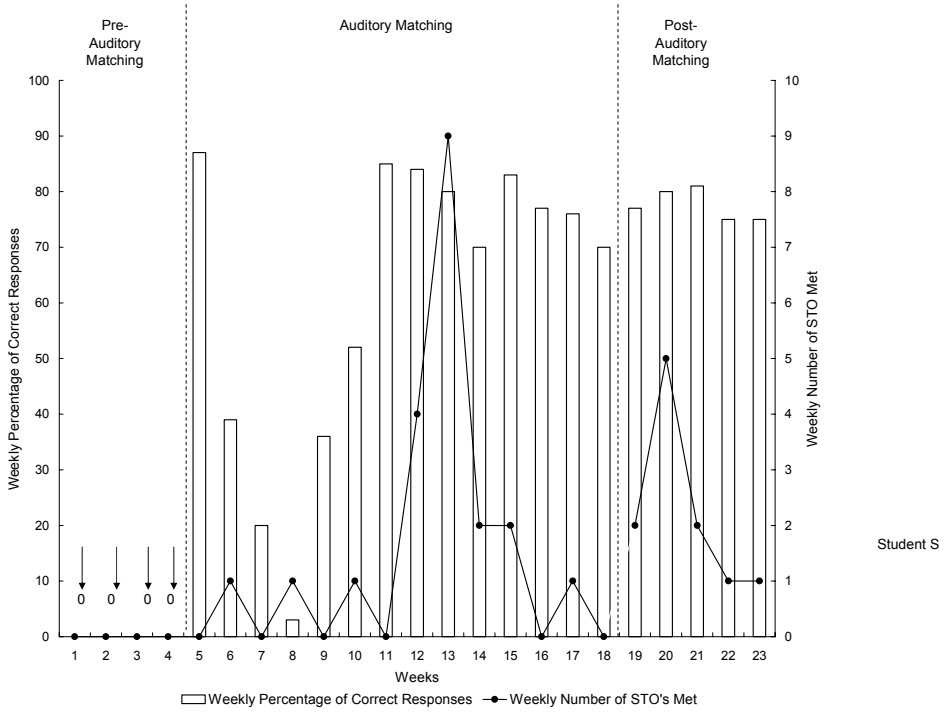

Figure 8. Weekly percentages of correct responses and weekly number of short-term objectives met during vocal mand and tact instructions for Student S.

Results

Participant D emitted selection, or pointing to stimuli responses, during the 'post five sounds *vs.* non-sounds probe' session. Another probe was conducted with a new set of stimuli, Set 2 to determine if she emitted the untaught pointing responses after instruction on matching with a novel set of stimuli. The participant emitted 14 correct responses out of 20 trials during the probe. During the 'post five different sounds probe', she emitted 19 untaught pointing to stimuli with Set 1, 17 with Set 2, and 18 with a novel set, Set 3. During the last probe session, she emitted 18 untaught pointing to stimuli with Set 1, 19 with Set 2, 16 with Set 3, and 19 with Set 4 (novel).

Participant D did not show a significant increase in echoics emitted with Set 1, Set 2, Set 3 or Set 4. With Set 1, the participant emitted 5 echoics during the first probe session, 5 during next probe session, 7, 18, 16, and then13 during the last probe session. With Set 2, she emitted 19, 20, 18, 16, and then 20; with Set 3, she emitted 6, 6, 16, and then 15; and with Set 4, she emitted 18 echoics during the last probe session. Table 3 shows the results for Participant D.

Table 3: *Number of Tact, Pointing, and Echoic Participant D Emitted during Probe Sessions with Set 1, Set 2, Set 3, and Set 4*

Phase	Behavior	Set 1		Set 2		Set 3		Set 4	
		Pre-Matching	Post-Matching	Pre-M	Post-M	Pre-M	Post-M	Pre-M	Post-M
Baseline	Tact	2	5						
	Pointing	5	11						
	Echoic	9	5						
Post-5 Sounds *vs.* Non-Sound	Tact		5	0	4				
	Pointing		18	7	14				
	Echoic		5	15	19				
Post 5 Sounds	Tact		10		1	0	5		
	Pointing		19		17	5	18		
	Echoic		7		20	5	6		
Post 5 Words *vs.* 2 Non Senses	Tact		6		6		5		
	Pointing		16		16		18		
	Echoic		18		18		6		
Post 5 Words	Tact		8		3		0		
	Pointing		19		19		19		
	Echoic		16		16		16		
Post 5 Sets of Words with Similar Phonetic Structure	Tact		5		10		7	0	4
	Pointing		18		19		16	12	19
	Echoic		13		20		15	18	18

Participant S did not show a significant increase in untaught pointing to stimuli responses until she mastered matching five words in the presence of non-sense words. She emitted the 17 target responses out of 20 trials during the 'post five words *vs.*, two non-sense words probe' session. She emitted 20 untaught pointing to stimuli with a novel set, Set 3 during the probe phase. With Set 1, the participant emitted 11 untaught selection or pointing to stimuli responses during the 'post five sounds *vs*. non-sound probe' session, 10, 17, 17, and then 18 during the last probe phase. With Set 3, she emitted 20 untaught pointing to stimuli out of 20 trials during the 'post five words *vs*. non-sense words probe' session, 16, and then 19 during the last probe session. With Set 4, she emitted 16 untaught selection or pointing to stimuli responses during the last probe phase.

Participant S did not show the emergence of untaught tacts until she mastered matching five words in the presence of other words. She emitted 4 tacts during the 'post five words probe' session, and 4

during the last probe phase. With Set 3, she emitted 3 tacts during the same probe phase, 13 during the next phase. She emitted 8 tacts with Set 4 during the same probe phase. The participant began to emit echoics during the 'post five sounds vs. sounds probe' session. She emitted two echoics during the 'post five sounds vs. sounds probe session, 0, 3, and then 4 during the last probe phase. With Set 3, she emitted five echoics during the 'post five words *vs.* non-sense words probe' session, 13, and then 12 during the last probe phase. With Set 4, she emitted 10 echoics during the last probe phase. Table 4 shows the results for Participant S.

Table 4: *Number of Tact, Pointing, and Echoic Participant S Emitted during Probe Sessions with Set 1, Set 3 and Set 4*

Phase	Behavior	Set 1		Set 3		Set 4	
		Pre-Matching	Post-Matching	Pre-M	Post-M	Pre-M	Post-M
Baseline	Tact	0	0				
	Pointing	3	1				
	Echoic	0	0				
Post-5 Sounds *vs.* Non-Sound	Tact		2				
	Pointing		11				
	Echoic		0				
Post - 5 Sounds	Tact		0				
	Pointing		10				
	Echoic		2				
Post 5 Words *vs.* 2 Non-Senses	Tact		0	0	11-20		
	Pointing		17	8			
	Echoic		0	5	10		
Post-5 Words	Tact		4		3		
	Pointing		17		16		
	Echoic		3		13		
Post-8 5 Sets of Words 16 with Similar 10 Phonetic Structure	Tact		4		13	0	
	Pointing		18		19	10	
	Echoic		4		12	7	

Discussion

The purpose of the current experiment was to determine if there was a functional relation between the acquisition of the listener component of Naming and an auditory matching procedure. The experimenters also conducted probes to determine if the auditory matching procedures increased the emission of echoics and tacts. The results showed that as the participants moved through more difficult levels of the auditory matching procedure, they acquired the listener component of Naming. We controlled for maturation by using a time lagged multiple probe design and exposure to stimuli by introducing a novel set of stimuli once the participants showed emergence of selection responses. Both participants showed the emergence of listener responses to untaught stimuli for novel sets after match to sample instruction by the end of the auditory matching sequence.

Participant S did not have generalized matching non-identical pictures in her repertoires and she needed 15 sessions to teach her to match pictures of Set 1. Participant D had a generalized matching repertoire. However, she received instruction on matching pictures for two sessions for each set to ensure that she had opportunities to hear the words for the pictures.

Participant D required 55 sessions to complete auditory matching instruction. The completion of the auditory matching procedure affected her emission of echoics for the target stimuli. The participant showed 5 accurate echoics out of 20 trials during the first probe phase and by end of treatment, she emitted 12 echoics out of 20 trials to a novel set. Participant S required 32 sessions to complete auditory matching instruction and she began to emit untaught selection responses, tacts, and echoics during the 'post five words vs. non-sense words probes.' Additionally, Participant S demonstrated an increased rate of correct responding and increased number of short-term objectives during vocal mand and tact instruction during her classroom programming which she received daily. Figure 6 shows the weekly percentage of correct responses and the weekly number of short-term objectives she met during vocal mand and tact instructions before auditory matching instruction began and during auditory matching instruction.

Participant D emitted untaught selection responses which indicated the emergence of the listener component of Naming after the first intervention phase, sounds *vs.* no sound. However, the participant failed to emit the target response with a new set, Set 2 during the post sounds *vs.* no sound probe session. She showed the response with another new set, Set 3 during the post sounds vs. sounds probe session, and with Set 4 during the post words vs. words with similar phonetic structures probe sessions. Perhaps the listener component of Naming occurred with Set 2 as function of repeated exposure to the stimuli, however, with Set 1, Set 3, and Set 4, she required only two sessions of exposure in order to emit the target selection responses.

Participant S emitted untaught pointing responses during the post- words *vs.* nonsense words probe sessions. The participant showed the behavior with new sets, Set 3 and Set 4.

For Participant D and Participant S, approximations of tacts were accepted as correct responses. For the echoic responses, only accurate echoics were counted as correct responses because the correct echoic production was the behavior of interest. Participant S emitted five echoics with the second set (Set 3) during the probes which were conducted prior to matching instruction with the set, and eight echoics with third set (Set 4) during the pre-matching instruction probe.

Multiple exemplar experiences have been shown to result in the emergence of Naming and other higher order operants. For children with and without disabilities, specifically designed multiple exemplar instruction has been shown to induce Naming repertoires. For typically developing children, such experiences may occur naturally in their environments. Children with age appropriate listening skills are

likely to attend readily to multiple exemplar verbal occurrences, and thus they become verbal experiences. For the two students who participated in this study, multiple exemplar instruction was not the independent variable yet the listener component of Naming did emerge. Our data suggest that the children we studied who lacked basic listener capabilities and who then received intense instruction in auditory discrimination were then better able to attend to the natural verbal occurrences in their environments, and thus learn from them. Our data suggest that additional research in the relation between auditory matching and naming may identify this as a useful intervention. However, additional tests with other similar children are needed to test for the generality of the effect.

References

Brown, A.K., Brown, J.L. & Poulson, C.L. (1995). Generalization of children's identity matching to sample performances to novel stimuli. *The Psychological Record, 45,* 29-43.

Chavez-Brown, M. (2005). The effects of the acquisition of a generalized word match-to- sample repertoire on the echoic repertoire under mand and tact conditions. Unpublished Doctoral Dissertation: Columbia University Graduate School of Arts and Sciences.

Chomsky, N. (1957). *Syntactic structures.* Mounton. The Hague

Fields, L., Reeve, K.F., Matneja, P., Varelas, A., Belanida, J., Ditzer, A. & Shamoun, K. (2002). The formation of a generalized categorization repertoire: Effect of training with multiple domains, samples and comparisons. *Journal of the Experimental Analysis of Behavior, 78,* 291-313.

Feliciano, G.M. (2006). Multiple exemplar instruction and the listener half of Naming in children with limited verbal capabilities. Paper presented at the 2006 Association for Behavior Analysis Convention in Atlanta, GA.

Fiorile, C. A. & Greer, R. D. (2006). The induction of naming in children with no echoic-to-tact responses as a function of multiple exemplar instruction. Manuscript submitted for publication.

Gena, A., Krantz, P.J., McClannahan, L.E. & Poulson, C.L. (1996). Training and generalization of affective behavior displayed by youth with autism. *Journal of Applied Behavior Analysis, 29,*291-304.

Gilic, L. (2005). Development of naming in two-year-old children. (Doctoral dissertation, Columbia University, 2005). Abstract from: UMI Proquest Digital Dissertations [on-line]. Dissertations Abstract Item: AAT 3188740.

Greer, R. D. & Keohane, D.D. (2005). The evolution of verbal behavior in young children. *Behavioral Development Bulletin*, *1, 31-48.*

Greer, R. D., Stolfi, L., Chavez-Brown, M., & Rivera-Valdez, C. (2005). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior, 21,*123-134.

Greer, R.D. & Yuan, L. (2004). Kids say the darnedest things. Paper presented at the 2004 International Conference of the Association for Behavior Analysis in Boston, Mass.

Greer, R. D., Yuan, L. & Gautreaux, G. (2005). Novel dictation and intraverbal responses as a function of a multiple exemplar history. *The Analysis of Verbal Behavior, 21,* 99-116.

Hart, B, & Risely, T.R. (1996). *Meaningful Differences in the Everyday Life of America's Children.* NY: Paul Brookes.

Hayes, S.C. & Barnes, D. (1997). Analyzing derived stimulus relations requires more than the concept of stimulus classes**.** *Journal of the Experimental Analysis of Behavior, 68,* 235-243.

Hayes, S.C., Barnes-Holmes, D. & Roche, B. (Eds.) (2001). *Relational Frame Theory*. New York: Kluwer Academic/ Plenum Publishers.

Horne, P.J. & Lowe, C.F. (1996). On the origins of Naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior, 65,* 185-241.

Jackendoff, R. (2002). *Foundations of Language*. Oxford, UK: Oxford University Press.

Kerr, N., Meyerson, L., and Flora, J.A. (1977). The measurement of motor, visual and auditory discrimination skills. [Monograph]. Rehabilitation Psychology, 24, 95-112.

Lowe, C.F., Horne, P.J., Harris, F.D.A., & Randle, V.R.L (2002). Naming and categorization in young children with vocal tact training. *Journal of the Experimental Analysis of Behavior, 78,* 271-290.

Marion, C., Vause, T., Harapiak, S. Martin, G.L., Yu, C.T., & Sakko, G. (2003). The hierarchical relationship between several visual and auditory discriminations and three verbal operants among individuals with developmental disabilities. *The Analysis of Verbal Behavior, 19,* 91-105.

O'Hora, D., Roche, B., Barnes-Holmes, D. & Smeets, P., (2002). Response latencies to multiple derived relations: testing two predictions of relational frame theory. *The Psychological Record, 52, 51-76.*

Pinker, S. (1999). *Words and Rules.* New York, NY: HarperCollins Publishers

Skinner, B.F. (1957). *Verbal Behavior.* Acton, MA: Copley Publishing Group.

Speckman-Collins, J. & Greer, R.D. (2006). Multiple exemplar instruction and the emergence of generative production of suffixes as autoclitic frames. Paper submitted for publication.

Vause, T. (1998). Relationship between ABLA test performance, auditory matching and communication ability. The University of Manitobo, Canada.

Vause, T., Martin, G & Yu, D.C.T. (2000). ABLA test performance, auditory matching and communication ability. *Journal on Developmental Disabilities, 7(2),* 123-141.

Zimmerman, I.R., Steiner, V.G. & Pond, R.E. (2002). *Preschool Language Scale 4 (PLS- 4)*. The Psychological Corporation.

Author Contact Information:

Jeanne Marie Speckman, Ph. D.
Fred. S. Keller School
1 Odell Plaza
Yonkers, NY 10701
Phone (914) 965-1152 x 223
Fax (914) 965-1419
E-Mail: jeannespeckman@optonline.net

Hye-Suk Lee Park, Ph. D
Fred. S. Keller School
680 Oak tree Rd.
Palisades, NY 10964
Phone (845) 359-8846
Fax: (845) 359-8849
E-Mail: parkhye42@hotmail.com

R. Douglas Greer
Box 76 Teachers College
Columbia University
New York, NY 10027
Email:DGreer3872@aol.com

Message from the Publisher

BAO Journals will soon publish a two issue, edited volume entitled *"*Behavior Analysis Review 2007," which will contain a "best of" selection of articles that were previously published in the Behavior Analyst Today.

BAO is a special interest group within the Association for Behavior Analysis International. As a SIG, we have become actively involved in helping other ABA: SIGs in achieving their mission through collaboration.

Along this line, we are following the lead of Mark Dixon and his Behaviorists Interested in Gambling SIG in the creation of a third journal, entitled *"Analysis of Gambling Behavior*." This journal will focus on the experimental analysis of gambling behavior and behavioral interventions to reduce problems in gambling. The Analysis of Gambling Behavior (AGB) will be a peer-reviewed electronic publication that contains original general interest and discipline specific articles related to the scientific study of gambling. Articles considered appropriate for the AGB include: a) full-length research articles, b) research reports, c) clinical demonstrations, d) technical article, and e) book reviews.

In addition, BAO is proud to announce our collaboration with the Development and Behavior Analysis SIG to bring the Behavioral Development Bulletin our group of journals. The Behavioral Development Bulletin is a ten year old journal with an excellent track record for behavior analytically oriented articles to child development. Stay tuned for the next announcement which will give notice of publication and where you can read the BDB journal.