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A Comparison of Methods to Teach Auditory-Auditory Identity Matching to Persons With Developmental Disabilities

Tracey Sewell

University of Manitoba

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A Comparison of Methods to Teach Auditory-Auditory Identity Matching to Persons With Developmental Disabilities

BY

Tracey Sewell

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I would like to acknowledge the support and assistance of a number of people without whom this project would have never come to fruition. First, my advisor, Dr. Garry Martin, whose quiet, steely support has been unwavering since the day he agreed to take me on as an occasional student. Second, my family and friends who have gone through this whole process with me. Third all the invaluable assistants who dedicatedly worked on this project and last but not least, all of the participants from St. Amant Centre and their families and caregivers, without whom this study would never have been completed.

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Abstract

Recent research suggests that learning to recognize that two sounds are the same (auditory-auditory identity matching, AAIM) may be worth examining as a bridging task for teaching vocal imitation to persons with developmental disabilities. Thus far, there have not been any published reports of attempts to teach AAIM to persons with developmental disabilities. The purpose of the present study was to compare standard prompting and reinforcement (SPR) to a multiple component-training package (MCTP) for teaching an AAIM training task to persons with developmental disabilities. The SPR included demonstration of a correct response at the beginning of a session, positive reinforcement for correct responses, and an extinction procedure following incorrect responses. The MCTP included within-stimulus prompt fading of volume prior to a participant's response on trials, a self-discovery reinforcement component following correct responses, and an error-interruption procedure following an error. In addition, in order to assess whether mastery of AAIM training tasks improves vocal imitation skills, participants were also administered a standardized test of vocal imitation at the beginning and the end of the study.

In Experiment 1, using a single-subject design, with sounds during training trials presented by an apparatus, two participants showed no progress on SPR, and considerable progress on MCTP, with one of the two participants mastering the training task.

Because of the difficulty that participants experienced with the sound-making apparatus, Experiment 2 was conducted with sounds presented live by the experimenter and 2 confederates. SPR was compared to two variations of MCTP for teaching an AAIM training task, using a single-subject design with 6 participants. None of the participants

learned the AAIM task using SPR. Four of the 6 participants met one or both of two mastery criterion for learning a variation of an AAIM training task using an MCTP. Across the two experiments, only one of the 5 participants who learned a variation of an AAIM task showed improvement on a test of echoics.

Although the results indicate that teaching an AAIM task to individuals with developmental disabilities is extremely difficult, the progress shown with an MCTP is encouraging, and will serve as a foundation for future research in this area.

A Comparison of methods to teach Auditory-Auditory Identity Matching to Persons With Developmental Disabilities

The Assessment of Basic Learning Abilities (ABLA) test was designed by Kerr, Meyerson and Flora (1977) to assess the ability of persons with developmental disabilities to learn basic discriminations that underlie many tasks. Kerr et al. (1977) observed a number of activities that such individuals were being taught and found that one or more of six skills, a simple imitation and five two-choice discriminations, were required to successfully perform these activities. Kerr et al. designed six training tasks, one for each of the six basic discrimination skills. The ABLA test consists of a standardized procedure for attempting to teach these six tasks, called levels, to a client. The six levels of the ABLA test are hierarchically ordered in difficulty, and DeWiele and Martin (1996) found that ABLA experts rated 69% of 194 randomly selected tasks that persons with developmental disabilities were taught required successful performance on an ABLA level in order to perform them. The ABLA has proven to be a valuable tool to match the learning ability of participants to the difficulty of training tasks (Martin & Yu, 2000).

The most difficult level of the ABLA test, level 6, is an auditory-visual discrimination. Across trials, two different containers occupy random right-left positions in front of a client. The tester randomly says the name of either of the two containers across trials, and the client is required to place an object in the container that is named. Expanding the ABLA test past level 6 would allow the differentiation of individuals classified at the upper limit, "level 6", and could lead to training of more complex skills. A task that may be a worthwhile addition to the ABLA test is auditory-auditory identity

matching (AAIM). In a prototype AAIM task, a participant hears three speech sounds, two of which are identical, and is then required to indicate the identical sounds (Harapiak Martin & Yu, 1999). The ability to match sounds has many applications in everyday life such as recognizing successive instances of a doorbell ringing, recognizing when one has accurately repeated a word spoken by another, and recognizing that one is whispering when others are whispering versus shouting when others are shouting. Research has indicated that a prototype AAIM task is more difficult than ABLA level 6, has good test-retest reliability, has good predictive ability for other types of AAIM tasks, and may be worthwhile examining as a bridging task for learning language skills (Harapiak et al., 1999; Marion et al. 2003; Vause, Harapiak, Martin & Yu, 2003). The current study focused on three questions to help determine whether AAIM is a worthwhile addition to the ABLA test: (1) Similar to the ABLA levels, is a failed prototype AAIM task difficult to teach with a standard prompting and reinforcement procedure? (2) If AAIM is difficult to teach using a standard prompting and reinforcement procedure, can a multiple component training procedure be used to rapidly teach a failed AAIM task? and (3) Does mastery of AAIM facilitate performance on a test of vocal imitation?

The Assessment of Basic Learning Abilities Test

The ABLA test consists of six hierarchically arranged levels. The test materials are easy to construct, and are made from primary colors and common shapes that have application in everyday life. The materials also make the assessment of correct and incorrect responses easy to determine. They include a large yellow can, a red box with optional dark stripes, an irregularly shaped piece of foam that is neither yellow nor red, a small yellow wooden cylinder, and a small red wooden cube with optional dark stripes.

Level 1 of the ABLA test is an imitation task, where the client is asked to imitate the tester by placing the piece of foam into a container in front of him or her. Level 2 is a position discrimination task that requires the client to place the piece of foam into the container on the left when the red box and yellow can are placed in front of him or her in fixed positions. Level 3 is a visual discrimination task, which requires the client to always place the foam into the can (versus the box) regardless of which randomly placed right-left position it holds. Level 4 is a quasi-identity match-to-sample discrimination task which requires the client to place the randomly presented yellow cylinder into the randomly positioned yellow can, and place the randomly presented red block into the randomly positioned red box. Level 5 is an auditory discrimination task requiring the client to correctly place the piece of foam in the red box or yellow can, placed in fixed positions, when the examiner randomly says "red box" or "yellow can". The examiner also provides easily discriminated auditory cues by requesting "red box" in a high-pitched rapid fashion and "yellow can" in a low-pitched drawn-out fashion. Level 6 is an auditory-visual discrimination task requiring the client to respond as in level five, however with the addition that the position of the containers is randomly switched.

The six levels of the ABLA test can usually be administered to a client in approximately 30 minutes. Prior to the testing of a level, a demonstration trial, a guided trial and a practice trial are conducted. Only after the participant makes an independent correct response on the practice trial of a level does the testing and recording begin at that level. Positive reinforcement (praise and an edible) for correct responses is provided. If the participant makes an error, he or she is told that the response was incorrect, and an error correction procedure follows. This procedure consists of the examiner

demonstrating the correct response, guiding the participant to make the same response, and then asking the participant to perform the task independently. Testing at each level continues until the participant makes eight consecutive correct responses, not including error correction responses, or until a participant makes eight cumulative errors including errors on the independent responses part of error correction. Kerr et al. (1977) selected these stringent criteria to minimize the likelihood of a participant passing the test by chance.

Generalizations from research on the ABLA Test

The six ABLA levels are hierarchically ordered in difficulty according to the six levels described previously. Kerr et al. (1977) found that 111 of the 117 individuals with developmental disabilities they studied who passed a certain level of discrimination also passed at lower levels, and those who failed a certain level also failed at higher levels. Martin, Yu, Quinn, and Patterson, (1983) reported similar findings, and Ward and Yu (2000) reported similar findings with children with autistic spectrum disorders. Kerr and Meyerson (1977) and Wacker (1981) reported similar results with hearing impaired multiply handicapped participants, and Casey and Kerr (1977) also found the same hierarchy with typically developing children.

The ABLA has been shown to be highly predictive of performance on new tasks (Martin, Yu, & Vause, 2004). For example, Stubbings and Martin (1995) found that tasks similar to a previously mastered discrimination level, as assessed by the ABLA, would usually be learned within 30 learning trials using a standard prompting and reinforcement procedure (described later), while tasks that require a level of discrimination that has been failed on the ABLA were not learned after 120 trials of standard reinforcement and

prompting procedures. Stubbings and Martin (1998) found that the ABLA was also a better predictor of a client's learning performance than experienced staff members who worked directly with the client. The ABLA therefore has application for teaching new skills to individuals. The staff members can analyze the discriminations required for the task and be able to identify tasks that a given individual is likely to learn based on his or her ABLA level. This would increase success rate, likely reduce frustration of both staff member and client, and potentially reduce off-task and/or behavioral difficulties arising from this frustration (Vause, Martin, & Yu, 1999). Potentially numerous tasks are being presented to individuals who do not have the skills to learn those tasks (Vause, Martin, Cornick, et al., 2000). These use a lot of resources, perhaps requiring hundreds of trials to learn, and may not be learned at all. Moreover, matching an individual's ABLA level to the ABLA difficulty of tasks as a tactic for decreasing problem behaviors fits nicely with the general strategy of curricular revision for decelerating problem behavior as described by Carr, Coriaty, and Dozier (2000).

Although failed ABLA levels are very difficult to teach using standard prompting and reinforcement procedures, research has shown that it is possible for participants to learn tasks at a failed ABLA level if a multiple component technique is used. This possibility will be discussed later.

Performance on the ABLA test has been shown to correlate with previous measures of language development. Casey and Kerr (1977) in their study of 42 typically developing children found that ABLA levels 5 and 6 developed concurrently between the ages of 27-32 months, the period when rapid growth of speech is experienced by normally developing children. They also found that children who passed the ABLA

auditory levels had significantly higher performance on vocabulary, mean length of utterance, and longest utterance than children who failed the ABLA auditory levels. Kerr and Meyerson (1977) found that children with developmental disabilities who failed ABLA levels 5 and 6 also failed the Distar Reading Readiness test, whereas those individuals who passed ABLA levels 5 and 6 passed the Distar Reading Readiness Test. Ward (1994 as cited in Vause, Martin, & Yu, 2000) demonstrated that individuals with developmental disabilities who were unable to pass levels 5 and 6 of the ABLA were identified as being at a communication level of using single words or less, while conversely, individuals who passed these auditory levels were able to combine two or more words in phrases and sentences. Finally Barker-Collo, Jamieson, & Boo (1995) assessed individuals with developmental disabilities on the ABLA test, the communication portion of the Vineland Adaptive Behavioral Scale (VABS) (Sparrow, Balla, & Ciccetti, 1984), and the Communication Status Survey (CSS) (Barker-Collo et al., 1995). The results indicated that ABLA levels were significantly and positively correlated with VABS scores of receptive and expressive communication, and aspects of communication measured by items on the CSS.

Standard prompting and reinforcement versus a multiple-component package for teaching failed ABLA levels

As discussed previously, research has found that when a level of the ABLA has been failed, it is very difficult to teach that level using standard prompting and reinforcement procedures that include most or all of: (1) reinforcer preference testing at the start of each session to identify a preferred reinforcer; (2) a demonstration trial, a hand-over-hand physical guidance trial, and an independent practice trial for each correct

response at the start of each session; (3) extra-stimulus prompt fading; (4) a positive reinforcement contingency in which each correct response during a session is followed by praise and an edible reinforcer; and (5) an error-correction procedure following each error, consisting of a demonstration, a hand-over-hand physical guidance trial, and a practice trial (Martin & Yu, 2000). The standard prompting and reinforcement procedure is essentially the procedure that is followed during ABLA testing to determine the ease or difficulty with which a participant is able to learn an ABLA task. That procedure was adopted by Kerr et al. (1977) because it was similar to training procedures commonly applied by frontline staff when attempting to teach persons with developmental disabilities. Martin and Yu (2000) recommended that the acquisition of an ABLA level in 100 training trials or less, may be considered rapid based on their review of studies by Yu and Martin (1986), Witt and Wacker (1981), and Stubbings and Martin (1995, 1998) which indicated that 120 training trials is typically insufficient to teach a failed ABLA level using standard prompting and reinforcement procedures.

Four studies indicate that variations of a multiple-component training package may be effective in rapidly teaching failed levels of the ABLA. In all of the studies supplementary components replaced the standard ABLA procedures to attempt to rapidly teach a failed level. Two of the studies (Hazen, Szendrei, & Martin, 1989; Yu & Martin, 1986) included three components: (1) a within-stimulus prompt fading procedure, (2) a self-discovering reinforcer technique contingent on correct responses, and (3) an error-interruption procedure. Using this training package, one of three participants learned a failed ABLA level 3 task, and three participants learned a failed level 4 task, in under 100 trials.

Two studies did not use within-stimulus prompt fading, but they incorporated three additional components into the multiple-component training package: (1) continuous presentation of auditory cues, (2) delayed prompting, and (3) multiple reinforcer preference testing (Conyers, Martin, Yu, & Vause, 2000; Walker, Martin, & Graham, 1991). Three of four participants in the Walker et al. (1991) study who were taught a failed level 5 task using this procedure learned it in 95, 8, and 15 trials respectively. Using this same procedure, Conyers et al. (2000) taught a failed level 6 task to four participants in 20, 21, 32 and 23 trials respectively.

The ABLA Test and other auditory discrimination tasks

Researchers have suggested that there are additional auditory discriminations that might be added to the ABLA test that are more difficult than ABLA level 6 (Martin and Yu (2000). One such task is auditory-auditory identity matching (AAIM). In an AAIM prototype task, a tester says a word (e.g., "pen pen" rapidly in a high-pitched tone) on some trials, and a different word (e.g., "b-l-o-c-k" in a drawn out, low-pitched tone) on other trials. On each trial one assistant says the matching word in the same tone as the experimenter and another assistant says the non-matching word. The assistants randomly alternate regarding who speaks first and who says the matching word. The client's task is to point to the assistant who says the same word. The standard prompting, reinforcement, and error correction procedures of the ABLA test are used and testing continues until the client meets the pass or fail criterion of the ABLA test. Research indicates that the AAIM prototype task has high test-retest reliability and high predictive validity for similar AAIM tasks (Harapiak et al., 1999; Vause et al., 2003).

A second type of auditory matching discrimination involves recognizing that two speech sounds go together, even though they are different. For example, if one person says, "tea" and a second person says, "cup" and a third person says, "book", a correct response is matching "tea" and "cup" together. Research to date suggests that this auditory-auditory non-identity matching (AANM) discrimination is more difficult than AAIM and ABLA level 6 (Harapiak et al., 1999; Vause et al., 2000; Vause et al., 2003).

Vause et al. (2000) found that the addition of AAIM and AANM tasks differentiated communicative ability for individuals classified above ABLA level 6 to a greater extent than the ABLA test by itself. They found that although the ABLA level was a significant predictor of communication skills, the two auditory matching tasks were a better predictor. In general, the higher the number of auditory matching levels passed by an individual, the higher the communication scores on the VABS. Therefore Martin et al. (2004) indicated that the addition of auditory matching tasks to the standard ABLA might improve the tests ability to predict complex language discriminations. Further more, they indicated that the addition of auditory matching tasks might allow educators to further differentiate participants classified as ABLA level 6.

Marion et al. (2003) assessed a group of persons with developmental disabilities on the ABLA test, the prototype tasks for AAIM and AANM, and a test of echoics, tacts and mands. They found that: (a) for participants who failed AAIM and AANM, those who passed ABLA level 6 performed significantly better on the test of echoics, tacts and mands than those who passed ABLA level 4; (b) participants who passed AAIM and AANM performed significantly better on the test of echoics, tacts, and mands than those who passed level 6 but failed AAIM and AANM; and (c) the test of echoics, tacts and

mands had very high test-retest reliability. These results raise the possibility that mastery of AAIM and/or AANM might facilitate learning of echoics, tacts, and mands.

Considerations for adding a new level to the ABLA test

If a new level is to be added to the ABLA test, then it is reasonable to expect that research should demonstrate that the generalizations that hold for existing ABLA levels would also hold for the new level. As indicated previously, the existing ABLA levels are: (a) hierarchically ordered in difficulty; (b) show high test-retest reliability; (c) have good predictive validity regarding pass/fail performance on similar tasks; (d) are difficult to teach using standard prompting and reinforcement; and (e) can be taught rapidly using a multiple component training package. Regarding the possibility of adding a prototype AAIM task to the ABLA test, the first three generalizations have been demonstrated (Harapiak et al., 1999; Vause et al., 2003). Regarding the latter two generalizations, no published reports were found that attempted to teach AAIM. Penner (2001), in an unpublished Honors Thesis, reported limited success in attempting to teach AAIM to five participants who failed the AAIM prototype task. Thus, as will be described later, the current study replicated the Penner study, but with several modifications.

Statement of the Problem

The preceding review suggests that two questions that have been addressed for ABLA levels have not yet been addressed for AAIM: (1) is a failed prototype AAIM task difficult to teach with a standard prompting and reinforcement procedure? (2) If AAIM is difficult to teach using a standard prompting and reinforcement procedure, can a multiple component training procedure be used to rapidly teach a failed AAIM task?

Thus far, only one unpublished study has addressed these questions. Penner (2001) reported that four of five persons with developmental disabilities failed to learn an AAIM training task after 122, 180, 200, and 267 training trials respectively on standard prompting and reinforcement (SPR), and one person learned the task after 55 trials. This provides preliminary evidence that AAIM may be difficult to learn using SPR. Penner also reported that two of four participants learned an AAIM task after 138 and 219 training trials respectively with a multiple component training package (MCTP), while two other participants failed to demonstrate mastery after 269 and 370 trials respectively of the MCTP procedure. Therefore, none of the participants on the MCTP met the criterion of rapid learning identified by Martin and Yu (2000) of 100 training trials or less.

Experiment 1 of the present study replicated Penner, but with four differences. First, the AAIM training task used by Penner et al. involved speech sounds spoken by confederates. However, Lamberts (1981) reported that persons with developmental disabilities learned auditory discriminations more easily if they involved simple environmental sounds rather than speech sounds. Therefore, the AAIM training task in Experiment 1 involved simple environmental sounds presented on tape recorders. Second, in their MCTP, Penner did not use within-stimulus prompt fading, which was used in two previous successful MCTP's (Hazen et al., 1989; Yu & Martin, 1986). Experiment 1 incorporated within-stimulus prompt fading into the MCTP. Third, Penner did not assess whether or not mastery of an AAIM task improved performance on a test of echoics. Experiment 1 did so. Fourth, Experiment 1 attempted to use a stronger single-subject research design than that used by Penner.

In summary, Experiment 1 was designed to compare an SPR procedure to an MCTP for teaching an AAIM training task to persons with developmental disabilities, and assessed whether or not mastery of the AAIM training task led to improved performance on an AAIM prototype task, and on a test of echoics.

As will be described later, 4 out of the 6 participants experienced great difficulty learning to respond to the apparatus when sounds were presented via tape recorders in Experiment 1, and these participants were not able to be exposed to the experimental comparison. Therefore Experiment 2 used confederates who spoke sounds in an attempt to compare SPR to MCTP for teaching participants an AAIM task. Post-test assessments were also conducted in an attempt to clarify the factor, or factors, that might have aided the participants to learn the AAIM task. In addition, before-and-after tests of echoics were conducted to assess whether improvements were shown in participants' echoic ability.

Experiment 1

Method

Participants

Participants were 6 individuals with developmental disabilities from the St. Amant Centre, a residential and community treatment facility for persons with developmental disabilities. Prior to participation in the study, written consent was obtained from the legal guardian of each client, where appropriate (see Appendix A and B). Additionally, the experiment was described to each participant prior to starting and the participants' consent or assent (for those incapable of giving informed consent) throughout the study was required to continue. Each participant's auditory and visual

functioning was noted from client records. Each participant was also assessed on the two communication subscales of the Vineland Adaptive Behavior Scales (Sparrow et al., 1984). Weschler Adult Intelligence-III (WAIS-III) assessment was attempted, however the highest functioning participant was unable to complete the task and it was therefore not attempted with the other members. Participants selected were those who passed ABLA level 6, failed the prototype AAIM task, failed an AAIM training task, scored lower than 80% (the pass criterion) on a test of echoics (Marion et al., 2003), and who were determined to have good hearing based on agency records. The characteristics of the participants are presented in Table 1 (see Participants A to F on p. 14).

Setting

Testing and training were conducted in a testing room at the St. Amant Centre or in a room in a community home that was free from distractions. Only the researcher, confederates, and the participant were present.

Materials

The following materials were required to administer the ABLA test: a yellow can approximately 15 cm in diameter and 17 cm in height, a red box approximately 14 x 14 x 10 cm with dark stripes, an irregularly shaped piece of foam approximately 5 x 5 x 5cm that was neither yellow nor red, a yellow wooden cylinder approximately 9 cm long and 4 cm in diameter and a red wooden cube with dark stripes approximately 5 x 5 x 5cm. No materials were required to test AAIM or echoics.

ABLA data sheets described by DeWiele and Martin (1998) were used to record ABLA levels (see Appendix C). AAIM data sheets based on those described by Marion

Table 1

Participant Information

Participant	Expt. 1	Expt. 2	Gender	Age	Level of Mental Retardation[a]	Sight	Hearing	Vineland adaptive level: Expressive	Vineland adaptive level: Receptive
A	X	X	F	36	Severe	Good	Good	Low	Low
B	X	X	F	33	Moderate	Good	Good	Low	Low
C	X		M	20	Severe	Good	Good	Low	Low
D	X		M	28	Moderate	Good	Good	Low	Low
E	X	X	F	46	Moderate	Good	Good	Low	Low
F[b]	X		M	33	Moderate	Good	Bilateral hearing aids	Adequate	Low
G		X	M	35	Severe	Good	Good	Low	Low
H		X	M	21	Severe	Good	Good	Low	Low
I		X	M	31	Severe	Good	Good	Low	Low

[a]Based on Agency records. [b]Unable to complete WAIS-III

et al. (2003) were used during AAIM testing and echoic probes (see Appendices D and E).

An AAIM training task was created to teach to the participants. Two identical open-ended inverted boxes were placed on a tray with the open ends facing the experimenter. A small tape recorder was placed underneath each of the boxes. An additional tape recorder, matching the devices under the boxes, was placed on the tray between the boxes (see Figure 1 on p. 16).

Procedure

Each participant was assessed on the ABLA, the AAIM prototype task, the AAIM training task, and a test of echoics prior to inclusion in the study. All but one participant took part in pre-training (explained later) and then received one of the two training packages (SPR or MCTP).

Assessment of ABLA. All participants were tested on the ABLA test as stated by Kerr, Meyerson and Flora (1977), and as described previously.

Assessment of AAIM prototype task. The AAIM prototype task was assessed prior to training using the procedures as stated by Marion et al. (2003) and as described previously. The tester randomly said one of two sounds, and each confederate said a sound, one matching, and one non-matching. The order of speaking by the confederates and the sounds they spoke were randomized. The participant was required to point to the confederate that produced the matching sound. Similar to the ABLA test, the participant was given a demonstration trial, a physical guidance trial, and an opportunity for an independent response with each of the sounds. Testing then began. Correct responses were reinforced (with praise and edibles) and incorrect responses were followed by the

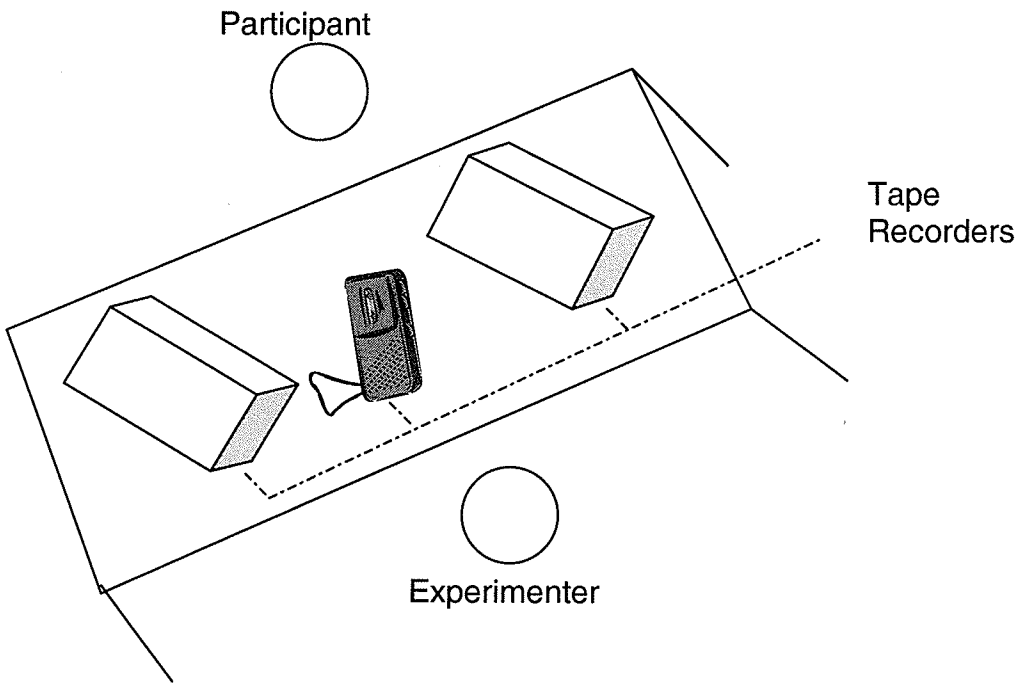

Figure 1. A schematic of the training situation with the analogue training task.

ABLA error correction procedure. Each session continued until the participant met the pass criterion of eight consecutive correct responses, or the fail criterion of eight cumulative incorrect responses.

Assessment of echoics. Echoics were assessed at the beginning and end of the experiment using the test of vocal imitation described by Marion et al. (2003). Eleven words (e.g., cup, juice) were selected from a list of the first 240 words that should be taught to children with developmental disabilities provided by Sundberg and Partington, (1998). The vocal imitation assessment consisted of the tester saying to the participant, "Say ---" (e.g., "Say juice"). The response given by the participant was scored as either correct (pronouncing all syllables correctly), an approximation (vocalizing part of the word correctly), incorrect (not pronouncing any part of the word correctly), or an omission (no response after 10 seconds). The test has very high inter-rater and test-retest reliability (Marion et al., 2003).

AAIM training task. The testing procedures were modeled after those described for the AAIM prototype task. The tester produced the sound (bell or siren) to be matched from the recorder in the centre of the tray. Then, the tester produced a sound from each of the recorders at either end of the tray, one matching, and one non-matching, randomly alternated across trials. The participant was required to point to the box that covered the recorder that had produced the matching sound in order to receive reinforcement (edibles and praise). Each assessment continued until the participant met the pass criterion of eight consecutive correct responses, or the fail criterion of eight cumulative incorrect responses.

Standard prompting and reinforcement (SPR) procedure. The box apparatus (as shown in Figure 1), with orange coloured boxes, was used during the SPR procedure. The experimenter first made the middle device produce a sound, and then reached into the boxes to alternately produce the matching and non-matching sounds. The participant was required to point to the box containing the matching sound. Across trials, the order of play and the position of the matching and non-matching sounds were randomly alternated. Between trials the apparatus was moved out of the participants' reach to signal the end of a trial, and placed back within reach to signal the beginning of a new one. Mastery criterion for the task was defined as eight consecutive correct responses during two sessions in a row. Although the mastery criterion of a level of the ABLA test is 8 consecutive correct responses achieved just once, the more stringent criterion listed above decreased the likelihood of participants meeting the mastery criterion by chance. The SPR contained the following components:

1. Prior to each session, a participant was given the choice of one of six edibles. The edible chosen was then used as a reinforcer during the session.

2. Each session started with a demonstration, a guided trial, and an opportunity for an independent response for each sound.

3. The participant was given praise and an edible reinforcer for independent correct responses.

4. Unlike the standard ABLA administration, there was no error correction procedure for incorrect responses. Instead, following an error, the participant was ignored for several seconds while the error was recorded and the experimenter prepared for the next trial. This procedure, rather than the standard ABLA error correction procedure, was

used because it appeared during assessment of the AAIM training task and the AAIM prototype task that the numerous interactions between the experimenter and the participant during error correction were reinforcing to the participants. In addition, it appeared that too much verbiage seemed to confuse the participants.

5. Pacing prompts were used if needed. If the participant did not respond within five seconds of the examiner presenting the stimulus, the experimenter said, "Point to the correct box."

Multiple component-training package (MCTP). A box apparatus similar to the SPR was used. However, the boxes were black with an easy to hold handle attached to the top. Instead of requiring a participant to point to the correct container, as in SPR, a correct response consisted of the participant lifting the correct container by the handle, revealing a reinforcer. The MCTP included a demonstration, guided trial, and independent response for each sound prior to each session, as well as pacing prompts during the session, as described above. The mastery criterion used during the SPR was also used for the MCTP. In addition the following components were included:

1. Prior to each session each participant, with the exception of Participant F, was allowed to choose three out of six edibles following a variation of the procedure described by Carr, Nicolson and Higbee (2000). The three edibles were then varied randomly throughout the session when reinforcing correct responses. Varying reinforcers throughout a session has been found to be more effective than using a single reinforcer in studies of discrimination learning with children with developmental disabilities (Engel, 1980). Regarding Participant F, prior to the experiment it was discovered that he enjoyed playing catch with a ball, but did not appear to enjoy edibles. Therefore, during

preference testing at the start of each session, Participant F was presented with five edibles and a ball. He frequently chose the ball and refused the edibles. Therefore as a reinforcer for correct responses, Participant F was given the opportunity to play catch for a few seconds with the experimenter and the confederate.

2. A discovery-reinforcer contingency for correct responses was used. Prior to each trial, and out of the participant's view, a confederate hid one of the selected reinforcers beneath the correct box that contained the matching noise-making device. When the client made a correct response, he or she was prompted to lift the box, and discover the reinforcer beneath it. A discovery-reinforcer contingency has been found to be more effective than simply handing a reinforcer to a participant in studies of discrimination learning with persons with developmental disabilities (Koegel & Williams, 1980). Verbal praise was also provided for a correct response.

3. A response-interruption procedure for errors was implemented. For this component, the incorrect box (containing the non-matching noise-making device) was secured to the tray so that it could not be lifted. Glenn, Whaley, Ward, and Buck, (1980) found a response-interruption procedure to be an effective strategy for interrupting position stereotyping when teaching a two-choice discrimination.

4. Within-stimulus prompt fading of the volume of the sounds was used. This involved initially providing the incorrect non-matching sound at a much lower volume than the correct sound. The volume of the incorrect non-matching sound was steadily increased across trials until it was the same volume as the matching sound. This was done in seven steps with 5 consecutive correct responses required at a step before going to the next step. Following 3 cumulative errors, the experimenter backed up a step. Within-

stimulus prompt fading has been found to be more effective than extra-stimulus prompt fading in studies of discrimination learning with persons with developmental disabilities (Schreibman, 1975).

Pre-training procedures. I originally assumed that the demonstration and physical guidance trials at the beginning of the sessions in the SPR and MCTP conditions would be sufficient to influence participants to respond on subsequent trials. However, during pre-experimental pilot trials, it quickly became obvious that participants, not being used to responding to boxes from which different sounds emanated, were uncomfortable, responded hesitantly, and frequently sided. However, the boxes were required as part of the reinforcer-discovery component of the MCTP procedure. I therefore attempted one or more of three pre-training procedures before comparing SPR to MCTP.

The use of the apparatus with the tape recorders was essentially a delayed matching procedure. That is, a participant was required to hear a sample sound, a non-matching sound, and a matching sound (randomly presented) and then respond, which required at least five seconds. Therefore the first pre-training procedure was designed to introduce a participant to the delayed matching task on a gradual basis. With this procedure the tester started by placing the three recorders on the table, clearly visible (without the boxes), and demonstrating each pair of matching sounds to the participant. Next, with the box apparatus in place, the sample sound was presented and followed by the matching sound, and the non-matching sound was not presented. The participant was required to point to the matching sound to be reinforced. Over steps 1 through 4 there was an increasing time delay between the original sound and the matching sound, until a delay of five seconds was reached. In order to progress from one step to the next, the

participant had to make eight consecutive correct responses on the first step, and then four consecutive correct responses on subsequent steps. Over steps 5, 6 and 7, all three sounds were presented. Eight consecutive correct responses at the final step were required to move on from the pre-training. Since the first pre-training procedure was not successful, a second pre-training procedure was developed.

The second pre-training procedure was similar to the first pre-training procedure, but had many more steps. The second procedure is summarized in Appendix F. Just as for the first procedure, the participant had to make four consecutive correct responses at a step to move to the next one, and eight consecutive correct responses at the final step. Since the second pre-training procedure was not successful, a third pre-training procedure was developed.

Because participants did not have a history of localizing and responding to sounds emanating from a tape recorder, the third pre-training procedure was designed to give them a brief history of doing so. Before beginning the third pre-training procedure, it was determined that, when given a ball, each participant would roll the ball to the experimenter (versus a confederate), when the experimenter asked him or her to "Roll me the ball." The goal of the third pre-training procedure was to teach the participant to respond appropriately when such an instruction came from either of one of two tape recorders, one in front of the experimenter and one in front of the confederate. During the first step, the confederate and the experimenter sat side by side and across the table from the participant. The experimenter and confederate both held a piece of paper over their mouths to avoid providing visual cues to the participant. On the first step, for several trials, the experimenter asked the participant to "Roll me the ball." On this and all

subsequent trials, correct responses were reinforced with praise and an edible. Next, over several trials, the experimenter said, "Roll me the ball" while the confederate simultaneously played the same instruction from the tape recorder. Next, over several trials, the experimenter repeated the previous step but said fewer and fewer words of the instruction while the entire phrase emanated from the tape recorder. That is, the experimenter said, "Roll me the ball", then "Roll me", then "Roll" and then just "Ro". Next, over several trials, the experimenter said, "Ro" more and more quietly, while the adjacent confederate, holding the tape recorder at mouth level, played the entire phrase on the tape recorder at the normal volume, until the point was reached where the participant was appropriately responding to the instruction from the tape recorder alone. Next the experimenter moved to one end of the table and the confederate sat at the opposite end of the table, with the participant sitting in the middle on one side of the table. The experimenter or confederate, while holding the recorder under the table out of view of the participant, randomly pressed the recorder to say, "Roll me the ball." Finally, the recorders were placed under the boxes, one in front of the confederate and one in front of the experimenter, and the recorded sound was played randomly from each box. Eight consecutive responses were required to pass this final step.

Experimental Design

In his description of an applied research strategy, Azrin (1977) argued in favor of the use of a multiple-component treatment package to solve an applied problem, rather than research that emphasizes isolating a single variable. That was the rational for choosing the MCTP. Azrin also argued in favor of comparing an experimental treatment to the most prevalent existing treatment. That was the rational for selecting the SPR,

which was commonly used during ABLA assessments. The original plan was to compare SPR to an MCTP using a single-subject, multiple-baseline design across participants. In the multiple-baseline design, three participants were to be first given SPR, followed by the MCTP, and three were first to receive MCTP, followed by SPR. However, because of the failure of two participants to pass the pre-training phases, and because two participants withdrew from the experiment, only 2 participants were exposed to both experimental conditions.

Interobserver and procedural reliability. An observer was present during a minimum of 85% of all sessions. To assess interobserver reliability (IOR), the researcher and the observer independently recorded the participant's response for each trial throughout training. IOR's were calculated by dividing the number of agreements between the researcher and the observer during a session by the total number of agreements plus disagreements and multiplying this number by 100% (Martin and Pear, 2003). Average IOR across all participants was 98%, and ranged from 95% to 100%. During 46% of all sessions, an observer was present to independently complete standardized procedural reliability (PR) checklists. Average PR across participants was 98%, and ranged from 92% to 100%. During 28% of all sessions, two observers were present and reliability assessments were calculated between the observers in the same manner as described above for IOR. Average IOR of PR was 98%, and ranged from 94% to 100%.

Results

Participant A was scheduled to receive MCTP first, but she did not make it past the pre-training stage. After 725 pre-training trials without reaching the mastery criterion

any of the pre-training procedures, Experiment 1 was terminated with her.

Participant B was also scheduled to receive MCTP first. After 422 pre-training trials, she was presented with 36 MCTP trials before she became ill and Experiment 1 was terminated with her.

Participant C was scheduled to receive SPR first. However, after 287 pre-training trials without reaching criterion on any of the pre-training procedures, Experiment 1 was terminated with him.

Participant D was the only participant who did not appear to require pre-training. He was presented with SPR. However, after 120 trials of responding at approximately chance level, he voluntarily withdrew from Experiment 1.

After meeting criterion on the third pre-training phase, Participants E and F both experienced SPR and MCTP. These results are shown in Figure 2. Participant E failed to meet criterion for passing with the SPR procedure, performing at essentially chance level over a total of 190 trials. She was then able to progress through the lower steps of the MCTP procedure quite rapidly (38 trials), but was unable to achieve the mastery criterion on the seventh and final step, with full volume (see Figure 2 on p. 26), after a total of 198 trials at the final step and 236 trials in total for the MCTP procedure. She was then retested on the AAIM prototype task, and failed.

Participant F received the MCTP procedure before the SPR procedure. Because there was no progress on the first fading step of MCTP after 76 trials, he was presented with SPR. He failed to meet the mastery criterion after 105 SPR trials and performed at approximately chance level. He was then given the MCTP procedure again and demonstrated mastery of each of the successive steps. He was able to obtain 8

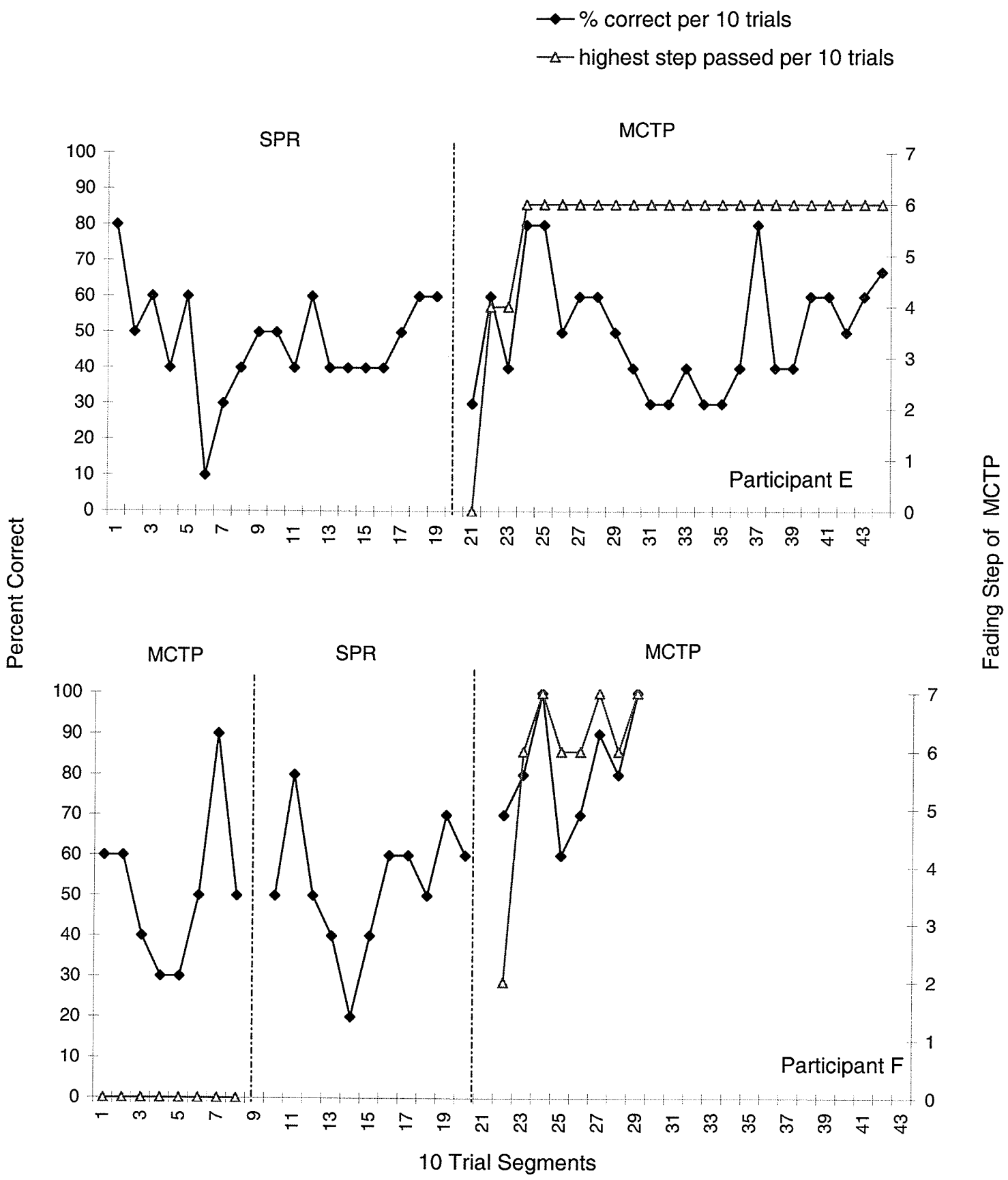

Figure 2. Training performance of Participants E and F.

consecutive correct in a row after 28 trials (8 trials at step 7), but was not able to get another successive 8 in a row to meet pass criterion. However, after a further 48 trials over several sessions, he met the mastery criterion of 2 successive sessions of 8 consecutive correct in a row, after a total of 56 trials at the final step and 76 trials in total for the second application of the MCTP procedure. However, he failed the live AAIM prototype task.

Participants E and F did not show any change in their echoic assessments from the start to the conclusion of Experiment 1.

Discussion

Experiment 1 confirmed that the AAIM level task is difficult to teach with SPR procedures. None of the 3 participants (C, D and E) who received SPR training first, nor Participant F who received SPR training after exposure to MCTP, met the mastery criterion with SPR training.

Experiment 1 also suggests that AAIM is difficult to teach using an MCTP. Participant F was able to meet mastery criterion with the MCTP procedure, but only after receiving 76 trials of the MCTP, then 105 trials of SPR, and then another 76 trials of MCTP. Moreover, after passing the AAIM training task, he was unable to pass the prototype task.

Participant F was able to get 8 consecutive correct words of the prototype task ("pen" and "block") using the tape recorders in a row once, after a total of 98 trials, but was unable to meet the mastery criterion of 2 such sessions in a row after a total of 158 trials. This inability to replicate may be related to the very difficult time keeping Participant F focused and on task. There were a number of sessions that had to be

discontinued because of emotional factors. These included his being upset because of something that had occurred earlier in the day, his excitement with plans after the session, teasing and flirting with the experimenters, and difficulties with his hearing aids (i.e. low batteries and or feedback). Similar factors contributed to difficulties with attention for the other participants. Another factor that may have contributed to difficulty with learning may have been the artificial nature of the apparatus. The recorders had inherent delays, sounded artificial and gave noise feedback, particularly for Participant F who wore hearing aids.

Given that only 2 of the 6 participants reached the point where they could be exposed to the MCTP procedure with the tape recorders, in spite of considerable effort spent on pre-training trials, Experiment 2 was conducted with sounds presented live by confederates.

Experiment 2

Method

Participants

Six individuals participated in Experiment 2. Three of the participants (A, B and E) did so after completing Experiment 1. Characteristics of the three new participants (G, H and I) are presented in Table 1 (see p. 14). This study used the same selection criteria as Experiment 1.

Setting

Testing and training were conducted in the same locations as Experiment 1.

Procedure

Each participant was assessed on the ABLA test, the AAIM prototype task, the

test of echoics, and the AAIM training task 2 (described below) before training began. All tests were conducted as described for Experiment 1. Just as in Experiment 1, the participants were also tested on echoics at the beginning and the end of Experiment 2, except for Participant I. He initially participated in the testing, but when the assistant working with him (his favorite) had to be changed, he would only occasionally say the words. His scores therefore actually reflected his compliance more than his echoic abilities. He was therefore exempted from the final echoics testing.

AAIM training task 2. A new task was designed where the experimenter and confederates spoke the words. The words used were a quick high pitched "tack tack" and a low, drawn out "wrench". The words and the manner in which they were spoken were selected in an attempt to maximize their discriminability. The AAIM training task 2 was assessed prior to training using the procedure described previously for assessing the AAIM prototype task. The tester said the sound ("tack tack" or "wrench") to be matched while sitting in the centre of the table. Then two confederates, one sitting at each end of the table, would say either the matching, or non-matching sound. The participant was required to point to the person who had produced the matching sound in order to receive reinforcement. Trials continued until the participant met the pass criterion of eight consecutive correct responses, or the fail criterion of eight cumulative incorrect responses.

Standard prompting and reinforcement (SPR). There was no apparatus used during the SPR procedure in Experiment 2. The experimenter sat across the table from the participant, and a confederate sat at each end with their hands on the table. The experimenter first said one of the words, then one confederate said the matching word,

and the other said the non-matching word. The participant was required to point to the confederate who said the matching word. Across trials, the order in which the confederates spoke and the position of the matching and non-matching words were randomly alternated. Mastery of the task was defined as eight consecutive correct responses, two sessions in a row. The SPR protocol in Experiment 2 contained the same components as in Experiment 1:

1. At the start of each session Participants G, I, A, and B, were given the choice of six edibles. The chosen edible was then used as a reinforcer for correct responses during the session. Participant H was given the choice of 1 of 6 different games to engage in with the experimenters, as he was unable to consume edibles. The chosen game (played for approximately 30 seconds per reinforcement) was then used as a reinforcer during the session as described for Experiment 1.

2. Each trial started with a demonstration, guided trial, and opportunity for an independent response for each sound.

3. The client received praise and an edible for independent correct responses.

4. There was no error correction procedure. Instead following an error, the participant was ignored for several seconds while the error was recorded and the experimenter prepared for the next trial.

5. Pacing prompts were used if needed, as described for Experiment 1.

Multiple Component Training Package 2 (MCTP2). Several sessions were conducted with Participants E and G in which variations of an MCTP were explored. A procedure was then finalized for Experiment 2, and is referred to as MCTP2. This procedure used the training arrangement and apparatus shown in Figure 3 (see p. 31).

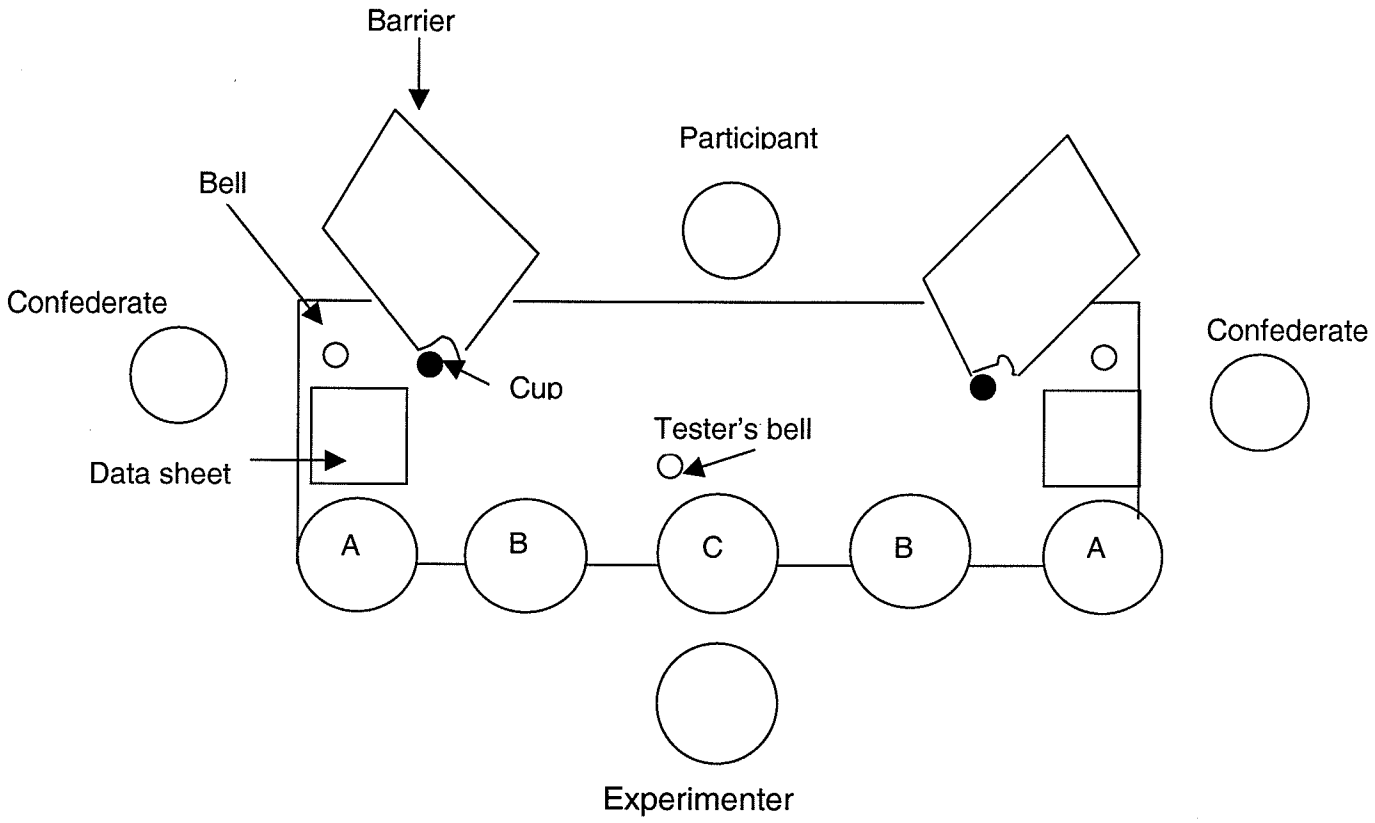

Figure 3. Schematic of Multiple Component Training Procedure 2.

The basic training task was the AAIM training task 2 described previously. During each trial, the experimenter was seated at 1 of 5 positions on the opposite side of a table from the participant. The confederates sat at either end of the table. Each confederate was seated behind a wooden barrier so that his or her face was obscured from the participant's view. This was done to eliminate possible visual cues from the faces of the confederates while saying the matching and non-matching words. A notch was cut out of the side of the barrier where a cup could rest. The participant was to point to the cup that was visible in the apparatus, in front of the confederate who made the matching sound. Following a correct response the confederate would slide the cup forward so that the participant would discover the edible inside the cup. The following components were included:

1. At the start of each session, each participant was allowed to choose three out of six edibles. These were used as reinforcers during the session as described for Experiment 1.

2. A discovery-reinforcer contingency for correct responses was used as described above.

3. An extinction procedure was used for incorrect responses. For this procedure, when the participant pointed to the incorrect confederate, the confederates moved the cups (from the location where they were visible to the participant) to a position behind the barrier (where they were no longer visible to the participant, see Figure 3), and the participant was ignored for several seconds while the error was recorded and the experimenter and confederates prepared for the next trial.

4. Extra-stimulus visual prompt fading was used. The tester provided a visual cue by moving and sitting beside the correct confederate at the beginning of each trial. This

prompt was faded by having the tester move back to the centre of the table across trials (see Figure 3 and steps 1, 2 and 3 in Appendix G).

5. Within-stimulus auditory prompt fading of the number of repetitions of the words was used. In this procedure, the tester said one of the test words, followed in a random order by the correct and incorrect confederates. The tester and the correct confederate then alternated in repeating the correct words twice, while the incorrect confederate remained silent. This was done to enhance the participant's exposure to the correct match. Over trials, repetition of the incorrect word was faded in until the experimenter and the two confederates repeated their words three times each (see Steps 1 through 5 in Appendix G).

6. Extra-stimulus auditory prompt fading was used. The experimenter and the two confederates each had a bell located in front of them and out of the sight of the participants (see Figure 3). A bell sound was presented together with the spoken "tack tack" word. This was done to enhance discriminability of "tack tack" versus "wrench". This prompt was faded out across trials (see Steps 5 through 8 in Appendix G).

At each of the 10 steps of MCTP2 (see Appendix G), the criterion for moving to the next step was six consecutive correct responses, or seven correct out of eight consecutive responses. At any time, 4 cumulative errors at a fading step led to returning to the previous fading step. Mastery of the procedure was defined as eight consecutive correct responses, or 9 correct out of 10 consecutive responses, two sessions in a row, at step 10 (see Appendix G).

An error-correction procedure was added for Participant G as he frequently picked one side, independent of where the correct matching sound occurred. This

procedure involved inserting two trials, one for each word, on his non-preferred side. The confederate who said the wrong word removed her apparatus from the table on those trials. Participant G was required to identify two consecutive correct responses before moving to the next trial designated on the data sheet.

Multiple Component Training Package 3 (MCTP3). Five of the participants were exposed to MCTP2, and, as discussed later, only Participant E showed some progress. Therefore, the MCTP3 procedure was developed. No apparatus was used except for the cups, which were placed on the table in front of the confederates. During each trial, the experimenter was seated at the centre of a table with the confederates sitting on either side of her. The participant was to point to the confederate who said the matching sound. The following components were included:

1. At the start of each session Participants G, I, A, and B, were allowed to choose 3 out of 6 edibles. These were used as reinforcers during the session as described for Experiment 1. Participant H was given the choice of 6 different games to engage in with the experimenters, as he was unable to consume edibles. The three chosen games (played for approximately 30 seconds per reinforcement) were then used as reinforcers during the session as described for Experiment 1.

2. A discovery-reinforcer contingency for correct responses was used. Before each trial and out of sight of the participant, an edible or game (or game piece if the entire game was too big) was put into the cup. Following a correct response on a trial, the confederate slid the cup forward and the participant was able to 'discover' what was inside.

3. An extinction component for incorrect responses was used. For this procedure, when the participant pointed to the incorrect confederate, the confederates removed the cups from the table and the participant was ignored for several seconds while the error was recorded, and the experimenter and confederates prepared for the next trial.

4. Extra-stimulus visual prompts were used. The tester provided 2 prompted trials at the beginning of each day, and at the beginning of each step, by using pointing prompts to point to the correct confederate on either side, for each sound. This was done to promote correct responding and reduce siding.

5. An extra-stimulus verbal prompt was used. Training began by teaching a participant to point to a confederate when the confederate said, "Point to me" (for Participant A and I, the prompt was their name, followed by "Point to me", as they would not respond to just "Point to me"). At step 1, the two confederates alternated saying "Point to me", while the experimenter was silent (see Appendix H). At step 2, the confederates alternately said either; "tack" or "wrench" followed by "Point to me", while the experimenter was silent (see Appendix H). At step 3, the experimenter alternately said "tack" or "wrench", and one of the confederates would say the matching word followed by "Point to me" (see Appendix H). Step 4 was similar to step 3, except that there was a 2 second pause between when the experimenter said the word and when the confederate said the word followed by "Point to me."

Two preliminary steps were required for Participant G. During both steps the experimenter was silent. First one confederate said one word and the other confederate said, "word, Point to me." During the following step the words were differentiated further by one confederate saying one word in a whisper and the other confederate saying the

other word and "Point to me" loudly.

6. Within-stimulus auditory prompt fading was used. By the end of step 4, a participant was responding by pointing to a confederate who said the matching word followed by "Point to me", but the non-matching word was not yet presented. Over steps 5 through 9, a confederate's saying of the non-matching word was gradually faded in, initially by saying the non-matching word in a whisper, and then saying it louder and louder across steps until it was said in a normal tone of voice (see Appendix H).

7. Fading of the extra-stimulus verbal prompt was used. Over steps 9 through 12, the verbal prompt "Point to me" was gradually faded out by the confederate who said the matching word (see Appendix H). By the end of step 12, the tester and the two confederates were all speaking in a normal tone, the words "tack" and "wrench" were both said just once, and the confederate who said the matching word no longer said "Point to me."

8. Within-stimulus fading to exaggerate the difference between the spoken words was used. Steps 13 through 15 involved fading in the differential presentation of the words. For step 13, the words were spoken in a normal tone by the experimenter and the confederates (who randomly alternated matching and non-matching words), but tack was said twice. During step 14 tack was again said twice, but in a normal tone of voice, while wrench was said in a drawn out manner and in a low tone. Step 15 was similar to the prototype task, in that "tack tack" was said in a high tone and "wrench" was drawn out and said in a low tone. Steps 13 through 15 were included to increase the chances that the prototype task would be passed if a participant first passed the training task.

At each of the 15 fading steps, the criterion for moving to the next step was six

consecutive correct responses, or seven correct out of eight consecutive responses. Mastery of the task was defined as eight consecutive correct responses, two sessions in a row at the final step.

Post-test Assessments. As will be described later in the results section, three participants were able to pass step 12 of MCTP3 where "tack" and "wrench" were spoken once by the tester and the confederates in a normal tone, but these three participants were not able to progress through step 15 where "tack tack" was said rapidly in a high tone while "wrench" was spoken slowly in a low tone. In an attempt to determine whether the repetition of one of the spoken words or the exaggerated difference in the tone of the words was interfering with the learning of AAIM discriminations, four post-tests were conducted.

The first two post-tests used a normal tone for saying the words, and manipulated repetition and "dragging out". In post-test 1, using the standard protocol of the AAIM prototype task, participants were assessed with "ball ball" repeated twice in a normal tone and "shoooeee" dragged out in a normal tone. In post-test 2, the AAIM standardized assessment was then repeated with the same words (ball and shoe), with the words spoken in a normal tone and with no repetition or dragging out of the words.

The third and fourth post-tests exaggerated tone in both assessments, and manipulated the repetition and dragging out of the words. Specifically, in post-test 3 using the standard AAIM protocol, participants were assessed with "glue glue" said twice in a high pitch tone and "maaattt" dragged out in a low tone. In post-test 4, they were then reassessed with "glue" said once in a high-pitched tone and "mat" said once in a low tone and not dragged out. The assessment order of the four post-tests was randomized

across participants.

Experimental design. A single-subject, multiple-baseline design across participants was used. Three participants were first given the SPR procedure. When they failed to meet mastery they were given one of the MCTP procedures. The other three participants first received the MCTP2 procedure. When they failed to show progress, they were given MCTP3.

Interobserver and procedural reliability. IOR's and PR's were calculated in the same fashion as in Experiment 1. An observer was present during 95% of all sessions (including Baseline sessions, MCTP2, MCTP3 and post-tests). Average IOR across participants was 99%, with a range of 98% to 100%. PR's were calculated for 67% of all sessions. Average PR was 100%, with a range of 99% to 100%. Two observers were present for 68% of sessions and each observer completed standardized procedural reliability checklists. Average IOR of PR, across participants was 97%, with a range of 95% to 99%.

Results

SPR. Participants E, G and H were given the SPR procedure and failed to meet the mastery criterion after 140, 380, and 721 trials respectively (see Figure 4).

MCTP2. Five participants (E, G, B, I and A) were given MCTP2, and only Participant E showed considerable progress (see Figures 4 and 5). Participants G, B, I and A did not progress past step 2 of MCTP2 after 338, 83, 127 and 220 trials respectively. Therefore they were given MCTP3. Participant E progressed rapidly during the first few steps of MCTP2 (see Figure 4). However, after a total of 814 trials of MCTP2, Participant E was not able to pass step 9 of the 10 training steps.

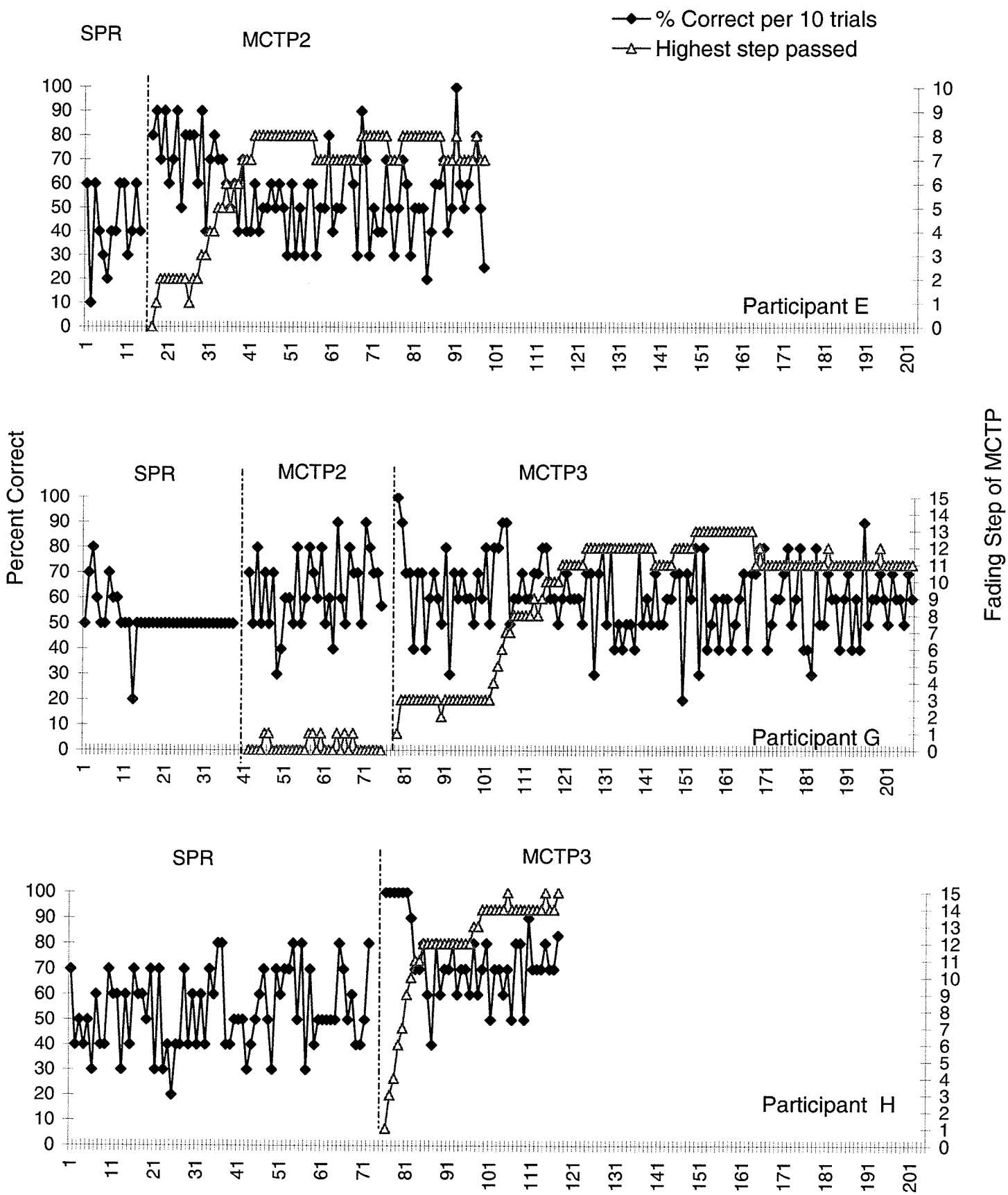

Figure 4. Training performance of Participants E, G and H.

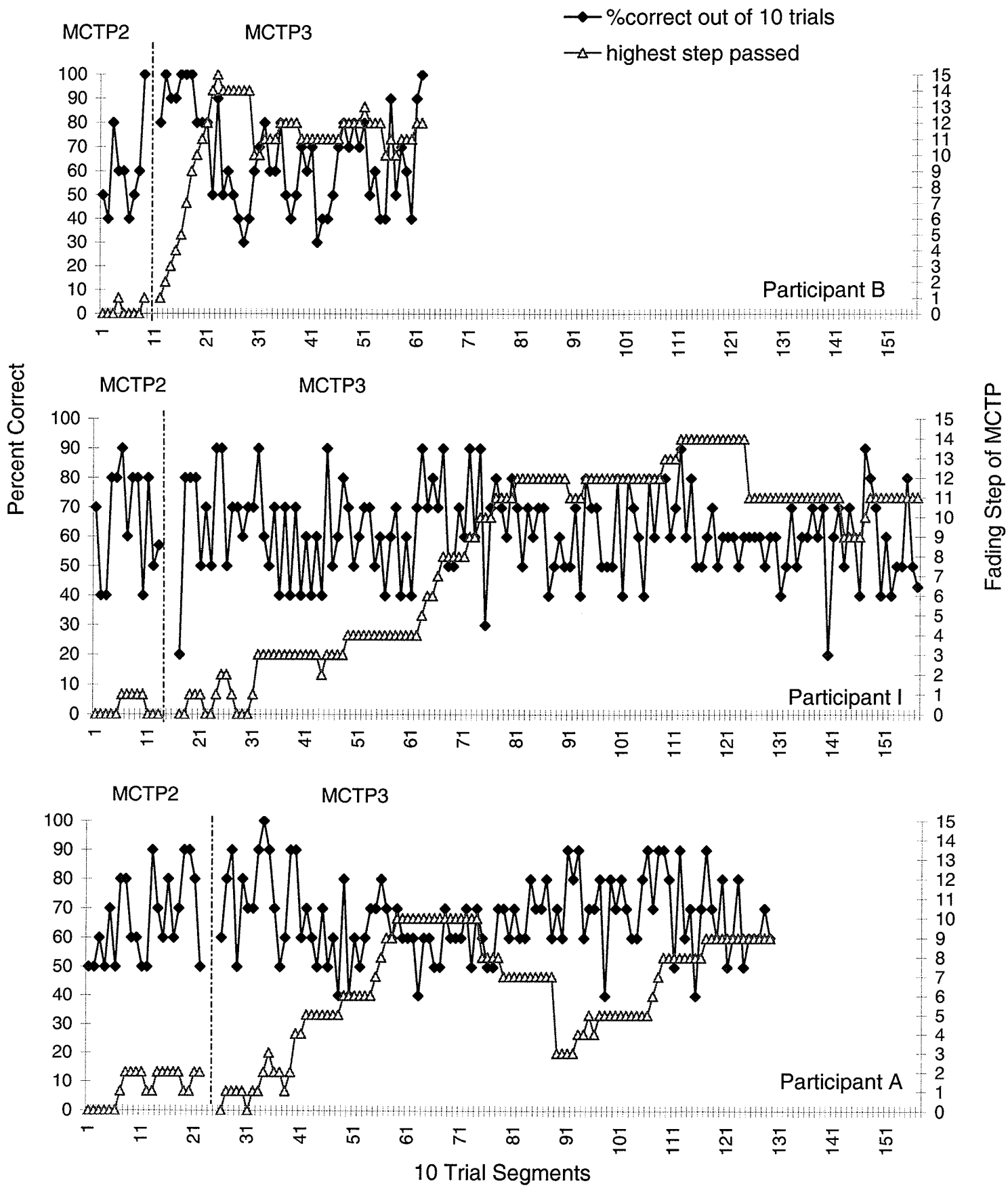

Figure 5. Training perfromance of Participants B, I and A.

MCTP3. Of the 5 participants who were exposed to MCTP3, all 5 made considerable progress (see Figures 4 and 5), and 4 participants (G, H, B and I) learned an AAIM discrimination to the extent that they passed Step 12 of MCTP3 (see Appendix H). At step 12, the tester randomly said either "tack" or "wrench" and the confederates randomly said "tack" or "wrench", all in a normal tone of voice. Participants G, H, B and I first passed step 12 after 477, 96, 101, and 643 trials respectively, and they repeated this accomplishment several times each. The pass criterion for steps was 6 consecutive correct responses, or 7 out of 8 responses correct. However, when the experimenter attempted to progress to Step 15 in which "tack tack" was said rapidly, in a high pitched tone and "wrench" was said in a low drawn-out fashion, only Participant H met the final mastery criterion of 8 consecutive correct responses for two sessions in a row. Criterion was reached with Participant H after 416 total trials of MCTP3. Participant G was able to pass step 13 on one occasion, but had a difficult time passing steps 14 and 15. Participant B passed steps 13, 14 and 15 on one occasion, but was unable to replicate this. Similarly, Participant I was able to pass steps 13 and 14 on one occasion, but was unable to replicate this. Participants G, B and I experienced a total of 1289, 506 and 1408 training trials respectively on MCTP3.

Participant A was unable to pass step 11 of the MCTP3 procedure after 1047 training trials (see Figure 5). Steps 9 through 12 involved fading of the verbal prompt, "Point to me." It appears that Participant A was under the stimulus control of that prompt and could not perform the AAIM match when that prompt was faded.

Post-test assessments. Concerning echoic assessments, the pre-experiment 2 and post-experiment 2 assessments are shown in Table 2 (p. 42). As can be seen in Table 2,

Table 2

Experiment Two: Echoic Performance at Baseline and Following Training

	Echoics[a]			
Participant	Baseline		Post training	
	correct	approximately	correct	approximately
A	61	36	64	36
B	48	36	33	21
E	0	9	0	9
G	15	21	27	48
H	0	0	0	0
I				

[a]Percent correct

of the 5 participants who were assessed, only Participant G showed considerable improvement. Participant B's score decreased and the scores of the other participants changed only slightly, or stayed the same.

Participant A passed the AAIM prototype task on the post-test assessment. All the other participants reached the fail criterion without achieving the pass criterion. The percentage correct obtained by participants on the post-test across trials (until the pass or fail criterion was reached) are shown in Table 3.

On the post-tests conducted in an attempt to evaluate the importance of the words stated in a normal tone versus in an exaggerated fashion, Participant E passed post-test P3, and Participant H passed post-tests P1 and P4. On all other of these post-tests the failure criterion was reached without achieving a pass. Percent correct performances on trials until the pass or fail criterion was reached are presented in Table 3. Post-test 2 was the one conducted in which words were spoken once in a normal tone, which is the condition in which 4 participants reached criterion on step 12 of MCTP3, but 3 of them (G, B, and I) were unable to progress to step 15 where the words were exaggerated in tone and frequency. Interestingly, none of the participants showed their highest rate of percent correct performance on post-test 2 in comparison to the other 3 post-tests. Overall, no obvious trends were discernable in the 4 post-tests.

Discussion

This research confirmed that teaching an AAIM task to individuals who failed the AAIM prototype task is indeed difficult. Across the two experiments, none of the six participants who received SPR were able to learn an AAIM task. Of the 6 participants who received a variation of an MCTP, 5 of the participants learned at least one variation

Table 3

Experiment 2: Prototype Task Assessments and Post-test Assessment Percentage Correct

	Prototype task assessments		Post-test (P) assessments			
Participant	Baseline	Following training	P1	P2	P3	P4
A	27	80[a]	53	38	58	58
B[c]	58	73	62	62	56	47
E	27	58	71	65	79[a]	60
G[c]	50	20	50	38	50	58
H[b]	65	67	85[a]	68	69	77[a]
I[c]	47	47	64	56	53	68

Note. P1 = normal tone, repeat word, dragged out word; P2 = normal tone, no repetition, no dragged out word, P3 = high/low tone, repetition, dragged out word; P4 = high/low tone, no repetition, no dragged out word. [a]Indicates pass criterion met. [b]Indicates pass criterion met on all steps of training task. [c]Indicates pass criterion met on Step 12 of training task.

of an AAIM task; 2 did so by achieving the final mastery criterion of 8 consecutive correct responses on the final training step for 2 sessions in a row, and 3 did so by repeatedly achieving the step criterion of 6 consecutive correct responses on the training step where the words to be matched were spoken in a normal tone of voice. However, only one of the participants was able to pass the AAIM prototype task following training. Martin and Yu (2000) recommended that acquisition in 100 training trials or less may be considered rapid learning when teaching failed ABLA levels to persons with developmental disabilities. However, only a small number of participants have actually met this criterion. Four studies used variations of MCTP's in an attempt to teach a failed ABLA level. Yu & Martin (1986) taught a failed ABLA level 3 task to a client in 90 trials. Hazen et al. (1989) taught a failed level 4 task to three clients in 87, 87 and 84 trials respectively. Three participants in Walker et al. (1991) learned a failed level 5 task in 95, 8 and 15 trials respectively. Four participants in Conyers et al. (2000) learned a failed level 6 task using 20, 21, 32 and 23 trials respectively. In all of these experiments mastery criterion was 8 consecutive correct responses, rather than the more stringent criterion employed in this study of 8 consecutive correct responses during two sessions in a row. However, other studies have demonstrated that many more trials than 100 are needed for teaching various visual and auditory discriminations to persons with developmental disabilities. For example, Vause, Martin, Yu, Marion and Sakko (2005) demonstrated that one participant, who had passed ABLA level 6, required 1375 and 756 trials for learning two visual-visual non-identity matching tasks, while another participant, who had passed ABLA level 6, required 1382 and 2243 trials to learn the same tasks. As another example, eight children who had passed ABLA level 4, but failed

ABLA level 5, required between 88 and 460 trials, with a mean of 216 trials to learn a level 5 task using a variation of an MCTP (Witt & Wacker, 1981). What should the criterion for rapid learning be? It is not clear, but perhaps 100 trials is too low.

There were several difficulties associated with conducting the experiments that deserve comment. As the data collection was lengthy, a change in confederates occurred several times. This produced excitement or disappointment with many of the participants, which may have affected their attendance to the tasks. Frequently, the place designated for data collection was within earshot of others, which was distracting to some of the participants. Many participants had a difficult time with attention and concentration and frequently attempted to interact socially with the researchers, rather than attend to the tasks at hand. Identifying sufficient participants to meet the study criteria was also difficult.

Another difficulty concerned the use of tape recorders to present the sounds in Experiment 1. Tape recorders were used because of research indicating that simple environmental sounds may be easier for persons with developmental disabilities to discriminate than speech sounds (Lamberts, 1981). However, using tape recorders was problematic as described previously. Nevertheless, future research should examine other variations of an apparatus that would present simple auditory sounds to teach AAIM. This may then make it easier for participants to subsequently learn AAIM with speech sounds.

A weakness in the experimental design should be noted. One of the participants in Experiment 1 (F) and 4 out of the 6 participants in Experiment 2 (B, G, H, I) all learned a variation of an AAIM task using an MCTP (either by meeting the step criterion or the

overall mastery criterion). But all did so only after prior exposure to either SPR or a different variation of MCTP. Therefore, because of the potential for multiple treatment interference, it cannot be said that learning occurred on the basis of a single MCTP alone. Further research is needed to confirm the value of the MCTP's that were successful in the two experiments.

Across the two experiments in this research, and the unpublished report by Penner (2001), 8 of 12 individuals have learned a variation of an AAIM training task, at least based on either the criterion for passing individual steps or the overall mastery criterion. After doing so, however, only one of those individuals was able to pass the AAIM prototype task. This leads to two suggestions. One suggestion is that future research is needed for teaching generalized AAIM ability. Another suggestion is that the prototype AAIM task may not be representative of more general AAIM ability. The AAIM prototype task involves exaggerating the distinction between the words "Pen" and "Block" by saying "Pen pen" in a high-pitched voice and saying "B-l-o-c-k" in a low, drawn out fashion. However, considering that the AAIM prototype task has been shown to have good predictive validity for everyday sounds (e.g. barking versus meowing) presented via tape recorders, as well as for other pairs of words presented similarly to "Pen pen" versus "B-l-o-c-k" (Vause et al., 2003), it seems reasonable to suggest the future research should first focus on strategies to teach generalized AAIM ability.

Only one participant (G) from both experiments showed improvement on the test of echoics at the end of Experiment 2. Future research is needed to assess whether mastery of AAIM may be a bridging task for learning echoics.

In summary, several conclusions can be reached. First, this research confirmed that it is extremely difficult to teach an AAIM task using SPR procedures to individuals who failed the AAIM prototype task. Second, some success was achieved in teaching an AAIM task using an MCTP. Third, only one of the participants who learned an AAIM training task was subsequently able to pass the AAIM prototype task. Fourth, future research is needed to determine if learning an AAIM training task will affect a participant's score on a test of echoics. While the current research constitutes a beginning step in the development of training strategies for teaching AAIM to persons who fail the AAIM prototype task, future research is needed to refine procedures for teaching AAIM training tasks, and to produce generalized AAIM ability. Future research is also needed to determine if acquiring AAIM ability serves as a bridge for learning echoics.

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Appendix A

PROJECT DESCRIPTION AND CONSENT FORM FOR PARTICIPANTS

Project Title: Assessment and Comparison of Methods of Teaching Auditory Discriminations and Expressive Language

This project will be conducted by Tracey Sewell, a Psychology student at the University of Manitoba, and supervised by Dr. Garry Martin, Professor of Psychology at the University of Manitoba, and Dr. Dickie Yu, Research Director at St. Amant Centre. This project has been approved by the Psychology / Sociology Research Ethics Board (PSREB) and any complaints regarding procedures may be reported to the human ethics secretary at 474-7122.

What is the study about?

When assessing the types of tasks that a person can readily learn to perform, it is important to know your ability to make certain types of discriminations. One particular discrimination involves matching two objects together that are not similar to one another (e.g., matching a sock to a shoe vs. matching a spoon to a soup bowl). In this study, we will assess a variety of tasks of this nature.

We will also be assessing you to determine whether you are able to match identical sounds. If not, you will be taught a sound-matching task using standard prompting and reinforcement procedures. These are procedures that daily staff typically use to teach new tasks. If you are not able to learn it within a set period of time, then we will try to teach the matching task using a new instructional package that focuses on a more effective way of providing prompts and reinforcers. We believe that this new instructional package may be more effective than standard prompting and reinforcement and will assist you to learn to perform the task more quickly.

What will the project include, and how long will it last?

If you would like to participate, we will :

1. Assess your visual and auditory discriminations to determine what types of tasks you can readily learn.

2. Determine your ability to learn several matching tasks involving two objects that differ in size, shape, and color.

3. Assess your ability to imitate words.

4. Do an assessment to see if you are able to do a sound-matching task.

5. If you do not know how to do the task, I will do a small number of teaching sessions to see if you can learn it quickly using standard prompting and reinforcement techniques (demonstration, guided practice, independent response).
6. If you are able to learn it, great. If not, I will try again, using a new teaching package (with error prevention, direct response-reinforcer relationship and slowly fading in the incorrect stimulus from an extremely quiet volume back to normal volume).

This study requires five half-hour sessions per week and will be completed within 6 months.

Is participation voluntary?
Yes. Participation is voluntary. Whether you agree to participate will in no way affect any services you may be receiving now or in the future from St. Amant Centre.

Can the client stop at any time?
Yes. You can withdraw your consent any time and for any reason. It will not affect any services you may be receiving now or in the future.

What personal information will be obtained?
Age, diagnostic information including intellectual and adaptive functioning level, and medications will be obtained from your records at St Amant Centre. This information will be collected for research purposes only, to examine how it relates to your performance.

Will my personal information be kept confidential?
Yes. The identities of all participants will be kept strictly confidential. All data collected during the study will be kept in a locked office and will be accessible only to the researcher. Any presentations, reports, or publications resulting from this project will not contain any identifying information. The assessment results however may be useful for Centre staff who work with you and it will be beneficial for you to share this information with them. Please indicate whether you give permission for us to share the results with the Centre staff at the end of this consent form by checking the appropriate box.

Are there any risks to taking part in the study?
No. The assessment procedures will include modeling, verbal prompting, and positive reinforcers (e.g. praise and/or preferred activities). These are common procedures, and present no risk to you.

Are there any benefits in taking part in the study?
Yes. The information obtained may help staff to better support you in your living and learning environments. We will share the assessment results with staff if you give us permission to do so.

Will participation cost anything?
No.

Is there any compensation for participating?
No. There is no financial compensation for participation.

Who should I call if I have questions or concerns about the project?
If you have any questions or concerns about the project please call Tracey Sewell (256-4301 ext. 350), or Dr. Dickie Yu (256-4301, ext. 328), or Dr. Garry Martin (474-8589).

What should I do if I am interested?
Please complete the next section, and mail the form back in the self addressed stamped envelope enclosed.

Signature of Person Authorized to Give Consent

By signing this form, I, _____ agree to participate in the above named research project. I am aware that I may stop at any time with no impact on any services that I am receiving or may receive in the future. I agree to allow the project staff to :

- **Gather demographics and diagnostic (age, functioning, diagnosis, sensory and physical impairments, medication) information about myself from the clinical/agency records.**
- **Do assessments with me.**
- **Try to teach me a sound-matching task.**
- **Include my results in publications, reports, and talks, so that other may learn from this project. Identity, however will not be disclosed.**

The project staff ☐ can ☐ cannot share the results with the Centre Staff.

_____	_____	_____
Print Name of Person	**Signature of Person**	**Date**

Giving Consent **Giving Consent**

Witness : _____

Appendix B

PROJECT DESCRIPTION AND CONSENT FORM FOR LEGAL GUARDIAN

Project Title : Assessment and Comparison of Methods of Teaching Visual Discriminations, Auditory Discriminations, and Expressive Language

This project will be conducted by Tracey Sewell, a Ph.D. Psychology student at the University of Manitoba, and supervised by Dr. Garry Martin, Professor of Psychology at the University of Manitoba, and Dr. Dickie Yu, Research Director at St. Amant Centre. This project has been approved by the Psychology / Sociology Research Ethics Board (PSREB) and any complaints regarding procedures may be reported to the human ethics secretary at 474-7122.

What is the study about?

When assessing the types of tasks that a person can readily learn to perform, it is important to know his or her ability to make certain types of discriminations. One particular discrimination involves matching two objects together that are not similar to one another (e.g., matching a sock to a shoe vs. matching a spoon to a soup bowl). In this study, we will assess a variety of tasks of this nature.

The participant will also be assessed to determine whether he/she is able to match identical sounds. If not, he/she will be taught a sound-matching task using standard prompting and reinforcement procedures. These are procedures that daily staff typically use to teach new tasks. If he/she is not able to learn it within a set period of time, then we will try to teach the matching task using a new instructional package that focuses on a more effective way of providing prompts and reinforcers. We believe that this new instructional package may be more effective than standard prompting and reinforcement and will assist him/her to learn to perform the task more quickly.

What will the project include, and how long will it last?

If you support the client's participation, we will :

1. Assess the participant's visual and auditory discriminations to determine what types of tasks he or she can readily learn.

2. Determine the participant's ability to learn several matching tasks involving two objects that differ in size, shape, and color.

3. Assess the participant's ability to imitate words.

4. Do an assessment to see if he/she is able to do a sound-matching task.

5. If he/she does not know how to do the task, I will do a small number of teaching sessions to see if he/she can learn it quickly using standard prompting and reinforcement techniques (demonstration, guided practice, independent response).

6. If he/she is able to learn it, great. If not, I will try again, using a new teaching package (with error prevention, direct response-reinforcer relationship and slowly fading in the incorrect stimulus from an extremely quiet volume back to normal volume).

This study requires five half-hour sessions per week and will be completed within 6 months.

Is participation voluntary?
Yes. Participation is voluntary. Whether you agree for the client to participate will in no way affect any services he or she may be receiving now or in the future from St. Amant Centre.

Can the client stop at any time?
Yes. You can withdraw your consent any time and for any reason. It will not affect any services the client may be receiving now or in the future.

What personal information will be obtained?
Age, diagnostic information including intellectual and adaptive functioning level, and medications will be obtained from the individual's records at St Amant Centre. This information will be collected for research purposes only, to examine how it relates to the individual's performance.

Will the client's personal information be kept confidential?
Yes. The identities of all participants will be kept strictly confidential. All data collected during the study will be kept in a locked office and will be accessible only to the researcher. Any presentations, reports, or publications resulting from this project will not contain any identifying information. The assessment results however may be useful for Centre staff who work with the client and it will be beneficial for the client to share this information with them. Please indicate whether you give permission for us to share the results with the Centre staff at the end of this consent form by checking the appropriate box.

Are there any risks to taking part in the study?
No. The assessment procedures will include modeling, verbal prompting, and positive reinforcers (e.g. praise and/or preferred activities). These are common procedures, and present no risk to the client.

Are there any benefits in taking part in the study?

Yes. The information obtained may help staff to better support the client in his/her living and learning environments. We will share the assessment results with staff if you give us permission to do so.

Will participation cost anything?
No.

Is there any compensation for participating?
No. There is no financial compensation for participation.

Who should I call if I have questions or concerns about the project?
If you have any questions or concerns about the project please call Tracey Sewell (256-4301 ext. 350), or Dr. Dickie Yu (256-4301, ext. 328), or Dr. Garry Martin (474-8589).

What should I do if I am interested?
Please complete the next section, and mail the form back in the self addressed stamped envelope enclosed.

Signature of Person Authorized to Give Consent

By signing this form, I give consent for (print name of participant) _____ to participate in the above named research project. I am aware that he/she may stop at any time with no impact on any services that the participant is receiving or may receive in the future. I agree to allow the project staff to :

- **Gather demographics and diagnostic (age, functioning, diagnosis, sensory and physical impairments, medication) information about the participant from the clinical/agency records.**
- **Do assessments with the participant.**
- **Try to teach him/her a sound-matching task.**
- **Include the participant's results in publications, reports, and talks, so that other may learn from this project. Identity, however will not be disclosed.**

The project staff ☐ can ☐ cannot share the results with the Centre Staff.

_____	_____	_____
Print Name of Person Legally Authorized to Give Consent	**Signature of Person Authorized to Give Consent**	**Date**

Appendix C

Data Sheet for ABLA Level 6

Student_____ Tester_____ Observer_____ Date_____

Instructions: If response is correct, circle trial number. If response is incorrect, place X on trial number. Continue to place Xs for incorrect responses on the lines below until the student corrects the error. Upon correction, place a check mark on the next line below, and then move on to the next trial.

Level 6 (Auditory-Visual) 'L' and 'R' indicate correct placement of can
Say, "Red Box" (RB) or "Yellow Can" (YC)

R	R	L	L	L	R	R	L	R	L	R	R	L	R
YC	RB	YC	RB	YC	YC	RB	RB	YC	YC	RB	YC	RB	RB
1	2	3	4	5	6	7	8	9	10	11	12	13	14
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—

L	R	L	L	L	R	L	R	L	R	R	L	L	R
YC	RB	RB	YC	RB	YC	YC	RB	RB	RB	YC	YC	RB	YC
15	16	17	18	19	20	21	22	23	24	25	26	27	28
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
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R	L	R	L	L	R	L	R	L	R	L	R		
RB	YC	YC	RB	YC	RB	RB	YC	YC	YC	RB	RB		
29	30	31	32	33	34	35	36	37	38	39	40		
—	—	—	—	—	—	—	—	—	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—

8 right in a row (counting circled numbers, not counting checks during error correction)?
That's a PASS. Go to the next level.
8 wrong altogether (counting X's on numbers and X's on lines)?
FAIL!!! STOP THE WHOLE TESTS.

Appendix D

Prototype Task Assessment Sheet

Date: **Tester:**
Participant: **IOR(s):**

P = "pen" B = "block"
say each word 3 times; the tester speaks, then the person in bold speaks

T:	B	P	B	P	B	P	B	P	B	P	B	P	B	P	B	P	B	P
A	B	P	**P**	**B**	P	**P**	B	**B**	**P**	B	**B**	P	**P**	**B**	P	**P**	B	**B**
B	**P**	**B**	B	P	**B**	B	**P**	P	B	**P**	P	**B**	B	P	**B**	B	**P**	P
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

T:	B	P	B	P	B	P	B	P	B	P	B	P	P	B
A:	B	P	**P**	B	**B**	**P**	B	**B**	**P**	B	**B**	P	B	**B**
B:	**P**	**B**	B	**P**	P	B	**P**	P	B	**P**	P	**B**	**P**	P
	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–
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	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix E

Echoic and Tact Data Sheets

Participant_____
Tester: _____ IOR: _____
Date:_____
Circle: Echoics or Tacts % correct ____ IOR _____

WORD	CORRECT	APPROXIMATION (indicate in the same box)	INCORRECT	OMISSION
1. box		bah, ox		
2. can/tin		cah, ann/tii, inn		
3. pen		en, peh		
4. juice		juu, uice		
5. cup		cuh, up		
6. pudding		pudd, puh, ding		
7. spoon		spoo, oonh		
8. bowl		boh, ohl		
9. foam/sponge		foh, ooam/sponn, onge		
10. puzzle/bear		puzz, zzle/beaa, air		
11. paper		peh, perr, pape		
12. box		bah, ox		
13. can/tin		cah, ann/tii, inn		
14. pen		en, peh		
15. juice		juu, uice		
16. cup		cuh, up		
17. pudding		pudd, puh, ding		
18. spoon		spo, oonh		
19. bowl		boh, ohl		
20. foam/sponge		foh, ooam/sponn, onge		
21. puzzle/bear		puzz, zzle/beaa, air		
22. paper		peh, perr, pape		
23. box		bah, ox		
24. can/tin		cah, ann/tii, inn		
25. pen		en, peh		
26. juice		juu, uice		
27. cup		cuh, up		
28. pudding		pudd, puh, ding		
29. spoon		spoo, oonh		
30. bowl		boh, oohl		
31. foam/sponge		foh, oam/sponn, onge		
32. puzzle/bear		puzz, zzle/beaa, air		
33. paper		peh, perr, pape		

Appendix F

Pre-training Procedure 2

Step	Tester's sound	Delay between middle & matching	Matching sound	Correct sound placement	Non-matching sound	Least to most prompts
1a	Sound 1: played 1st	3 s.	Sound 1: played 2nd	Left	Absent	Present
1b	Sound 2: played 1st	3 s.	Sound 2: played 2nd	Right	Absent	Present
1c	Sound 1: played 1st	3 s.	Sound 1: played 2nd	Right	Absent	Absent
1d	Sound 2: played 1st	3 s.	Sound 2: played 2nd	Left	Absent	Absent
2a	Sound 1: played 1st	5 s.	Sound 1: played 2nd	Left	Absent	Absent
2b	Sound 2: played 1st	5 s.	Sound 2: played 2nd	Right	Absent	Absent
2c	Sound 1: played 1st	5 s.	Sound 1: played 2nd	Right	Absent	Absent
2d	Sound 2: played 1st	5 s.	Sound 2: played 2nd	Left	Absent	Absent
3a	Sound 1: played 1st	N/a	Sound 1: played 3rd	Left	Pretend to play Sound 2 2nd	Absent
3b	Sound 2: played 1st	N/a	Sound 2: played 3rd	Right	Pretend to play Sound 1 2nd	Absent
3c	Sound 1: played 1st	N/a	Sound 1: played 3rd	Right	Pretend to play 2nd	Absent
3d	Sound 2: played 1st	N/a	Sound 2: played 3rd	Left	Pretend to play 2nd	Absent

Appendix F continued

Step	Tester's sound	Delay between middle & correct	Matching sound	Matching sound placement	Non-matching sound	Least to most prompts
4a	Sound 1: played 1st	N/a	Sound 1: played 2nd	Right	Pretend to play 3rd	Absent
4b	Sound 2: played 1st	N/a	Sound 2: played 2nd	Left	Pretend to play 3rd	Absent
4c	Sound 1: played 1st	N/a	Sound 1: played 2nd	Left	Pretend to play 3rd	Absent
4d	Sound 2: played 1st	N/a	Sound 2: played 2nd	Right	Pretend to play 3rd	Absent
5a	Sound 1: played 1st	N/a	Sound 1: alternate playing 2nd & 3rd	Alternate Left and Right	Alternate Pretend to play 3rd & 2nd	Absent
5b	Sound 2: played 1st	N/a	Sound 2: alternate playing 2nd & 3rd	Alternate Left and Right	Alternate Pretend to play 3rd & 2nd	Absent

Appendix G

The Multiple Component Training Procedure 2

Step	Position of experimenter[a]	Repetitions of correct word (tester and confederate)	Repetitions of non-matching word (confederate)	Bell Volume with "tack tack"	Word Volume
1	A	3	1	Full	T-T[b]=loud, W[c]= soft
2	B	3	1	Full	T-T=loud, W= soft
3	C	3	1	Full	T-T=loud, W= soft
4	C	3	2	Full	T-T=loud, W= soft
5	C	3	3	Full	T-T=loud, W= soft
6	C	3	3	Partly Muffled	T-T=loud, W= soft
7	C	3	3	Muffled More	T-T=loud, W= soft
8	C	3	3	Absent	T-T=loud, W= soft
9	C	3	3	Absent	T-T=loud, W= said twice: first soft, second loud
10	C	3	3	Absent	Correct word loud, incorrect regular volume

[a]Position A= beside correct confederate, Position B = Halfway between the centre of the table and the correct confederate, Position C = Centre of the table. [b]T-T = "tack-tack". [c]W = "wrench".

Appendix H

The Multiple Component Training Package 3[a]

Step	Experimenter says S^D	Confederate says matching word (S^+)	Confederate says non-matching word (S^-)	"Tack" said	"Wrench" said	Extra verbal prompt (EVP)	Order of words
1	-	-	-	-	-	+	EVP only
2	-	+	-	+	+	+	S^+ plus EVP
3	+	+	-	+	+	+	S^D, S^+ plus EVP
4	+	+ 2 second pause	-	+	+	+	S^D, pause, S^+ plus EVP
5	loud	loud	whisper	+	+	+	S^D, S^-, S^+ plus EVP
6	loud	loud	whisper	+	+	+	S^D, S^+ plus EVP, S-
7	loud	loud	whisper	+	+	+	S^D, randomly alternate S^+ plus EVP & S^-
8	loud	loud	soft voice	+	+	+	S^D, randomly alternate S^+ plus EVP & S^-
9	+	+	+	+	+	+	S^D, randomly alternate S^+ plus EVP & S^-
10	+	+	+	+	+	+ (soft voice)	S^D, randomly alternate S^+ plus EVP & S^-
11	+	+	+	+	+	+ (whisper)	S^D, randomly alternate S^+ plus EVP & S^-
12	+	+	+	+	+	-	S^D, randomly alternate S^+ & S^-
13	+	+	+	+'+[b] regular tone	+ regular tone	-	S^D, randomly alternate S^+ & S^-
14	+	+	+	+'+ regular tone	+ slowly, low tone, drawn out	-	S^D, randomly alternate S^+ & S^-
15	+	+	+	+'+ rapidly, high tone	+ slowly, low tone, drawn out	-	S^D, randomly alternate S^+ & S^-