Auditory Discrimination Learning with Developmentally Disabled Persons

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Table of Contents

Abstract

The Assessment of Basic Learning Abilities (ABLA) Test assesses the ease or difficulty with which individuals are able to learn a simple imitation and five two-choice discriminations that are hierarchically ordered in difficulty. It has been demonstrated that the ABLA Test is a useful assessment and training tool for developmentally disabled persons. Previous research suggests, however, that it may be worthwhile to add a bridging task between ABLA Level 4 - a visual-visual identity discrimination task, and ABLA Level 5 - an auditory-visual nonidentity discrimination task involving speech sounds. The present study focussed on this possibility. The proposed bridging task (an auditory matching task) involved presenting the participant with one of two "simple" sounds (the identity of which was randomly alternated across trials) and then requiring him or her to respond by manipulating one of two objects to produce a matching sound. The results of the present research suggest that the acquisition of auditory (speech) discriminations is a complex process that may be influenced by numerous factors, including developmental level and living environment. The present research did not conclusively demonstrate that learning a simpler auditory discrimination facilitated learning a more complex auditory (speech) discrimination. Directions for further research are suggested that could enhance the effectiveness of the ABLA as a practical assessment tool.

Recent behavioral research in developmental disabilities has focussed on several important areas, including: (a) the functional analysis and treatment of problem behaviors (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman, 1994; Vollmer, Marcus, & LeBlanc, 1994), (b) issues of choice and preferences (e.g., Fisher & Mazur, 1997; Lerman, Iwata, Rainville, Adelinis, Crosland, & Kogan, 1997), (c) self-instructional training for persons with developmental disabilities (e.g., Feldman & Case, 1997; Feldman, Ducharme, & Case, 1997), (d) behavioral training of parents with developmental disabilities (e.g., Feldman, 1994; Feldman, Case, Rincover, Towns, & Betel, 1989), (e) the assessment and training of communication skills (e.g., Barker-Collo, Jamieson, & Boo, 1995), and (f) the assessment and training of fundamental learning skills (e.g., McDonald & Martin, 1993; Stubbings & Martin, 1995; Walker & Martin, 1994). The latter area is particularly important in that if an individual does not acquire fundamental or basic learning skills, she or he will be unable to learn higher level adaptive skills that are integral to growth and development (e.g., communication and self-care skills).

Mastery of fundamental learning skills includes the ability to perform two-choice discriminations. In the developmental disabilities literature, an often cited concern is participants' failure to learn such discriminations (McDonald & Martin, 1993; McIlvane, Dube, Kledaras, Iennaco, & Stoddard, 1990; Saunders & Spradlin, 1989; Yu, Martin, & Williams, 1989). Failure to acquire appropriate discrimination skills typically precludes mastery of various adaptive skills, including communication, self-care, educational, and vocational skills (Kerr, Meyerson, & Flora, 1977).

In many cases, the failure to learn particular skills and tasks may be explained by examining the specific task requirements in relation to the learner's abilities. Kerr et al.

(1977) examined various tasks (e.g., self-care and educational tasks) presented to individuals with developmental disabilities, and determined that successful performance of these tasks required some or all of six operationally definable discrimination skills. They proposed that an individual's ability to master particular tasks could be predicted by first assessing his or her ability to perform basic discriminative skills using the Assessment of Basic Learning Abilities (ABLA) Test.

The Assessment of Basic Learning Abilities (ABLA) Test

The ABLA Test, commonly referred to as the ABLA (Kerr et al., 1977; formerly known as the Auditory Visual Combined [AVC] Discrimination Test), was developed as a method of assessing the ability of persons with a developmental disability to learn imitation and basic position, visual, and auditory discrimination skills. The ABLA includes six learning-to-learn tasks, and has proven to be a valuable tool for skill assessment, program placement, and remedial programming. The six tasks are: (a) Level 1, Imitation - the learner demonstrates imitation ability if the tester's behavior of placing an object into a container is imitated; (b) Level 2, Position Discrimination - when a yellow and a red container are presented in a fixed left-right position, the learner demonstrates position discrimination ability if a piece of foam is consistently placed into the same container; (c) Level 3, Visual Discrimination - when a yellow and a red container are presented with their left-right positions varied unsystematically, the learner demonstrates visual discrimination ability if a piece of foam is consistently placed into the same container, independent of its position; (d) Level 4, Visual Match-to-Sample Discrimination - when a round yellow container and a square red container are presented as comparison stimuli with their left-right positions varied across trials, and then a the same container, independent of its position; (d) Level 4, Visual Match-to-Sample Discrimination - when a round yellow container and a square red container are presented as comparison stimuli with their left-right positions varied across trials, and then a smaller red cube or yellow cylinder is presented as the sample stimulus, the learner demonstrates visual match-to-sample ability if the red cube is consistently placed in the red box and the yellow cylinder is placed in the yellow container; (e) Level 5, Auditory (speech) Discrimination - when a red box and a yellow can are presented in a fixed left-right position and one of two distinctive auditory stimuli is presented (i.e., the spoken words "red box" or "yellow can"), the learner demonstrates auditory discrimination ability if the manipulandum (a small piece of foam) is placed in the container that is named by the auditory stimulus; and (f) Level 6, Auditory-Visual Combined Discrimination - for example, when the left-right positions of the red box and yellow can are varied unsystematically, and either "red box" or "yellow can" is spoken (with the order of the two stimuli varied unsystematically), the learner demonstrates auditory-visual discrimination ability if the manipulandum is placed in the container that is named. The ABLA tasks are summarized in Table 1.

Table 1

Summary of ABLA tasks

ABLA Task Level	**Comparison Stimuli**	**Manipulandum/ Sample Stimulus**	**Response Required**
1 - Imitation	Red box; Yellow can (presented individually)	*Manipulandum:* Irregularly-shaped piece of foam	Imitate behavior of placing foam in either the red box or the yellow can
2 - Position Discrimination	Red box; Yellow can (presented together, with left-right position invariant across trials)	*Manipulandum:* Irregularly-shaped piece of foam	Place piece of foam in the same container (e.g., yellow can) across trials
3 - Visual Discrimination	Red box; Yellow can (presented together, with left-right position alternated across trials)	*Manipulandum:* Irregularly-shaped piece of foam	Place piece of foam in the same container (e.g., yellow can), regardless of position of container

(table continues)

ABLA Task Level	**Comparison Stimuli**	**Manipulandum/ Sample Stimulus**	**Response Required**
4 - Visual Match-to-Sample Discrimination	Red box; Yellow can (presented together, with left-right position alternated across trials)	*Manipulandum and sample stimulus:* small red cube or small yellow cylinder	Place red cube into red box or place yellow cylinder into yellow can
5 - Auditory (speech) Discrimination	Red box; Yellow can (presented together, with left-right position invariant across trials)	*Manipulandum:* Irregularly-shaped piece of foam *Sample stimulus:* spoken words "red box" or "yellow can"	Place piece of foam into the comparison stimulus that is related to the auditory stimulus
6 - Auditory-Visual Discrimination Combined	Red box; Yellow can (presented together, with left-right position alternated)	*Manipulandum:* Irregularly-shaped piece of foam *Sample stimulus:* "red box" or "yellow can"	Place piece of foam into the comparison stimulus that is related to the auditory stimulus

(table continues)

For all tasks: Passing criterion: 8 consecutive correct responses

Failure criterion: 8 cumulative incorrect responses

Since its development, the ABLA has proven to be a valuable tool for those working with individuals with developmental disabilities. Rather than simply evaluating an existing repertoire of skills, the ABLA was designed to assess the ability to learn the correct response for each in a series of progressively more difficult tasks. The six ABLA tasks were developed to be representative of the imitative and discriminative skills frequently required in educational and vocational training programs. In addition, the ABLA tasks are easy to administer and require only a nonlanguage, motor response. The latter feature is important in that many individuals with a developmental disability may be capable of performing various discriminations, but lack the receptive and/or expressive language skills necessary to demonstrate their knowledge. Finally, because the ABLA evaluates fundamental imitation and discrimination skills, it is especially useful for the assessment of individuals with severe and profound disabilities whose developmental age is at or below two to three years. The paucity of measures of learning ability that are suitable for use with this population has been cited as a deficit in the existing literature (e.g., Kerr et al, 1977; Lambert, 1990). In summary, the ABLA provides valuable information regarding an individual's ability to learn fundamental discrimination skills. This information can then be used to develop individualized educational and/or prevocational programs.

Research on the ABLA

Over the past 20 years, research has investigated a number of issues pertaining to the ABLA, including its hierarchical nature, its predictive validity, and the difficulties encountered in teaching failed levels of discrimination. These investigations have served a dual purpose: (a) to provide support for the use of the ABLA as an assessment and program planning tool, and (b) to provide direction for continued research.

ABLA tasks are hierarchical. It has been demonstrated that the ABLA tasks have a consistent hierarchical pass/fail pattern in the order listed previously (Kerr et al., 1977). With few exceptions, individuals with developmental disabilities who passed a certain level of discrimination also passed at lower levels of the hierarchy, whereas those who failed a particular level also failed at higher levels of the hierarchy (Kerr et al., 1977; Martin, Yu, Quinn, & Patterson, 1983; Wacker, Kerr, & Carroll, 1983; Yu et al., 1989). The consistent hierarchical ordering also has been demonstrated with hearing-impaired, multiply-handicapped clients when physical gestures were used in place of auditory cues (Wacker, 1981), with young normal children (Casey & Kerr, 1977), and with autistic children (Ward, 1994). Together, these studies demonstrated that the hierarchical structure among position, visual, and auditory discriminations was consistent for persons with mild to profound handicaps; for young, nondisabled children; and for persons with hearing impairments.

ABLA has predictive validity. It has been demonstrated that the ABLA is predictive of performance on classroom tasks, on measures of language development, on measures of communication behaviors, and on vocational tasks (Barker-Collo et al., 1995; Martin et al., 1983; Stubbings & Martin, 1995, 1998; Tharinger, Schallert, & Kerr, 1977; Wacker, 1981; & Wacker et al., 1983). For example, Tharinger et al. reported that performance on the ABLA typically predicted performance on a variety of educational tasks that required auditory or auditory-visual discrimination skill, and Meyerson (1977) described a relationship between ABLA results and performance on a reading readiness test. Barker-Collo et al. reported that ABLA performance was related to performance on the Vineland Adaptive Behavior Scales of receptive and expressive communication. Research has also investigated the value of utilizing the ABLA in vocational training settings. Results from these investigations have indicated that, with few exceptions, performance on the ABLA predicted performance on prevocational and vocational training tasks (e.g., Martin et al., 1983; Wacker et al., 1983; Stubbings & Martin, 1995). Moreover, recent research by Stubbings and Martin (1998) demonstrated that performance on the ABLA was a significantly better predictor of performance on vocational training tasks as compared to the subjective judgements of staff who worked with individuals with developmental disabilities in a teaching or vocational setting. It also has been demonstrated that if an individual has not consistently demonstrated the ability to perform a particular type of discrimination, then tasks requiring that skill are typically learned slowly or not at all when standard prompting and reinforcement procedures are used. Collectively, this body of research demonstrates that an important characteristic of the ABLA is that it is predictive of performance on various adaptive learning tasks.

Failed ABLA levels are difficult to teach. Meyerson (1977) reported that attempts to teach a failed level of discrimination using standard prompting and reinforcement procedures required between 100 and 900 training trials before the new discrimination was mastered, if it was learned at all. Similar difficulties in teaching new levels of discrimination were reported by Wacker et al. (1983), Yu and Martin (1986), and Stubbings and Martin (1995). In particular, the ABLA levels requiring auditory discrimination ability have been the most difficult for learners to acquire and also have been considerably difficult to teach, despite the use of multi-component packages designed to address common problems such as stimulus overselectivity (e.g., Witt & Wacker, 1981; Walker, Martin, & Graham, 1991). The difficulty encountered in teaching failed levels of discrimination has prompted researchers to continue investigating effective methods of facilitating new learning.

Auditory Discrimination Ability

Kerr et al. (1977) suggested that all of the skills evaluated by the ABLA are important for persons with developmental disabilities in that these skills are required to successfully master various self-care, communication, educational, and vocational skills. Auditory discrimination ability appears to be particularly important as it is a prerequisite for many adaptive behaviors, including behaviors involved in responding to various sounds and words (e.g., attending to a speaker when one's name is spoken, responding to a fire alarm, or following instructions). The ability to respond appropriately to auditory stimuli enhances an individual's ability to interact competently and independently with his or her environment, and decreases reliance on tactics such as visual prompting and physical guidance (Hupp, Mervis, Able, & Conroy-Gunter, 1986; Kerr et al., 1977).

Furthermore, responsiveness to auditory stimuli is often a prerequisite for progress in educational and vocational programs (Meyerson, 1977).

Auditory discrimination ability is also important as it is a fundamental prerequisite for receptive and expressive language. As summarized by Casey and Kerr (1977), increasingly complex auditory discriminations are a prerequisite for comprehension of the spoken word, which typically precedes production of the spoken word. Owens and Rogerson (1988) also noted the hierarchical nature of communication behaviors, with receptive language skills typically preceding functional expressive language skills. While nonhandicapped individuals typically develop these discrimination and language skills with age and experience, many individuals with severe and profound handicaps are noted to have significant deficits in communication skills, including receptive and expressive language skills (Grossman, 1983; cited in Calculator, 1988; McIlvane, Bass, O'Brien, Gerovac, & Stoddard, 1984).

In addition to being one of the more important skills for the learner with a developmental disability, auditory (speech) discrimination ability appears to be the most difficult component of the ABLA hierarchy to acquire (Kerr et al., 1977). Of 117 individuals with developmental disabilities included in Kerr et al.'s original sample, approximately one-half failed those levels requiring auditory (speech) discrimination ability (i.e., Levels 5 and 6). Moreover, as reported previously, auditory discrimination ability has typically been the most difficult of the ABLA skills to teach. Witt and Wacker (1981) reported that attempts to teach a failed auditory discrimination using a visual prompt-fading procedure were unsuccessful, even after participants had received, on average, more than 500 training trials each. Similarly, Walker et al. (1991) reported that some participants demonstrated difficulty learning an auditory (speech) discrimination, despite the use of a multi-component training procedure and hundreds of training trials.

Difficulties Associated with Auditory Discrimination Tasks

As the preceding body of research documents, teaching a failed auditory (speech) discrimination has proven to be a challenging task. There are a number of factors that may contribute to the difficulty level of these tasks, including: (a) the abstract and complex nature of auditory (speech) stimuli, (b) the arbitrary relationship between the auditory stimulus (e.g., spoken word) and its referent (e.g., an object), and (c) stimulus overselectivity. Each of these factors is discussed further below.

Complexity. Auditory discriminations require the learner to respond to complex and abstract stimuli. As noted in previous research, auditory (speech) stimuli are complex cues that can vary along numerous dimensions, including intonation, rate, manner of articulation, pitch, volume, duration, and phonetic content (Reynolds, Newsom, & Lovaas, 1974; Schreibman, Kohlenberg, & Britten, 1986). Thus, auditory (speech) discriminations require the learner to differentiate between complex, multi-dimensional cues. In comparison, many nonspeech auditory stimuli (e.g., object sounds, music sounds) are considerably less complex and require the learner to attend to fewer dimensions.

Arbitrary relationships. Auditory discrimination tasks typically require the participant to learn an arbitrary relationship between an auditory sample stimulus (e.g., the spoken words "red box") and its referent (e.g., a red, square-shaped container). There is no physical similarity between the sample and comparison stimuli, thus the individual must learn to relate the two stimuli arbitrarily, guided only by experimental contingencies (i.e., differential consequences following correct and incorrect responses). As reported by Saunders and Spradlin (1989), it is not uncommon for developmentally disabled learners to easily learn to match a comparison stimulus to an identical sample, but then fail to master a task in which the sample and comparison stimuli are related only on an arbitrary basis. Smeets and Lancioni (1984) also noted that discrimination tasks involving iconic stimuli (i.e., stimuli that are obviously related to each other) were typically learned more rapidly relative to tasks involving highly symbolic stimuli such as spoken or written words. In general, an "identity" matching task in which the sample and correct comparison stimulus are identical is considered to be easier to learn than a "nonidentity" or arbitrary matching task in which the sample and correct comparison stimulus are related but are different on some dimension(s) (Keogh & Reichle, 1985; cited in Mirenda & Locke, 1989).

The ABLA Level 5 auditory (speech) discrimination task is an example of a nonidentity matching task that requires learners to match a symbol (e.g., the spoken words "red box") to its referent (e.g., a red, square-shaped container). Previous research regarding the hierarchical ordering of the ABLA tasks has confirmed that the Level 5 nonidentity matching task is indeed more difficult than both a visual identity matching task (i.e., ABLA Level 4 - Visual Match-to-Sample) and an auditory matching task that involves the learner manipulating an object (i.e., one of two visual comparison stimuli) to produce a sound that matches the sound presented as the sample stimulus (Walker, Martin, & Lin, 1994).

Stimulus Overselectivity.. Another factor that appears to contribute to the difficulty of auditory (speech) discrimination tasks is stimulus overselectivity, a term originally proposed by Lovaas, Schreibman, Koegel, and Rehm (1971) to describe the tendency of individuals to selectively respond to a one or a limited number of stimuli in situations in which multiple stimuli are present. In subsequent research, Rincover, Feldman, and Eason (1986) described stimulus overselectivity as a stimulus control deficit in which behavior does not come under the control of all of the relevant environmental cues; rather, behavior is controlled by only a limited portion of the available stimuli. Bickel, Stella, and Etzel (1984) suggested that stimulus overselectivity is not simply a consequence of limited stimulus control, but is also an indication that behavior is controlled by a stimulus control hierarchy in which S elements are higher in the hierarchy than the intended S^D elements (i.e., the learner is responding to stimuli that were not intended to function as controlling stimuli).

Since Lovaas et al. (1971) initially described the phenomenon of stimulus overselectivity, subsequent research has furthered our understanding of its nature and the conditions under which it is more likely to occur. For example, it has been observed that stimulus overselectivity is a function of developmental level, rather than being associated with a particular diagnosis such as autism (Frith & Baron-Cohen, 1987; Kolko, Anderson, & Campbell, 1980; Rincover & Ducharme, 1987; Schover & Newsom, 1976; Wilhelm & Lovaas, 1976). The behavior of individuals with a higher level of functioning more frequently comes under the control of a broader array of relevant stimulus variables, whereas individuals with a lower level of functioning (i.e., those individuals with severe and profound disabilities) are more likely to exhibit stimulus control deficits.

A number of studies have examined stimulus overselectivity in relation to the number of stimuli present and the modality in which they are presented. Research has indicated that stimulus control deficits are more likely to be exhibited as the number of relevant stimuli increases (e.g., Lovaas et al., 1971; Lovaas & Schreibman, 1971). Overselective responding has been demonstrated in learning situations involving two cues (e.g., Lovaas & Schreibman, 1971), multiple cues presented in the visual modality (e.g., Koegel & Wilhelm, 1973), and multiple cues presented in the auditory modality (e.g., Reynolds, Newsom, & Lovaas, 1974). Together, these studies indicate that stimulus overselectivity is more likely to occur as the number of cues increases but is not peculiar to any sensory modality.

Research has also sought to clarify the relationship between stimulus overselectivity and the nature of stimulus components present in the learning situation. Rincover et al. (1986) proposed that in addition to the number of stimulus components present, the proximity of stimuli was a relevant variable. It was hypothesized that participants' responding would be more reliably controlled by each component of a multidimensional discriminative stimulus when individual components were presented in close proximity relative to when there was greater distance separating the components. The results supported this hypothesis: The extent to which responding was controlled by each feature of a multidimensional discriminative stimulus (i.e., a visual stimulus with three components) depended upon the distance between the components. Specifically, autistic children responded to all three components when the components were presented in close proximity, but exhibited overselective responding when there was a greater distance between the components. Rincover et al. proposed the notion of "tunnel vision" to describe the stimulus control deficit observed when elements of a complex discriminative stimulus were not presented in close proximity to each other.

A consequence of stimulus overselectivity is that relevant environmental stimuli may remain neutral or nonfunctional in controlling behavior or facilitating new learning. For example, in order to develop functional receptive and expressive language skills, an individual must attend to numerous relevant variables (e.g., phonetic content, pitch, rate). If, however, the individual is overselective in his or her attention to particular stimulus variables that are less relevant (e.g., attending to tone rather than content of spoken words), the ability to correctly learn auditory (speech) discriminations would be limited. As noted by Schreibman et al. (1986), difficulties in learning to respond to and produce spoken words may occur if an individual selectively responds to any one element of the multidimensional auditory (speech) stimulus. More generally, when behavior comes under the control of fewer and/or irrelevant stimuli, an individual will be more likely to exhibit a variety of behavioral deficits (e.g., social and language deficits).

As the previous sections illustrate, there are a number of factors that contribute to the difficulty involved in mastering auditory (speech) discrimination tasks, such as the tasks at Levels 5 and 6 of the ABLA hierarchy. It is also apparent that the absence of these skills can result in numerous deficits. It seems that a worthwhile endeavour, therefore, will be to investigate methods to assist persons unable to pass these ABLA tasks in mastering these skills. Examination of the Level 4 and 5 tasks indicates that there are a number of differences in the requirements for mastery of these tasks. The Level 4 task (Visual Match-to-Sample) involves presenting the learner with two comparison stimuli (i.e., a red square-shaped container and a yellow round-shaped container). Next, either a small red cube or yellow cylinder is presented as the sample stimulus. The sample and comparison stimuli are present throughout the trial. The visual matching discrimination at Level 4, therefore, requires the learner to make a simultaneous, visual-visual identity match with color, shape, and size as relevant stimulus dimensions. In the Level 5 auditory (speech) discrimination task, the same visual comparison stimuli are presented, an auditory sample stimulus is presented once (i.e., the spoken words, either "red box" or "yellow can"), then the learner has the opportunity to respond by placing the manipulandum in one of the containers. Level 5, therefore, requires the learner to make a delayed / successive, auditory-visual nonidentity match with phonetic content, pitch, and rate as relevant auditory cues, and with position, colour, shape, and size as relevant visual cues. (Note - Although the ABLA Level 5 task has been identified as the auditory [speech] discrimination level in previous ABLA research, it is more correctly described as an auditory-visual discrimination task as it requires the learner to relate an auditory to a visual stimulus. However, in order to be consistent with previous ABLA research, the Level 5 task will typically be referred to as an auditory [speech] discrimination task in this paper).

As described in the preceding section, ABLA Levels 4 and 5 are different on three dimensions: (a) simultaneous versus delayed/successive presentation of sample and comparison stimuli, (b) within versus cross-modal presentation of sample and comparison stimuli, and (c) identity versus nonidentity matching. These differences in task requirements may result in a relatively large "gap" between Levels 4 and 5 for learners to bridge as they progress through the ABLA hierarchy. Given these differences, it was suggested that a learner may benefit from the addition of a task (or tasks) that would serve a bridging function between Levels 4 and 5 (Walker et al., 1994). The present research examined one possible bridging task, an auditory-visual nonidentity (sound) matching task (also referred to in the present research simply as an auditory matching task) that utilized object sounds rather than speech sounds, and in which a correct response produced a "matching" sound (i.e., a correct response resulted in the production of a sound that was the same as the sound produced by the auditory sample stimulus).

An Auditory-Visual Discrimination to Produce a Matching Sound: A Worthwhile Addition to the ABLA Test?

Walker et al. (1994) proposed an auditory matching task as an adjunct to the ABLA. Given the complex nature of the original Level 5 task, the matching task was developed as a less complex auditory-visual discrimination task. Rather than utilizing complex speech cues as stimuli, simpler object sounds were used. First, a table bell (that produced a bell sound when manipulated) and a tambourine (modified to produce a drum sound when manipulated) were placed on a table in front of the learner. An auditory sample stimulus was then presented (i.e., either a bell sound or a drum sound, identical to that produced by one of the comparison stimuli) until the learner responded by manipulating one of the comparison stimuli. If, for example, a bell sound was presented as the sample stimulus, a correct response required the learner to visually discriminate (bell versus tambourine) and then manipulate the bell comparison stimulus to produce a matching bell sound. In summary, the proposed bridging task between ABLA Levels 4 and 5 is similar to Level 5 in that it is an auditory-visual nonidentity matching task, but different from Level 5 in two respects: (a) it utilizes a simpler auditory stimulus (i.e., sound stimuli), and (b) a correct response produces an additional consequence of a matching sound. Hereafter, for the purposes of brevity and consistency with previous research, the task will be referred to either as the auditory matching task or as the bell-tambourine task (to reflect the specific stimuli used in the task).

As indicated previously, there are differences between the auditory (sound) matching task and ABLA Level 5 in the consequences for correct responses. In both tasks, correct responses are followed by praise, however, the auditory matching task includes the additional consequence of the production of a matching sound (e.g., a drum sound). The pairing of the production of a matching sound with praise and intermittent edibles across trials may establish the matching sound as a conditioned reinforcer (Martin & Pear, 1996). Moreover, the relationship between the response (e.g., banging a tambourine) and the subsequent consequence (e.g., production of a drum sound) is functional rather than arbitrary. In previous discrimination learning research (e.g., Koegel & Williams, 1980), some learners acquired new skills more quickly when a functional rather than arbitrary response-consequence relationship was included. The use of simpler auditory cues and a functional response-consequence relationship are both factors that may facilitate mastery of the bell-tambourine task.

A number of arguments support the proposal that the inclusion of an auditory matching task in the ABLA hierarchy may be beneficial for the learner. First, Casey and Kerr (1977) noted that increasingly complex auditory discriminations are one of the prerequisites for speech comprehension. It is reasonable to suggest that the ability to perform auditory discriminations involving simple sounds is a prerequisite for the acquisition of more complex auditory discriminations, such as the ABLA Level 5 (speech) discrimination. This suggestion is in accordance with the "Christmas Tree" model proposed by Kerr (1977) to explain increasingly complex repertoires of behavior. In this model, branches at different levels of the trunk represent different, and increasingly complex, classes of discriminative stimuli that influence behavior (e.g., kinesthetic, visual, and auditory stimuli represent branches at different levels of the tree). At any particular level, there are different forms of discriminative stimuli, with some being more complex than others. For example, within the auditory stimulus class, Kerr differentiated between pure tone and speech stimuli, with the latter being a more complex auditory stimulus.

Second, support for the inclusion of an auditory matching task with simple sounds comes from previous research which suggests that ABLA performance predicts generalization to other tasks requiring similar types of discrimination abilities. It has been demonstrated that once the initial discrimination at a particular level has been mastered, additional and more complex discriminations at that level will be learned more readily (Kerr, 1977; Meyerson & Kerr, 1977; Witt & Wacker, 1981). If an auditory discrimination involving a bell and a drum sound is simpler than an auditory speech discrimination, learners who have acquired auditory matching ability might learn additional and more complex auditory discriminations with greater ease relative to those who have not.

As the preceding sections illustrate, there are a number of persuasive arguments to support the inclusion of an auditory matching task in the ABLA hierarchy. However, in order to thoroughly evaluate the value of such an addition, it was necessary to address a number of issues. These issues are discussed below.

Placement of the bell-tambourine task in the ABLA hierarchy. As suggested, it may be beneficial to include a task in the ABLA hierarchy that would serve a bridging function between Levels 4 and 5. A first step, therefore, was to develop a task that required an auditory-visual discrimination to produce a matching sound, and then to assess a group of learners on this task to determine whether their pass-fail performance would consistently place the task at the appropriate level within the ABLA hierarchy. The bell-tambourine task described previously was administered to 31 individuals with developmental disabilities, using the same format as the ABLA tasks (Walker et al., 1994). Although this sample was smaller than in the original research by Kerr et al. (1977; n=117), results supported the positioning of the bell-tambourine task between Level 4 (Visual Match-to-Sample Discrimination) and Level 5 (Auditory [speech] Discrimination). All participants who passed ABLA Level 5 also passed the bell-tambourine task, while those who failed Level 4 also failed the bell-tambourine task. In this investigation, the critical group of interest consisted of 8 participants who passed ABLA Levels 1 through 4 but failed Levels 5 and 6. If the new auditory-visual discrimination task (i.e., auditory matching task) is an intermediary between ABLA

Levels 4 and 5, it was expected that some learners in the critical group would pass the task while others would fail. Of the eight participants in this group, three passed the bell-tambourine task and five failed. These results, therefore, confirmed the hypothesis that the bell-tambourine task was more difficult than the Level 4 visual match-to-sample task, but easier than the Level 5 auditory (speech) discrimination task.

Predictive ability of the bell-tambourine (auditory-visual matching) task. It has been reported that an important feature of the ABLA is its predictive validity (McDonald & Martin, 1993, Stubbings & Martin, 1995; Yu et al., 1989). Previous research has demonstrated that pass-fail performance on ABLA tasks typically predicts performance on various tasks requiring the same type of discrimination ability. For example, in research conducted by Stubbings and Martin (1998), 18 participants with developmental disabilities were initially assessed on the ABLA and were then presented with 12 training tasks that had been preselected such that there were two tasks that required the same discrimination skills as each of the six ABLA tasks (e.g., for two training tasks, the highest level of discrimination required to master the task was Level 3 - visual discrimination ability; for two tasks, the highest level of discrimination required to master the task was Level 4 - visual match-to-sample discrimination ability, and so forth). The authors reported that ABLA performance predicted performance on the training tasks in 90% of the cases (phi-coefficient of .80). Tharinger et al. (1977) reported similar findings in a study with 11 participants in which the ABLA was administered prior to a series of classroom tasks. They predicted that: (a) participants would be able to master tasks that required discrimination skills that had been passed on the ABLA, but (b) be unable to master tasks that required discrimination skills that had not been demonstrated during

ABLA assessment. Overall 84% of the predictions were confirmed. In addition to the preceding examples, the predictive ability of ABLA tasks was also addressed in research by Wacker et al. (1983; n=7). Although sample sizes in these studies have been relatively small, the consistency of the findings supports the conclusion that performance on the ABLA is an effective method of predicting performance on subsequent tasks. In order to consider the bell-tambourine task as a useful adjunct to the ABLA, it was therefore important to evaluate whether this task had similar predictive properties. That is, it was necessary to evaluate whether performance on the auditory matching task predicted performance on similar auditory-visual discrimination tasks.

This issue was partially addressed in previous research in which it was reported that participants' performance on the bell-tambourine task predicted performance on similar tasks (Walker et al., 1994). Participants were initially assessed on the ABLA and the bell-tambourine task, and were then presented with additional auditory (sound) discrimination tasks that involved stimuli frequently present in the participants' daily environment (e.g., sounds produced by various toys, a telephone) and in which the correct response produced a matching sound. Four participants who mastered the bell-tambourine task also mastered the additional sound discriminations, while four participants who failed the bell-tambourine task also failed to learn the sound matching discriminations. Although the sample size was relatively small (n=8), these results suggested that, similar to the existing ABLA tasks, the auditory matching task has predictive validity.

Does mastery of the bell-tambourine task facilitate learning additional auditory (speech) discriminations? An additional issue to be evaluated was whether auditory matching ability (as demonstrated by mastery of the bell-tambourine task) enabled the learner to more readily acquire complex auditory discriminations, such as the ABLA Level 5 auditory (speech) discrimination. The difficulty associated with teaching new levels of discrimination is well documented, and the need for additional research on teaching auditory discriminations has been cited in previous investigations (e.g., Meyerson, 1977; Witt & Wacker, 1981; Walker et al., 1991). Particularly for severely and profoundly handicapped clients with significant deficits in receptive and expressive language, there is a need for strategies that will facilitate acquisition of these skills.

<u>Statement of the Problem</u>

The specific purpose of the present research was to investigate whether the ability to perform an auditory (sound) discrimination (i.e., an auditory matching task such as the bell-tambourine task) facilitated learning a more complex auditory (speech) discrimination, such as the ABLA Level 5 task. It was hypothesized that participants who passed the bell-tambourine task (and thereby demonstrated auditory matching ability) would learn an ABLA Level 5 analog task (i.e., an auditory [speech] discrimination) in fewer trials relative to participants who did not pass the auditory matching task.

Three groups of participants were evaluated on their ability to learn an ABLA Level 5 analog task. Initially, participants for all groups met identical selection criteria in that they passed ABLA Levels 1 - 4 and failed Levels 5 and 6. For the purpose of the present study, the key difference between participants was whether the auditory matching (i.e., bell-tambourine) task was passed or failed. Group 1 consisted of participants who passed ABLA Levels 1 through 4 but failed the bell-tambourine task and ABLA Levels 5 and 6. Group 2 also consisted of participants who passed ABLA Levels 1 through 4 but failed the bell-tambourine task and ABLA Levels 5 and 6, however, these participants received training on a task similar to the bell-tambourine task until they passed that training task and, subsequently, passed the bell-tambourine task. Group 3 consisted of participants who passed ABLA Levels 1 through 4 and the bell-tambourine task but failed ABLA Levels 5 and 6. The rationale for having three groups was twofold: (a) to investigate whether participants who demonstrated auditory matching ability (i.e., Group 3 participants and Group 2 participants subsequent to training) were able to master a Level 5 analog task more quickly relative to those participants who had not demonstrated this ability (i.e., Group 1 participants); and (b) to evaluate whether there were differences in the acquisition of the Level 5 analog task between participants who demonstrated auditory matching ability at the time of the initial assessments (i.e., Group 3 participants) and participants who demonstrated this ability after explicit training (i.e., Group 2 participants).

After a series of initial assessments and training steps (to be described in forthcoming sections), the three groups were compared on their trials to criterion on a Level 5 analog task similar to the ABLA Level 5 auditory (speech) discrimination task. The strategy of training on an auditory matching task and then testing on the bell-tambourine task, and the strategy of training on a Level 5 analog task and then testing on ABLA Level 5, rather than directly training on the bell-tambourine task and Level 5, was done to facilitate comparisons to previous ABLA research. That is, in three previous studies (Hazen, Szendrei, & Martin, 1989; Walker et al., 1991; Yu & Martin, 1986) that investigated multi-component training procedures for teaching failed ABLA levels, two of the training components necessitated that modifications be made to the normal ABLA training apparatus. Therefore, those researchers adopted the strategy of training on an analog task and testing on the corresponding ABLA level. To facilitate comparisons to previous ABLA research, that strategy was followed in the present research.

Method

Participants

Participants were individuals with a developmental disability from two residential facilities and a community sheltered workshop (age range: 16 to 64 years). Individuals were selected to participate if the following criteria were satisfied: (a) they passed ABLA Levels 1 - 4 but failed ABLA Levels 5 and 6, (b) their hearing was within normal limits (according to information obtained from chart records), (c) they did not exhibit significant behavior problems (e.g., self-injurious behavior), and (d) their parent(s) and/or legal guardian(s) provided their written consent for research participation (see Appendixes A and B for Information and Consent forms). Over the course of the study, 84 individuals from three sites were assessed on the ABLA, with 17 meeting the initial selection criteria. Of the latter group, 5 individuals did not participate in the entire study due to ongoing problems with compliance during training sessions (e.g., noncompliance with task requirements) and/or refusals to attend sessions.

Of the 12 participants who remained in the study, eight passed ABLA Levels 1 through 4, but failed the bell-tambourine task and ABLA Levels 5 and 6. These participants were randomly divided into two groups of 4 participants, hereafter referred to as Groups 1 and 2. Groups 1 and 2 differed in that Group 2 participants were subsequently provided with training on an auditory matching task (analogous to the bell-tambourine task) while Group 1 participants were not provided with explicit training, but were exposed to the same auditory stimuli used in the auditory matching training task (these procedures are described in subsequent sections). Four of the 12 participants, referred to as Group 3, passed ABLA Levels 1 through 4 and the bell-tambourine task, but failed ABLA Levels 5 and 6. Characteristics of each participant are summarized in Table 2. In subsequent sections, participants are identified according to their group membership (i.e., Participants from Group 1 are identified as Participant 1-1, 1-2, 1-3, and 1-4; individuals from Group 2 are identified as Participant 2-1, 2-2, and so forth).

Table 2

Characteristics of Participants

Participant I.D.	Group	Age (yrs)	Sex	Diagnosis	Living Situation
1-1	1	38	M	Severe MR	long-term residential care
1-2	1	64	M	Severe MR	long-term residential care
1-3	1	16	M	Severe MR	long-term residential care
1-4	1	55	M	Severe MR	long-term residential care
2-1	2	26	F	Severe MR / Autism	long-term residential care
2-2	2	34	F	Severe MR / Autism	long-term residential care
2-3	2	32	M	Mild MR	family home
2-4	2	33	M	Severe MR/ Autism	long-term residential care
3-1	3	28	F	Severe MR	long-term residential care
3-2	3	30	F	Mild MR	family home
3-3	3	35	M	Moderate MR	long-term residential care
3-4	3	31	M	Mild MR	family home

(table continues)

Participant I.D.	Communication Characteristics	Highest ABLA Level passed	Initial status on bell-tambourine task
1-1	some speech sounds (unintelligible speech)	4	F
1-2	some vocalizations (unintelligible speech)	4	F
1-3	nonspeaking	4	F
1-4	mainly echolalic speech	4	F
2-1	mainly echolalic speech	4	F
2-2	nonspeaking (some gestures)	4	F
2-3	some phrases, mainly echolalic speech	4	F
2-4	nonspeaking	4	F
3-1	vocalizations but no intelligible speech	4	P
3-2	limited functional speech	4	P
3-3	functional speech	4	P
3-4	some functional speech & some echolalic speech	4	P

Setting

Assessment and training sessions were conducted in a quiet location that was physically separate from the individual's usual living or working environment (e.g., staff meeting rooms, testing rooms) . The exact dimensions of the rooms utilized varied depending upon the setting (i.e., residential setting or workshop). During sessions, the participant was seated in a chair or wheelchair at a table, with his or her chair placed directly across from the experimenter's. For some sessions, an additional observer (or observers) was seated adjacent to the participant to collect interobserver reliability data.

Materials and Procedure

Overview of Sequence of Assessment and Training Conditions

Initially, all participants were evaluated on the ABLA and the bell-tambourine task, and an assessment of potential reinforcers was conducted. Based on their performance on the ABLA and bell-tambourine task, participants were classified into groups (as outlined in previous section), each of which was exposed to a slightly different sequence of training conditions.

Subsequent to initial assessments and prior to training on a Level 5 auditory discrimination analog task, Group 2 participants (who initially failed the bell-tambourine task) received training on a task similar to the bell-tambourine task (the training task is hereafter referred to as the auditory matching training task). After achieving mastery criterion on the auditory matching training task, Group 2 participants received training on an ABLA Level 5 analog task. Group 1 participants (who also initially failed the bell-tambourine task) were provided with exposure to the same auditory stimuli used in the auditory matching training task but were not explicitly trained on this task. Exposure was provided in order to ensure that all Group 1 and 2 participants had experience with the auditory stimuli so as to control for the effects of exposure alone. Next, Group 1 participants received training on the ABLA Level 5 analog task. Group 3 participants (who passed the bell-tambourine task at the time of the pretest) proceeded directly to training on the ABLA Level 5 analog task. Therefore, the terminal step in the training sequence for all groups involved training on a ABLA Level 5 analog task. The sequence of training conditions for each of the three groups is summarized in Table 3 and additional information regarding the procedures employed is provided in subsequent sections.

Table 3

Sequence of assessment and training conditions

Assessment of Basic Learning Abilities (ABLA)		
Assessment on the bell-tambourine task (B-T task)		
Preference Assessment of Potential Reinforcers		
Group 1	Group 2	Group 3
Pass ABLA 1-4 Fail ABLA 5-6 Fail B-T task	Pass ABLA 1-4 Fail ABLA 5-6 Fail B-T task	Pass ABLA 1-4 Fail ABLA 5-6 Pass B-T task
Exposure to auditory stimuli used in auditory matching training task	Training on auditory matching task	
	Pass B-T task	
Training on 1st Level 5 analog task	Training on 1st Level 5 analog task	Training on 1st Level 5 analog task
ABLA posttest	ABLA posttest	ABLA posttest
If fail ABLA posttest, training on 2nd Level 5 analog task	If fail ABLA posttest, training on 2nd Level 5 analog task	If fail ABLA posttest, training on 2nd Level 5 analog task
ABLA posttest	ABLA posttest	ABLA posttest

Assessment of Basic Learning Abilities (ABLA)

The six ABLA tasks utilized two containers and three manipulanda: a yellow can measuring 13.0 cm in diameter and 16.5 cm in height, a red box with dark red stripes measuring 15.0 cm x 15.0 cm x 10.0 cm, a small yellow cylinder measuring 7.5 cm x 2.5 cm, a small red cube with dark red stripes measuring 3.2 cm x 3.2 cm x 3.2 cm, and a small piece of irregularly shaped sponge material. Data recording forms identical to those used by Kerr et al. (1977) were used for data collection for the ABLA (see Appendix C).

At the beginning of each of the six tasks, a participant was provided with a demonstration of the required response, a physically guided trial, and an opportunity to respond independently. Following a correct independent response by the participant, assessment trials were conducted and scored according to the protocol developed by Kerr et al. (1977). Correct responses were consistently followed by praise and intermittently by edibles (e.g., once every third correct response). Incorrect responses were consequated with an error correction procedure consisting of a demonstration trial, a physically guided trial, and an independent response trial. Error correction trials were repeated until either the error was corrected or the participant reached the failure criterion (described below). If no response occurred within 15 seconds, the trial was repeated.

For each of the six tasks, these procedures continued until either eight consecutive correct responses (passing criterion) or eight cumulative errors (failure criterion) occurred. The probability of passing a two-choice task by chance, when successive trials are independent of earlier trials, is 1 in 256 trials (i.e., 0.004). The failure criterion was designed such that if the learner failed, it was only after repeated correction trials and not as a result of a failure to respond.

Bell-Tambourine Assessment

During trials, a bell and tambourine were placed 45.0 cm apart on the tabletop in front of the participant, and remained equidistant from the participant during testing. A bell and tambourine were also placed side by side at the experimenter's feet, out of sight of the participant. The tambourines were modified so as to produce a drum sound. Each auditory matching trial began with the experimenter saying the participant's name and providing the instruction "make the same sound." The experimenter then presented an auditory sample stimulus (either a bell or drum sound was produced using foot movements to manipulate either a bell or modified tambourine placed under the table and out of sight of the participant). The participant was required to respond by manipulating either the bell or the tambourine on the tabletop to produce a sound.

At the beginning of the task, the participant was provided with a demonstration of the required response, a physically guided trial, and an opportunity to perform the response independently. Following one correct response to each stimulus, scored test trials commenced and were conducted as described in the preceding paragraph. The identity of the auditory stimulus presented by the experimenter across trials (i.e., bell or drum sound) varied unsystematically according to the data sheet (see Appendix D). Responses were defined as correct if the participant produced a sound that matched the sound presented by the experimenter (e.g., if the experimenter presented a bell sound, a matching response consisted of the participant also producing a bell sound). Responses were defined as incorrect if the participant produced a sound unlike the sound presented by the experimenter (e.g., if the experimenter presented a drum sound and the participant responded by producing a bell sound). Correct and incorrect responses were consequated according to the ABLA protocol. These procedures continued until either eight consecutive correct responses (pass criterion) or eight cumulative errors occurred (fail criterion). Pass-fail criteria were based on Kerr et al.'s (1977) criteria for the ABLA.

Preference Assessment of Potential Reinforcers

Subsequent to initial ABLA and bell-tambourine assessments and prior to further training, a preference assessment of potential reinforcers was conducted with each participant using a protocol adapted from research conducted by Green, Reid, White, Halford, Brittain, and Gardner (1988). Stimuli selected for inclusion in the preference assessment were based on: (a) recommendations from caregivers, (b) use in previous research as reinforcers with developmentally disabled learners, (c) availability and ease of presentation, and (d) an attempt to include stimuli representing a variety of types of sensory input. Examples of stimuli and their presentation format are provided in Table 4.

Table 4

Presentation Format for Assessment of Stimulus Preferences

Stimulus	Presentation Format
Hug	Experimenter places both hands around upper arms of participant
Verbal interaction	Experimenter talks to learner for 5 s
Juice	Experimenter places juice in visual field of participant, or places juice cup to side of participant's cheek
Edible	Experimenter places edible in visual field of participant, or places edible in hand and brings hand towards participant
Music	Tape player with music presented to participant
Hand Clap	Experimenter claps hands 3-5 times to the front, left, and right side of participant
Pictures	Experimenter places pictures (e.g., books, magazines) within visual field of participant
Stuffed toy	Experimenter touches stuffed toy to participant's arm, and places stuffed toy on participant's table top
Mechanical toy	Experimenter activates toy for 5 s within visual field of participant
Vibration	Experimenter places participant's hand on vibration device for 5 s

Each of the 10 stimuli was presented on 20 occasions during the preference assessment. Each assessment session consisted of five presentations of five stimuli (25 trials in total), with the order of stimulus presentation varying unsystematically during each session. On each assessment trial, the experimenter presented a stimulus to the participant and subsequently observed him or her for 10 s to monitor the occurrence of approach or avoidance behaviors. Approach behaviors were defined as the participant: (a) making an apparently voluntary body movement towards the stimulus (e.g., leaning towards stimulus, turning head towards stimulus), (b) contacting the stimulus for at least 3 s, (c) exhibiting a positive facial expression (e.g., smile), and/or (d) producing a positive vocalization (e.g., laughter). Avoidance behaviors included the participant: (a) pushing the stimulus away or making a movement away from the stimulus (e.g., turning head away), and/or (b) producing a negative vocalization (e.g., crying). Data recording forms used for the preference assessment are shown in Appendix E.

For each participant, after all assessment sessions were completed, the percentage of approach behaviors to each stimulus was calculated by dividing the frequency of approach behaviors to a particular stimulus by the total number of times the stimulus was presented, A stimulus was designated as "preferred" if the participant approached it on at least 80% of the assessment trials (Green et al., 1988; Pace, Ivancic, Edwards, Iwata, & Page, 1985), and preferred stimuli were subsequently used as reinforcers during training sessions.

Auditory Matching Training Task with Group 2

The auditory matching training task utilized two sets of stimuli, one each for the experimenter and participant. Each set included two sound-producing stimuli; a red-colored rubber squeak toy, and a blue rectangular tin can with glass marbles placed inside. The bottom of the tin can was attached at its midpoint to a 2.5 cm diameter wooden dowel such that it could be rolled from side to side to produce a sound. The training stimuli were presented to the participant on a rectangular wooden tray with markings on the edge facing the experimenter that served as guidelines for position prompt-fading (prompting procedures are described in forthcoming section). Three sets of markings were used: (a) a midpoint mark to designate the exact center of the tray, (b) "prompt level 1" markings that were 30.5 cm on either side of the midpoint, and (c) "prompt level 2" markings that were 61.0 cm on either side of the midpoint. Data recording forms for the training task are shown in Appendix F.

The training task employed a multiple-component training package evaluated in previous research (Walker & Martin, 1994). It included the following components: (a) use of simple auditory stimuli (i.e., sounds were used rather than words), (b) continuous presentation of auditory cues (i.e., during all training trials, the auditory sample stimulus was presented every 2 seconds until the participant responded), (c) presentation of preferred stimuli as consequences for correct responses, and (d) position prompt-fading (i.e., the teaching procedure included position prompts that were faded across a series of four stages).

At the beginning of each teaching session and stage, and for each auditory sample stimulus, the participant was provided with a demonstration trial, a physically guided trial, and an opportunity to perform the response independently. Following these trials, scored training trials began. Training trials in all stages included the experimenter providing the instruction "Make the same sound," and then presenting an auditory sample stimulus every 2 s until the participant responded by manipulating one of the comparison stimuli to produce a sound. Correct responses were defined as the participant producing a sound that matched the sample stimulus presented by the experimenter (e.g., if the experimenter presented the "tin can" sound, then a correct response entailed the participant producing a matching tin can sound). Correct responses were followed by the presentation of a preferred stimulus. Incorrect responses were defined as the participant producing a sound unlike that presented by the experimenter. Following an incorrect response, the experimenter said "No" and removed all materials from the table for approximately 10 s. If the participant did not respond within one minute, all stimuli were removed from the table, a 10-s time-out occurred, and the trial was then repeated. Pass and fail criteria varied across stages, and are described in subsequent sections. A failure to respond was not included in scoring for the pass or fail criteria.

During teaching sessions, if the participant met passing criterion at a particular stage, he or she proceeded to the next stage. If the participant reached failure criterion at a particular stage, the conditions of the previous stage were reinstated. Following the initial session, each subsequent teaching session began at the stage prior to that at which the previous session had ended. Training was continued until the participant achieved the mastery criterion at the final stage (Stage 4). Each stage is described in subsequent sections, and a summary of the position of the training materials in each stage is presented in Table 5.

Table 5

Summary of stages used in auditory matching training procedure

Stage	Position of training materials
1 - Imitation and demonstration trials	
	- one stimulus (either squeak toy or tin can) presented on tray and directly in front of participant
	- identical stimulus placed on table in front of experimenter
2 - Level 2 position prompt and visual prompt	
	- both stimuli presented to participant on tray; correct stimulus placed directly in front of participant; incorrect stimulus placed at far left-hand or far right-hand side of tray
	- correct stimulus placed on table in front of experimenter and visible to participant
3a - Level 2 position prompt only	
	- both stimuli presented on tray to participant as in Stage 2
	- experimenter's stimuli out of sight of participant

(table continues)

Stage	Position of training materials
3b - Level 1 position prompt only	
	- both stimuli presented to participant on tray; correct stimulus placed directly in front of participant, incorrect stimulus placed at the right- or left-hand level-1 prompt marking on tray
	- experimenter's stimuli out of sight
4 - No visual or position prompt	
	- stimuli equidistant from participant
	- experimenter's stimuli out of sight

Stage 1: Imitation and demonstration trials with only one stimulus present. During each trial, one stimulus (either squeak toy or tin can) was presented on the apparatus tray directly in front of the participant. An identical stimulus was placed on the table in front of the experimenter. Stage 1 training trials began with the experimenter manipulating the sample stimulus to produce a sound. The participant was then required to manipulate his or her stimulus to produce an identical sound. Passing criterion for Stage 1 was four consecutive correct independent responses to each auditory stimulus.

In all stages subsequent to Stage 1, both comparison stimuli were placed on the participant's apparatus tray, and their left-right positioning was invariant across trials.

The identity of the correct comparison stimulus varied unsystematically across trials according to a standardized data sheet (see Appendix F).

Stage 2: Training trials with a level-2 position prompt and a visual prompt. During Stage 2 trials, both comparison stimuli were presented to the participant. The correct comparison stimulus was placed directly in front of the participant while the incorrect comparison stimulus was placed at the level-2 position prompt marking (i.e., at the far-left or far-right hand side of the tray). The sample stimulus was placed on the table as a visual prompt for the participant. Passing criterion for Stage 2 was eight consecutive correct responses, and failure criterion was eight cumulative incorrect responses.

Stages 3a and 3b: Training trials with visual prompt removed and position prompt faded. During all Stage 3 trials, the sample stimulus was placed out of sight of the participant. For stage 3a trials, the incorrect comparison stimulus was placed at the level-2 position prompt marking. For Stage 3b trials, the position prompt was faded from a level-2 to a level-1 position prompt, with the final step of the fade occurring in Stage 4. For both Stage 3a and 3b, passing criterion was eight consecutive correct responses, and failure criterion was eight cumulative incorrect responses.

Stage 4: Training trials with no visual or position prompt (i.e., unprompted training trials). During Stage 4, no visual or position prompts were available to the participant. The two comparison stimuli were placed equidistant from the center of the apparatus tray and the participant, and the sample stimulus remained hidden from view. Mastery criterion for Stage 4 was eight consecutive correct responses, and failure criterion was eight cumulative incorrect responses. When participants achieved mastery criterion for Stage 4 (and therefore passed the training task), they were retested on the bell-tambourine task and were required to demonstrate mastery of this task before proceeding further.

Control/Exposure Procedure with Auditory Stimuli for Group 1 Participants

Group 2 participants were provided with training on an auditory matching task that involved repeated exposure to auditory stimuli. Group 1 participants did not receive this training. Differences between the two groups on the experimental measure (i.e., trials to criterion on Level 5 analog training task) might therefore be attributed to differential exposure to auditory stimuli rather than to training specific factors, if the two groups were not equated in terms of this variable. To control for the effects of auditory exposure alone, Group 1 participants were provided with exposure to the same auditory stimuli that were employed in the auditory matching training procedure with Group 2.

Due to practical constraints (i.e., it was necessary to recruit participants from three different sites over a period of time) and the method of random assignment used (details provided in Research Design section), Group 1 participants were not yoked to Group 2 participants in terms of auditory exposure as it was not always possible to train the Group 2 participants first. For each participant in Group 1, exposure to the auditory matching training task stimuli was provided during a total of 300 trials across eight sessions (150 trials with each of the two stimuli). The number of exposure trials was selected to be representative of an average number of prompted and unprompted trials required by participants in previous research to reach mastery criterion on the auditory matching training task.

On each trial in the exposure procedure, one stimulus was placed on the table in front of the participant (i.e., either tin can apparatus or squeak toy). First, the experimenter demonstrated how to manipulate the stimulus in order to produce a sound. Subsequently, the participant was physically prompted to manipulate the stimulus. The total duration of sound presentation during each trial was 10 s. Each session consisted of 40 trials (with the exception of the last session which consisted of 20 trials) and was approximately 20 minutes in length. After the exposure trials were completed, training commenced on the ABLA Level 5 analog task.

ABLA Level 5 Analog Training Task with All Groups

The ABLA Level 5 analog task employed two visual comparison stimuli (e.g., large picture puzzle pieces) and two auditory sample stimuli (i.e., spoken words) that were related to the comparison stimuli. The task involved presenting a participant with two large picture puzzle pieces (e.g., pictures of a dog and an airplane), and then teaching the participant to place the correct puzzle piece into a white container measuring 13.0 cm in diameter and 16.5 cm in height when the corresponding auditory cue was presented (e.g., when the auditory sample stimulus "dog" was presented, the correct response was to select the puzzle piece picture of the dog and place it in the central container). Prior to the commencement of training trials, pretests were conducted with the auditory sample and visual comparison stimuli to ensure that participants had not already mastered the auditory (speech) discrimination. For 8 of the participants, the same auditory sample and visual comparison stimuli were used (i.e., "airplane" and "dog"). With the other 4 participants, it was necessary to use different sample and comparison stimuli as these individuals passed the pretest using the initial stimuli. Although the latter participants passed the pretest with the initial set of auditory and visual stimuli, they continued to fail the ABLA Level 5 auditory (speech) discrimination task. It was decided, therefore, to have them remain in the study but to employ different training stimuli. The specific stimuli used with each participant are summarized in Table 6.

Table 6

Stimuli used in Level 5 analog training task

Participant Identification	Auditory Stimuli used in Level 5 analog task
Participants 1-1, 1-2, 1-3, 1-4, 2-1, 2-2, 2-4, 3-1	"airplane" and "dog"
Participants 2-3, 3-2, 3-3, 3-4	"triangle" and "round"

Prior to actual training on the Level 5 task, participants were taught to perform observing responses; that is, to attend to the discriminative stimuli. The purpose of the observing response component was to maximize the likelihood of participants attending to the relevant stimuli during training trials. After participants were reliably performing observing responses, training on the Level 5 task began.

Observing responses. In the present research, an observing response was defined as the participant looking at and touching a visual comparison stimulus presented at the participant's eye level. Upon performance of the observing response, the experimenter presented the auditory stimulus associated with the visual comparison stimulus (e.g., when the participant looked at and touched a picture of a dog, the experimenter said the word "dog"). On every trial, each of the auditory-visual stimulus pairs was presented individually (e.g., the picture of a dog was presented with the spoken word "dog", then the picture of an airplane was presented with the spoken word "airplane"). The order in which the comparison stimuli were presented during a trial varied unsystematically across trials. Correct observing responses were followed by praise and periodic presentation of a preferred stimulus (e.g., once every three correct responses).

During the first session of observing response training, each trial consisted of three components. First, the experimenter modelled the desired response of looking at and touching each comparison stimulus, which was followed by the experimenter presenting the corresponding auditory stimulus. Next, each comparison stimulus was presented individually at the participant's eye level and he or she was physically prompted to touch the stimulus, after which the corresponding auditory stimulus was presented. Finally, the participant was required to perform observing responses independently.

In all subsequent sessions of observing response training, experimenter modelling and guidance occurred only on the first trial. Following an initial independent observing response to each comparison stimulus, additional trials were conducted during which the experimenter presented the comparison stimuli individually, and the participant was required to perform an observing response independently. Each observing response training session consisted of 40 trials and was approximately 30 minutes in length. In order to progress to the training phase, participants were required to perform observing responses on at least 95% of the trials presented during a session.

Level 5 analog task training. The format and procedure for the training task was similar to the procedure used for the original ABLA Level 5 task, although there were several minor modifications. First, instead of intermittent reinforcement, all correct responses were consequated with a preferred stimulus identified during the preference assessment. After passing criterion was attained by the participant, the frequency of reinforcement was reduced across a number of subsequent sessions to approximate that employed during ABLA tasks. Second, in place of the Kerr et al. (1977) error correction procedure, incorrect responses were consequated with the word "no" and a brief time-out. Third, instead of a single sample presentation at the beginning of a trial, the auditory sample stimulus was presented every 2 s throughout the duration of the trial. This modified format was used to approximate the teaching format often used by direct-care staff who work with individuals with developmental disabilities.

At the beginning of each training session, a number of preliminary trials were conducted. First, the experimenter demonstrated the correct response (e.g., in the presence of the auditory stimulus "dog," the picture of the dog was picked up and placed in the center container). Second, a physically guided trial was conducted in which the experimenter presented the auditory sample stimulus, and then physically guided the participant to choose the correct comparison stimulus and place it in the center container. Finally, an independent response trial was conducted during which the experimenter presented the auditory sample stimulus and the participant was required to independently choose the correct comparison stimulus and place it in the center container. These trials were conducted for each of the two auditory sample stimuli. Following a correct independent response by the participant for each of the two sample stimuli, training trials commenced and responses were scored.

At the beginning of each training trial, the participant was required to perform observing responses to each of the comparison stimuli in the manner described previously. Next, the comparison stimuli were placed on the tabletop, equidistant from the participant, with a container placed midway between the stimuli and directly in front of the participant. The experimenter then presented an auditory sample stimulus every 2 s (for a maximum duration of 60 s) until the participant responded by choosing one of the comparison stimuli and placing it in the center container. The identity of the auditory sample stimulus varied unsystematically across trials according to the data sheet (see Appendix G). The left-right positioning of the comparison stimuli remained invariant across trials.

A response was scored as correct if the participant selected the correct comparison stimulus (e.g., the puzzle piece [picture of dog] associated with the auditory sample stimulus [spoken word "dog"]). Correct responses were consequated with praise and the presentation of a preferred stimulus. A response was scored as incorrect if the participant selected the comparison stimulus that did not correspond to the auditory sample (e.g., choosing the airplane puzzle piece in the presence of the spoken word "dog"). Errors were followed by the experimenter saying "No" and removing all training stimuli from the table for 10 s. A trial was scored as "no response" if the participant failed to respond within 60 s.

Each training session was approximately 30 minutes in duration. Training sessions continued until either the participant reached passing criterion (eight consecutive correct responses) or 400 training trials had been administered, whichever event occurred first. When a participant achieved mastery criterion on the task, a number of additional training sessions were conducted. Across a number of sessions, the frequency of reinforcement for correct responses was gradually reduced so as to approximate the reinforcement contingencies employed during the ABLA. Specifically, the schedule of reinforcement was thinned across sessions from FR1 to VR3, with the latter schedule representing approximately the same conditions of reinforcement present during the ABLA. The change in reinforcement schedule occurred in a step-wise fashion across successive sessions (e.g., session 1: FR1; session 2: VR2; session 3: VR3). In order to progress to the next stage (e.g., from VR2 to VR3), the participant was required to meet the same passing criterion employed during the training task (i.e., eight consecutive correct responses). Once a participant met passing criterion under the terminal schedule of reinforcement (i.e., VR3), she or he was reassessed on the ABLA.

If a participant failed the auditory discrimination level of the ABLA at the time of the posttest, she or he received training on a second Level 5 analog task. The training procedure for the second training task was the same as that employed for the first, with the exception that different auditory and visual stimuli were used as the sample and comparison stimuli. Following training on the second task, the participant was again reassessed on the ABLA.

ABLA Reassessment. At the termination of training (i.e., termination as a result of either passing the task or reaching the 400 training trial limit) on a Level 5 analog task, each participant was reassessed on the ABLA using the same procedures as described for the initial ABLA assessment.

Data Recording and Reliability Assessments

Prior to data collection with research participants, observers (undergraduate students in Psychology) received training on the methods employed in the proposed research (i.e., ABLA procedures, bell-tambourine assessment procedure, preferred stimulus assessment procedure, auditory matching training procedure, and Level 5 analog task training procedure). Training included a demonstration of the procedures to be followed during a particular phase of the research (e.g., auditory matching training task), a review of response definitions and scoring criteria, and a review of procedural reliability checklists in conjunction with a demonstration of the procedures. Following the initial instruction session, a practice session was conducted during which the experimenter and an observer simulated an assessment or training session. Additional observers were required to complete a data recording form and procedural reliability checklist for the session, and it was required that observers demonstrate 100% agreement with the experimenter prior to beginning data collection with research participants.

During all assessment and training sessions, participants' responses and procedural reliability data were recorded by the experimenter. In addition, during 28% of assessment and training sessions, one or two additional observers independently recorded participants' responses and completed procedural reliability checklists (see Appendixes H and I for examples) to ensure that the data were accurate and experimental procedures were followed correctly and consistently. Interobserver agreement and procedural reliability agreements were independently calculated by dividing the number of agreements by the number of agreements plus disagreements within a session, and then multiplying by 100. Overall, reliability of response recording was 100%, and procedural reliability averaged 96% (M).

Research Design

The purpose of the present research was to compare three small groups on their acquisition of an ABLA Level 5 analog task. Group size was limited by two considerations. First, as described earlier, the initial groupings were formed by selection rather than by random assignment or manipulation. Participants were selected if they passed ABLA Levels 1 through 4 and failed Levels 5 and 6. Unfortunately, although a large number of potential participants were screened, there were a limited number of participants who met the selection criteria. The second consideration was a practical one in that this type of research is very labour and time intensive and typically involves several hundred training trials per participant.

The initial groupings were formed by selection rather than by random assignment or manipulation. Participants in Group 3 were individuals who passed ABLA Levels 1 - 4 and the bell-tambourine task, and failed Levels 5 and 6. Participants in Groups 1 and 2 were individuals who passed ABLA Levels 1 - 4 and failed the bell-tambourine task and ABLA Levels 5 and 6. These latter individuals were randomly assigned to either Group 1 or Group 2. Due to the difficulty in locating participants who met the selection criteria, it was not possible to begin with a group of eight individuals and randomly divide this group into two groups of four. Random assignment was therefore done in blocks of two (e.g., Kazdin, 1992, p. 86) - the first two individuals who passed ABLA Levels 1 - 4 but failed Levels 5 and 6 and the bell-tambourine task were randomly assigned to either Group 1 or Group 2. The third individual meeting the same selection criteria was assigned to the second "block" and randomly assigned to either Group 1 or Group 2; the fourth individual was included in the second block and placed in whichever of Group 1 or 2 the third participant had not been assigned to, and so on for the remaining four participants.

Although it was originally intended to match participants in different groups on level of functioning, this was not accomplished due to practical constraints. As indicated in the Participants section, a large number of clients from various settings (i.e., two residential facilities and a sheltered workshop) were assessed before a sufficient number of participants were obtained who met the required ABLA and bell-tambourine performance selection criteria. A decision was therefore made by my advisor and myself to proceed with the participants who were available and to use random assignment as a method of placing participants in different groups.

Group 1 participants (who had passed ABLA Levels 1 to 4, and failed the bell-tambourine task and ABLA Levels 5 and 6) were exposed to a control condition which provided exposure to the auditory stimuli that were used in the auditory matching training task presented to members of Group 2. Then, an attempt was made to teach each Group 1 participant a Level 5 analog task.

Group 2 participants (who had passed ABLA Levels 1 to 4, and failed the bell-tambourine task and ABLA Levels 5 and 6) were provided with training on an auditory matching training task until the task was passed, and were then reassessed on the bell-tambourine task. After demonstrating mastery of the bell-tambourine task, an attempt was made to teach each Group 2 participant a Level 5 analog task.

Group 3 participants had passed ABLA Levels 1 through 4 and the bell-tambourine task, and failed ABLA Levels 5 and 6. As was the case for Group 1 and 2 participants, an attempt was made to teach each Group 3 participant a Level 5 analog task after the initial ABLA and bell-tambourine assessments. Participants in all groups were retested on the ABLA subsequent to their exposure to a Level 5 analog task. If, after passing a Level 5 analog task, a participant failed the retest of ABLA Level 5, he or she was provided with exposure to a second Level 5 analog training task and was again reassessed on the ABLA at the termination of training.

Results

ABLA Testing Prior to Participant Selection

In total, 84 individuals from three sites were assessed on the ABLA. Summary results of ABLA assessments are presented in Table 7. The performance of all participants on the six basic learning tasks conformed to the ordering established in previous research, providing further validation for the hierarchical ordering of tasks reported by Kerr et al. (1977). That is, if a particular ABLA task was passed, all lower level ABLA tasks were also passed and if an ABLA task was failed, all higher level tasks were also failed.

Of 84 individuals, 23 met the initial selection criteria of passing ABLA Levels 1 - 4 and failing Levels 5 and 6. Of these 23 individuals, 6 were excluded due to mild hearing impairments which, although not noticeable in daily living situations, could have affected their performance on either the ABLA or the training tasks. Of the remaining 17 participants, 5 (2 participants from Group 1, 2 participants from Group 2, and 1 participant from Group 3) were eventually excluded from the study due to ongoing behavior problems (e.g., refusals to attend training sessions, noncompliance with training program despite the use of stimuli identified as preferred during the reinforcer assessment phase). The difficulties encountered in working with these 5 individuals had also been observed by caregivers in the past, and the behaviors involved were described by caregivers as having a lengthy history. The final participant group consisted of 12 individuals, 8 who failed (comprising Groups 1 and 2) and 4 who passed the bell-tambourine assessment (comprising Group 3).

Table 7

Summary of ABLA evaluations

HIGHEST ABLA LEVEL ACHIEVED	FREQUENCY
Demonstration of Level 1	2
1	2
2	9
3	15
4	23
5	0
6	33

Auditory Matching Training with Group 2 Participants

As indicated previously, 4 participants who initially failed the bell-tambourine task (i.e., Group 2) received subsequent training on an auditory matching task prior to training on a Level 5 analog task. All 4 individuals met mastery criterion on the auditory matching task relatively quickly: (a) Participant 2-1 passed in 43 unprompted training trials, that is, trials during which no extraneous prompts were available (109 total training trials across 4 sessions), (b) Participant 2-2 passed in 41 unprompted training trials (136 total training trials across 7 sessions), (c) Participant 2-3 passed in 8 unprompted training trials (43 total training trials in 1 session), and (d) Participant 2-4 passed in 49 unprompted training trials, (100 total training trials across 3 sessions). After mastering the auditory matching training task, all 4 participants also passed a retest on the bell-tambourine task. These results are similar to those obtained in previous research in which the majority of participants relatively quickly mastered a previously failed auditory (sound) - visual discrimination when the same training procedures were used (Walker & Martin, 1994).

Group 1 participants were provided with exposure to the same auditory stimuli used in the auditory matching training task with Group 2 participants. To control for the effects of auditory exposure alone, each Group 1 participant received 300 exposure trials during which one of the two auditory stimuli was presented for 10 seconds (i.e., 150 trials with each stimulus). In all cases, the exposure provided to Group 1 participants exceeded the exposure received by Group 2 participants during training (i.e., 109, 136, 43, and 100 training trials respectively).

ABLA Level 5 Analog Task Training

The primary purpose of the present study was to evaluate whether an ABLA Level 5 analog task (i.e., a complex auditory [speech] - visual discrimination) would be acquired more quickly by individuals who had demonstrated the ability to perform auditory-visual matching discriminations with simple sounds (either apriori or after training) relative to individuals who had not demonstrated this ability. A summary of the results - the number of training trials to passing criterion (or to the 400 trial maximum) for each participant - is provided in Figure 1.

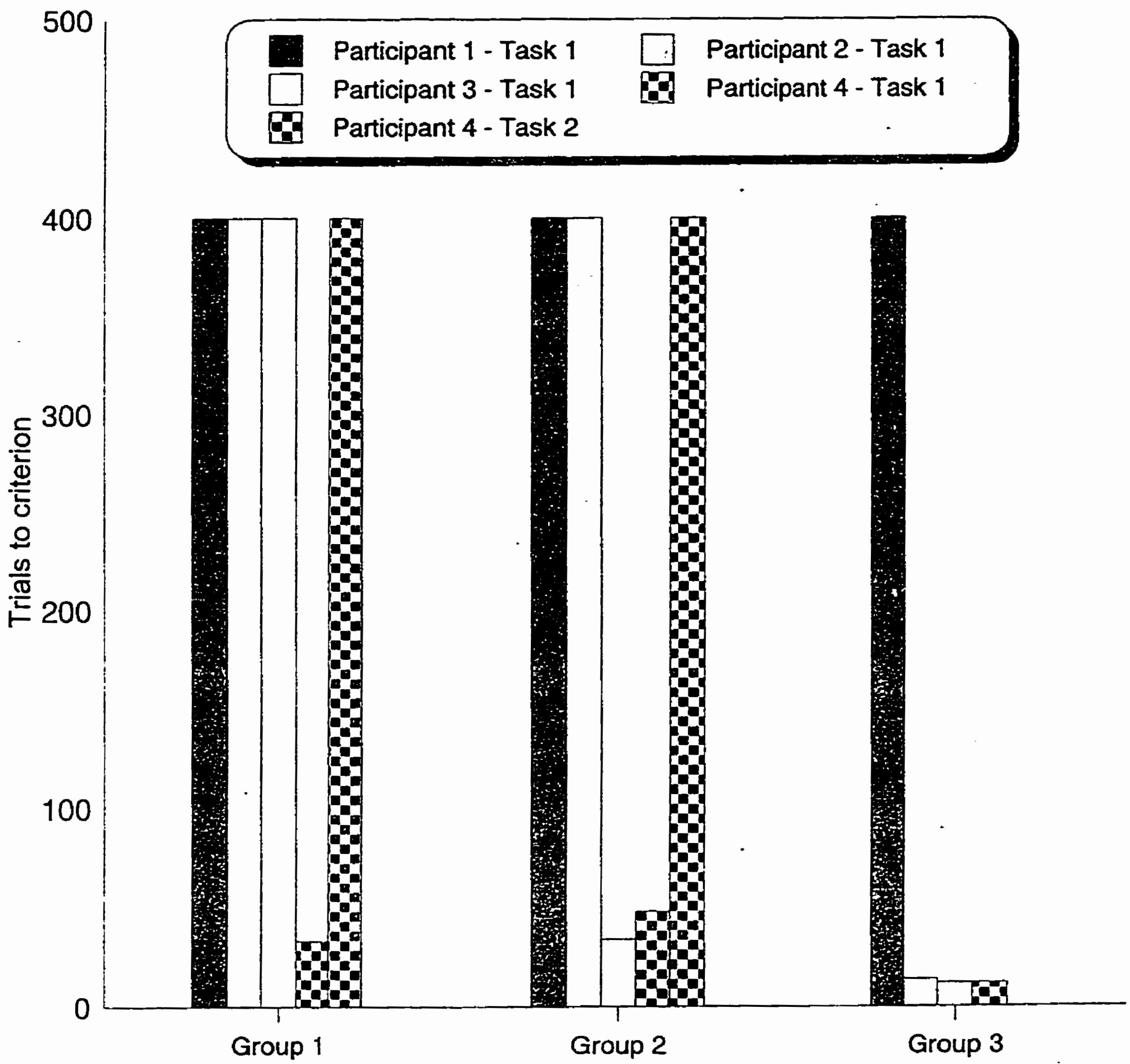

Figure 1 - Trials to criterion on Level 5 analogue training tasks for each participant in each of the three groups. "Participant 1" refers to the first participant in each group (e.g., Participant 1-1, 2-1, etc.), "Participant 2" refers to the second participant in each group (e.g., Participant 2-2, 2-3),and so forth. "Task 1" refers to performance on the first Level 5 analogue training task; "Task 2" refers to performance on the second Level 5 analogue training task (presented only to Participants 1-4 and 2-4.)

Group 1 participants passed ABLA Levels 1 - 4, failed ABLA Levels 5 and 6, and received the control/exposure procedure with auditory stimuli prior to training on the Level 5 analog task. Three participants in Group 1 (Participants 1-1, 1-2, and 1-3) did not pass the Level 5 analog training task within the 400 trial limit and also failed the ABLA Level 5 post-test. These 3 participants shared a number of other similarities: All had diagnoses of severe mental retardation, all were long-term residents of a care facility, and none demonstrated functional speech (i.e., they were either nonspeaking or had unintelligible vocalizations). One of the participants (Participant 1-4) passed the first Level 5 analog training task, but subsequently failed the ABLA Level 5 post-test. This participant then received training on a second Level 5 analog training task, but failed to reach passing criterion within the 400 training trial limit, and again failed the ABLA Level 5 post-test. Participant 1-4 had a diagnosis of severe MR, was a long-term resident of a care facility, and his speech was echolalic.

Group 2 consisted of 4 participants who initially passed ABLA Level 4, but failed the bell-tambourine task and ABLA Levels 5 and 6. Each Group 2 participant subsequently received training on the auditory matching task until passing criterion was attained, and each Group 2 participant also passed a retest on the bell-tambourine task. Of four Group 2 participants, two did not pass the Level 5 training task within the 400 trial limit and also failed the ABLA Level 5 post-test (i.e., Participants 2-1 and 2-2; see Figure 1). Participants 2-1 and 2-2 both had diagnoses of severe MR and autism, both had been living in a residential care facility for an extended period of time, and neither demonstrated functional speech (one was nonspeaking and one's speech was echolalic). One participant (Participant 2-4) passed the first Level 5 training task in 48 training trials, but subsequently failed the ABLA Level 5 post-test. This participant then received training on a second Level 5 task, but did not attain passing criterion within the 400 trial limit, and again failed the ABLA Level 5 post-test. Participant 2-4 had a diagnosis of severe MR and autism, was a long-term resident of a care facility, and was nonspeaking. The remaining participant (Participant 2-3) passed a Level 5 training task in 34 training trials, and passed the ABLA Level 5 post-test. This participant had a diagnosis of mild MR, lived at home with family, and had some functional speech and some echolalic speech. Overall, two Group 2 participants learned at least one auditory (speech) - visual discrimination, but only 1 participant passed the ABLA Level 5 post-test.

Group 3 consisted of 4 participants who originally passed ABLA Levels 1-4 and the bell-tambourine task, but failed ABLA Levels 5 and 6. Three Group 3 participants passed a Level 5 training task in fewer than 15 trials and subsequently passed the ABLA Level 5 post-test (Participants 3-2, 3-3, and 3-4; see Figure 1). These 3 participants had diagnoses of either mild or moderate MR, 2 lived in a family home setting and 1 was a long-term resident of a care facility, and all had some functional speech capabilities. Only 1 of 4 participants (Participant 3-1) did not pass a Level 5 training task within the 400 training trial limit, and also failed the ABLA Level 5 post-test. This participant had a diagnosis of severe MR, was a long-term resident of a care facility, and had no functional speech (i.e., unintelligible vocalizations only). Additional summary data pertaining to the first Level 5 analog training task and the ABLA Level 5 post-test for Groups 1, 2, and 3 are presented in Table 8.

Table 8

Summary results of Level 5 analog task training and ABLA posttests

		Number of participants passing ABLA Level 5 training task	Number of participants passing ABLA Level 5 post-test
Group 1		1 (Participant 1-4)	0
Group 2		2 (Participants 2-3 & 2-4)	1 (Participant 2-3)
Group 3		3 (Participants 3-2, 3-3, & 3-4)	3 (Participants 3-2, 3-3, & 3-4)
Totals		6	4

As illustrated in Figure 1 and Table 8, there were a number of differences between the results of Groups 1, 2, and 3. Within Group 1, 3 of 4 participants failed to reach passing criterion within the 400 trial limit, while 3 of 4 Group 3 participants passed the training task in relatively few trials (i.e., 15 trials). In Group 2, participants' results exhibited greater variability; two individuals passed the first Level 5 analog training task quickly (i.e., 50 trials), while two failed to master the task within the 400 trial limit.

There were also a number of differences between the participants who passed versus failed the Level 5 analog task in terms of their level of functioning, their daily living environment, and their communication abilities. A review of the characteristics of individual participants in each of Groups 1, 2, and 3 (see Table 2) indicates that participants who passed at least one Level 5 analog task were more likely to have the following characteristics: (a) a higher level of functioning (i.e., mild to moderate mental retardation as compared to severe mental retardation), (b) living in a family home setting (i.e., as compared to a large residential care facility), and (c) demonstrating some form of expressive language (i.e., rather than being nonspeaking). While these characteristics were not unequivocally present in all participants who passed a Level 5 analog training task, they were present in 4 of the 6 participants who passed the task (i.e., Participants 2-3, 3-2, 3-3, & 3-4). Furthermore, the 4 participants who passed a Level 5 analog task and the ABLA Level 5 post-test were all within the mild to moderate range of retardation, 3 of 4 lived in a family home setting, and all had some form of expressive language. Another notable characteristic of the 4 latter participants is that all had passed a pretest with the initial training stimuli (i.e., "airplane" and "dog") and therefore were presented with different auditory and visual stimuli (i.e., "triangle" and "round") during training on the Level 5 analog task. The alternate set of stimuli used with the latter participants (i.e., "triangle" and "round") may be more complex than the stimuli described previously (i.e., "airplane" and "dog").

Another finding of interest pertains to a difference in the results obtained by participants who passed a Level 5 analog task as compared to those who did not. Visual inspection of participants' results across sessions (i.e., percent correct on training task, see Figures 2, 3, and 4) indicates that those participants who passed the task typically passed quickly, in one or two sessions (e.g., Participants 2-3 and 3-3) . In comparison, participants who failed to master the task within 400 trials typically performed at close to chance levels throughout training (e.g., Participants 1-2 and 2-1). Overall, this pattern of

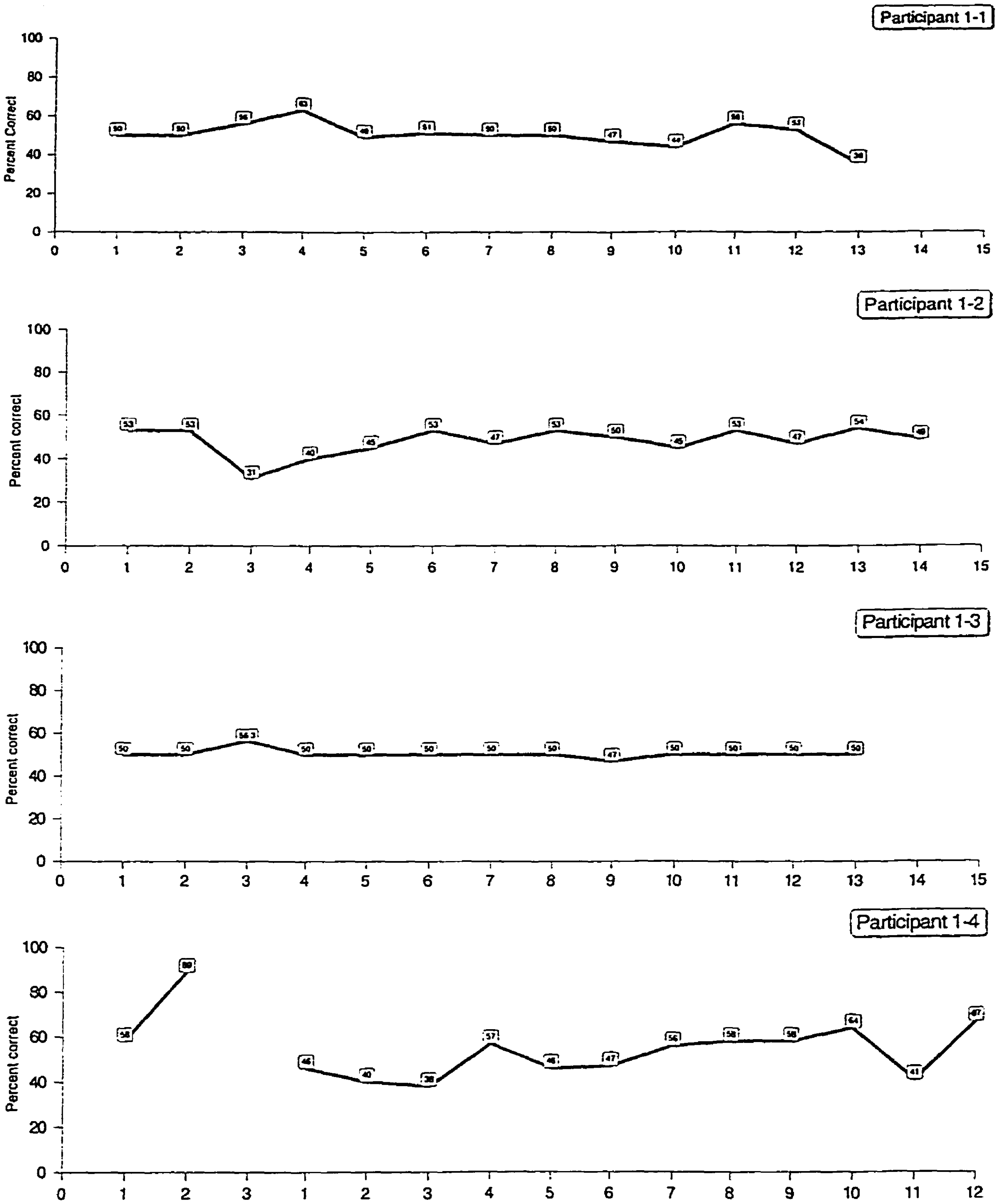

Figure 2. - Percent correct across sessions on first Level 5 analogue training task for Group 1 participants. For Participant 1-4 only, sessions 1 & 2 indicate performance on first Level 5 task, and subsequent sessions (1-12) indicate performance on second Level 5 task.

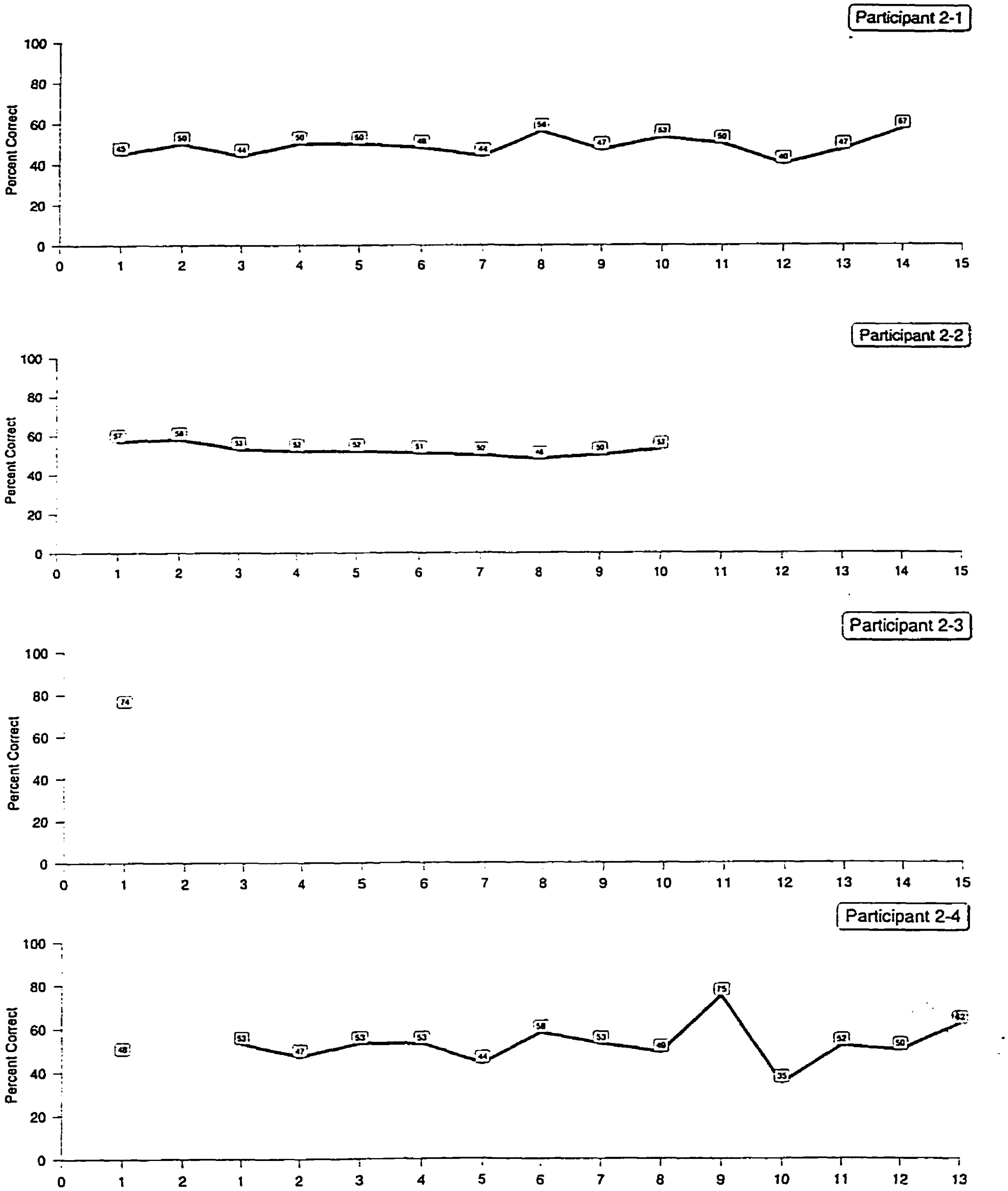

Figure 3. - Percent correct across sessions on first Level 5 analogue training task for Group 2 participants. For Participant 2-4 only, session 1 indicates performance on first Level 5 task, and subsequent sessions (1-13) indicate performance on second Level 5 task.

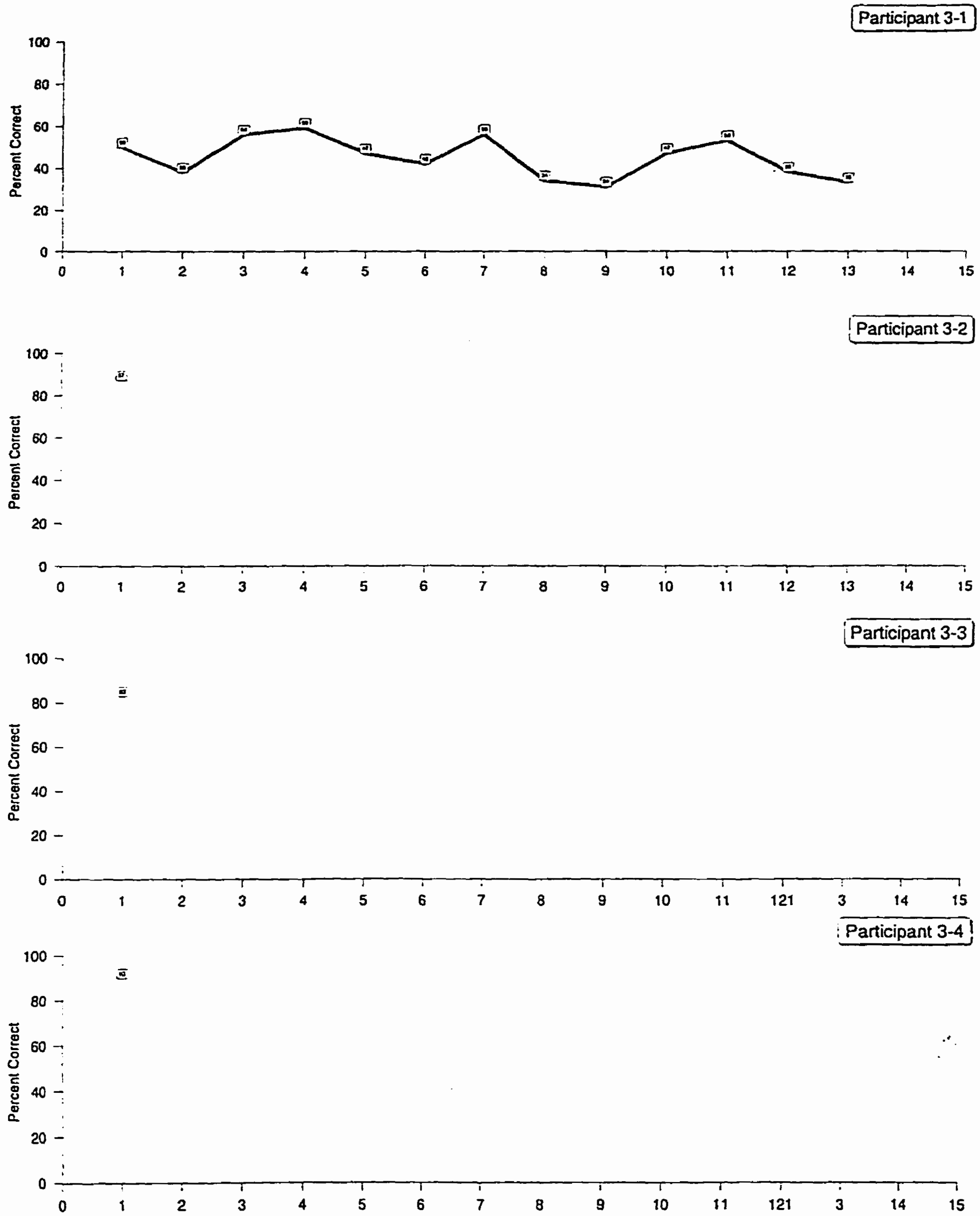

Figure 4. - Percent correct across sessions on Level 5 analogue training task for Group 3 participants. For Participants 3-2, 3-3, and 3-4, the sole data point indicates that the training task was passed in one session.

results suggests that behaviors involved in correctly discriminating between auditory-visual stimuli and responding appropriately either came under the control of the relevant stimuli relatively quickly or not at all. Repeated training trials did not typically result in a significant improvement in performance (as measured by changes in percent correct across training sessions).

Discussion

The current study is consistent with previous research (e.g., Walker et al., 1994; Ward, 1994) in demonstrating that an auditory-visual discrimination involving simple sound stimuli is at a lower level in the ABLA hierarchy relative to the ABLA Level 5 auditory (speech) - visual discrimination and thus represents an easier skill for the learner to master. The key issue addressed by this project was whether mastery of such an auditory matching task facilitated learning a more complex auditory (speech) - visual discrimination such as the ABLA Level 5 task.

Does Mastery of the Bell-Tambourine Task Facilitate Mastery of ABLA Level 5?

The results indicated that individuals who had mastered a simpler sound discrimination (i.e., had passed the bell-tambourine task either at the time of the pretest or after training on the auditory matching analog task) were more likely to acquire a more complex speech discrimination (i.e., a Level 5 analog task), relative to those individuals who had not mastered the simpler discrimination. Five of 8 participants who mastered the bell-tambourine task subsequently learned at least one Level 5 analog task (i.e., an auditory [speech] - visual discrimination), whereas only 1 of 4 participants who did not pass the bell-tambourine task was able to pass at least one Level 5 analog task. Of the 4 participants from Groups 2 and 3 who passed the bell-tambourine analog task, the ABLA Level 5 analog task, and then ABLA Level 5, all were mildly or moderately developmentally disabled. Three of these 4 participants lived in family homes, and one lived in a long-term residential care facility. The other four participants from Groups 2 and 3, all of whom failed the ABLA Level 5 post-test, were severely developmentally disabled and lived in a long-term residential care setting. Thus, if one looks only at the results of this study, the best explanation would be that the differences obtained on the ABLA Level 5 post-test were likely due to differences in level of functioning.

However, when the current results are viewed in light of previous ABLA research, and in light of some preliminary data from an attempt to replicate the current research, the possibility that the ability to perform the bell-tambourine task may facilitate learning ABLA Level 5 remains a worthwhile question to pursue. First, consider previous ABLA research concerning the relationship between ABLA Test performance and level of retardation as assessed by IQ test performance. ABLA Test results and level of retardation are roughly correlated in that in a study of 117 individuals with developmental disabilities, no individuals diagnosed as profoundly disabled passed all six ABLA levels, while mildly disabled individuals passed all six ABLA levels by their eleventh year of age (Kerr et al., 1977). However, the ABLA is a much better predictor of the ability to learn two-choice discriminations than is level of functioning. In three studies (Harapiak, Martin, & Yu, in press; Stubbings & Martin, 1995, 1998), a total of 28 individuals were tested who passed ABLA Level 4, and either passed or failed ABLA Levels 5 and 6 (and failed a higher level auditory-auditory identity matching task). Of those individuals who passed Level 4 and failed Levels 5 and 6, five were severely retarded and six were moderately retarded. Of those who passed Level 5 only, or Levels 5 and 6, eight were severely retarded and nine were moderately retarded. These latter results suggest that at least for persons with severe and moderate handicaps, level of functioning is not a good explanation of why individuals would pass or fail the bell-tambourine task and ABLA Level 5.

Secondly, in an ongoing systematic replication of the current study, 3 participants were selected who were matched in level of functioning (all at the severe level) and all living in a residential care setting. One of the three passed ABLA Level 4 and the bell-tambourine task but failed ABLA Levels 5 and 6. This participant was given the training that was presented to Group 3 clients in the current study. After training on a Level 5 analog task, this participant passed ABLA Level 5. The other 2 participants passed ABLA Level 4 and failed the bell-tambourine tasks and Levels 5 and 6. One of these individuals was randomly assigned to Group 1 training conditions and the other was assigned to Group 2 training conditions. Training with these 2 participants is currently ongoing. Thus, the combination of the results of the current study, previous studies that demonstrated that a severe or moderate level of functioning was not a good predictor of performance on ABLA Levels 4, 5, and 6, and an ongoing replication of the current study with matching between groups to control for level of functioning and living environment suggests that further research is needed to determine if mastery of a bell-tambourine type of task will facilitate learning of ABLA Level 5.

Discussion of Participants who Passed at Least One ABLA Level 5 Analog Task

Four participants (2-3, 3-2, 3-3, and 3-4) passed a Level 5 analog task and the ABLA Level 5 post-test, while two participants (1-4 and 2-4) passed a Level 5 analog task but failed the ABLA Level 5 post-test and a second Level 5 analog task . As indicated previously, the 4 who passed were moderately or mildly developmentally disabled while the other 2 were severely developmentally disabled. It is also notable that the four individuals (i.e., Participants 2-3, 3-2, 3-3 and 3-4) who demonstrated auditory matching ability, passed a Level 5 analog task, and passed the ABLA Level 5 post-test had also passed a pretest with the original training stimuli (i.e., "airplane" and "dog"). However, because these participants continued to fail the ABLA auditory (speech) - visual discrimination task, it was decided that they would remain in the study, but that different auditory and visual stimuli would be used in the Level 5 analog training task (i.e., the spoken words "triangle" and "round" and corresponding puzzle pieces). Given that these participants had demonstrated auditory matching ability and passed a pretest with one set of auditory and visual stimuli, it is reasonable to suggest that their subsequent mastery of a Level 5 analog task (i.e., with the second set of stimuli; "triangle" and "round") and the ABLA Level 5 post-test was facilitated by either one or both of the former experiences. That is, these individuals had already demonstrated the ability to correctly discriminate in the presence of a number of auditory-visual stimulus exemplars. Thus, their mastery of the training task and ABLA Level 5 posttest could represent the occurrence of stimulus generalization. As described by Stokes and Osnes (1989), one of the tactics to facilitate generalization involves the use of multiple stimulus exemplars. In the present research, the auditory-visual stimuli employed in the auditory matching training task and Level 5 training task pretest may be considered as stimulus exemplars that acquired control over discriminative behavior. Then, when other (similar) auditory-visual stimuli (i.e., stimuli in the Level 5 training task and ABLA Level 5 post-test) were presented, they too acquired control over discriminative behavior.

It is, nevertheless, difficult to account for the results of Participants 1-4 and 2-4. Both of these individuals mastered one Level 5 training task and subsequently failed a similar task despite hundreds of training trials. This result is in contrast to previous ABLA research in which, for most participants, mastery of a task requiring a particular skill (e.g., auditory [sound] discrimination ability) facilitated mastery of subsequent tasks requiring the same skill (e.g., Martin et al., 1983; Walker et al., 1994). In the current research, the two Level 5 analog tasks were similar in a number of ways: (a) they utilized the same format and reinforcement contingencies, and (b) both pairs of auditory-visual stimuli appeared similar in their complexity (e.g., number of syllables) and distinctiveness (e.g., different consonant and vowel sounds). Perhaps Participants 1-4 and 2-4 had some prior experience with these stimuli (i.e., the words "dog" and "airplane" and the corresponding pictures) that facilitated their mastery of the task. Another possibility is that, rather than acquiring generalized auditory-visual discrimination skill, these participants may have attended to some idiosyncratic features of the first set of stimuli that enabled them to pass the first task. A final possibility, albeit a less likely one, is that these two individuals passed the first training task by chance. The probability of obtaining eight consecutive correct responses by chance in a two-choice situation is 1 out of 256.

Another factor to be considered in understanding the current results is the role of stimulus overselectivity. As described previously, research has indicated that there is a relationship between stimulus overselectivity and the following variables: (a) developmental level (i.e., stimulus control deficits are more likely to be exhibited by individuals with lower levels of functioning), (b) number of stimulus components (i.e., stimulus overselectivity is more likely to occur as the number of components increases), and (c) proximity of salient stimuli (i.e., stimulus overselectivity is more likely to occur as the distance between stimuli increases).

In the current study, many of the participants were classified as being in the severely developmentally disabled range and would therefore be more likely to exhibit stimulus control deficits. All six participants who failed to master a Level 5 analog task were in the severely handicapped range (Participants 1-1, 1-2, 1-3, 2-1, 2-2, and 3-1). In comparison, in the group of six participants who met passing criterion on the first Level 5 analog task, only two were in the severely handicapped range (i.e., Participants 1-4 and 2-4). Regarding the other factors related to the occurrence of stimulus overselectivity, there were multiple cues involved in the Level 5 analog training task, including pitch, phonetic content, and duration as relevant auditory cues and position, color, shape, and size as relevant visual cues. In addition, there was a relatively large distance between the sample (i.e., the auditory stimulus presented by the experimenter) and comparison stimuli (i.e., puzzle pieces placed adjacent to the participant).

The cumulative effect of these factors may account for the apparent difficulty that some learners (i.e., Participants 1-1, 1-2, 1-3, 2-1, 2-2, and 3-1) experienced in learning the discrimination. Previous research has provided numerous examples of behavior failing to come under the control of the relevant stimuli (e.g., Lovaas et al., 1971; Reynolds et al., 1974; Rincover et al., 1986). In the present research, the failure to learn the discrimination indicates the presence of a stimulus control deficit, that is, the behavior of the learners was not under the control of the relevant auditory and visual stimuli. It is more likely that their behavior was under control of one or a limited portion of the relevant cues (e.g., position as a visual cue). It is also possible that responding was partially under the control of stimuli that were irrelevant to the learning situation (e.g., the examiner's facial movements).

Relation of the Results to Previous ABLA Research

Although not an explicit purpose of the present research, the pass-fail performance of participants replicated a finding noted in previous ABLA research. Specifically, in the current research, participants either mastered the Level 5 analog task quickly (i.e., in less than 50 trials) or failed to learn the discrimination even after hundreds of training trials. This dichotomy was also noted in the original research by Kerr et al. (1977), who reported that 95% of the tests administered were either passed quickly and with few errors or were failed after pure chance performance. A simiiar pass-fail pattern was also reported in two previous studies that involved teaching participants auditory discriminations (Walker et al., 1991; Walker & Martin, 1994). In both cases, participants either passed training tasks quickly (in fewer than 100 trials) or continued to perform at approximately chance levels after hundreds of training trials. This finding has implications for evaluating training procedures - it suggests that if an individual has not mastered a task within 150 training trials, unless there is a significant upward trend in the data, additional training trials using the same training procedure are unlikely to benefit the learner. In such a case, time and staff resources could be used more productively in other pursuits, such as in the development of more effective and efficient interventions.

An outcome of the assessment of a large sample of individuals in order to obtain participants for this study is the suggestion that the ABLA could be streamlined by deleting the existing Level 5 task. The rationale for deleting the existing Level 5 task follows from the typical pass-fail patterns of participants on the ABLA. In studies reporting pass-fail data for each level, there were very few participants who passed Level 5 and not Level 6. For example, in the original research by Kerr et al. (1977), of 117 participants, there were 63 persons who passed Level 5. Only 3 of these individuals did not subsequently pass Level 6. In recent research by Barker-Collo et al. (1995) and Walker et al. (1994), out of 71 individuals, there were 22 participants who passed Level 5. Only 1 of these participants did not subsequently pass Level 6. In the current research, of the 84 individuals who were initially screened, there were no persons who passed Level 5 but not Level 6. Overall, the results suggest that Level 5 requires the same skills as Level 6; therefore, the deletion of Level 5 could be undertaken without jeopardizing the quality or utility of the ABLA.

Conclusion

Overall, the results of the current research, in conjunction with other studies pertaining to the ABLA, suggest that acquisition of ABLA Level 5 is a complex process that may be influenced by a multiplicity of factors. The relative influence of any particular factor is likely to vary across individuals. Due to a number of confounding variables (e.g., different levels of developmental disability, different living environments), the present research was unable to demonstrate that learning of an auditory matching task facilitated learning the ABLA Level 5 auditory (speech) -visual discrimination task. In order to more definitively resolve the issue of whether learning a simpler auditory (sound) - visual discrimination task facilitates learning a more complex auditory (speech) - visual discrimination task such as the ABLA Level 5 task, additional research is necessary. One strategy would require that groups of individuals equated on several dimensions (e.g., all individuals with severe developmental disabilities and no functional speech living in a residential care facility) be exposed to the training and testing contingencies presented to Groups 1, 2, and 3. Another strategy would involve the use of a multiple-baseline-across-individuals design to evaluate whether mastering an auditory (sound) discrimination faciliates mastery of an auditory (speech) discrimination. A third possibility could be to analyze the different dimensions of the tasks and different dimensions of the auditory stimuli for Level 5 in order to more carefuly identify the types of stimulus control that individuals are under when they master the tasks. Such information might then be used to identify possible training strategies.

In summary, previous research attempting to teach failed ABLA auditory discriminations has indicated that such discriminations are especially difficult to master. These types of discriminations are, nevertheless, important for learners to acquire as they appear to be necessary for the development of many adaptive behaviors, including communicative, educational, and vocational skills. The present study extended previous research regarding the inclusion of an additional auditory-visual discrimination task in the ABLA, and suggested further directions for research that could maximize the value of the ABLA as an effective and efficient assessment tool.

References

Barker-Collo, S., Jamieson, J., & Boo, S. (1995). Assessment of Basic Learning Abilities Test: Prediction of communication ability in persons with developmental disabilities. International Journal of Practical Approaches to Disability, 19, 23-28.

Bickel, W. K., Stella, E., & Etzel, B. C. (1984). A reevaluation of stimulus overselectivity: Restricted stimulus control or stimulus control hierarchies. Journal of Autism and Developmental Disorders, 14, 137-157.

Calculator, S. N. (1988). Exploring the language of adults with mental retardation. In S. N. Calculator & J. L. Bedrosian (Eds.), Communication Assessment and Intervention for Adults with Mental Retardation. (pp. 95-106). Boston: College-Hill.

Casey, L., & Kerr, N. (1977). Auditory-visual discrimination and language production [Monograph]. Rehabilitation Psychology, 24, 137-155.

Feldman, M. A. (1994). Parenting education for parents with intellectual disabilities: A review of outcome studies. Research in Developmental Disabilities, 15, 299-332.

Feldman, M. A., & Case, L. (1997). Effectiveness of self-instructional audiovisual materials in teaching child-care skills to parents with intellectual disabilities. Journal of Behavioral Education, 7, 235-257.

Feldman, M. A., Case, L., Rincover, A., Towns, R., & Betel, J. (1989). Parent education project III: Increasing affection and responsivity in developmentally handicapped mothers: Component analysis, generalization, and effects on child language. Journal of Applied Behavior Analysis, 22, 211-222.

Feldman, M. A., Ducharme, J. M., & Case, L. (in press). Using self-instructional pictorial manuals to teach child-care skills to mothers with intellectual disabilities. Behavior Modification.

Fisher, W. W., & Mazur, J. E. (1997). Basic and applied Research on choice responding. Journal of Applied Behavior Analysis, 30, 387-410.

Frith, U. & Baron-Cohen, S. (1987). Perception in autistic children. In D. Cohen & A. Donellan (Eds.), Handbook of Autism and Developmental Disabilities, (pp. 85-102), New York: Wiley.

Green, C. W., Reid, D. H., White, L. K., Halford, R. C., Brittain, D. P., & Gardner, S. M. (1988). Identifying reinforcers for persons with profound handicaps: Staff opinion versus systematic assessment of preferences. Journal of Applied Behavior Analysis, 21, 31-43.

Harapiak, S. M., Martin, G. L., & Yu, D. (in press). Hierarchical ordering of auditory discriminations and the Assessment of Basic Learning Abilities Test. Journal on Developmental Disabilities.

Hazen, A., Szendrei, V., & Martin, G. L. (1989). The AVC discrimination test: A valuable tool for teachers of developmentally disabled persons. Journal of Practical Approaches to Developmental Handicaps, 13(1), 7-13.

Hupp, S. C., Mervis, C. B., Able, H., & Conroy-Gunter, M. (1986). Effects of receptive and expressive training of category labels on generalized learning by severely mentally retarded children. American Journal of Mental Deficiency, 90, 558-565.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. Journal of Applied Behavior Analysis, 27, 197-209.

Kerr, N. (1977). Implications of results for theory and practice: The "Christmas Tree" model [Monograph]. Rehabilitation Psychology, 24, 133-136.

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

Koegel, R. L., & Wilhelm, H. (1973). Selective responding to the components of multiple visual cues by autistic children. Journal of Experimental Child Psychology, 15, 442-453.

Koegel, R., & Williams, J. (1980). Direct versus indirect response-reinforcer relationships in teaching autistic children. Journal of Abnormal Child Psychology, 8, 537-547.

Kolko, D. J., Anderson, L., & Campbell, M. (1980). Sensory Preference and overselective responding in autistic children. Journal of Autism and Developmental Disorders, 10, 259-271.

Lambert, J. L. (1990). The development of thinking in mentally retarded children: Has behaviourism something to offer? In D. E. Blackman & H. Lejeune (Eds.) Behaviour Analysis in theory and Practice: Contributions and Controversies. (pp. 139-157). Hillsdale, NJ: Lawrence Erlbaum.

Lerman, D. C., Iwata, B. A., Rainville, B., Adelinis, J. D., Crosland, K., & Kogan, J. (1997). Effects of reinforcement choice on task responding in individuals with developmental disabilities. Journal of Applied Behavior Analysis, 30, 411-422.

Lovaas, I., & Schreibman, L. (1971). Stimulus overselectivity of autistic children in a two stimulus situation. Behavior Research & Therapy, 9, 305-310.

Lovaas, I., Schreibman, L., Koegel, R., & Rehm, R. (1971). Selective responding by autistic children to multiple sensory input. Journal of Abnormal Psychology, 3, 211-222.

Martin, G., & Pear, J. (1996). Behaviour modification: What it is and how to do it (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.

Martin, G., Yu, D., Quinn, G., & Patterson, S. (1983). Measurement and training of AVC Test discrimination skills: Independent confirmation and extension. Rehabilitation Psychology, 28, 231-237.

McDonald, L., & Martin, G. L. (1993). Facilitating discrimination learning for persons with developmental disabilities. International Journal of Rehabilitation Research, 16, 160-164.

McIlvane, W. J., Bass, R. W., O'Brien, J. M., Gerovac, B. J. & Stoddard, L. T. (1984). Spoken and signed naming of foods after receptive exclusion training in severe retardation. Applied Research in Mental Retardation, 5, 1-27.

McIlvane, W. J., Dube, W. V., Kledaras, J. B., Iennaco, F. M., & Stoddard, L. T. (1990). Teaching relational discriminations to individuals with mental retardation: Some problems and possible solutions. American Journal on Mental Retardation, 95, 283-296.

Meyerson, L. (1977). AVC Test behaviour and attempts to modify it [Monograph]. Rehabilitation Psychology, 24, 119-122.

Mirenda, P. & Locke, P. (1989). A comparison of symbol transparency in nonspeaking persons with intellectual disabilities. Journal of Speech and Hearing Disorders, 54, 131-140.

Owens, R. E., & Rogerson, B. S. (1988). Adults at the presymbolic level. In S. N. Calculator & J. L. Bedrosian (Eds.), Communication Assessment and Intervention for Adults with Mental Retardation, (pp.189-230). Boston: Little, Brown and Company.

Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T. J. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. Journal of Applied Behavior Analysis, 18, 249-255.

Reynolds, B. S., Newsom, C. D., & Lovaas, O. I. (1974). Auditory overselectivity in autistic children. Journal of Abnormal Child Psychology, 2, 253-263.

Rincover, A. & Ducharme J.M. (1987). Variables influencing stimulus overselectivity and "tunnel vision" in developmentally delayed children. American Journal of Mental Deficiency, 4, 422-430.

Rincover, A., Feldman, M., & Eason, L. (1986). "Tunnel vision": A possible keystone stimulus control deficit in autistic children. Analysis and Intervention in Developmental Disabilities, 6, 283-304.

Saunders, K. J., & Spradlin, J. E. (1989). Conditional discrimination in mentally retarded adults: The effect of training the component simple discriminations. Journal of the Experimental Analysis of Behavior, 52, 1-12.

Schover, L. R., & Newsom, C. D. (1976). Overselectivity, developmental level, and overtraining in autistic and normal children. Journal of Abnormal Child Psychology, 4, 289-298.

Schreibman, L., Kohlenberg, B. S., & Britten, K. R. (1986). Differential responding to content and intonation components of a complex auditory stimulus by nonverbal and echolalic autistic children. Analysis and Intervention in Developmental Disabilities, 6, 109-125.

Smeets, P. M., & Lancioni, G. E. (1984). Acquisition on non-vocal communication and discrimination learning in severely handicapped children. In J. Dobbing (Ed.), Scientific Studies in Mental Retardation, (pp. 375-387).

Stubbings, V. & Martin, G. L. (1995). The ABLA Test for predicting performance of developmentally disabled person on prevocational training tasks. International Journal of Practical Approaches to Disability, 10, 12-17.

Stubbings, V. & Martin, G. L. (1998). Matching training tasks to the abilities of people with developmental disability: ABLA Test vs. experienced staff. American Journal on Mental Retardation.

Tharinger, D., Schallert, D., & Kerr, N. (1977). Use of AVC Test tasks to predict classroom learning in mentally retarded children [Monograph]. Rehabilitation Psychology, 24, 113-118.

Vollmer, T. R., Marcus, B. A., & LeBlanc, L. (1994). Treatment of self-injury and hand mouthing following inconclusive functional analyses. Journal of Applied Behavior Analysis, 27, 331-334.

Wacker, D. P. (1981). Applicability of a discrimination assessment procedure with hearing impaired/mentally handicapped clients. Journal of the Association for the Severely Handicapped, 6, 51-58.

Wacker, D. P., Kerr, N. J., & Carroll, J. L. (1983). Discrimination skill as a predictor of prevocational performance of institutionalized mentally retarded clients. Rehabilitation Psychology, 28, 45-59.

Walker, J. G., & Martin, G. L. (1994). Teaching an auditory matching task to developmentally disabled persons. Developmental Disabilities Bulletin,22, 16-26.

Walker, J. G., Lin, Y. H., & Martin, G. L. (1994). Auditory matching skills and the ABLA Test: Where do they fit? Developmental Disabilities Bulletin, 22, 1-15.

Walker, J., Martin, G. L., & Graham, M. (1991). Rapid teaching of an auditory two-choice discrimination to severely mentally handicapped persons. Journal of Practical Approaches to Developmental Handicaps, 15, 8-11.

Ward, R. (1994). Bridging the gap between visual and auditory discrimination learning in children with severe developmental disabilities. Unpublished doctoral dissertation. University of Toronto, Toronto, Ontario.

Wilhelm, H., & Lovaas, I. (1976). Stimulus overselectivity: A common feature in autism and mental retardation. American Journal of Mental Deficiency, 81, 26-31.

Witt, J. C., & Wacker, D. P. (1981). Teaching children to respond to auditory directives: An evaluation of two procedures. Behaviour Research of Severe Developmental Disabilities, 2, 175-189.

Yu, D., & Martin, G. (1986). Comparison of two procedures to teach visual discriminations to severely mentally handicapped persons. Journal of Practical Approaches to Developmental Handicaps, 10, 7-12.

Yu, D., Martin, G. L., & Williams, L. (1989). Expanded assessment for discrimination learning with mentally retarded persons: A practical strategy for research and training. American Journal on Mental Retardation, 94, 161-169.

Appendix A

INFORMATION FORM

1. Title and purpose of project:

"Facilitating auditory discrimination learning with developmentally disabled persons". This project will utilize the Assessment of Basic Learning Abilities Test, which provides valuable information regarding an individual's abilities, aids staff in choosing activities that are consistent with each person's abilities, and provides direction for the development of teaching programs. The objective of the project is to investigate wbhether it would be beneficial to add a task to the ABLA Test.

2. Name of researcher:

Jackie Walker M.A. (Ph.D. student; Department of Psychology, University of Manitoba)

3. Name of project supervisor:

Garry L. Martin, Ph.D. (Professor of Psychology; Department of Psychology, University of Manitoba)

4. Times that individual will participate:

Assessment and teaching sessions will be conducted approximately three times per week, with each session lasting approximately thirty minutes. All assesmnet and teaching sessions will be conducted at times when individuals are not involved in other activities or programmes.

5. Skills to be taught:

(a) following instructions, for example, placing an object into a container when instructed to do so.

(b) matching simple sounds, for example, learning to ring a bell when another bell sound is heard.

(c) learning to respond to words and instructions, for example, learning to point to a picture of a dog when the teacher says the word "dog".

6. Procedures to be used:

The researcher will use instructions, demonstrations, and guidance to explain the task to the learner. Throughout each session, the learner will be encouraged and praised for their effort. In addition, praise and rewards will be provided following correct responses. The rewards will include listening to music, looking at books, playing with various toys, and so forth.

7. Possible benefits for the participant:

(a) the opportunity to learn a variety of tasks in a one-on-one teaching situation that willinlcude individual attention and positive instructional techniques.

(b) completion of additional assessments that will be helpful to staff for selecting tasks that are suitable for each individual and their unique abilities.

8. Possible risks for the participant:

None

Appendix B

PSYCHOLOGY RESEARCH CONSENT FORM

Name of researcher: ____________________________

Name of research project: ____________________________

Dear ____________________________________,

Please complete this form and return it in the attached envelope.

I ______________________________ hereby give _______, do not give ________ my consent for ________________________________ to be screened and if selected to participate in the research project listed above. I understand that the above project has been approved by the Ethics Committes of both the University of Manitoba and the Manitoba Developmental Centre. I also understand that my consent, once given, can be withdrawn at any time.

Signature _________________________________

Date _________________________________

Appendix C

ABLA Test Data Collection Form

Name:
Date:

Tester:
Observer:

Task 1 - demonstration

trials: (red box)
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16

trials: (yellow can)
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16

Task 2 - position discrimination

trials:
1 2 3 4 5 6 7 8

9 10 11 12 13 14 15 16

17 18 19 20 21 22 23 24

25 26 27 28 29 30 31 32

Task 3 - visual discrimination

trials:
L R L L R L R R
1 2 3 4 5 6 7 8

R L L R L R L R
9 10 11 12 13 14 15 16

L L R L R R L R
17 18 19 20 21 22 23 24

Task 4 - visual match-to-sample

trials: R R L R L L R L
C B B C C B B C
1 2 3 4 5 6 7 8

L L R L R R L R
B C B C B B C B
9 10 11 12 13 14 15 16

R L R L L R L L
C B B C B C B C
17 18 19 20 21 22 23 24

Task 5 - Auditory discrimination

trials:
B B C B C C B C
1 2 3 4 5 6 7 8

C B C B B C B B
9 10 11 12 13 14 15 16

C B B C B C B C
17 18 19 20 21 22 23 24

Task 6 - auditory-visual combined

trials:
R R L L R L L R
B C C B C B C B
1 2 3 4 5 6 7 8

L L R L R L R R
C C B C B B B C
9 10 11 12 13 14 15 16

L R L L R L R R
B C C B C B C B
17 18 19 20 21 22 23 24

Appendix D

Auditory Identity Matching Data Collection Form

Name: ____________________

Date: ____________________

Tester: ____________________

Observer: __________________

T = tambourine sound
B = bell sound

Correct response:	T	B	B	T	B	T	B	T
Trial number:	1	2	3	4	5	6	7	8
	T	B	T	B	B	T	B	B
	9	10	11	12	13	14	15	16
	T	B	T	T	B	T	T	B
	17	18	19	20	21	22	23	24
	T	T	B	T	B	B	T	B
	25	26	27	28	29	30	31	32
	B	T	B	B	T	B	T	T
	33	34	35	36	37	38	39	40

number of correct responses = _____
number of total responses = _____
Percent correct = _____

Appendix E

Stimulus Preference Assessment Data Collection Form

Name: ________________________ Residence: ________________________

Date: ________________________ Session #: ________________________

Procedure

1) At beginning of session, present each of the 5 stimuli chosen for session for 5 seconds (i.e., participant is prompted to touch, taste, or look at each stimulus). This is the "primer."
2) Following primer, present each of the stimuli 5 times (counterbalanced across and during session). On each trial, the stimulus is presented as described in the stimulus preference assessment procedure.
3) If **approach behavior** occurs, then present stimulus for an additional 5 seconds, then begin a new trial.
4) If **avoidance behavior** or **no response** occurs, then remove stimulus and begin a new trial.

Scoring

AP: occurrence of an approach behavior in the presence of the stimulus
AV: occurrence of an avoidance behavior in the presence of the stimulus
NR: no response in the presence of the stimulus

Stimulus	Primer	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

Stimulus	Primer	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

Appendix F

Auditory Matching Training Task Data Collection Form

Name: ____________________ Tester: ____________________

Date: ____________________ Observer: ____________________

S= squeak toy T= tin sound

Stage 1 S S S S S S S S

T T T T T T T T

passing criterion: 4 consecutive correct to each stimulus

Stage 2 T S T T S T S S

T S S T S T S T

S T T S T S T S

passing criterion: 8 consecutive correct

Stage 3A T S T T S S T S

S S T S S T S T

passing criterion: 4 consecutive correct

Stage 3B S T T S T S S T

T S S T T T S S

passing criterion: 4 consecutive correct

Stage 4 S T T S T T S S

T S T S T T S T # correct responses: _____

total # responses: _____

T S T T S S T S Percent correct: _____

passing criterion: 8 consecutive correct

Appendix G

Level 5 Auditory Discrimination Training Task Data Collection Form

Name:__________________ Tester: __________________

Date: __________________ Observer:__________________

1) The "correct" stimulus/response is the word/picture puzzle piece that is presented as indicated below (e.g., A: the word (& picture) "airplane" is the correct stimulus; D: the word (& picture) "dog" is the correct stimulus).
2) Stimuli remain in the same left-right position throughout the session.
3) At the beginning of each trial, the participant is required to perform an observing response (i.e., look at and touch) to each of the two stimuli. Following the observing response, the "correct" auditory stimulus is presented approximately every 2 seconds and is repoeated until the participant responds.

Correct response:	A	D	D	A	D	A	D	A
Trial number:	1	2	3	4	5	6	7	8
	A	D	A	D	D	A	D	D
	9	10	11	12	13	14	15	16
	A	D	A	A	D	A	A	D
	17	18	19	20	21	22	23	24
	A	A	D	A	D	D	A	D
	25	26	27	28	29	30	31	32
	D	A	D	D	A	D	A	A
	33	34	35	36	37	38	39	40

number of correct responses = _____
number of total responses = _____
Percent correct = _____

Appendix H

Auditory Matching Training Task - Interobserver Reliability Data Collection Form

Name: Tester:

Date: Observer: Session #:

Trials

	1	2	3	4	5	6	7	8	9	10
1) Began at correct stage (1, 2,...)										
2) If at Stage 1: - did imitation trials										
If at Stage 2: - experimenter stimuli visible - Level 2 position prompt										
If at Stage 3A: - experimenter stimuli hidden - Level 2 position prompt										
If at Stage 3B: - experimenter stimuli hidden - Level 1 position prompt										
If at Stage 4: - experimenter stimuli hidden - no position prompt										
3) If necessary, changed stages if pass or fail criterion was attained										
4) Provided initial instruction "____, same sound"										
5) Presented sound every 2 seconds										
6) Recorded participant's response										
7) If correct response: preferred reinforcer and praise										
8) If incorrect response: "no", removed apparatus & 5 sec. time-out										
9) If no response: removed apparatus & 5 sec. time-out										

Appendix I

Level 5 Analog Training Task - Interobserver Reliability Data Collection Form

Name: Tester:

Date: Observer: Session #:

Trials

	1	2	3	4	5	6	7	8	9	10
1) Conducted imitation, guided and independent response trials for each auditory-visual stimulus pair										
2) Conducted observing response component at beginning of each trial for each stimulus										
3) Presented auditory stimulus every 2 seconds until participant responded										
4) Recorded participant's response										
5) If correct response: presented preferred reinforcer and enthusiastic praise										
6) If incorrect response: "no", removed apparatus & 5 sec. time-out										
7) If no response: removed apparatus & 5 sec. time-out										