The Relative Difficulty of Three Position Discriminations for Persons with Severe to Profound Developmental Disabilities

by

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Abstract

The Assessment of Basic Learning Abilities (ABLA) test, developed by Kerr, Meyerson, and Flora (1977) assesses the ease or difficulty with which individuals with developmental disabilities are able to learn a simple imitation and five two-choice discrimination tasks. During ABLA Level 2, referred to as a position discrimination task, the client is presented with a yellow can always on the left and a smaller red box always on the right. The client is required to place an irregularly shaped piece of foam into the container on the left (the yellow can) for a correct response. With this task a client can learn to make a correct response based on position, colour, shape, or size cues, or some combination of these. The current study evaluated the relative difficulty of ABLA Level 2 and two additional types of position discriminations. The first type of task was similar to ABLA Level 2, except that it used identical containers, and thus contained both relative and absolute position cues (the REAB task), but not shape, colour, or size cues. The second type of task was similar to ABLA Level 2; however, it incorporated identical containers that varied in their absolute positions, which required a relative position discrimination to arrive at the correct response (the RE task). In Experiment 1, I used an alternating-treatments design with replication within and across three participants who passed ABLA Level 2 but failed all higher levels, to examine how many trials were required to master tasks analogous to ABLA Level 2, versus REAB tasks, versus RE tasks. In Experiment 2, I used a within-subject design with replication across three participants to further clarify the relative difficulty of the three position discrimination tasks, and to determine whether correct container location (i.e. left versus right) can influence the difficulty of learning the tasks. The results demonstrated that there was no consistent difference in difficulty between the three types of tasks, and the difficulties experienced by P1 and P2 can be accounted for entirely by an interaction between the right-left location of the correct response and handedness.

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Introduction

Developing and implementing individualized educational programs for persons with developmental disabilities can be a complicated task (Martin & Yu, 2000). While individuals without developmental disabilities may have no problem transferring a skill, such as opening a window, from one setting to another, persons with developmental disabilities might have great difficulty generalizing such skills across contexts. Over several years working in many different schools, Kerr, Meyerson, and Flora (1977) consistently observed instances where a child with a developmental disability would fail to acquire a new skill, despite the fact that seemingly similar skills had been acquired earlier when taught by the same teacher, using the same instructional method and reinforcement system. According to Kerr et al., such discrepancies often arise due to deficiencies in prerequisite skills necessary to acquire self-care, educational, and vocational behaviours.

The majority of behavioural checklists for persons with developmental disabilities, designed to identify an individual's level of functioning, assess global, learned behaviours of the individual, such as dressing and grooming skills (Martin & Yu, 2000). Unfortunately, these checklists do not assess the prerequisite discrimination skills identified by Kerr et al. (1977) as necessary to perform these global behaviours. Consequently, Kerr et al. developed the Auditory Visual Combined Discrimination Test, or the AVC test (now referred to as the Assessment of Basic Learning Abilities or ABLA test). The ABLA test assesses the ease or difficulty with which an individual is able to learn six tasks, called levels, hierarchically arranged in difficulty: an imitation task, a position discrimination, a visual discrimination, a match-to-sample discrimination, an auditory discrimination, and an auditory-visual discrimination (Kerr et al., Martin & Yu, see Table 1).

Table 1. A description of the ABLA levels and the types of discriminations required.

	Types of Discriminations	Everyday Examples
ABLA Level 1, Imitation		
A tester puts an object into a container and asks the client to do likewise	A simple imitation	A child claps his hands upon seeing his mother clap her hands
ABLA Level 2, Position Discrimination		
When a red box and a taller yellow can are presented in fixed positions, a client is required to consistently place a piece of beige foam in the container on the left when the tester says, "Where does it go?"	A simultaneous visual discrimination with position, colour, shape, and size as relevant cues	Placing scrap paper into the paper recycling bin located to the left rather than the pop can recycling bin located to the right
ABLA Level 3, Visual Discrimination		
When the red box and the yellow can are randomly presented in left-right positions, a client is required to consistently place a piece of beige foam in the yellow can when the tester says, "Where does it go?"	A simultaneous visual discrimination with colour, shape, and size as relevant cues	Locating one's own coat among many coats hung up on a coat rack
ABLA Level 4, Match-to-Sample Discrimination		
When the yellow can and the red box are presented in random left-right positions and a client is presented with a yellow cylinder or a red cube, the client consistently places the cylinder in the yellow can and the cube in the red box	A conditional visual-visual identity discrimination with colour, shape, and size as relevant cues	Sorting socks into pairs

Table 1 Continued

ABLA Level 5, Auditory Discrimination		
When presented with the yellow can and the red box (in fixed positions), a testee is required to consistently place the piece of beige foam in the appropriate container when the tester randomly says, 'red box' (in a high-pitched rapid fashion) or 'yellow can' (in a low-pitched drawn-out fashion)	A conditional auditory-visual non-identity discrimination with pitch, pronunciation, and duration as relevant auditory cues, and with position, colour, shape, and size as relevant visual cues	Responding appropriately to requests such as, "fork" vs. "spoon", when both are in a consistent location on either side of a plate
ABLA Level 6, Auditory-Visual Discrimination		
The same as Level 5, except that the right-left position of the containers is randomly alternated	A conditional auditory-visual non-identity discrimination, with the same auditory cues as Level 5, and with only colour, shape, and size as relevant cues	Responding appropriately to requests such as, "pass the salt" vs. "pass the pepper" when the salt and pepper shakers are in different places on the table from meal to meal

*Adapted from Martin and Yu (2000).

Prior to assessing a particular level, a client is given a demonstration trial, a guided trial, and an opportunity for an independent response at that level. Following a correct independent response, testing trials at that level begin. During testing at a particular level, the client is provided with praise and edibles following correct responses. An error correction procedure is instituted following errors. Testing of a level continues until the client achieves eight consecutive correct responses (considered a pass), excluding correct responses during error correction practice trials, or until eight cumulative errors occur (considered a fail). The ABLA test takes approximately 30 minutes to administer to a client (Martin & Yu, 2000), and has proven to be very useful for direct-care staff in matching the learning ability of persons with developmental disabilities to the difficulty of various training tasks.

Kerr et al. (1977) referred to Level 2 (of what is now called the ABLA) as a position discrimination. However, as can be seen from the description of Level 2 in Table 1, a correct response could be made on the basis of relative position cues, absolute position cues, colour cues, shape cues, or size cues. This may have been intentional on the part of Kerr et al., as additional visual cues, such as shape, colour, and size, often accompany position cues in real-life situations. For example, the fact that a trashcan is usually found to the left of a recycling bin in the cafeteria serves as a position cue for individuals throwing away unfinished food after a meal. However, there are additional shape, colour, and size cues present to make the discrimination of where to place garbage: the trash can is typically circular, grey, tall and wide while the recycling bin (in Manitoba, Canada) is rectangular, blue, short, and narrow. It is important to note, however, that there are real-life examples in which additional visual cues may not be readily available, and that the person must primarily rely on position cues to behave appropriately in these situations. For example, correctly discriminating the doorway to the bathroom located down a hallway with doorways identical in appearance on either side would require relative and/or absolute position discrimination(s). For the purposes of testing whether an individual possesses such discrimination skills, ABLA Level 2 could be modified so that identical containers are used. A correct response could then be made on the basis of relative position cues or absolute position cues (a REAB task, see Figure 1). If ABLA Level 2 were modified so that the containers were identical, and in addition, on some trials the two containers were to the left of the participant, and on some trials to the right of the participant, then a correct response could be made only on the basis of relative position cues (a RE task, see Figure 1). A RE discrimination may be required in real-life when an individual has a set place in line (for example, always behind Paul) when a group of residents from a developmental disability treatment facility go on a field trip. In this scenario, regardless of the absolute position of the line-up of residents (for example, a facility room vs. a park), the resident is to always line up behind Paul. For my research I conducted two experiments to examine the relative difficulty of these three types of tasks, ABLA Level 2 analogue tasks, REAB tasks, and RE tasks, with persons with severe to profound developmental disabilities. Differences in the relative difficulty of the three types of tasks may serve as an indication that participants are attending to cues other than (or in addition to) position during the ABLA Level 2 task (e.g. colour, shape, and/or size cues), and that the number of available visual and positional cues present may change the difficulty of a discrimination task.

Research Findings on the ABLA

ABLA Levels Are Ordered in Difficulty. Using the statistical test, order analysis, Kerr et al. (1977) observed that 111 of 117 persons with developmental disabilities who passed at a

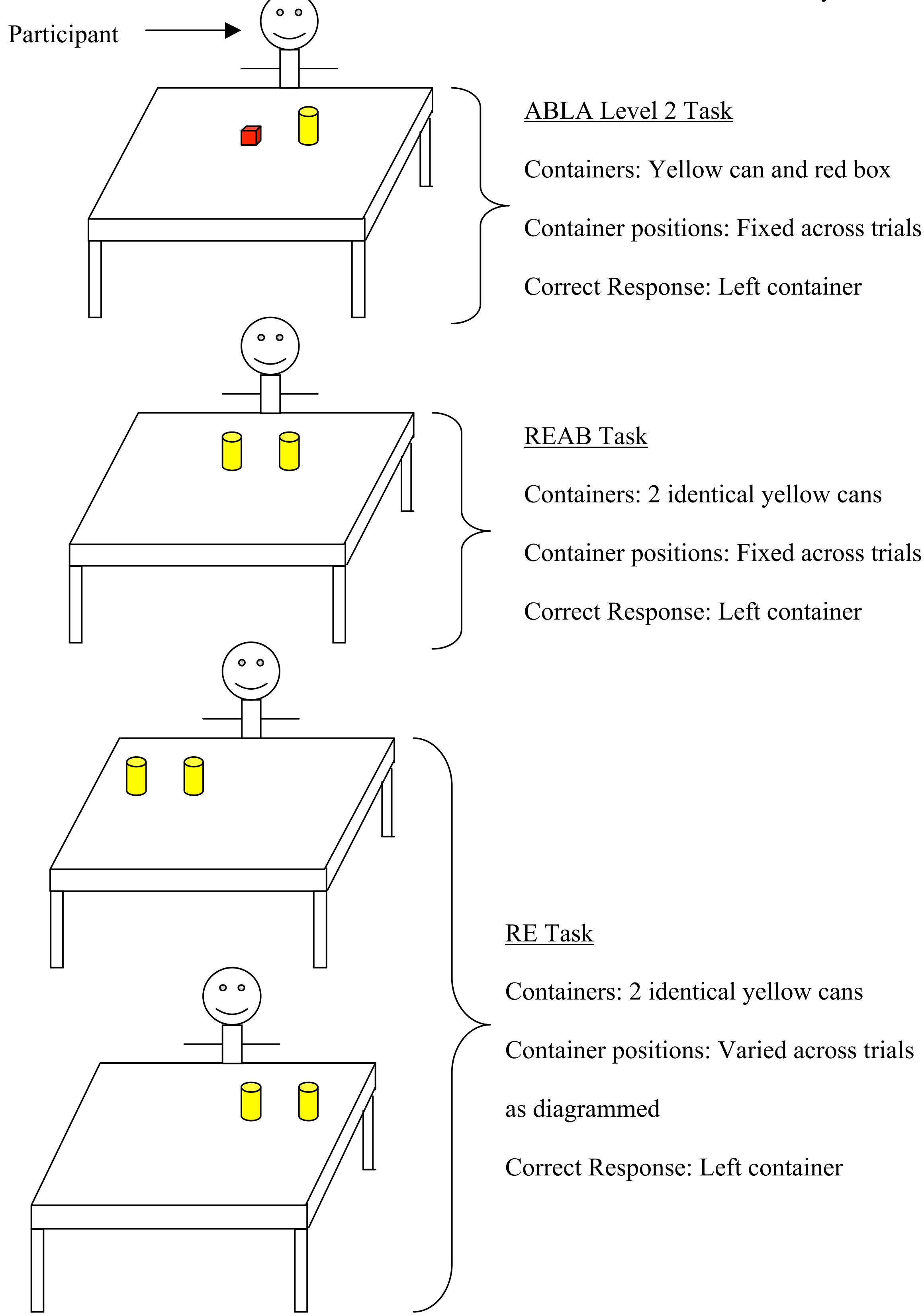

Figure 1. Schematic of ABLA Level 2, a REAB task, and a RE task. (REAB refers to relative and absolute position task, RE refers to relative position task). The location of the correct response is from the participant's perspective.

certain level also passed at lower levels and failed at higher levels of the ABLA. Martin, Yu, Quinn, and Patterson (1983) obtained results confirming the hierarchical ordering of the ABLA's discrimination tasks for 39 of 41 adults with intellectual disability who passed and failed some ABLA levels. Similar findings have been observed for persons with Autistic Spectrum Disorders (Ward & Yu, 2000), for those who are deaf and mentally retarded (Kerr & Meyerson, 1977), for typically developing individuals (Casey & Kerr, 1977), and for hearing-impaired multiply handicapped clients (Wacker, 1981).

ABLA has High Test-retest and Inter-tester Reliability. Research suggests that the test-retest and inter-tester reliabilities of the ABLA are high. Martin et al. (1983) found that 42 individuals with intellectual disability tested on the ABLA and retested three months later did not change in their performance level. Furthermore, different individuals performed the original tests and the retests, demonstrating that the ABLA test is also inter-tester reliable.

ABLA Performance is Related to Age and Level of Retardation. Kerr et al. (1977) reported that variability in ABLA performance is related to a client's age and level of retardation. For example, in contrast to an adult sample, three-fourths of children, age 3 to 6 with mental retardation, and two-thirds of individuals age 7 to 10 with mental retardation, did not pass ABLA Level 5. Furthermore, no children with moderate to severe mental retardation, age 3 to 6, passed the Level 6 task, while fewer than half of children labelled mildly retarded passed this level. Finally, across children and adults poorer performance on the ABLA test related to greater levels of mental retardation (Kerr et al.).

Failed ABLA Levels are Difficult to Teach. Meyerson (1977) found that 97% of individuals who passed an ABLA level would do so in under 30 trials, while individuals who failed a level would require anywhere from 100 to 900 training trials before being able to reach the pass criterion for that level. Regardless of the ABLA level, the training required to reach the pass criterion for a previously failed level was extensive, involving various prompting and fading techniques. Indeed, numerous researchers have found that 100 trials incorporating standard prompting and reinforcement strategies (i.e. demonstration, guided trial, independent opportunity, praise following correct responses, and error correction following incorrect responses) is insufficient to teach previously failed ABLA Levels 3, 4, 5, and 6 (Meyerson; Stubbings & Martin, 1995; Wacker, Kerr, & Carroll, 1983; Wacker, Steil, & Greenbaum, 1983; Witt & Wacker, 1981; Yu & Martin, 1986). Research has yet to reveal the number of trials required to teach previously failed ABLA Levels 1 and 2.

ABLA Levels have High Predictive Validity for the Learning of Other Tasks. Performance on the ABLA can predict what other tasks individuals with developmental disabilities may readily learn. According to a comprehensive review by Martin, Thorsteinsson, Yu, and Martin (2008), a substantial number of researchers have found high predictive validity of the ABLA for the learning of other tasks, including simple imitation tasks and two-choice discriminations (e.g. Condillac, 2002; Stubbings & Martin 1998; Tharinger, Schallert, & Kerr, 1977; Wacker et al., 1983), three-choice and four-choice discriminations (Doan, Martin, Yu, and Martin, 2007; Wacker et al.), three types of preference assessments varying in their presentation modes (objects versus photographs versus verbal descriptions (Conyers et al., 2002; DeVries et al., 2005; Reyer & Sturmey, 2006)), compliance to instructions coupled with modeling and guidance versus instructions alone (e.g. Hiebert, Martin, Yu, Thorsteinsson, & Martin, 2007; LaForce & Feldman, 2000), and the learning of spoken names of pictures of common objects (Verbeke, Martin, Yu, and Martin, 2007).

ABLA Test Performance is a Better Predictor of Learning than Direct Care Workers' Estimates. A number of researchers have indicated that performance on the ABLA test is a better predictor of the acquisition of educational, prevocational, and vocational tasks by individuals with developmental disabilities than are the predictions from caregivers or experienced staff (e.g. Stubbings & Martin, 1998; Thorsteinsson et al., 2007). For example, Thorsteinsson et al. compared the predictive validity of caregivers and the ABLA test for the ease or difficulty with which 20 persons with intellectual disabilities would learn 15 everyday tasks (e.g. imitation of switch-pressing to turn a light on, requiring a Level 1 discrimination). They found that out of 300 predictions made based on ABLA performance, 282, or 94%, were confirmed, statistically significantly greater than the percentage of confirmed predictions by caregivers who had worked with the clients for at least 24 months (216 confirmed predictions, or 72%). These differences have considerable clinical significance when one considers the amount of time potentially spent teaching tasks that are well above or well below the client's discrimination skills as determined using the ABLA.

Aberrant Behaviour Occurs When Teaching Tasks are Mismatched to ABLA Level. Presenting tasks that are either above or below the highest ABLA level passed by the client may result in high levels of aberrant behaviour, and may drastically increase the number of teaching trials and training hours required by direct-care staff (Stubbings & Martin, 1998). For example, Vause, Martin, and Yu (1999) demonstrated that three individuals with intellectual disabilities displayed the greatest frequency of aberrant behaviour during training sessions when the teaching tasks were above their highest passed ABLA level, a lower frequency of aberrant behaviour when the tasks were below the highest passed ABLA level, and the lowest frequency of aberrant behaviour when the tasks required discriminations equivalent to the highest passed ABLA level (also see Vause et al., 2000, for similar findings).

Position Discrimination Research and ABLA Level 2

During ABLA Level 2, the client is presented with the yellow can always on the left and the red box always on the right (from the perspective of the client). The client is required to place the foam piece into the container on the left in order for the response to be considered correct. However, in addition to the position cue, the client is presented with visual cues, as the containers differ in their physical features (a tall yellow cylindrical can versus a shorter red box). Therefore, rather than responding to the position cue, the client may be attending to any or all of the shape, colour, and/or size cues of the yellow can in order to make the correct response. In the remainder of the Introduction, I will discuss research on position-discrimination learning.

While extensive research has been conducted on visual discrimination tasks involving dimensions such as hue, form, pattern, size, and order as relevant cues, very little research has addressed the role that position cues play during discrimination learning. Stratford and Metcalfe (1981) suggested that this is because many investigators consider position discriminations to be resistant to change, as they have arisen from primitive motor responses established very early in development, relative to more complex visual discriminations, which may be more subject to change via alteration of developmental and experimental variables. Nevertheless, two studies are relevant to the present research, one study with *Ermellinato* chicks (Vallortigara & Zanforlin, 1986) and one with persons with developmental disabilities (Murphy et al., 2007).

Vallortigara and Zanforlin (1986) conducted two experiments to examine performance by chicks on relative versus absolute position discrimination tasks. Using a shaping procedure, chicks were trained to peck on a black dot on a box to open a drawer that contained a reinforcer (grains). In Experiment 1, eight chicks were presented with an absolute position discrimination task, where two identical boxes were placed side-by-side on the wall facing the entrance of the cage. Box A was always the correct one, and was always located in the same spot, while box B alternated randomly from being placed to the right or left side of box A. In the second condition, another set of eight chicks were presented with a relative position task, where two identical boxes were placed side-by-side on the wall facing the entrance of the cage, but the absolute positions of the boxes varied across trials. For half of the chicks in this condition, the box containing a drawer of grains was always found on the left, and for the other four chicks, the box containing the grains was always on the right. The chicks trained on the absolute position discrimination task required a median of 96.5 trials to master the skill (10 consecutive correct responses), while those trained on the relative position discrimination task required 32.5 trials to master the task. The authors suggested that learning according to relative position cues is easier for chicks than learning based on absolute position cues. Because the boxes were identical and in close proximity to one another, the authors asserted that the chicks made a perceptual "grouping" according to the principle of good continuation (the Gestalt principle that elements that move together in the same direction are typically perceptually grouped together), and as a result, more readily distinguished the boxes according to relative rather than absolute position.

Vallortigara and Zanforlin (1986) hypothesized that if the boxes were placed further apart, then perceptual "grouping" would be more difficult, and the chicks would base their discriminations on absolute rather than relative position cues. With spatial separation of the boxes on different walls of the cage in Experiment 2 for both relative and absolute position discrimination tasks, results demonstrated that the absolute position discrimination task became easier (median trials to mastery criterion was 76 compared to 96.5 in Experiment 1), while the relative position discrimination task became more difficult (median trials to criterion was 59 compared to 32.5 in Experiment 1). These differences were statistically significant. Despite the authors' predictions, the number of trials to mastery for the relative position task was still lower than for the absolute position task, though this difference was not statistically significant. The chicks continued to learn faster using relative rather than absolute position cues, possibly due to the fact that distant landmarks with which to form absolute position discriminations were not very distinct in the study, as suggested by the authors.

A behavioural interpretation may be used to explain the above finding. In the absolute position task, the correct container was always in the centre of the cage wall opposite the cage door, but the position of the incorrect container varied randomly: either on the left or the right side of the correct container. Consequently, transfer effects may have influenced how many trials it took to shape each chick's response across trials. For example, suppose that Chick 1 (C1), as a result of randomization, was presented with the first two trials of the absolute position task with the incorrect container on the left. Suppose then that the next three trials, according to randomization, resulted in two right presentations and a left presentation of the incorrect container. It is possible that varying the location of the incorrect box may increase the number of trials necessary to shape the chick's response if C1 is under the stimulus control of the sight of both correct and incorrect boxes collectively rather than environmental cues necessary to make a correct absolute position discrimination, especially considering that distant landmarks were not distinct. With respect to the relative position task, fewer trials may have been necessary to shape the chick's response if chicks were attending to the sight of both boxes collectively rather than environmental cues that facilitate making absolute position discriminations, particularly considering that the correct response was always on the left for some chicks and always on the right for other chicks.

A study on position discriminations with persons with developmental disabilities was conducted by Murphy et al. (2007). The part of their study that is relevant to my research is the performance of eight participants who passed ABLA Level 2 (and failed higher levels) when they were tested on an AB task and on a RE task using standard ABLA test procedures (for a schematic of the version of the REAB and RE tasks that I used in my study, see Figure 1 on p. 6). The AB task used by Murphy et al. was the same as my REAB task, except that the position of the correct container was always in the same place on the table and a second container was either to the right or the left of the correct container. One of the participants passed both the AB and the RE tasks and a second participant failed both tasks, so that these two participants did not provide information on the relative difficulty of the three tasks. Four of the participants who passed Level 2 passed the AB task and failed the RE task, two participants failed the AB task and passed the RE task, and two performed similarly on the AB and RE tasks (one failed both and one passed both). Because of the small sample size, the differences reported by Murphy et al. were not statistically significant. The purpose of my research was to further examine the relative difficulty of similar types of position discrimination tasks.

Statement of the Problem

Two experiments were conducted to evaluate the relative difficulty for persons with developmental disabilities of learning ABLA Level 2 analogue tasks (that contain relative and absolute position cues, and colour, shape, and size cues) versus position tasks that contain both relative and absolute position discrimination cues (REAB tasks) versus position tasks that contain relative position cues only (RE tasks, see Figure 1 on p. 6).

In both experiments, I utilized single-subject designs, with replication across three participants who had passed ABLA Level 2 and failed Level 3. The dependent variable in both experiments was the number of training trials required to master a discrimination task analogous to ABLA Level 2, versus a REAB task, and versus a RE task. Standardized training procedures were used to teach examples of all three tasks in both experiments. Because the fewest number of cues to correctly make a discrimination were available to the participant during the RE tasks, while the most cues were available during the ABLA Level 2 analogue tasks, I hypothesized that the RE tasks would be the most difficult to learn, followed by the REAB tasks, and then followed by the ABLA Level 2 analogue tasks.

As expressed by Martin and Pear (2007), operant conditioning researchers have a long history of using single-subject designs to evaluate the effect of an intervention on a measure of behaviour, whether they be basic researchers or applied researchers. In the latter case, the applied researchers commonly refer to themselves as applied behaviour analysts (ABA's). An experiment is said to have internal validity if it consistently demonstrates that an independent variable caused an observed change in the dependent variable. This implies that an experiment would also have internal validity if it consistently demonstrates a lack of an experimental effect. With some single-subject designs, an experiment can be conducted with one participant (e.g., Roy-Wasiaki, Marion, Martin, and Yu, in press), although they usually include several participants (e.g., Wolko, Hrycaiko, & Martin 1993). When analyzing single-subject data to determine if there is an experimental effect, single-subject researchers typically visually inspect a graph of the results. Guidelines have evolved for visually inspecting data to judge whether a treatment had an effect on a dependent variable (Martin & Pear). However, because the judgment is subjective, single-subject researchers have typically claimed that an experiment has demonstrated internal validity only when there is an obvious, large experimental effect. Although it is possible to demonstrate small effects using control groups and statistical techniques, ABA practitioners have typically relied on single-subject designs and large experimental effects to identify treatments that have clear clinical value (Martin & Pear). As expressed by Martin and Pear, an experiment is said to have external validity to the extent that a finding can be generalized to other individuals (or other behaviours, settings, or treatments). An experiment with a single-subject design is typically weak on external validity. ABA researchers have consistently relied on subsequent replication in follow-up experiments to demonstrate external validity of a finding. Thus, across my experiments, there was the potential for a large effect that would be strong on internal validity, but weak on external validity, and such an outcome is widely accepted by ABA researchers.

Method Common to Both Experiments

Setting and Participants

Three adults with severe to profound developmental disabilities were recruited from St. Amant, a residential and community treatment facility for individuals with developmental disabilities in Winnipeg, Manitoba. The participants were randomly selected from individuals at St. Amant who had previously passed ABLA Level 2 and failed Level 3. Participant 1 was a 40 year-old woman diagnosed with Congenital Microcephaly with a severe to profound delay in functioning, Participant 2 was a 39 year-old woman admitted with Fetal Alcohol Syndrome with a profound delay in functioning, and Participant 3 was a 42 year-old woman with a profound developmental delay. Consent was obtained from the legal guardians of these individuals for them to participate, and for access to their diagnostic information from personal health records.

Participants were reassessed on the ABLA to confirm that they passed ABLA Level 2 and failed ABLA Level 3. Taking into consideration the rights of all participants, if at any time a participant left the table or indicated that she wished to stop a session, the session was terminated and resumed on a different day.

Sessions took place in a meeting room at St. Amant containing several tables and chairs. Participants sat at a table across from me during sessions. During inter-observer agreement and procedural reliability checks, a trained observer sat behind and to the left of the participant.

Materials

The materials required to administer ABLA Levels 1, 2, and 3 included a yellow cylindrical can (15 cm in diameter, 17 cm in height), a red box (14 cm X 14 cm X 10 cm) with black diagonal stripes, and an irregularly-shaped beige piece of foam (5 cm in diameter). ABLA Levels 4, 5, and 6 were not administered. Kerr et al. (1977) chose these materials for their low cost, their ease of attainment, and their practical value as common shapes and primary colours (Martin & Yu, 2000).

Murphy et al. (2007) suggested that prior experience with the ABLA test, particularly with Level 2, may have influenced which cues participants in their study attended to during the position discrimination tasks. Taking this into consideration, the training materials were altered to maximize the difference between discrimination cues so that performance on the position discrimination tasks of this study were less likely to be influenced by previous experience with the ABLA tasks. The training materials for the experiments are described later.

Procedure

Preference assessments. To select reinforcers prior to commencing each session for Experiments 1 and 2, I conducted a preference assessment at a table, while sitting across from a participant, to assess the participants preferences among six different edibles. If the participant was uninterested or unable to consume the edibles, I presented a series of non-edible items to the participant (e.g. games, puzzles). During a preference assessment I lined up the six items from left to right in front of the participant, and would then say, “Take one.” When the participant selected an item she then consumed it, or was allowed to play with it for approximately 5 seconds if it was a non-edible item. She was allowed to select and consume (or play with) an additional 1 to 2 items if desired. Those chosen items were then used to reinforce correct responses in an alternating fashion during that session.

ABLA test administration. ABLA test administration followed the procedures outlined by Kerr et al. (1977) and Martin and Yu (2000), and as summarized in Table 1. The client sat at a table across from me while I administered the discrimination tasks. The testing of a level began with a demonstration, a guided trial, and an opportunity to respond independently. During the demonstration of a level, I instructed the participant “When I say ‘where does it go?’, it goes in here”, and would then model the correct placement of the manipulandum (the piece of foam) for the participant. During the guided trial I provided the verbal cue “Where does it go?” and then prompted the participant to perform the correct response. The participant was then given the opportunity to perform the task independently following the verbal cue “Now you try. Where does it go?”. Following a correct response during the independent opportunity on a level, I then began taking data on the participant’s responses on trials at that level, which counted towards the pass or fail criteria. Test trials were conducted exactly as outlined in the above procedure for an independent opportunity. Participants were given an edible and praise (e.g. “good job!”) for correct responses. As ABLA Level 1 is an imitation task, any action not involving placement of the manipulandum within the container was considered an error. For ABLA Levels 2 and 3, placement of the manipulandum within the incorrect container constituted an error, while no response within 10 s, or any action not involving placement of the manipulandum within a container was considered a non-trial and not scored. This was due to the fact that such actions may not necessarily represent the participant's inability to make the discrimination, but may rather represent non-compliance on the part of the participant. When an error occurred, a correction procedure was used consisting of a demonstration, a guided trial, and an opportunity to respond independently. Eight consecutive correct responses were required in order to pass a level, while eight cumulative errors constituted a fail. Correct placement of the manipulandum during the independent opportunity of the error-correction procedure did not count towards the passing criterion. An error during the error-correction procedure, however, did count towards the fail criterion. Once the pass or fail criterion had been met on Level 1, I then continued testing on ABLA Level 2, and then Level 3.

Reliability Assessments. During approximately 25% and 80% of all training sessions for Experiments 1 and 2, respectively, one of two additional trained observers was present to independently record the responses of the participant for the purposes of assessing inter-observer agreement (IOA). These additional observers, one an undergraduate researcher, and the other a Ph.D. student with five years experience administering the ABLA test to clients with developmental disabilities, were trained by myself on the procedures and data collection involved for Experiments 1 and 2. Trials on which an observer and I both recorded a response as correct, or both recorded a response as incorrect, were considered agreements. An IOA score for a session was calculated by dividing the number of agreements during that session by the total number of agreements plus disagreements and multiplying by 100%.

Approximately 25% and 80% of all training sessions for Experiments 1 and 2, respectively, were scored for procedural integrity and procedural reliability. During such checks, one of the two additional trained observers and I independently scored the steps that I followed on a procedural checklist. Procedural integrity for a session was calculated by dividing the number of steps recorded by the observer as performed correctly by the total number of steps and multiplying by 100%. Procedural reliability was calculated by dividing the number of agreements during a session (the observer and I both recorded a step as occurring or not occurring) by the total number of agreements plus disagreements and multiplying by 100%.

Experiment 1

The purpose of Experiment 1 was to compare the number of trials required for persons with developmental disabilities to master three discrimination tasks: tasks analogous to ABLA Level 2 (ANL2), REAB tasks, and RE tasks. A single-subject alternating-treatments design (Martin & Pear, 2007) with three replications within a participant, repeated across three participants (P1, P2, and P3) found to be at ABLA Level 2, was employed.

Training Materials

The materials used to administer the three tasks to a participant differed from the original ABLA test and from each other within a comparison with respect to shape and colour cues. Container type was counterbalanced across task types and across comparisons for each participant to minimize the likelihood that experimental effects could be attributed to the container type. Containers for the three comparisons included a blue octagon-shaped container, a purple triangle-shaped container, an orange star-shaped container, a dark green clover-shaped container, and a lime green hexagon-shaped container (see Figure 2). The manipulandum was an irregularly shaped brown piece of rubber. However, for P1 and P2, the piece of brown rubber

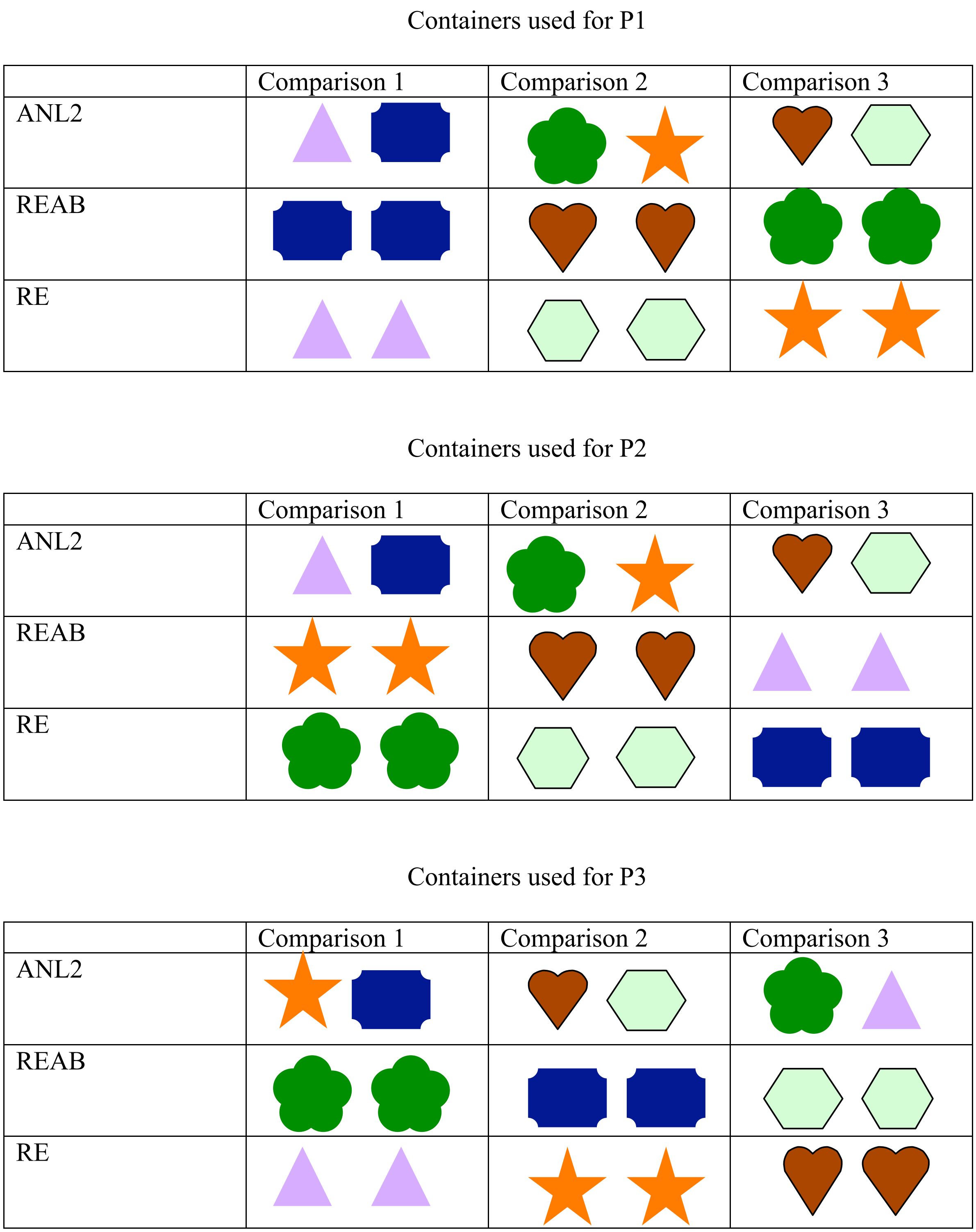

Figure 2. Shape of the containers used for teaching the ANL2 tasks, the REAB tasks, and the RE tasks for P1, P2, and P3 across three comparisons of Experiment 1.

was replaced by a crumpled up piece of paper towel on several occasions due to frequent mouthing of the rubber piece by P1, and difficulty grasping the rubber piece by P2. The ANL2 discrimination tasks differed from the ABLA Level 2 only in the materials used for their administration with respect to shape and colour cues. Like ABLA Level 2, the REAB tasks used containers in fixed positions, except that the containers during a comparison were identical, and thus contained both relative and absolute position cues, but not shape and colour cues. Note that the containers that were used for the REAB and RE tasks for a comparison with a participant were different than the containers that were used for the ANL2 task for that comparison, with one exception being the container types used during Comparison 1 for P1 (see Figure 2 for the containers used for each participant). The RE tasks were similar to ABLA Level 2; however, they incorporated identical containers that varied in their absolute positions, which required a relative position discrimination to arrive at the correct response (see Figure 3 for an illustration of RE task trial set-up across trials used for Comparison 3 for P2).

During a RE task administration the absolute positions of the identical containers (see Figure 3, positions 1 through 4, illustrated by the two different trial types) were randomized across trials, such that the task required a relative position discrimination to arrive at the correct response. To ensure that position placements 1 to 4 were consistent across trials, markers were placed on the table's edge, visible only to the tester, to designate the four possible positions for the containers.

Within a comparison, across each of the three types of training sessions, surrounding visual stimuli including the experimenter's clothes and the tablecloth differed. These stimuli included a beige table cloth and a bluish beige apron and beige hat for the ANL2 task; brown table cloth and a brown apron and black hat for the REAB task; and red table cloth and a red

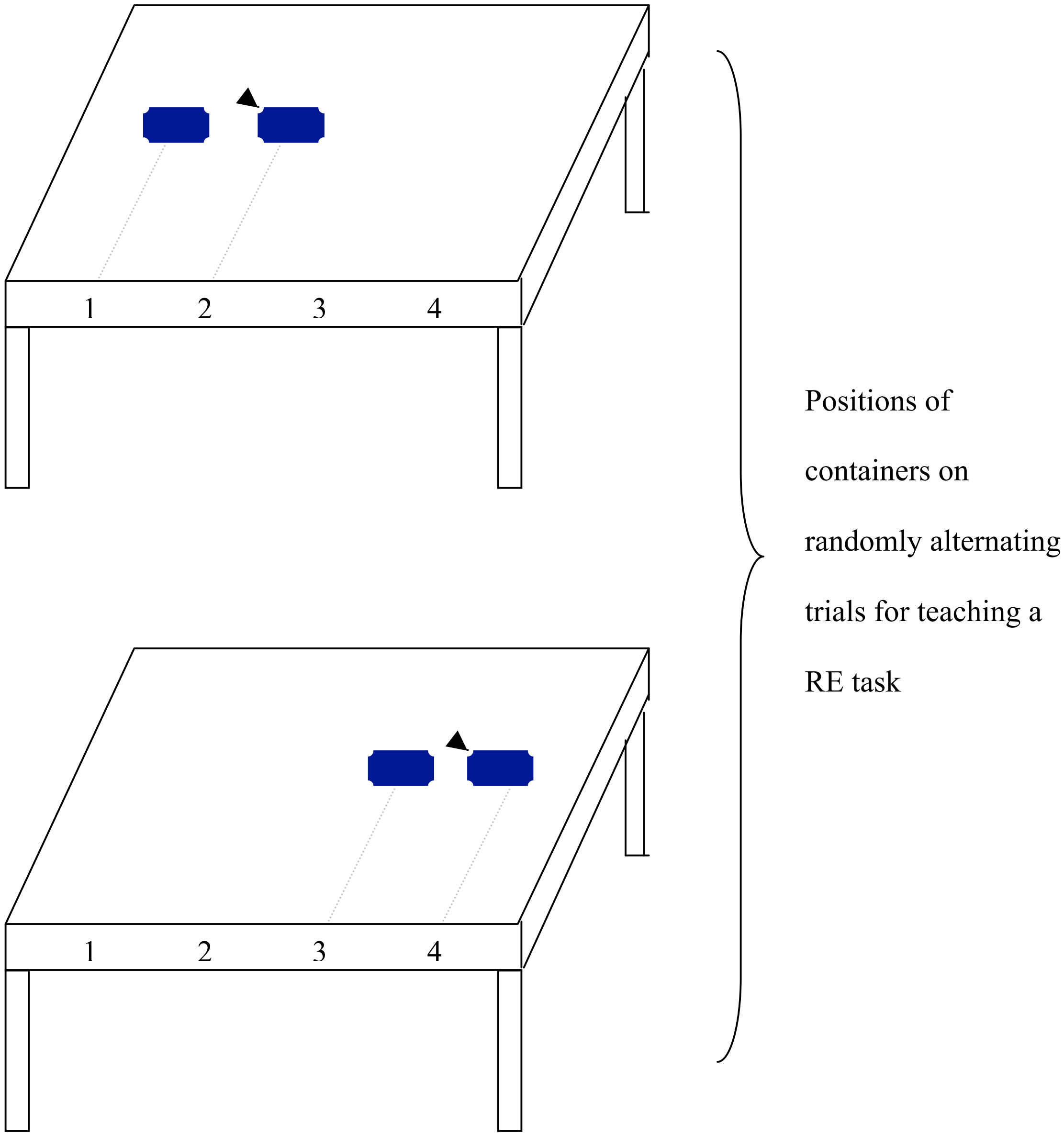

Figure 3. An example of the RE task, administered to P2 during Comparison 3 of Experiment 1 from the perspective of the tester. The absolute positions that the containers occupied from trial to trial was marked by 1, 2, 3, and 4 on the table out of site of the participant. Arrows indicate correct container for placement of the manipulandum.

apron and hat for the RE task. The purpose of varying such visual cues across the three treatment conditions, and comparing the RE and REAB tasks to ANL2 task rather than the original ABLA Level 2, was to maximize the difference between discrimination cues, so that performance on one type of discrimination task was less likely to influence performance on another type of discrimination task.

Research Design

As indicated previously, an alternating-treatments design was used to compare the relative difficulty of the three types of tasks within a participant. There were three sequential replications of the comparison within a participant, repeated across three participants. Within a comparison, all three task types were taught concurrently to a participant, but were alternated across sessions. An average of two training sessions per participant per week were conducted. The presentation order of the three types of sessions were counterbalanced for each participant. Correct container placement was also systematically balanced across comparisons for each participant (see Table 2).

Procedure

The training procedure used to teach participants the three different position discrimination tasks was the ABLA Level 2 testing procedure outlined by Kerr et al. (1977) and Martin and Yu (2000). The participant sat at a table across from me while I administered the task. A training session for a task lasted approximately 30 to 40 min, or for 30 to 50 trials, whichever came first (mean = 24.7 trials, range = 7 – 49 trials). Following a preference assessment to select edible or non-edible reinforcers (as described previously), each session began with a demonstration, a guided trial, and an opportunity to respond independently.

Table 2. Correct container placement (from the perspective of the participant) across comparisons for each participant in Experiment 1.

	Comparison 1			**Comparison 2**			**Comparison 3**		
	ANL2	**REAB**	**RE**	**ANL2**	**REAB**	**RE**	**ANL2**	**REAB**	**RE**
P1	Left	Right	Right	Right	Left	Left	Left	Right	Right
P2	Left	Left	Left	Right	Right	Right	Left	Left	Left
P3	Left	Left	Left	Right	Right	Right	Left	Left	Left

During the demonstration of a task, I instructed the participant “When I say ‘where does it go?’, it goes in here”, and would then model the correct placement of the manipulandum for the participant. During the guided trial I provided the verbal cue “Where does it go?” and then prompted the participant to perform the correct response. The participant was then given the opportunity to perform the task independently following the verbal cue “Now you try. Where does it go?”. Following a correct response on the independent opportunity, training trials began. Training trials were conducted exactly as outlined in the above procedure for an independent opportunity. Participants were given an edible or non-edible reinforcer and praise (e.g. “good job!”) for correct responses. Placement of the manipulandum within the incorrect container constituted an error, while no response within 10 s, or any action not involving placement of the manipulandum within a container was considered a non-trial and was not scored. When an error occurred, a correction procedure was used consisting of a demonstration, a guided trial, and an opportunity to respond independently. The pass criterion for each discrimination task was eight consecutive correct responses, not counting correct placement of the manipulandum during the independent opportunity of the error-correction procedure. The fail criterion was 110 completed trials without reaching the pass criterion. The selection of 110 trials as a fail criterion allowed participants considerable practice with the task such that a failure was likely to represent considerable difficulty in mastering the skill (97% of individuals tested on the ABLA typically reached the ABLA pass or fail criterion in under 30 trials, Meyerson, 1977). Likewise, eight consecutive correct responses was likely to represent mastery of a task due to the low probability of such an occurrence by chance. A trained research assistant conducted the training sessions for Comparisons 1, 2, and 3 for P3, and Comparisons 2 and 3 for P2, while I conducted the IOA. PR, and PI checks for these sessions. All other training sessions were conducted by me.

Results and Discussion

The IOA scores across comparisons were 99.5%, 100%, and 100% for the ANL2, REAB, and RE tasks, respectively. For the ANL2, REAB, and RE tasks, the PI scores across comparisons were 100%, 99.8%, and 100%, respectively. Finally, the PR scores across comparisons were 98.8%, 92.4%, and 98.3% for the ANL2, REAB, and RE tasks, respectively.

Visual inspection was used to determine whether there was indeed a difference in the number of trials required to reach criterion for the three tasks for each individual. It was predicted that the fewest number of trials to mastery would occur for the ANL2 tasks, then the REAB tasks, and then the RE tasks. The results for each participant will be reviewed in turn.

Figure 4 depicts the number of teaching trials administered to P1 before the pass or fail criteria were met for each task for Comparisons 1, 2, and 3. Figure 4A illustrates that, for Comparison 1, the number of trials to criterion were 9, 12, and 12, for the ANL2, REAB, and RE tasks, respectively. During Comparison 2, (Figure 4B), P1 passed the ANL2 task in 9 trials and the REAB task in 38 trials, but failed the RE task (reached the fail criterion of 110 trials). During Comparison 3 (Figure 4C), P1 failed the ANL2 task (110 trials), but passed both the REAB and RE tasks in 9 trials each.

P1 passed all three tasks in very few trials during Comparison 1 (Figure 4A), suggesting no difference in the difficulty of the three tasks. However, during Comparisons 2 and 3, the results for P1 contradict one another. During Comparison 2, P1 required the fewest number of trials to complete the ANL2 task, somewhat more trials to pass the REAB task, and failed the RE task, supporting the hypothesized level of difficulty of the three tasks. During Comparison 3, P1 failed the ANL2 task, and passed the REAB and RE tasks in few trials, suggesting that the ANL2 task was the most difficult, with the REAB and RE tasks being similar in their level of difficulty.

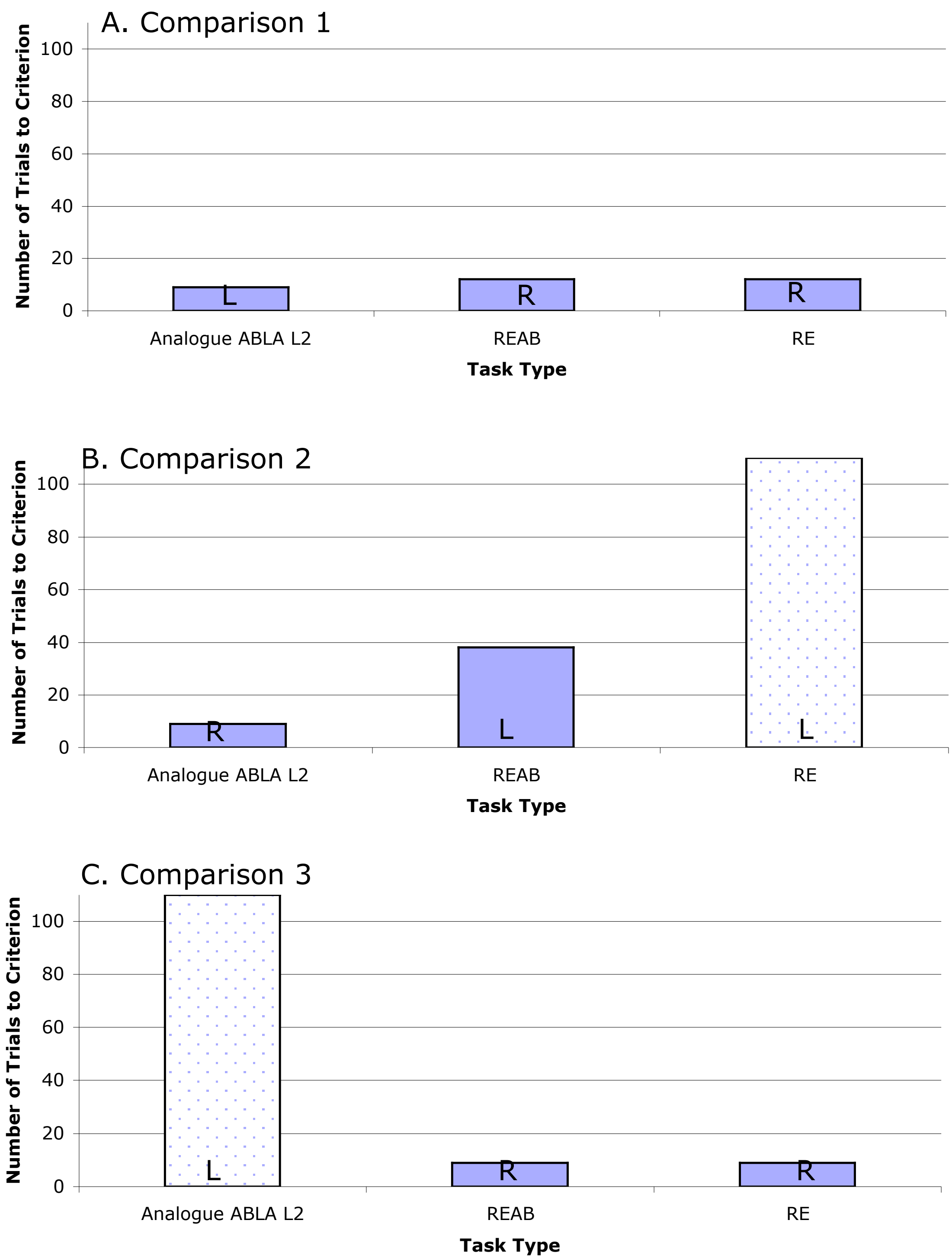

Figure 4. The number of teaching trials administered before P1 reached the pass or fail criterion per task for each of three comparisons during Experiment 1. L = Correct container on left from the perspective of the participant. R = Correct container on right from the perspective of the participant. Speckled bars indicate failed tasks.

Thus, across the three comparisons there was no consistent order of difficulty of the three tasks relative to one another for this participant.

During the conduct of the comparisons for P1, I observed that the error rate was usually much greater during tasks where the correct response required placement of the manipulandum into the container on the left (from the perspective of the participant). Indeed, across all three comparisons, P1 passed 5 out of 5 tasks that required placement of the manipulandum into the right container in 12 trials or less. However, during the 4 times that the correct container was on the left, P1 failed the task (110 trials) twice, and required 38 trials to master the task another time. Further, Comparison 2's RE task (correct container on the left) resulted in 30 errors when the containers were in absolute positions 3-4 (and thus closer to P1's left-hand side), and only 8 errors when the containers were in absolute positions 1-2 (closer to P1's right-hand side). These findings suggest that for P1, the three tasks may be relatively equal in difficulty, and that variability in performance may be due primarily to the interaction between handedness (with P1 being right-handed) and the location of the correct response.

Figure 5 depicts the number of teaching trials administered to P2 before the pass or fail criteria were met for each task for Comparisons 1, 2, and 3. Figure 5A illustrates that for Comparison 1, P2 performed similarly on all 3 tasks, passing the ANL2, REAB tasks, and RE tasks in 9 trials, 9 trials, and 16 trials respectively. During Comparison 2, P2 failed the RE task (110 trials), and passed the ANL2 and REAB tasks, though requiring a few more trials relative to Comparison 1 (40 and 22, respectively, see Figure 5B). During Comparison 3, P2 required few trials to pass each task: namely 9, 16, and 13 trials for the ANL2, REAB, and RE tasks, respectively (Figure 5C).

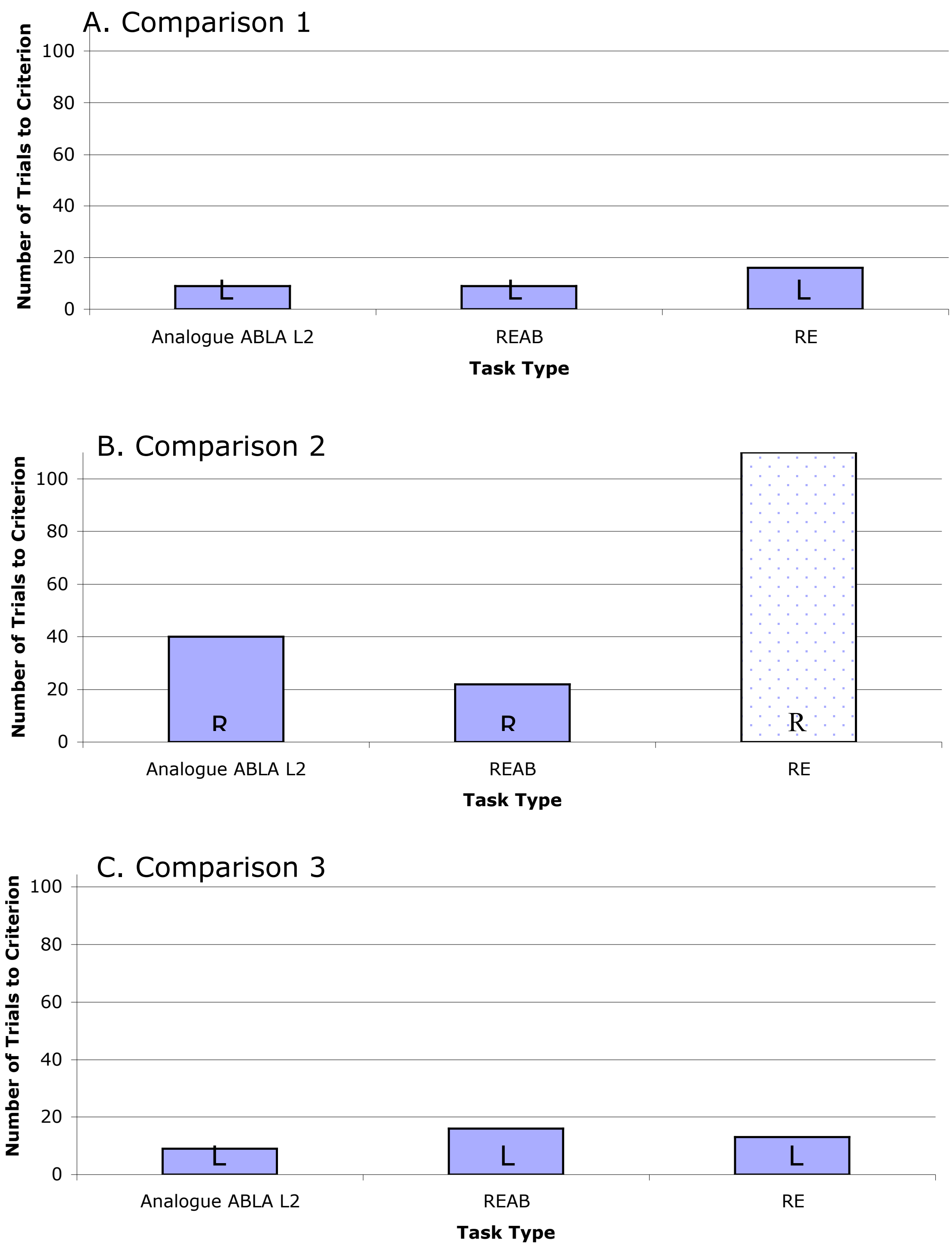

Figure 5. The number of teaching trials administered before P2 reached the pass or fail criterion per task for each of three comparisons during Experiment 1. L = Correct container on left from the perspective of the participant. R = Correct container on right from the perspective of the participant. Speckled bars indicate failed tasks.

Comparisons 1 and 3 for P2 demonstrate that all three tasks were passed in a similar number of trials, indicating no notable difference in the level of difficulty among the three tasks. Comparison 2, however, shows a different result. P2 failed the RE task, and passed the ANL2 and REAB tasks, though requiring more trials to do so relative to Comparisons 1 and 3. While the tasks in Comparisons 1 and 3 required placement of the manipulandum in the left-hand container, Comparison 2 required placement of the manipulandum in the right-hand container. Further, Comparison 2's RE task (correct container on the right) resulted in 26 errors when the containers were in absolute positions 1-2 (and thus closer to P2's right-hand side), and only 13 errors when the containers were in absolute positions 3-4 (closer to P2's left-hand side). This suggests that for P2, like P1, the observed differences across comparisons may be due to the interaction between handedness (with P2 being left-handed) and the location of the correct response, rather than being related to differences in the relative difficulty of the three tasks.

Figure 6 shows the number of teaching trials required by P3 to reach the pass or fail criteria for each task for Comparisons 1, 2, and 3. During Comparison 1 (Figure 6A), P3 passed the ANL2 task in 9 trials, and the RE task in 45 trials, and failed the REAB task (110 trials). Figure 6B illustrates that during Comparison 2, P3 passed all three tasks, requiring 35 trials to pass the REAB task, 44 trials for the ANL2 task, and 74 trials for the RE task. During Comparison 3 (Figure 6C), P3 passed the RE task in 11 trials, but failed both the ANL2 and REAB tasks (110 trials for both tasks).

The number of trials required by P3 to reach the pass or fail criteria for the three tasks differed notably across the three comparisons (Figure 6). Indeed, each comparison appears to suggest a different relationship with respect to the relative difficulty of the tasks. Comparison 1 suggests that the REAB task is most difficult and the ANL2 task is least difficult. Comparison 2

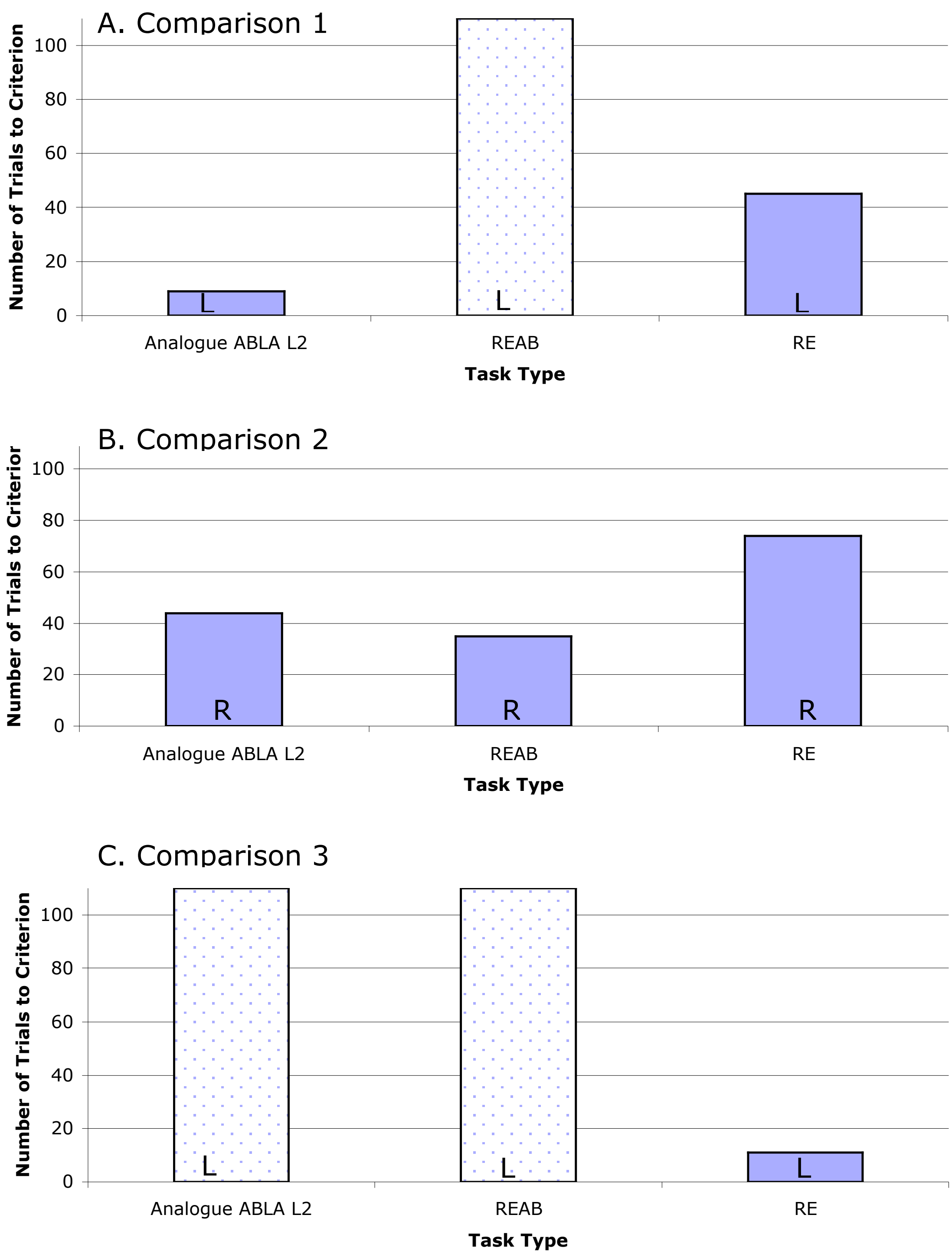

Figure 6. The number of teaching trials administered before P3 reached the pass or fail criterion per task for each of three comparisons during Experiment 1. L = Correct container on left from the perspective of the participant. R = Correct container on right from the perspective of the participant. Speckled bars indicate failed tasks.

suggests that the RE task is the most difficult, with little difference in difficulty between the ANL2 and REAB tasks. The third comparison suggests that the ANL2 and REAB tasks are much more difficult than the RE task. Therefore, no clear relationship was found concerning the difficulty level of the three tasks relative to one another.

Overall, the results from Experiment 1 do not demonstrate the predicted relationship of difficulty among the three tasks. No consistent difference in difficulty level of the three tasks was found across three comparisons within each of the three participants.

Experiment 2

Based on the results obtained during Experiment 1, the purpose of Experiment 2 was to further compare the relative difficulty among the ANL2, REAB, and RE tasks, and to determine whether correct container location (left versus right) may influence responding to position discrimination tasks. The same three participants involved in Experiment 1 participated in Experiment 2.

Research Design

For this experiment, I used a within-subject design in which a participant was taught one of the tasks (to the pass or fail criterion) with the correct container on the right from the perspective of the participant, and then was taught that same task with the correct container on the left. This was repeated for the second task, and then for the third task. Only after a participant reached the pass or fail criteria on a task did I move on to administering the next task. Thus, with respect to the right-left position of the correct container, this design was an ABABAB within-subject design. Because I wanted to maintain the reversal/replication nature of the design, it was necessary, within a participant, to start with either the right or left as correct, and to repeat the sequence as described above. Because at least one participant was right-handed and one was left-handed, I decided to use a right/left sequence for all participants independent of handedness. However, in terms of the combination of the right-left position of the correct container with the type of task, this design would be more appropriately referred to as an ABCDEF case study with replication across three subjects. See Table 3 for the order of the tasks, counterbalanced across the three participants.

Based on the results obtained in Experiment 1, it was hypothesized that there would be no difference in difficulty between the three position tasks. In other words, all three tasks would require a similar number of trials to reach pass/fail criteria. Furthermore, it was hypothesized that correct container position would influence responding in Participants 1 and 2.

Materials

Training on the ANL2 task was done using the star and octagon containers. Training on the REAB and RE tasks was done using two star containers. The purpose of using only the two container types across all three tasks was to minimize possible effects of using different types of containers across treatment conditions. Furthermore, among each of the three types of training sessions, surrounding visual stimuli, including tablecloth type and the experimenter's clothes, also differed (i.e. beige table cloth and a bluish beige apron and beige hat for the ANL2 tasks; brown table cloth and a brown apron and black hat for the REAB tasks; and red table cloth and a red apron and hat for the RE tasks) just as in Experiment 1.

Procedure

The training procedures for a task were the same as those utilized in Experiment 1. Training sessions for a task lasted approximately 30 to 40 min, or for 30 to 50 trials, whichever came first. The pass criterion for each discrimination task was eight consecutive correct responses, while the fail criterion was 110 completed trials without reaching the pass criterion.

Table 3. Presentation order of the three tasks for each participant in Experiment 2.

	ANL2-Right	**ANL2-Left**	**REAB-Right**	**REAB-Left**	**RE-Right**	**RE-Left**
P1	1	2	3	4	5	6
P2	5	6	1	2	3	4
P3	3	4	5	6	1	2

An average of two training sessions per participant per week were conducted. Time separation between administering two different task types was always at least 24 hours.

Results and Discussion

The IOA scores across comparisons were 100%, 100%, 99.7%, 100%, 100%, and 100% for the ANL2-R, ANL2-L, REAB-R, REAB-L, RE-R, and RE-L tasks, respectively. The PI scores across comparisons were 100% for all tasks. Finally, the PR score across comparisons was 99.7%, 98.7%, 100%, 100%, 97.4%, and 100%, for the ANL2-R, ANL2-L, REAB-R, REAB-L, RE-R, and RE-L tasks, respectively.

Figure 7 illustrates the number of teaching trials administered to participants before the pass or fail criteria were met for each of the three types of tasks when the correct response was placement of the manipulandum in the right container, and then in the left container. Figure 7A shows that when the correct container was the one on the right, P1 passed the ANL2, REAB, and RE tasks in very few trials (9, 9, and 11 trials, respectively). However, when the correct container was on the left, P1 passed the REAB task in 75 trials and failed the other two tasks (110 trials).

P1's performance on the position tasks of Experiment 2 was as predicted. P1 passed all three tasks in very few trials when the correct container was on the right. However, P1 required many trials to meet the pass or fail criteria on the three tasks when the correct container was on the left. Further, the RE-Left task resulted in 33 errors when the containers were in absolute positions 3-4 (and thus closer to P1's left-hand side), and only 4 errors when the containers were in absolute positions 1-2 (closer to P1's right-hand side). These results suggest that for P1, the ANL2, REAB, and RE tasks are approximately equal in their level of difficulty.

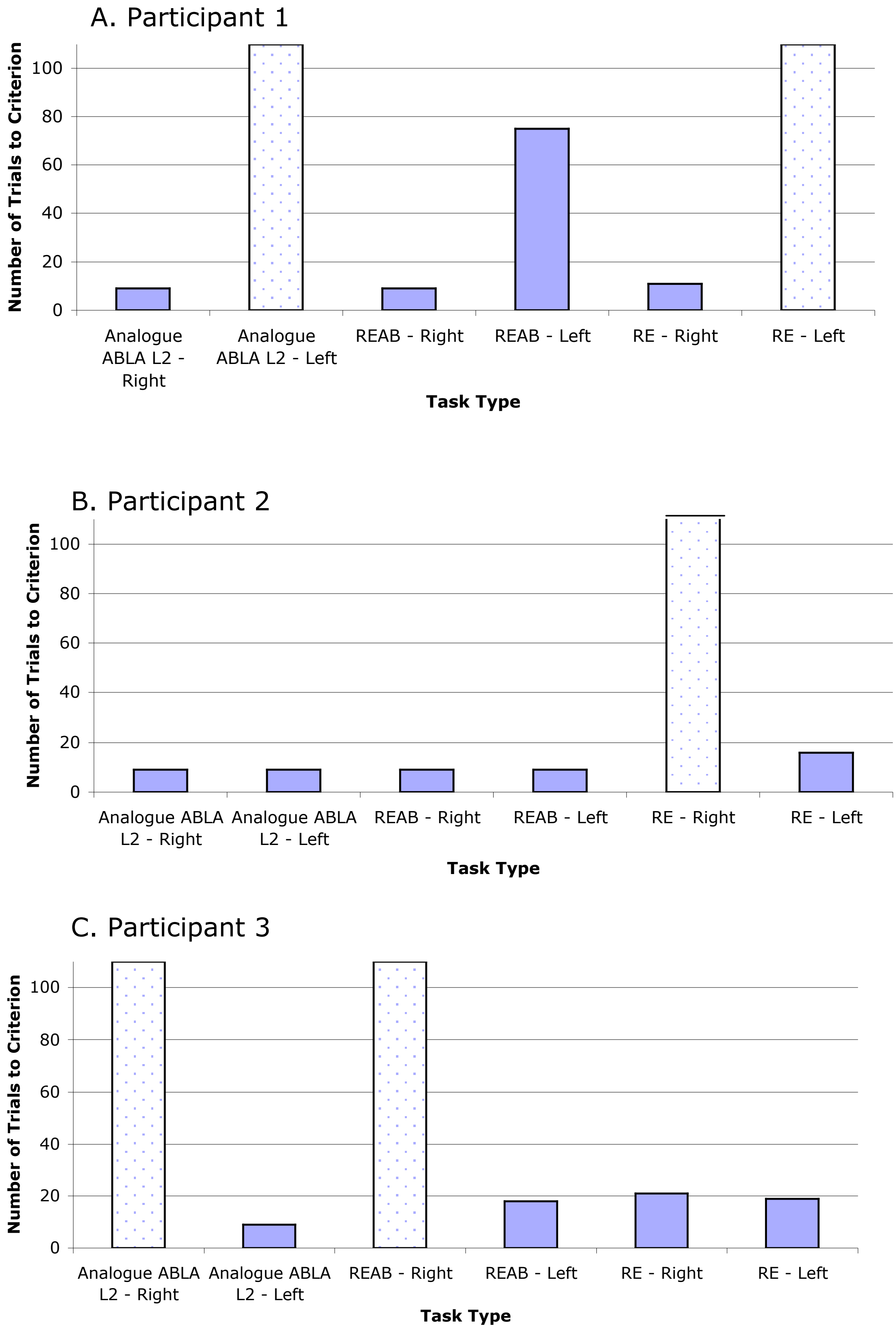

Figure 7. Number of teaching trials administered before participants met the pass or fail criterion per task for Experiment 2. Speckled bars indicate failed tasks.

Figure 7B illustrates that P2 quickly learned the ANL2 and REAB tasks (9 trials for each), regardless of whether the correct response was placement of the manipulandum in the left or the right container. P2 learned the RE task in 18 trials when the correct container was on the left; however, P2 failed the RE task when the correct container was on the right. For the ANL2 and REAB tasks, placement of the manipulandum in either the left or right container appeared to be relatively easy. However, for the RE task, because the absolute positions of the containers changed across trials (see Figure 3 on page 22), placement of the manipulandum in the right container required much more effort than would right container placement in either the ANL2 or REAB tasks. Indeed, the RE-Right task resulted in 19 errors when the containers were in absolute positions 1-2 (and thus closer to P2's right-hand side), and only 9 errors when the containers were in absolute positions 3-4 (closer to P2's left-hand side). This difference across the three task types might explain why P2 failed the RE task when the correct container was on the right-hand side, considering that P2 was left-handed.

Figure 7C illustrates that for P3, the number of trials to reach pass criterion was similar for the RE task when the correct container was on the right (21 trials) versus the left (19 trials). Also, P3 passed the ANL2 task (9 trials) and the REAB task (18 trials) with relative ease when the correct response was placement of the manipulandum in the left container, but failed both tasks when the correct container was the one on the right. P3 was right-handed.

In summary, with P3, the results obtained across both experiments show no consistent pattern to suggest any particular relationship among the relative difficulty of the three position tasks, or left versus right correct container placement.

General Results and Discussion for Both Experiments

I attempted to teach three exemplars of each type of task to each participant in Experiment 1, and two exemplars of each type of task to each participant in Experiment 2. One way of determining the relative difficulty of the three types of tasks within each participant (an assessment of internal validity) would be to examine the number of exemplars (maximum of 5 of each type of task) that were learned rapidly, and the number that were learned slowly. In order to identify a definition of rapid learning, one possibility is to examine prior research on the ABLA test. As expressed in the Introduction, in the development of the ABLA, Kerr et al. (1977) assessed the ease or difficulty with which individuals with developmental disabilities are able to learn each of the six ABLA tasks, using standard prompting and reinforcement procedures. In a review of research on the ABLA, Martin and Yu (2000) reported that 97% of testees who achieved the pass criterion of eight consecutive correct responses, or the failure criterion of eight cumulative errors typically did so in 30 trials or less. However, if a client fails an ABLA level, that level is typically difficult to teach, sometimes requiring in excess of 100 training trials to achieve mastery. Based on this research, and considering that 97% of testees who pass an ABLA level do so in 30 trials or less, this number will be used as a definition of rapid learning to examine the number of exemplars of each type of task that were rapidly learned by each participant. In Figure 8 we can see that: P1 rapidly learned three exemplars of each type of task; P2 rapidly learned an average of four exemplars of each type of task, + or –1; P3 rapidly learned an average of two exemplars of each type of task, + or – 1; and across the three participants, the mean number of exemplars of each type of task that were learned rapidly was three per task.

An examination of the number of exemplars of each type of task that were learned rapidly, within and across participants, strongly suggests that there is little difference in the

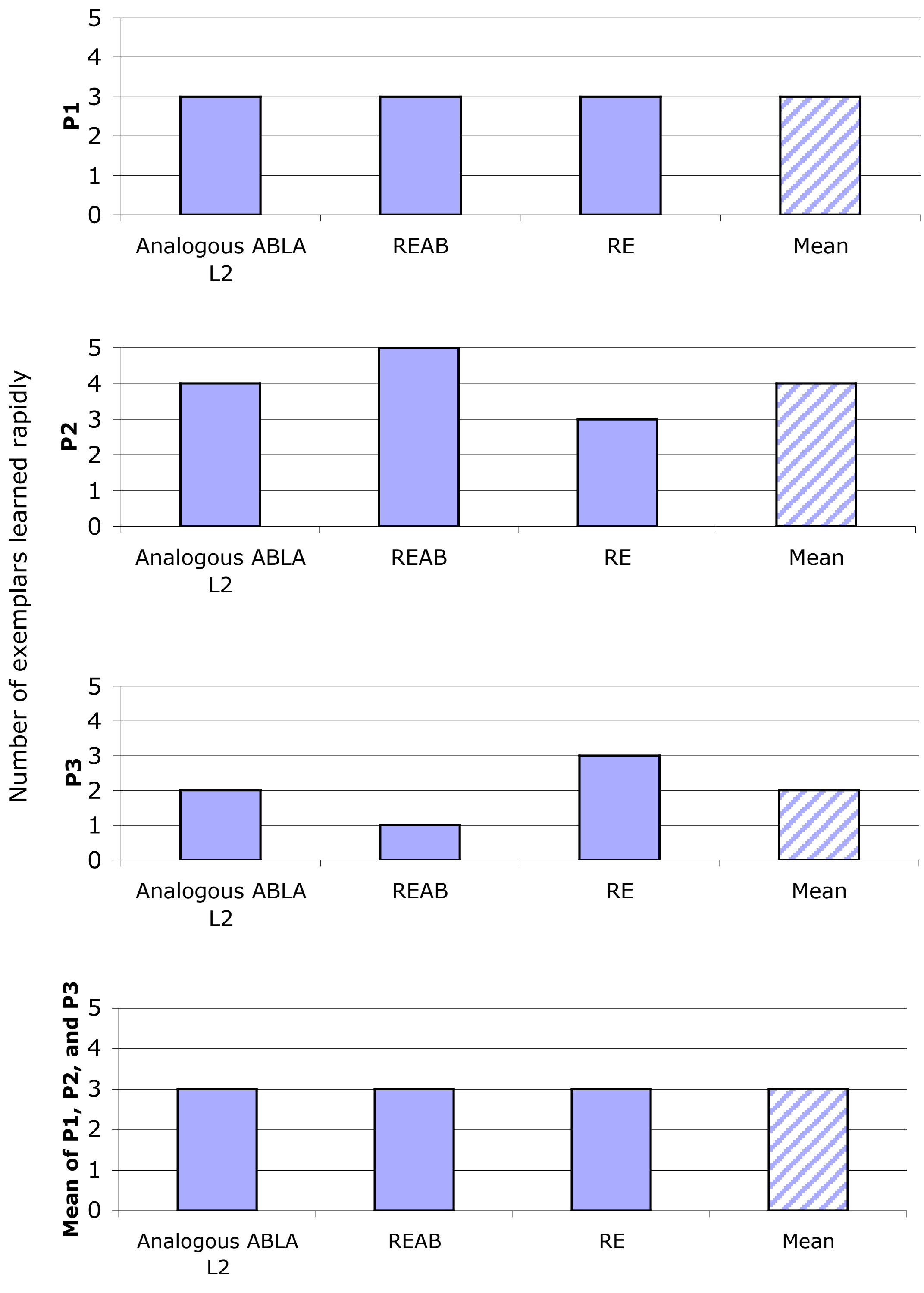

Figure 8. Number of exemplars (max. of 5) of each type of task that were learned rapidly (equal to or less than 30 trials).

difficulty of the three types of tasks for these participants. Now, let's examine the number of exemplars (maximum of five) of each type of task that were learned slowly. As indicated previously, when an ABLA level is failed, it typically takes considerably more than 30 trials for that level to be mastered. Thus, one possible criterion of slow learning would be a task that requires greater than 70 trials (a number more than twice the criterion for rapid learning), or not learned within 110 trials. Using this criterion, the number of exemplars of each type of task for each participant that were learned slowly (if at all) are shown in Figure 9. As can be seen in Figure 9, P1 showed slow learning on one or two exemplars of each type of task, P3 showed slow learning on an average of two exemplars of each type of task, + or –1, and P2 had difficulty only with the RE task. However, as expressed earlier, the difficulties experienced by P1 and P2 can be accounted for entirely by an interaction between the right-left location of the correct response and handedness. Across the three participants, as shown in Figure 9, the mean number of exemplars of each type of task that were difficult to teach is very similar for each task.

To consider another summary statistic, across both experiments and all three participants, there were 15 attempts to teach the ANL2 task, 15 attempts to teach the REAB task, and 15 attempts to teach the RE task. The mean number of trials to criterion was very similar for all three tasks (see Figure 10). Nevertheless, as shown in Figure 10, the average number of trials to meet a pass or fail criterion across all three participants was slightly more for the RE task. Also, as shown in the bottom portion of Figure 9, the mean number of exemplars of each type of task that were learned slowly was slightly higher for the RE task. It may very well be that, across a large sample of participants, this difference in task difficulty, although small, might be statistically significant. Nevertheless, across my two experiments, with three participants, a large effect clearly did not emerge.

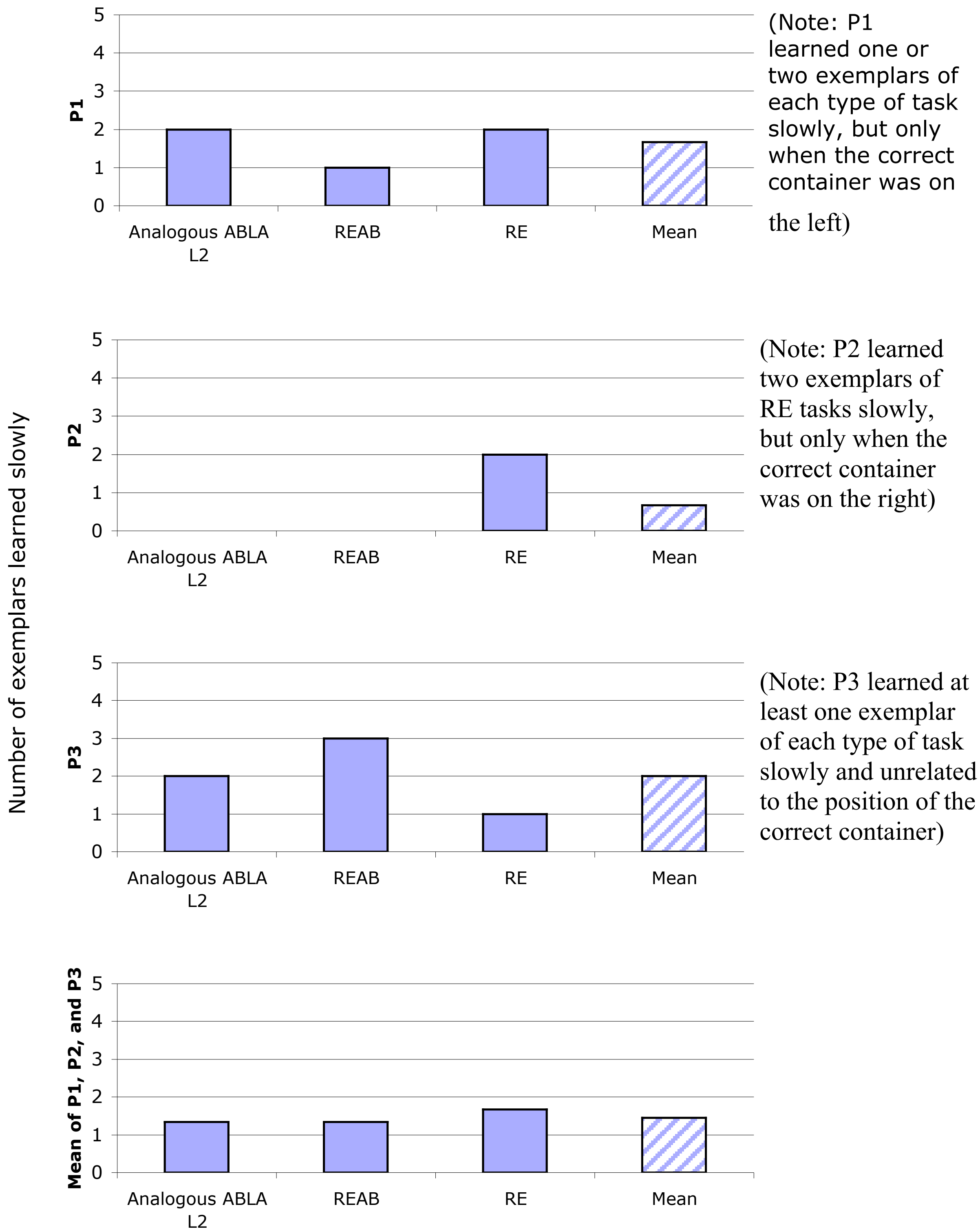

Figure 9. Number of exemplars (max. of 5) of each type of task that were learned slowly (greater than 70 trials) or not learned (within 110 trials).

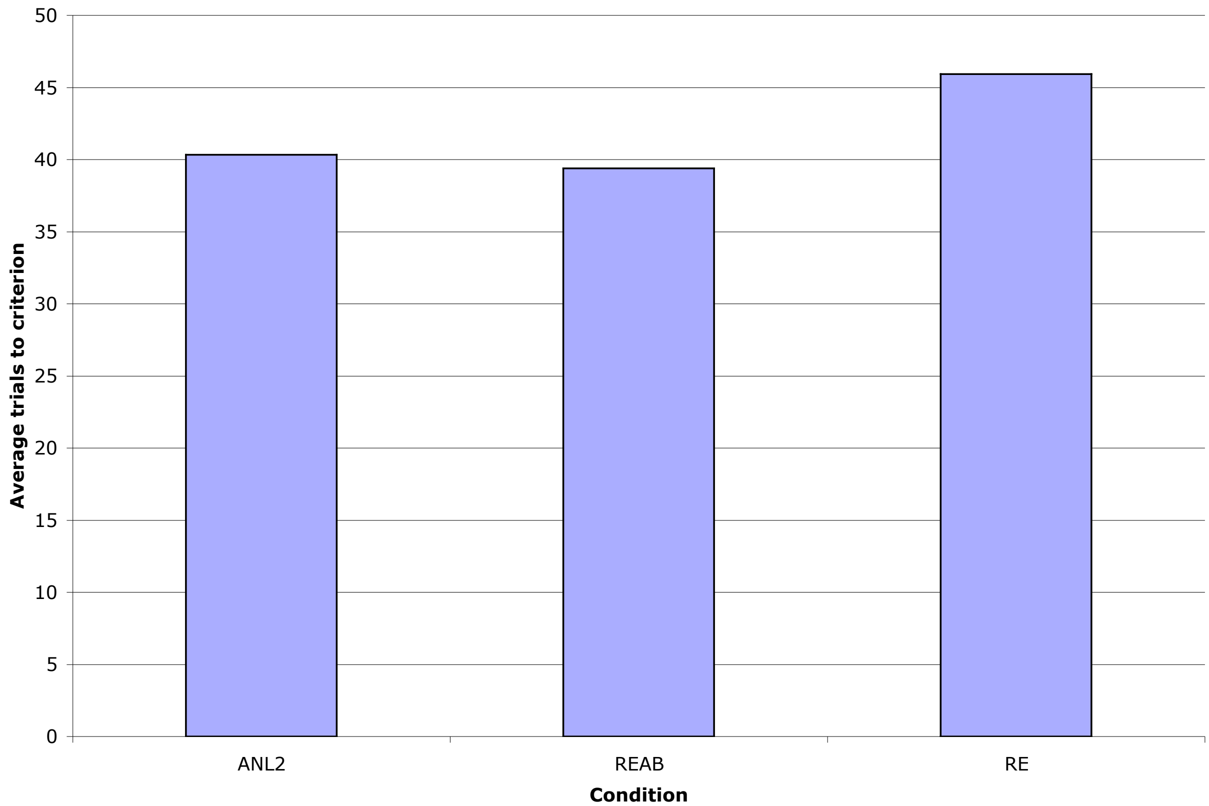

Figure 10. Mean number of trials to meet pass or fail criterion for the ANL2, REAB, and RE tasks across all 15 teaching attempts of each task across Experiments 1 and 2 for all participants.

The two studies that I conducted are the first training studies to be reported that compared the relative difficulty of an ANL2 task, a REAB task, and a RE task. The results suggest that none of the position tasks was consistently more difficult than the others, and if there is a difference in the relative difficulty of the three tasks, then such an effect was so small that it could not be clearly demonstrated within or across the three participants. However, as expressed in the Introduction, single-subject designs are weak on external validity. Future studies are necessary to replicate this research, and they might also include an examination of variations of the RE task. For example, future researchers might explore how employing two different container types for the RE task, thereby introducing additional shape, colour, and size cues, will affect task difficulty relative to ANL2 and REAB tasks. A real world example of such a task would be the placement of a knife to the right of a plate at each place setting of a table.

Another question to explore is whether increasing the number of locations of the absolute positions for container placement during the RE task might affect participant performance. That is, instead of just four different absolute position locations for the RE task, a researcher might incorporate six or eight absolute position locations. One might also examine whether the orientation and the distance between sets of absolute positions of the containers within the RE task relative to the participant might alter task difficulty. That is, will the number of trials required for the participant to reach criterion be affected if one set of absolute locations is on one table within the testing room while the other set of absolute locations is on a different table within the testing room? Such a task may be more representative of real world situations, where relative position discriminations are required across a greater space than that occupied by a 0.91 X 1.52 m table. An analogous real-world example of such a task is an individual who locates her correct place in line on the way to a group activity (for example, always behind Paul) regardless of where the line is located within a treatment facility for persons with developmental disabilities.

An important finding of this study is that the performance of at least two of the three participants was influenced by whether the correct container was on the left- versus the right-hand side during the position discrimination tasks. Future research needs to examine the extent to which handedness affects performance on position discrimination tasks, including ABLA Level 2. In particular, is this a widespread phenomenon for people with developmental disabilities? Might individuals with Autism also display this phenomenon? Finally, can the generalization be made that when there is an interaction between handedness and correct container location, then the most difficult tasks will be those where the correct container is the one furthest from the dominant hand? These are but some of the research questions that might extend the literature on position discriminations and the ABLA test.

Potential Significance of Research

Persons with developmental disabilities living in the community and at residential treatment facilities are likely to encounter tasks requiring REAB and RE discriminations in their day-to-day lives. The present research suggests that analogous ABLA Level 2 tasks, REAB tasks, and RE tasks are approximately of equal difficulty. As expressed previously, considering that the present research used single-subject designs, these results need to be replicated to convincingly establish external validity. However, the present research and that of Murphy et al. (2007) suggest that the addition of prototype REAB, RE, and AB tasks (the latter included in Murphy et al. but not this study) to the ABLA test may not be necessary for the ABLA test to have acceptable predictive validity for performance on position discrimination tasks. This is an important clinical finding for practitioners charged with the responsibility of teaching basic skills to persons with severe to profound developmental disabilities.

References

Casey, L., & Kerr, N. (1977). Auditory-visual discrimination and language prediction. *Rehabilitation Psychology, 24 (Monograph Issue),* 137–155.

Condillac, R. A. (2002). Assessment of discrimination skills in individuals with autism: Validity of the assessment of basic learning abilities test. *Unpublished Doctoral Thesis, University of Toronto.*

Conyers, C., Doole, A., Vause, T., Harapiak, S., Yu, D. & Martin, G. L. (2002). Predicting the relative efficacy of three presentation methods for assessing preferences of persons with developmental disabilities. *Journal of Applied Behavior Analysis, 35*, 49-58.

DeVries, C., Yu, C. T., Sakko, G., Wirth, K. M., Walters, K. L., Marion, C., & Martin, G. L. (2005). Predicting the relative efficacy of verbal, pictorial, and tangible stimuli for assessing preferences of leisure activities. *American Journal of Mental Retardation, 110*, 145-154.

Doan, L. A., Martin, C. T., Yu, C. T., and Martin, G. L. (2007). Do ABLA test results predict performance on three-choice discriminations for persons with developmental disabilities? *Journal on Developmental Disabilities, 13(3),* 1-11.

Hiebert, R., Martin, G. L., Yu, C. T., Thorsteinsson, J., & Martin, T. L. (2009). Using the ABLA test to predict compliance of children with and without developmental delay. *Canadian Journal of Behavioural Science, 41(1),* 31-36.

Kerr, N., & Meyerson, L. (1977). Further evidence on ordering, generalization, and prediction from the AVC scales: AVC skills in deaf retarded adults. *Rehabilitation Psychology, 24 (Monograph Issue),* 127–131.

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

LaForce, J. C., & Feldman, M. A. (2000). Role of discrimination ability in the cooperative behavior of persons with developmental disabilities. *Journal on developmental disabilities, 7*, 156-170.

Martin, G. & Pear, J. (2007). *Behavior modification: What it is and how to do it (8th Ed.).* Upper Saddle River, N.J.: Pearson Prentice Hall.

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

Martin, G. L., Thorsteinsson, J. R., Yu, C. T., and Martin, T. L. (2008). The Assessment of Basic Learning Abilities Test for predicting learning of persons with intellectual disabilities: A review. *Behavior Modification*. 32(2), 228-247.

Martin, G. L. & Yu, C. T. (2000). Overview of research on the Assessment of Basic Learning Abilities Test. *Journal on Developmental Disabilities, 7(2),* 10-36.

Martin, G. L., Yu, C. T., & Vause, T. (2004). Assessment of Basic Learning Abilities test: Recent research and future directions. In W. L. Wiliams (Ed.), *Developmental disabilities: Etiology, assessment, intervention, and integration*. (pp. 161-176). Reno, NV: Context Press.

Meyerson, L. (1977). AVC behavior and attempts to modify it (Monograph Issue), *Rehabilitation Psychology, 24*, 119-122.

Murphy, C., Johnston, G., Martin, T., Yu, C.T., Martin, G., & Verbeke, A. (2006). Where do absolute and relative position discriminations fall in the Assessment of Basic Learning

Abilities hierarchy? *Unpublished Honour's* thesis, University of Manitoba, Winnipeg, Manitoba.

Reyer, H. S. & Sturmy, P. (2006). The Assessment of Basic Learning Abilities (ABLA) test predicts the relative efficacy of task preference for persons with developmental disabilities. *Journal of Intellectual Disability Research, 50*, 404-409.

Roy-Wasiaki, G., Marion, C., Martin, G. L., and Yu, C. T. (In Press). Teaching a child with autism to request information by asking "What?" *Developmental Disabilities Bulletin.*

Stratford, B., & Metcalfe, J. A. (1981). Position cues in discrimination behaviour of normal, down syndrome and other mentally handicapped children. *Journal of Mental Deficiency Research, 25*, 89-103.

Stubbings, V. & Martin, G. (1995). The ABLA test for predicting performance of developmentally disabled persons on prevocational training tasks. *International Journal of Practical Approaches to Disability, 19 (1),* 12-17.

Stubbings, V., & Martin, G.L. (1998). Matching training tasks to abilities of people with mental retardation: A learning test versus experienced staff. *American Journal on Mental Retardation, 102,* 473–484.

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

Thorsteinsson, J. R., Martin, G. L., Yu, C. T., Spevack, S., Martin, T. L., & Lee, M. S. (2007). Predicting learning ability of people with intellectual disabilities: Assessment of Basic Learning Abilities Test versus caregivers' predictions. *American Journal on Mental Retardation, 112(2),* 130-139.

Vallortigara, G., and Zanforlin, M. (1986). Position learning in chicks. *Behavioural Processes, 12,* 23-32.

Vause, T., Martin, G. L., Cornick, A., Harapiuk, S., Chong, I, Yu, C. T., & Garinger, J. (2000). Training task assignments and aberrant behaviour of persons with developmental disabilities. *Journal on Developmental Disabilities, 7*, 37-53.

Vause, T., Martin, G. L., & Yu, C. T. (1999). Aberrant behaviour of persons with developmental disabilities as a function of the characteristics of training tasks. *International Journal of Rehabilitation Research, 22*, 321-325.

Verbeke, A. K., Martin, G. L., Yu, C. T., and Martin, T. L. (2007). Does ABLA test performance predict picture name recognition with persons with severe developmental disabilities? *The Analysis of Verbal Behavior*, *23*, 35-39.

Wacker, D. P. (1981). Applicability of 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 children. *Rehabilitation Psychology, 28*, 45-59.

Wacker, D. P., Steil, D. A., & Greenebaum, F. T. (1983). Assessment of discrimination skills of multiply-handicapped preschoolers and prediction of classroom task performance. *Journal of the Association for the Severely Handicapped, 8*, 65-78.

Ward, R., & Yu, D. (2000). Bridging the gap between visual and auditory discrimination learning in children with autism and severe developmental disabilities. *Journal on Developmental Disabilities, 7,* 142–155.

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

Wolko, K. L., Hrycaiko, D. W., & Martin, G. L. (1993). A comparison of two self-management packages for improving practice performance of gymnasts. *Behaviour Modification*, *17*, 209-223.

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