Nonidentity Matching Training as a Supplement to the Audio-Visual Combination Test

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NONIDENTITY MATCHING TRAINING AS A SUPPLEMENT TO THE AUDIO-VISUAL COMBINATION TEST

by

Melissa Wilson

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
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The Audio-Visual Combination Test is an assessment tool developed by Kerr, Meyerson, and Flora (1977), and used by those working with developmentally disabled persons to assess learning-to-learn skills. The test measures motor, visual, and auditory discrimination learning.

The experimenter attempted to determine if there were an important step--visual nonidentity discrimination--between AVC subtests 4 and 5/6 of the test. Twelve developmentally disabled adults were tested with three different sets of tasks interposed between a revised subtest 4 and 5/6. Results showed that most subjects had greater difficulty with the visual nonidentity discrimination than with the auditory/visual discrimination, subtest 5/6. The results with the last set of tasks suggests that with a refined fading procedure the visual nonidentity discrimination may fall between subtests 4 and 5/6. It was also suggested that a visual nonidentity task might be a useful addition to the AVC test for other reasons.
ACKNOWLEDGEMENTS

I should like to express my sincere appreciation to my advisor and committee chairman, Dr. Jack Michael, for his direction and assistance throughout my undergraduate and graduate years at Western Michigan University, Kalamazoo. I should also like to thank Dr. Alan Poling for his encouragement, advice, and for the opportunities he provided me during graduate school.

Acknowledgement and appreciation is also due to Mr. Scott Schrum and the home coordinators and staff at Residential Opportunities Incorporated of Kalamazoo, Michigan, for their time and flexibility when I was selecting and testing subjects for my project. Appreciation also goes to David Thompson for taking time out of his busy schedule to be my second observer.

I wish also to acknowledge the sincere support and encouragement that I received from two good friends, Susan Goeters and Karen Fitzhenry.

And last, but certainly not least, I extend thanks to my wonderful, loving, supportive mother. Her support and encouragement never died.

Melissa Wilson
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Nonidentity matching training as a supplement to the audio-visual combination test

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Western Michigan University, 1991

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CHAPTER I

INTRODUCTION

The Audio-Visual Combination Test

The Audio-Visual Combination test is a collection of six subtests developed by Kerr, Meyerson, and Flora (1977) to assess the discrimination skills of those with developmental disabilities. The test is a well-validated assessment tool used by educators, direct care workers, psychologists and others who work closely with this population. It is inexpensive, easy to administer, and can be administered in a relatively short time period. The test permits the user to combine individuals into groups that are homogeneous with respect to discrimination skills, so that quicker, more effective training of discrimination tasks can occur. This permits persons working with this population to spend less time and money trying to teach tasks for which the learners do not have the prerequisite skills, and more time teaching those skills which are necessary for various tasks involving discriminated responding.

In addition to its use as an assessment tool, it is also used as a predictor of performance in prevocational, vocational, and generalization tasks (Kerr & Meyerson, 1977; Martin, Yu, Quinn, & Patterson, 1983; Tharinger, Schallert, & Kerr, 1977; Wacker, 1981; Wacker, Kerr, & Carroll, 1983; Wacker, Steil, & Greenebaum, 1983; Yu, Martin, & Williams, 1989). For instance, an educator may want to see if an individual can effectively and proficiently sort mail. To do this, the individual will have to match to sample, and the AVC test can be used to assess this discrimination skill before actually permitting the individual to attempt the mail-sorting task.
The AYC test was designed so that the six subtests are given to the subject in an order from simple to complex, and researchers have found that with few exceptions failure at one level is predictive of failure at all the higher levels (Kerr & Meyerson, 1977; Kerr et al., 1977; Martin et al., 1983; Wacker, 1981; Wacker, Kerr, & Carroll, 1983; Wacker, Steil, & Greenebaum, 1983; Yu et al., 1989). The subtests are described below in the order in which they are administered.

The Six Subtests of the AYC Test

1. **Imitation or demonstration:** The experimenter places either a large yellow can (a two-pound coffee can) or a red box of about the same size on the table in front of the subject. The experimenter then places either an irregularly shaped piece of white foam rubber, a small yellow cylinder or a small red cube in the container, and then asks the subject to do the same. When the yellow can is present, the subject has to put the foam rubber or the yellow cylinder into the can. If the red box is present, s/he puts the foam rubber or the red cube into the box. There are four trials per container before the next container is presented and the first one removed, two consecutive trials with the foam rubber, then two trials with either the yellow cylinder or the red cube depending on which container is on the table. The subject has only to imitate the response of the experimenter. This skill is necessary for individuals to be successful with a variety of tasks requiring a response to the instruction “Do this.”

2. **Position:** This subtest measures responding to two simultaneously occurring stimuli which remain in the same position. During this subtest, both containers are on the table in front of the subject and the subject is to put the foam rubber in the yellow can. This test measures stimulus control by the visual stimuli related to the position of one container relative to the other, as well as the colors and shapes of the containers.
The subtest is called a position discrimination by the authors because the color and shape cues are not essential, and they believed that position cues are easier to learn than color cues (Kerr et al., 1977). This is the type of responding that occurs when one selects one’s toothbrush from the same holder for each use.

3. **Visual**: This subtest measures responding made in the presence of two stimuli occurring simultaneously whose positions are randomly alternated. During this subtest, the subject must put the foam rubber in the yellow can whether it is on the right or the left of the red box. This subtest is similar to finding one's jacket in a closet where others also hang their jackets. The individual must be able to select the correct jacket among other jackets hanging in the closet despite its location in the closet.

4. **Match-to-Sample**: This subtest measures responding made to stimuli which are similar to each other in shape and color. The yellow can and red box are presented simultaneously. The experimenter holds up either a small yellow cylinder or a small red cube and the subject is to put the yellow cylinder in the yellow can and the red cube in the red box. The positions of the containers are randomly alternated. This is a type of conditional discrimination sometimes referred to as an identity match-to-sample task. Correct responding depends jointly on the color/shape of the object given to the subject and the color/shape of the container, and there is physical similarity between each object and its appropriate container. This type of responding occurs when one places an article of clothing in a container with a picture of that type of clothing on the container.

5. **Auditory**: This subtest measures responding to auditory as well as visual stimulation. The yellow can and the red box are on the table in front of the subject and the positions of the containers are stable. The subject must put the foam in the yellow can or the red box depending upon the instruction given by the experimenter ("Put it in the yellow can"). As with subtest 4, this is a conditional discrimination where correct
responding depends jointly on the auditory stimulus ("yellow can" or "red box") and the position/color/shape of the container. However, this conditional discrimination differs from that of subtest 4 in two obvious ways: (1) it is a nonidentity match since the auditory stimulus does not physically resemble either of the correct containers in any way; and (2) the controlling stimuli are in different sense modes--the auditory instruction and the visual characteristics of the correct container. The authors did not consider this task as difficult as subtest 6 where the positions of the containers are randomly alternated. This is because, although color and shape cues are present in subtest 5, correct responding can occur on the basis of the position of the correct container, and they considered position to be an easier cue to learn than color and shape. This response resembles responding to instructions such as "Put the socks in the washer" and "Put the shirt in the dryer" when the washer and dryer are present at the same time and stay in the same position with respect to each other.

6. Audio-visual: This subtest measures responding to auditory as well as visual stimuli. During this subtest, the positions of the containers are randomized and the subject must put the foam rubber in either the yellow can or the red box, depending on the instruction. Like subtest 5, this is a nonidentity conditional discrimination, but the position cue is no longer available. This type of responding resembles responding to "Pass me the salt" or "Pass me the pepper" when the salt and pepper are present at the same time but not always in the same location with respect to each other. The subject must be controlled by the auditory stimuli produced by a speaker's vocal behavior, and the visual stimulation coming from the salt and pepper containers.

All subtests begin with a demonstration of the correct responses by the experimenter and then a practice trial by the subject. Correct responses are followed by praise and/or edibles or drinks. Incorrect responses are followed by a correction procedure in
which the experimenter says “No, it doesn’t go there, it goes here,” or “No, that’s not the ___ , this is the ___” and induces the subject to make the correct response using physical guidance if it is necessary. The experimenter then says “Now, do it all by yourself. Where does it go?” or “Now, do it all by yourself. Put it in the ___” (Kerr et al., 1977). Correct responses made during a correction trial are not counted as correct; however, incorrect responses made during a correction trial are counted as incorrect.

Trials in subtests 1 to 4 begin with the cue “Where does it go?” and trials of subtests 5 and 6 begin with the cue “Put it in the yellow can/red box” (Kerr et al., 1977). Testing for one subtest is terminated when either eight consecutive correct responses occur (passing) or eight cumulative incorrect responses occur (failing). Testing always proceeds systematically from subtest 1 through 6.

Research With the AVC Test

Tharinger et al. (1977) reported that the test was a useful means of assessing the ability to learn specific types of tasks. Wacker (1981) predicted the performance of hearing impaired individuals assessed with the AVC test and then trained to perform various tasks. Overall, 96% of the predictions made were accurate. Both Tharinger et al. and Wacker found that individuals acquired tasks more quickly if the tasks required the same discrimination skills demonstrated by the subject in the AVC test. Wacker et al. (1983) found that performance on a prevocational task could be predicted on the basis of performance on the AVC test. Others have found similar results (Kerr & Meyerson, 1977; Tharinger et al., 1977; Wacker, Steil, & Greenebaum, 1983; Yu et al., 1989).

A feature of the test that is most relevant to the present research question is the finding that advancing from levels 1 to 2, 2 to 3, and 3 to 4 appears to be considerably
easier than advancing from level 4 to 5 and 6. Kerr et al. (1977) looked at the number of subjects out of 117 who passed specific subtests. As the subtests were given, an average of 10 persons dropped out of the passing group with each increasingly difficult subtest until subtests 5 and 6. Here approximately 30 persons failed after having passed subtests 1 through 4. (The same number of persons passed both 5 and 6.)

The Davine Study

From the perspective of discrimination theory, Davine (1990) reasoned that the gap between subtests 4 and 5/6\(^1\) may be too large for optimal assessment of discrimination skills. In subtest 4, the subject must place an object inside another object that resembles it both in color and shape. This is a fairly easy match-to-sample task. It also requires control by only one sense mode, visual (although tactile and kinesthetic stimulation from holding and handling the objects may facilitate task performance). In subtests 5/6, the placement of the white foam rubber depends on control by a stimulus that does not resemble the correct container in any way, and is also in a different sense mode. Technically, subtest 4 is an identity conditional discrimination involving a single (visual) sense mode, and subtests 5/6 a nonidentity conditional discrimination involving two (visual and auditory) sense modes. It is also the case that the auditory stimulation in subtests 5/6 is transient whereas in subtest 4 the visual stimulation is constantly available.

\(^{1}\)The conditional discriminations involved in subtests 5 and 6 only differ in that the containers remain in the same position in 5 but are alternated randomly in 6. In either case, the correct response requires control by the auditory stimulus resulting from the tester's spoken word ("yellow can" or "red box") and also visual stimuli arising from the containers or their positions. Throughout the remainder of this paper the two subtests will be grouped together as 5/6.
Following this logic, Davine (1990) developed three possible intermediate steps between subtests 4 and 5/6. She then tested the extent to which the three tasks thought to be intermediate in difficulty between subtest 4 and 5/6 actually fell between those in difficulty, using developmentally disabled subjects. Her first task (labeled 7) was a visual (and also tactile and kinesthetic) nonidentity match-to-sample. The subject had to place objects that had no physical resemblance to the yellow can or a red box into one of these containers. A small black toy car was to be placed in the yellow can and a black haired troll doll in the red box.

Her second task (labeled 8) was a visual nonidentity match-to-sample task where the subject had to place the white foam rubber into the yellow can or the red box depending on which of the former objects (black car and troll doll) was held up by the experimenter. If the experimenter held up the black car, the subject was to put the foam rubber piece in the yellow can; if the troll doll was displayed the subject was to put the foam rubber in the red box. The logic here was that although this was a similar nonidentity conditional discrimination to that of 7, the subject did not have the tactile or kinesthetic supplementary cues, nor was the critical visual stimulus actually placed in the container.

Tasks 7 and 8 were chosen as possible intermediate steps between subtests 4 and 5/6 because the sample stimuli were unlike the comparison stimuli and only one sense mode was necessary for making the correct response. These tasks would seem to contain components of both subtests 4 and 5/6 of the AVC. They resembled subtest

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2The term subtest will be used when referring to the actual subtests of the AVC test; task will be used to refer to subtests developed for research purposes by Davine and by the present investigator.

3It is possible that the tactile and kinesthetic stimulation arising from this type of manipulation, as well as the placement of the object containing the relevant stimuli into the container, both enhance the ease of learning this discrimination. Davine considered this a possibility and for this reason her task 7 had distinctive tactile and kinesthetic stimuli, and the relevant objects were placed in the containers as with subtest 4.
4 in that only visual stimulation was involved and subtests 5/6 in that the conditional discrimination was a nonidentity discrimination.

Task 9 was a continuous, nonvocal auditory task. During this task, to respond correctly, the subject had to be controlled by a constant auditory stimulus, either a rattle made from a toy rattle or a squeak made from a squeaky toy (both auditory stimuli were produced out of sight of the subject). This task was chosen as possibly easier than subtest 5/6 because the relevant auditory stimuli were constantly available, as contrasted with the transient auditory verbal instruction of subtests 5/6. It seemed reasonable that a subject might sometimes "forget" the auditory cue given ("Put it in the red box/yellow can") and thus, respond only at chance level. However, if the auditory stimulus were constant, this difficulty would possibly be eliminated.

In all tasks, the experimenter used the same criteria for pass/fail as Kerr et al. (1977), eight consecutive correct responses for passing and eight cumulative incorrect responses for failing. She also began each trial with a demonstration of the correct response and then a practice trial, which was followed by a correction procedure if necessary.

Davine's (1990) study did not have the results anticipated. Task 7 may have been intermediate between subtests 4 and 5/6, since three subjects who passed 4 and failed 6 did pass 7, but five subjects passed 6 and failed 7. The difficulty of task 8 was badly underestimated. Only three of the more than 20 subjects who took this task passed it. Similarly, task 9 was passed by only a few of those who took the task. With the possible exception of task 7, the hypothesized intermediate steps were clearly not intermediate at all.
Research Objective

Davine (1990) considered several reasons why her results were not as expected, but in retrospect it appears that a better approach to intermediate steps would be to develop a gradual transition from the relatively easy identity discrimination to the more difficult nonidentity discrimination that characterized her task 8. It is possible that nonidentity matching is not greatly more difficult than identity matching, but that the nonidentity task is one with which the subjects have had very little experience in their ordinary interaction with the environment. Excluding verbal stimuli, there would not seem to be very many examples of nonidentity matching required in the ordinary developmentally disabled person’s environment. For all of the other tasks (1 though 6) there may be frequently occurring analogs in the ordinary environment, and correct performance may be partly due to transfer from these related activities. Terrace (1963a) noted that Pavlov (1927, p. 117), James (1890, p. 515), Schlosberg and Solomon (1943), and Lawrence (1952) had all reported that discrimination learning was acquired more quickly when the differences between stimuli were progressively reduced. The results of Terrace’s own study (1963b) further supported these findings in that his pigeons acquired a vertical/horizontal stripe discrimination with essentially no errors by virtue of his first developing an easier color discrimination and then fading the stripes onto the color stimuli and fading the colors off. A more gradual development of the nonidentity discrimination might provide a more accurate assessment of that skill, and under such conditions it might be expected, at least for some subjects, to be really intermediate between 4 and 5/6. In other words, Davine’s analysis may be correct. There may be subjects who fail subtests 5/6 because they cannot easily learn a nonidentity conditional discrimination, to say nothing of the joint control by stimuli.
from two different sense modes. And there may be some subjects who can learn a nonidentity conditional discrimination, but cannot easily acquire conditional control when the two stimuli are from different sense modes.

From a somewhat different perspective, even if the nonidentity visual discrimination is not intermediate between subtests 4 and 6 in the sense described immediately above, assessing the ease of acquiring a visual nonidentity discrimination may still be useful for the purposes of predicting success in other kinds of activities. Learning to communicate with a symbol board, and learning receptive sign language skills both involve such nonidentity discriminations.

The purpose of the present study was, like Davine's, to determine whether a nonidentity visual discrimination is an intermediate step between subtests 4 and 5/6 of the AVC test. However, because of the possible initial difficulty of a visual nonidentity matching task, in the present research that task was approached more gradually than in Davine’s study. This research may help us understand more completely the high failure rates on subtests 5 and 6 when 4 has been passed. On the other hand, ease of acquiring a visual nonidentity conditional discrimination may be an intellectual characteristic that is important in its own right, and adding a few tasks that assess this characteristic may increase the predictive power of the AVC. Detailed description of the various intermediate tasks is provided in the next chapter.
CHAPTER II

METHOD

Subjects

Twelve developmentally disabled adults, eight female and four male, were used in this study. All were residents of group homes operated by Residential Opportunities Incorporated located in Kalamazoo, Michigan. Their diagnoses ranged from profoundly to mildly mentally retarded and some had various other disabilities. However, none of the disabilities prevented them from participating in the research; all were able to hear the experimenter give instructions and could handle the object to be deposited into the containers. The subjects' characteristics are shown in Table 1 on the next page.

Subject Selection

Potential subjects were tested in their homes with subtests 1, 2, and 34 of the AVC test. All subjects selected had passed these first three subtests of the AVC test. Other requirements include being able to pick up, hold, and drop the foam rubber; the absence of behavior problems that could interfere with task performance (i.e., hyperactivity, aggression), and adequate vision. A total of 27 potential subjects were tested in order to obtain the 12 used in the study. Consent was obtained from guardians, the Western Michigan University Human Subjects Institutional Review Board, and from the Kalamazoo County Human Services Department prior to each subject's participation (see Appendix B).

4The small yellow cylinder and the small red cube were not used in the subject selection process. With that exception, the subtests were given as prescribed in the original test description (Kerr et al., 1977).
Table 1
Subject Characteristics

<table>
<thead>
<tr>
<th>S</th>
<th>Sex</th>
<th>Age</th>
<th>IQ Test</th>
<th>Primary Diagnosis (additional comments)</th>
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<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>31</td>
<td>40 GAS</td>
<td>severe retardation</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>30</td>
<td>35 GAS</td>
<td>severe retardation (mild spastic quadriplegia)</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>38</td>
<td>40 GAS</td>
<td>moderate retardation (seizures, hearing imp.)</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>44</td>
<td>55 GAS</td>
<td>mental retardation (seizures)</td>
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<td>5</td>
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<td>60 GAS</td>
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<td>6</td>
<td>F</td>
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<td>severe retardation</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>26</td>
<td>35 GAS</td>
<td>severe retardation (seizures, spast. quad.)</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>47</td>
<td>32 Stan-Binet 6</td>
<td>severe retardation (gen convulsive epilepsy)</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>40</td>
<td>35 Stan-Binet</td>
<td>severe retardation (gen convul seizures, “deaf”)</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>33</td>
<td>“below 20”</td>
<td>profound retardation</td>
</tr>
<tr>
<td>11</td>
<td>M</td>
<td>33</td>
<td>33 Stan-Binet</td>
<td>moderate retardation (gen convul epilepsy)</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>30</td>
<td>35 GAS</td>
<td>profound retardation (seizure disorder)</td>
</tr>
</tbody>
</table>

Setting and Reinforcers

The AVC assessment test (Kerr et al., 1977) and the additional tasks developed for this research were administered in a quiet area in the home of the subject. During

5Global Assessment Scale, Spitzer, Gibbon & Endicott, 1978.
most testing sessions, the experimenter sat across the table from the subject. Sessions lasted between 20 and 45 minutes.

Praise, fruit, and fruit juice were used as reinforcers. Praise was given on a continuous schedule of reinforcement and fruit or fruit juice was given on a variable ratio 10 schedule of reinforcement. Praise consisted of "Good job, Mary. Wow, you are doing a great job," or something similar. At times the experimenter used hand clapping and smiling. Correct responses made during correction trials were reinforced with praise only, as in other research with the AVC (Davine, 1990; Kerr et al., 1977; Yu et al., 1989).

Reliability

An observer was present during the testing of subjects 8, 9, 10, and 11, and scored all responses occurring during those 28 sessions (39% of the total 72 sessions in the study). To accommodate the schedule of the observer, these reliability observations all occurred at the same group home.

The observer was seated between and off to the side of the experimenter and the subject. He was trained on the scoring of correct, incorrect, and nonresponses prior to participating as an observer. The experimenter trained the observer by having him play the role of the subject, demonstrating how to score the different kinds of responses on the data sheet, and also how to score incorrect and correct responses occurring in a correction trial. The experimenter also provided examples of the types of extraneous cuing that could control responses, (i.e., dropping the eyes when the foam is held above the correct container, smiling just before the foam is dropped into the correct container, etc.). When the observer could score responses made by the experimenter
with 100% accuracy (5/5 trials) and without providing any extraneous cueing over five trials, the observer was considered trained.

A disadvantage of the method used to obtain interobserver reliability was that the secondary observer could hear the experimenter either praise or correct the subject during the sessions when the data for interobserver agreement were being collected. The observer knew that it was important to obtain valid information on the actual degree of agreement between his observations and those of the primary observer, and was instructed not to change any scoring because of the primary observer's reaction to the subject. However, it is possible that the observer's scoring was to some extent dependent upon the experimenter's reactions to the subjects' responses.

Experimental Procedure

The experiment consisted of three phases, in each of which the tasks presented to the subject between tasks 4b and 4d differed somewhat. The nature and number of the visual stimuli presented to the subject were altered twice during the course of the experiment in an attempt to fade more effectively from the simple color identity match of task 4b to the stripe-direction nonidentity match of task 4d. The original materials were used in phase 1, the first alteration of materials were used in phase 2, and the second alteration of the materials represented phase 3. Five subjects were tested with the original testing materials designed by the experimenter, two subjects were tested with the first set of altered stimuli, and five subjects were tested with the second set of altered stimuli. The stimuli were presented in the same order for all subjects within a phase.

Before data collection on task 4a began, all subjects were first given subtests 2 and 3 of the AVC, then a practice trial on task 4a. They had passed subtests 2 and 3 in
the process of being selected as subjects, but the AVC subtests are usually all given in a single session, and it was possible that performance on the later tasks would suffer if the earlier tasks had been taken several days earlier. All subjects did make some errors on subtests 2 and 3. These errors were not recorded, but when the subject failed the "refresher," this fact was noted on the data sheet. With 10 of the 12 subjects the experimenter practiced with the subject on subtests 1, 2, and 3 until three consecutive correct responses occurred on subtest 3. Two subjects (9 and 10) failed to reach this criterion, but the experimenter proceeded with tasks 4a, 4b, 4x, etc. anyway.

All subjects were tested with the same yellow can (16 cm x 12 cm), red box (17.5 cm x 18 cm x 16 cm), and piece of irregularly shaped white foam rubber. The various intermediate tasks all involved showing the subject a card 23 cm wide and 27 cm high on which the cue for placement of the piece of foam rubber had been painted or glued.

All subjects were provided with a demonstration of the correct response by the experimenter and a practice trial. During all sessions, the foam rubber that was to be placed in one of the two containers was given to the subject by placing it between the two containers and in front of the subject. Care was taken not to place the foam rubber closer to the container that would be the correct comparison stimulus for that trial. The experimenter would hold up a card (the particular card depending on the task and the trial), place the foam rubber between the two containers in front of the subject, and say "Where does it go?" At the end of each trial, the containers were removed from the table for five seconds before the next trial began. All correct responses were followed by praise, and some were followed by fruit or fruit juice. Incorrect responses were corrected using the correction procedure designed by Kerr et al. (1977).
Subtest 5 of the AVC test was not given on any occasion because it did not provide any additional information and was not considered to be easier than subtest 6 of the AVC test. Following 4d, which was given to all subjects, subtest 6 of the AVC was administered. The various intermediate tasks and their rationale are as follows.

**Intermediate Tasks Added to the AVC Test**

**Task 4a:** The original subtest 4 was modified in such a way that instead of giving the subject a small yellow cylinder or a small red cube to be placed in the can or box, the experimenter held up a card on which an enlarged photograph of the correct container had been glued. This served as the cue for correct placement of the piece of white foam rubber. The small yellow cylinder and small red cube were not used at all in this research. The unknown role of the tactile and kinesthetic cues provided by these objects makes an analysis of the task performances unnecessarily complex. Throughout the present research, the subject's response was to put the piece of white foam rubber into the correct container. Just as in the original subtest 4, this is an identity matching task, since the pictures were quite accurate two-dimensional representations of the yellow can and red box.

**Task 4b:** The next set of stimuli consisted of two cards, one painted the same yellow hue as the yellow can and the other the same red hue as the red box. These stimuli retained the color cues in the pictures of the can and box, but eliminated the shape cues in those stimuli.

**Task 4c(1):** The next set of stimuli consisted of a yellow card with superimposed black vertical stripes, and a red card with superimposed black horizontal stripes. In each case, there were three stripes, each 2.5 cm in width. The color cues were still available, but the direction of the black stripes was an additional stimulus.
feature that could become related to the relevant container. This task was at first called 4c, but because of the change described below, is best labeled 4c(1). The cards are shown in Figure 1 below with the colors represented by different degrees of shading.

![Color/Stripe Configurations for Tasks 4c(1), 4x, 4y, 4z, and 4d.](image)

**Figure 1.** Color/Stripe Configurations for Tasks 4c(1), 4x, 4y, 4z, and 4d.

**Task 4d:** What had been originally intended as the final set of visual cues consisted of white cards with only the black vertical and black horizontal stripes, as shown in Figure 1 above. Correct performance requires nonidentity matching, since the vertical and horizontal stripes do not resemble the can and box in any way.

Phase 1 of the study consisted of the use of the modified tasks, 4a, 4b, 4c(1) and 4d, followed by subtest 6 of the AVC test, with subjects 1-5. The results with these five subjects made it quite clear that the step from 4c(1) to 4d was too large. It was reasoned that interposing cards with the black stripes, but with a faded unsaturated yellow or red as background hue, might facilitate transfer to the nonidentity stripe stimuli (much as in the 1963b Terrace study mentioned earlier).
Task 4c(2): This task used cards that were painted either a lighter shade of red or yellow than the cards in 4c(1) above, but with the same black stripes. It was an attempt at fading the color of the cards as Terrace (1963b) had faded the color of his stimuli. As the similarity of the colors on the cards to the colors of the containers was reduced, presumably the controlling effectiveness of the black stripe direction would be enhanced, making it possible in the next fading step to further reduce or even eliminate the color cues entirely. In Figure 1 above, task 4c(2) is like task 4c(1) except that the colors are a faded yellow and a faded red rather than the saturated yellow and red of 4c(1).

Phase 2 of the study consisted in the use of tasks 4a, 4b, 4c(1), 4c(2), 4d and subtest 6, with subjects 6 and 7. Both subjects passed all tasks except 4d, strongly suggesting that the color fading was not successful. The step from 4c(2) to 4d was still too large. Furthermore, the development of cards with colors even more unsaturated while still bearing some resemblance to the colors of the containers was beginning to exceed the paint-mixing skills of the experimenter. At this point, it was decided to use a different approach to fading control from color to black-stripe direction. Since this approach did not use the original 4c task, the identifying system was changed to 4x, 4y and 4z as described below.

Task 4x: As cues designed to follow the solid-colored red and yellow cards of task 4b, the present cards were white, but with three yellow vertical or red horizontal stripes, each about 4.5 cm in width.

Task 4y: This task again used cards with white backgrounds that had three yellow vertical stripes or red horizontal stripes but the stripes were only 2.5 cm in width, like the black stripes of task 4d. The identity-match color cue is still present, but
closely associated with a stripe-direction cue, since the colors were present in the form of vertical or horizontal stripes.

**Task 4z:** These cards were identical to those of 4y above except that half of each colored stripe was replaced with black. The cards now had white backgrounds with narrow vertical or narrow horizontal stripes. The vertical stripes consisted of a narrow band of yellow (1.25 cm wide) with a narrow band of black (1.25 cm wide) adjacent to it. Similarly, the horizontal stripes were composed of adjacent red and black stripes. The color cue was in the process of becoming a stripe-direction cue, and if necessary could easily be further altered to contain more and more black and less and less color. The color and stripe configurations of the cards used in tasks 4x, 4y and 4z are shown in Figure 1 on page 17.

Phase 3 of the study consisted in the use of tasks 4a, 4b, 4x, 4y, 4z, 4d and subtest 6 of the AVC test with subjects 8-10.

**Response Definition**

The experimenter followed the same procedure for presentation of stimuli and demonstration of responses as did the originators of the AVC test (Kerr et al., 1977). The experimenter presented the yellow can and the red box on the table in front of the subject, placed the piece of white foam rubber between the two containers, held up a card, and said, "Where does it go?" The experimenter first demonstrated the correct response then permitted the subject to respond one time before responses were scored. The subject was given only one practice trial even if the response was incorrect. On all subsequent trials the experimenter presented the visual stimuli, placed the piece of foam rubber between the containers, and said, "Where does it go?" The subject need only submerge his/her hand into the container as far as his/her wrist for the response to be
considered correct or incorrect. A correct response was recorded if the subject put the foam rubber into the correct container (i.e., the solid red card was held up and the foam rubber was deposited into the red box). An incorrect response was recorded when the subject put the foam rubber into the incorrect container (i.e., the solid red card was held up and the foam rubber was deposited into the yellow can), or when a period of time passed during which the subject did not make any responses. This time period was approximately 15 seconds, but it varied somewhat depending on the physical abilities of the subject. Variations also occurred if interruptions were made in the environment (someone walked into the testing room, the telephone rang, etc.). Nonresponses were such things as mouthing, dropping, or throwing the object. When nonresponses were made the experimenter gave the subject the foam rubber again and also repeated the instruction.

Incorrect responses were corrected using the procedure designed by Kerr et al. (1977). When an incorrect response was made, the experimenter said, “No, it doesn’t go there, it goes here,” or “No, that’s not the ___ this is the ___” and deposited the foam rubber into the correct container. The experimenter then permitted the subject to respond again by stating the instruction again, holding up the card and placing the foam rubber in front of the subject between the two containers. If physical assistance were needed (i.e., the subject was not responding), the experimenter lightly touched the wrist of the subject and directed the hand towards the correct container. Correct responses made during the correction trial were not counted as correct, but incorrect responses made during the correction trial were counted as incorrect. This is based on the rationale that the correction trial is somewhat easier than the original trial (Kerr et al., 1977). Correct responses were indicated on the data sheet (see Appendix A) by circling the trial number, incorrect responses were indicated by putting an X on the trial
number, and incorrect responses made during a correction trial were marked with a line beneath the trial number which also has an X on it.

Pass/Fail Criteria

This study utilized the same pass/fail criteria developed by Kerr et al. (1977). When eight consecutive correct responses occurred before eight cumulative incorrect responses, the subject was considered to have passed that task. If eight cumulative incorrect responses occurred before eight consecutive correct responses occurred, the subject was considered to have failed that task. “Statistically, only four times in 1,000 trials will eight consecutive correct responses occur by chance in a two-choice situation” (Kerr et al., 1977, p. 103).
CHAPTER III

RESULTS

Reliability

There was 100% interobserver agreement. The second observer was encouraged to notify the experimenter if he noticed any extraneous cuing occurring or if the position of the containers were not correct as indicated by the trial number. There was one instance of the containers being in the wrong position for that trial. There was also one instance of extraneous cuing. The experimenter was told that she held the cue card closer to the correct container rather than holding it in the middle of the containers.

Phase 1

In this phase, the transition from the identity to the nonidentity discrimination took place in four steps: 4a, colored pictures of the containers; 4b, cards that matched the colors of the containers; 4c(1), a yellow card with vertical black stripes and a red card with horizontal black stripes; 4d, white cards with only the horizontal and vertical black stripes. As shown in Table 2 on the next page, the five subjects who participated in this phase (subjects 1-5) had difficulty passing the nonidentity match-to-sample task, 4d. Four subjects failed 4d, and the one who passed it took more trials to reach the pass criterion on that task than she had taken to pass any of the other tasks. It is also clear that the poor performances on task 4d did not arise from any general ineffectiveness of these subjects, because all five subjects passed tasks 4b, 4c(1) and subtest 6.
Table 2

Performances on Each Task During Phase 1

<table>
<thead>
<tr>
<th>Subject</th>
<th>Task 4a</th>
<th>Task 4b</th>
<th>Task 4c(l)</th>
<th>Task 4d</th>
<th>Task 6</th>
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<td>8 pass</td>
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<td>8 pass</td>
<td>21 fail</td>
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<td>4</td>
<td>14 pass</td>
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<td>8 pass</td>
<td>18 fail</td>
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<td>14 pass</td>
<td>17 pass</td>
<td>8 pass</td>
</tr>
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</table>

Phase 2

In this phase, the transition from identity to nonidentity discrimination was the same as in phase 1 except for the interposition of task 4c(2) which used unsaturated colored cards with black horizontal and vertical stripes. Both of the subjects (6, 7) who participated in this phase easily passed all five of the other tasks and both failed task 4d. These data are shown in Table 3 below.

Table 3

Performances on Each Task During Phase 2

<table>
<thead>
<tr>
<th>Subject</th>
<th>4a</th>
<th>4b</th>
<th>4c(1)</th>
<th>4c(2)</th>
<th>4d</th>
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<td>10 fail</td>
<td>8 pass</td>
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Phase 3

In this final phase of the study, the transition occurred in six steps as follows: task 4a, colored pictures of the containers; task 4b, cards that matched the colors of the containers; task 4x, a white card with broad vertical yellow stripes, and a white card with broad horizontal red stripes; task 4y, white cards with narrower vertical yellow and horizontal red stripes; task 4z, white cards with each narrow stripe composed of two even narrower adjacent stripes, one colored and one black; task 4d, white cards with only the horizontal and vertical black stripes. The results are shown in Table 4 below. Two of the five subjects in this phase (8 and 12) showed pass/fail patterns like those seen in the preceding phases, with success on cards with clear color cues, and on subtest 6, but failing on 4d. Three subjects, however, passed 4d and one of these three failed subtest 6.

<table>
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<tr>
<th>Subject</th>
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<th>4b</th>
<th>4x</th>
<th>4y</th>
<th>4z</th>
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Table 4
Performances on Each Task During Phase 3

Trials and outcome for each task (shown in the order administered)
CHAPTER IV

DISCUSSION

The Intermediacy of the Nonidentity Discrimination

The results of this study are quite clear with respect to one point: The visual nonidentity conditional discrimination based on the direction of the black stripes was much more difficult than the audio/visual nonidentity discrimination of subtest 6 of the AVC test. Of the 12 subjects, only subject 9 passed task 4d and failed subtest 6. Eight subjects failed 4d and passed subtest 6; two subjects passed both, but took more trials in passing 4d than subtest 6, and one subject failed both. Said another way, for 10 of the 12 subjects 4d was more difficult than subtest 6. The conclusion might be drawn that Davine (1990) had been wrong about a visual nonidentity discrimination being a missing step between the visual identity discrimination of subtest 4 and the audio/visual nonidentity discrimination of subtest 6. However, there are several factors suggesting that such a conclusion would be premature.

The efforts to develop the stripe-direction discrimination by simply placing the stripes on effective color cues and then removing the colors, or by introducing an additional step with the color somewhat faded, and then removing the colors were both quite unsuccessful. However, the approach to fading used in phase 3 was apparently quite successful. Three (9, 10 and 11) of the five subjects in this phase passed 4d, whereas only subject 5 of the 7 subjects (clearly the highest functioning of all the subjects according to the information in Table 1, page 12) previously tested passed this task. Also it should be noted that although subject 11 was one of the three highest
functioning subjects in terms of the information in Table 1 (page 12), subject 10 was one of the two lowest functioning and subject 9 was in the middle.

These results from phase 3 strongly suggest that with more effective use of the same general strategy—the colors becoming stripes, and then the stripes becoming more and more black—it would not be difficult to increase the number of subjects passing task 4d. Furthermore, task 4d itself may be a part of the difficulty, in that vertical and horizontal stripes may be more easily confused with each other than other kinds of different visual stimuli. In other words, with a more carefully chosen final visual nonidentity task, and further refinement of the fading methodology, quite a few more of the kinds of subjects used in the present study might succeed with the task, which raises another issue.

The subjects used in this study were all adults living in group homes in the community. It is quite possible that some responsiveness to the vocal instructions of caretakers was relevant to the selection of these subjects for community placement. Also, being in such placement may well provide further practice in responding to such instructions. Although there are no formal data to this effect, it is the experimenter's impression that several of these subjects could have followed the instruction to place the foam rubber in the yellow can or the red box without going through the training consisting of tasks 1 through 4b. On the other hand, neither normal group home living nor the activities of day care training centers seem to involve much in the way of visual nonidentity conditional discriminations. Lower functioning clients typically do not have to respond to things that go together but do not resemble each other in any way. Still the capacity to learn such discriminations may underlie more complex audio/visual nonidentity discriminations, or may be relevant to the prediction of other important
intellectual and practical tasks. Further research regarding these issues is clearly called for.

Future Research

There are a number of changes in the present procedure, materials used, and subjects tested that would make possible a considerably more effective investigation of the question involving the status of the visual nonidentity discrimination.

1. With respect to subjects, it is probably important to confine the study to lower functioning subjects, especially those who cannot "Put it in the yellow can" etc. before being exposed to the earlier parts of the AVC test. This could probably be accomplished by using a brief pre-test involving vocally presented terms such as put, red, yellow, can and box.

2. Although it may be necessary to use AVC subtests 1, 2, and 3 for subject selection, it is probably important to administer them again prior to the fading series leading up to the visual nonidentity discrimination, or to simply conduct the remainder of the testing as soon as the subject is selected. This would require obtaining client and guardian consent, and the various other approvals with more subjects than would ultimately be used in the study, but would certainly make the procedure more like that used by the originators of the test and by other researchers.

3. A better final task (instead of 4d of the present study) should be found using stimuli that do not in any way resemble the yellow can or red box, but that are clearly more different from each other than the vertical and horizontal black stripes. The only appropriate way to accomplish this is by experimenting with various stimuli prior to use as a part of the altered AVC test.
4. The fading stimuli should be very carefully designed, also with some actual experimentation prior to use with the AVC test. Even if the black vertical and horizontal stripes were used as the stimuli for the final task, there are several obvious improvements that could be made on the basis of the results of the present investigation. For example, the pictures of task 4a were no easier for the subjects of this study than the colored cards. If for lower functioning subjects the step from subtest 3 to the use of colored cards were too large, it would probably be better to simply hold up a three-dimensional, but replica of the can and box, or another identical can and box. Also, the narrow stripes used in the final task (4d) have no obvious advantage over wider stripes. It would probably be quite satisfactory for task 4a to consist of stripes that occupied about half of the card’s surface. Task 4b could then involve equally wide stripes but which are about 1/3 black. Task 4c could use stripes that were about 2/3 black, and then the final task, 4d, would eliminate all the color. However, it will probably be better to choose a different final task and empirically develop the optimal fading steps, where optimal implies as few steps as is possible while still maintaining accurate final task performance.

It may also be useful to replace the dependent variable used in the present research with one that covers a larger range of accuracy on each subtest than the present scoring system. The pass/fail criteria of the AVC test (pass if eight consecutive correct before eight cumulative incorrect responses, otherwise fail) permits the tester to stop testing when no further practical value would come from further testing. A measure of percent correct responding out of a fixed number of trials, with the number being as large as 30 or so, would provide a greater range of quantifiable data for research purposes. Of course, percent correct could be computed with the present data, but in
some cases the percent value would be based on as few as eight or nine trials and in others on more than 20 trials.

Conclusions

The AVC test (Kerr et al., 1977) would seem to be a very useful supplement to the various other kinds of assessment devices used with the developmentally disabled. However, the large step between subtests 4 and 5/6 may well represent a form of imprecision, with subjects who actually differ in some important way being classified together. It is also possible that the absence of an assessment of the ability to learn a visual nonidentity discrimination is a weakness with respect to the prediction of some kinds of practical and intellectual performances. The present study, like the Davine (1990) study, was an attempt to obtain information on the basis of which an already useful tool could be further improved. Although the information gained was not definitive, it certainly pointed in a direction that may be on the way to accomplishing this goal.
Appendix A

Data Recording Sheets
DATA RECORDING SHEETS

NAME_________ START_____________

DATE_________ FINISH__________

INSTRUCTIONS: If the response is correct put a circle around the
trial number. If the response is incorrect put an X on the trial
number. The task is complete when the subject either responds
correctly 8 consecutive times (passing) or incorrectly 8 cumulative
times (failing). Errors that occur as part of the correction
procedure put a line below the X (X). If a subject corrects an error
during the correction trial do not score it as correct.

Task 4a

Yellow can is placed on the subject's right (R) or (L) as
indicated by the top row. Hold up the picture of the red box
when B is indicated in the second. Hold up the picture of the
yellow can when C is indicated in the second row.

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NOTES
DATA RECORDING SHEETS

NAME_________ START____________

DATE_________ FINISH___________

INSTRUCTIONS: If the response is correct put a circle around the trial number. If the response is incorrect put an X on the trial number. The task is complete when the subject either responds correctly 8 consecutive times (passing) or incorrectly 8 cumulative times (failing). Errors that occur as part of the correction procedure put a line below the X (X). If a subject corrects an error during the correction trial do not score it as correct.

Task 4b

The yellow can is placed on the subject's left (L) or right (R) as indicated by the top row. Hold up the yellow can when C is indicated in the second row. Hold up the red card with B is indicated in the second row.

Trials

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Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
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Task 4C(1) match-to-sample

The yellow can is placed on the subject's left (L) or right (R) as indicated by the top row. Hold up the yellow card with superimposed black vertical stripes when C is indicated in the second row. Hold up the red card with superimposed black horizontal stripes when B is indicated in the second row.

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Task 4x

Place the yellow can on the subject's right (R) or left (L) as indicated by the top row. Hold up the card painted with pale yellow with superimposed black vertical stripes when C is indicated in the second row. Hold up the card painted with light red and superimposed black horizontal stripes when B is indicated in the second row.

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Task 4d

Yellow can is placed on the subject's right (R) or left (L) as indicated in the top row. The cardboard with the black horizontal lines is held up when the B is presented in the second row. The cardboard with the black vertical lines is held up when the C is presented in the second row.

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Task 6  AVC

Correct stimulus is what is asked for as indicated by a B for red box or a C for yellow can in the second row. Place the yellow can to the subject's right (R) or left (L) as indicated in the top row.

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Appendix B

Research Protocol Approval
Date: February 6, 1991
To: Melissa Wilson
From: Mary Anne Bunda, Chair
Re: HSIRB Project Number 91-01-26

This letter will serve as confirmation that your research protocol, "Non-Identity Matching Training as a Supplement to the Audio-Visual Combination Test," has been approved after expedited review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Jack Michael, Psychology

Approval Termination: February 6, 1992
TO: Scott Schrum, Director, ROI  
FROM: A. Roger Vander Schie, Ed.D.  
DATE: May 2, 1991  
RE: Research - Melissa Wilson  
"Nonidentity Matching Training as a Supplement to the Audio Visual Combination Test"

I am authorizing the commencement of the research proposal, "Nonidentity Matching Training as a Supplement to the Audio Visual Combination Test", contingent on compliance with recommendations made by the Research Review Committee.

Please forward a copy of the results of this study to the Recipient Rights Office.

ARV/cd  
cc: Patricia Davis Baker
Appendix C

Client Consent Forms
INFORMED CONSENT

This study, titled "Nonidentity Matching Training as a Supplement to the Audio Visual Combination Test", is concerned with the skills necessary for following simple instructions. The study will be conducted by Melissa Wilson who is a student at Western Michigan University in the Psychology Department. The second observer of the study is David Thompson, a staff member at R.O.I. and Mr. Scott Schrum, Director of R.O.I., is responsible for the project with respect to the project meeting guidelines designed by R.O.I.

This research is based on a proven test which classifies skills necessary for simple instruction following into several categories, and this study will attempt to make that test more useful by adding some new categories. The results of this research may improve the placement of individuals into training and vocational groups. The tasks being assessed apply to tasks such as putting dirty clothes in a hamper, going to the school bus, following verbal instructions and other similar tasks.

Subjects will be selected based on their performance in the first three subtests of the AVC test. If an individual passes all three subtests given by the experimenter they will be considered to be subjects in the proposed study. No subjects selected will be their own guardian. Subjects will be in a session for no more than 60 minutes at a time however, it is probable that most of the subjects will spend closer to 30 minutes in session rather than 60 minutes. Sessions will take place over several days and will be conducted in the subject's group home at times that do not interfere with other programs. Upon coming into the home the experimenter will ask the home coordinator, or the person in charge of the home at the time, if anything unusual has happened (i.e. med changes, behavioral issues) if such conditions have occurred the experimenter will then make a decision to test at that time or postpone the testing to a later time. In a session the subject will watch the experimenter perform a task, such as putting a small piece of foam rubber into a large yellow can, and will then be asked to perform the same task. Each task will be performed several times. During the session the subject will occasionally be given food and/or beverages that are approved by his or her guardian in order to maintain interest in the task. Food reinforcers will be given on
a napkin and placed in front of the subject. Liquid reinforcers will be placed in front of the subject in a cup. All reinforcers will be given immediately after correct responses. Praise will take the form of "Good job, ___. You are going a great job." Or something very similar. Incorrect responses will be followed by a correction trial consisting of the experimenter saying "No, that is not the ____ ___. This is the ____ ___" and induces the subject to make the correct response by using physical guidance if necessary. (Physical guidance will take the form of a light touch to the wrist of the subject by the experimenter and the experimenter may move the hand of the subject towards the correct container using a very light touch.) The experimenter then says "Now you do it all by yourself. Put it in the _____ _____." Because the tasks all involve following instructions the subject may benefit from an improvement in this general skill. Another benefit may be an increased ability to identify symbols and objects by name. The research may lead to an improvement in our ability to assess the developmentally disabled individual's present level of performance. It will also improve the training of new skills since it will help us understand the order in which the skills are ordinarily learned.

There are no risks to participants, and no discomfort other than being removed from the usual routine. Should the subject become uncomfortable in a way, the session will be stopped. The test will then be given again at a later time. Since the sessions will be occurring in the evening toothbrushing necessary will be facilitated by the routine dental hygiene care occurring before bedtime. Also, the evening sessions will not interfere with routine meal times.

All information will remain confidential. Only the researcher, the home staff, case managers, and guardians will be allowed to observe the sessions. All data collected or other materials which could potentially identify the subjects will be kept at R.O.I. in a locked file. In the written report of the study subjects will not be referred to by their real names. No identifiable information will be published without the subject's informed consent.

Participation is voluntary and although it is
recommended that participation continue throughout the entire project, the subject may withdraw at any time and the guardian may withdraw the subject at any time without jeopardy to current programming.

Questions regarding this research may be directed to Melissa Wilson at 329-4124.

Signature below indicates that you have read and understand the information above, that you will contact the experimenter should there be any concern about the participating subject or the research project. The witness signature insures that the authorized party signed the consent form voluntarily and had full knowledge of what they were signing. The witness signature also indicates that the authorized person is indeed the guardian of the individual of interest.

I,___________________ permit participation of ___________________________ in the research conducted by Melissa Wilson.

______________________ date

______________________

______________________ date

______________________ date

______________________

Guardian Signature

Experimenter Signature

Witness Signature

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ASSENT SCRIPT

Assent script stating what the researcher will say to the subject in the proposed study before the study begins.

“Hello, ______________. My name is Melissa. I would like you to help me with some research I’m doing at the university. I’ll sit on this side of the table and if you want to help me you will sit on the other side. All you do is put this piece of foam rubber into the yellow can or the red box, and what I do will tell you which one to put it in. It is sort of like a game. I would like you to help me with this research for a half hour or so at a time, and I may come back another day to get your help again. Will this be ok with you? Will you help me with the research? __________ (record Yes or No) Can you sign your name here? (or if the client cannot write his or her name) Can you make a mark on this piece of paper with this pen? __________

____________________ (a group home worker) will watch you make the mark.

Thank you for agreeing to help me. I’m really glad that we will be working together on this research project.
BIBLIOGRAPHY


