12-1992

An Arbitrary Matching Training Supplement to the AVC Discrimination Test

Charles P. Butler

AN ARBITRARY MATCHING TRAINING SUPPLEMENT TO THE AVC DISCRIMINATION TEST

by

Charles P. Butler

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
December 1992

ACKNOWLEDGEMENTS

I would like to express my appreciation to my advisor and committee chairperson, Dr. Jack Michael, for his ideas, support and encouragement throughout this project; and to my committee members, Dr. Dale Brethower and Dr. Paul Mountjoy for their advice and assistance.

I would also like to thank my good friend Tim Ungsrithong who provided encouragement and support in the early stages of this project, and to my friend Ann Juister for her support and sacrifice during the latter stages of this project.

Charles P. Butler

AN ARBITRARY MATCHING TRAINING SUPPLEMENT TO THE AVC DISCRIMINATION TEST

Charles P. Butler, M.A.

Western Michigan University, 1992

Kerr, Meyerson and Flora (1977) devised a series of small learning tasks that could be used to assess developmentally disabled individuals on the typical tasks to be performed in a school setting or sheltered workshop and required only very simple equipment. Davine (1990) suggested that there may be transitional skills between AVC levels IV and V not found by Kerr et al. Davine looked at four experimental steps designed to test this notion. The results of this study were inconclusive. Wilson (1991) tested the same notion by devising a series of nonidentity matching tasks which were generally found to be more difficult than AVC levels V and VI.

The present experiment consisted of a follow-up to the works of Davine and Wilson using physically simpler stimuli than those used by Davine in tasks similar to her tasks, and administering them in a different sequence. Subjects were recruited from the Center for Developmentally Disabled Adults in Kalamazoo Michigan, ranged in age from 26 to 82, and in retardation ranged moderate to severe. The instrumentation is the same as that used by Kerr et al. (1977).

TABLE OF CONTENTS

Table of Contents—Continued

Table of Contents—Continued

LIST OF TABLES

INTRODUCTION

Discrimination Skills and Developmentally Disabled Individuals

The assessment of repertoires in developmentally disabled individuals for the prediction of their success or failure on the typical tasks to be performed in a school setting or sheltered workshop has been historically poor. Intelligence testing is not a good predictor because it does not test the specific skills that are required for the low level tasks developmentally disabled individuals typically perform. Intelligence tests were specifically designed to assess the capabilities of normal individuals and more specifically for predicting their academic performance in regular classes. It is primarily the vocal and instruction following (language) behaviors of normal individuals that is manipulated in the academic environment while developmentally disabled individuals are typically taught non-language skills in their school or workshop settings. In particular, good performance on intelligence tests is highly correlated with well developed language skills, an area that is frequently lacking in developmentally disabled individuals. In some cases, language skills in developmentally disabled individuals may be so poor that they may not even be able to follow the instructions required to perform the intelligence test properly. However, even with such poor language skills, these developmentally disabled individuals can frequently be taught a variety of low–level non-language tasks.

Most baseline measures designed to assess repertoires in developmental

ly disabled individuals are checklists of relatively global, learned behaviors such as eating skills, dressing competence, personal hygiene skills, toileting independence, knowledge of current events, or skill with numbers or colors. These assessments do not identify specific component behaviors or discriminations that are required for successful performance of the global behaviors being assessed. In other words, these measures have limited utility both in specifying the component behavior and/or discrimination skills that a person has in his/her repertoire, and in identifying what behaviors and/or discriminations are needed for further learning to occur.

Kerr, Meyerson and Flora (1977) were puzzled by the inexplicable failure of some children to learn a new discrimination under the same system of reinforcement of successive approximations, and with the same teacher, that previously had resulted in rapid learning of other discriminations. Subsequently, they examined the curricula of developmentally disabled individuals in many programmed and traditional training settings. Regardless of the specific tasks that were taught in different settings and age groups, the following specific behaviors and/or discriminations were frequently required: imitation, position discrimination, visual discrimination, match-to-sample, auditory discrimination, and auditory–visual combined discrimination.

Kerr et al. (1977) investigated the rapidity with which the above listed tasks could be learned in developmentally disabled individuals, regardless of age. They devised a series of small learning tasks that would require only very simple equipment and that could be easily carried out in a simple testing situation. The materials used included a plain yellow can, a plain red and white striped box, a

small irregularly shaped piece of white foam rubber, a small yellow wooden cylinder, and a small red cube. Subjects were required only to place one of the three objects into one of the two containers. The behavior being tested was not the ability to place objects in containers but the ability to make specific discriminations based on the above listed tasks (imitation, position discrimination, etc.). The criterion for mastery was eight consecutive correct responses before eight cumulative errors were made. Specifically, the following questions were explored:

1. Do students show quick mastery of some tasks but not others. That is, are some tasks more difficult than others?

2. Does the same order of difficulty for the tasks exist for most subjects, or are patterns of success and failure idiosyncratic?

The goal was not just to test for the existence of the repertoire but to teach the correct responses for each task within a reasonable number of trials. Social approval followed each correct response. Tangible reinforcers such as M & M's, pretzels, fruit juice, or water served as back-up reinforcers on a variable ratio (VR) schedule (VR2–VR8 for different subjects).

In the Kerr et al. study, one hundred seventeen mentally retarded children and adults were examined. Some were institutionalized and some attended day schools. The severity of impairment ranged from mild to profound retardation and the subjects ranged in age from 3 to 36 years. Those who had physical handicaps that might impair their ability to perform the simple tasks involved were excluded from the group. Those with severely impaired vision or hearing were also excluded from the group. Except for those exclusions, an effort was made to include every

developmentally disabled individual attending the several schools and institutions in the area.

The AVC Test

The Combined Auditory and Visual discrimination (AVC) test divides the discrimination skills into six distinct categories. These categories were arranged such that they would attempt to test the simplest skill first, then the more difficult tasks in order of difficulty, and finally the most difficult task last. The six categories are described below:

Level 1: Imitation

The subject is taught to place the object in the same container as the experimenter. In this experiment, only one container is available to the subject at a time. The experimenter first *demonstrates* the behavior, *physically guides* the subject through the correct behavior, then *asks* the subject to do it. More specifically, the experimenter models placing the *red cube* in the red and white striped box (the red box, as it will be referred to subsequently, is the only container available) and then says to the subject "Put it in." In the next step, the experimenter models placing the *foam* in the *yellow can* (in this step, the yellow can is the only container available) and then says to the subject "Put it in." The subject is taught to put objects in the same container that the instructor puts the object in. Similarly, the subject is taught to place the yellow cylinder into the yellow can and the white foam into the red box.

Level 2: Position Discrimination

The subject is taught to place the foam in the same container as the experimenter. Two containers are placed in front of the subject and remain in the same position throughout testing but the object is always placed into the yellow can. First, the tester *demonstrates* the correct response *while describing* what is being done (e.g. "I am placing the foam into the yellow can"), *physically guides* the subject through the correct response, then *asks* the subject to do it by saying "Where does it go?" Both containers are available to the subject.

The subject may be taught one or both of two discriminations in this task: (1) to place the object in a container in a particular position, or (2) to place the object in a container with specific visual characteristics.

Level 3: Visual Discrimination

The subject is taught to select the correct container on the basis of visual stimuli. Both containers are placed in front of the subject. The containers are removed after each trial and replaced in the same or a different order, according to a predetermined pattern. The foam is always placed into the yellow can. In the first step, the tester *demonstrates* the correct response *while describing* what is being done (e.g. "I am placing the foam into the yellow can"), *physically guides* the subject through the correct response, then *asks* the subject to do it by saying "Where does it go?"

The subject is taught to place the object in a container with specific visual

characteristics. However, it is also possible that the subject is being taught to place the foam in the yellow can more often than the red box by increasing the number of reinforced trials for placing the foam in the yellow can compared to the number of reinforced trials for placing the foam into the red box. This may lead to an increase in the number of errors made by the subject in subsequent levels.

Level 4: Match-to-Sample

The subject is taught to place the object in the container with the color and shape which is similar to the object. In the first step, both containers are placed in front of the subject. The containers are removed after each trial and replaced in the same or a different order, according to a predetermined pattern. The tester *demonstrates* the correct response *while describing* what is being done (e.g. "I am placing the yellow cylinder into the yellow can"), *physically guides* the subject through the correct response, then *may ask* the subject to do it. During this pre-testing phase, the experimenter must place the yellow cylinder only in the yellow can and the red cube only in the red box. In the next step, the experimenter *asks* the subject to do it by saying "Where does it go?" The subject is taught to match-to-sample.

Level 5: Auditory Discrimination

The subject is taught to place the foam into a container with specific visual characteristics on the basis of auditory stimuli. Two auditory stimuli are used that are also vocal stimuli. Both containers are placed in front of the subject and remain

in the same position throughout testing. The tester *demonstrates* the correct response *while describing* what is being done (e.g. "I am placing the foam into the yellow can"), *physically guides* the subject through the correct response, then *may ask* the subject to do it.

Vocal instructions are provided which may instruct the subject as to which container to place the object into. The quality of the experimenter's voice is varied with each instruction (e.g., monotone and slow for the red box, and quicker and with a rising pitch for the yellow can) so as to make the voice sound as different as possible for each instruction. The subject is told to place the *foam* in either the *red and white striped box* or the *yellow can*.

The subject is taught to place the object in the correct container according to the auditory (vocal) stimulus provided by the experimenter and the specific visual characteristics of the container. There is a chance that the subject could learn to place the object into a container in a specific location since the container remains in the same location throughout.

At this level, the degree of receptive language present in each subject will determine whether this is a test of receptive language or of simple auditory discrimination. For subjects with good receptive language, this may simply be a test of receptive language rather than of auditory discrimination. For subjects with poor receptive language, this may be a test of both auditory discrimination and receptive language, or just auditory discrimination.

Level 6: Auditory and Visual Combined

This level attempts to combine levels 3 (Visual Discrimination) and 5 (Auditory Discrimination). The subject is taught to place the object into a container with specific visual characteristics on the basis of auditory (vocal) stimuli. Both containers are placed in front of the subject. The containers are removed after each trial and replaced in the same or a different order, according to a predetermined pattern. The tester *demonstrates* the correct response *while describing* what is being done, *physically guides* the subject through the correct response, then *may ask* the subject to do it.

Instructions are provided as to which container to place the object into. The quality of the experimenter's voice is varied with each instruction (e.g. monotone and slow for the red box, and quicker and with a rising pitch for the yellow can) so as to make the voice sound as different as possible for each instruction. The subject is told to place the *foam* in either the *red box* or the *yellow can*.

The subject is taught to place the object in the correct container according to the auditory (vocal) stimulus provided by the experimenter and its specific visual characteristics. The chance that the subject could learn to place the object into a container in a specific location, as in the previous level, has been eliminated since the location of the container changes with each trial. The comments regarding receptive language in level V also apply to this level. See Appendix A for a summary of this procedure.

Pass/Fail Criterion

The subject passes any particular level after eight consecutive correct trials and fails after 8 cumulative incorrect trials. In other words, after the subject makes a single error, s/he must then begin a new series of correct trials, scoring eight consecutive correct trials. When the subject makes an error, the experimenter will say to the subject "No, that's not the _____. This is the _____." The subject is physically guided in making a correct response if needed. Next, the experimenter says "Now do it all by yourself. Put it in the _____." A successful correction trial is not counted as a correct trial but an error on a correction trial is counted as an error.

Major Findings

The order of difficulty of learning for the six tasks from easiest to most difficult was: imitation, position discrimination, visual discrimination, match-to-sample, auditory discrimination, and auditory–visual combined (AVC) discrimination (level 6). These tasks were assigned levels ranging from level I for imitation, the least difficult, to level VI for the AVC task, the most difficult. This order of difficulty was the same for most of the students tested by these authors. These findings held for a heterogeneous sample of individuals who varied with respect to gender, level of retardation, and age.

Another result of this study was that older children tended to pass higher level AVC discriminations than younger children. The authors stipulate that while the subjects in their study were not representative of all developmentally disabled

individuals in the population, their data suggest that as age increases, so does auditory–visual discrimination skill, even among moderately and severely retarded adults. The authors suggest that there is no reason to ascribe the tendency of older children to pass higher level AVC discriminations solely to maturation. Data from Meyerson (1977) suggested that it was difficult to teach discriminations that subjects failed on the AVC test. Subjects who made eight cumulative errors on a particular level of the AVC test required up 900 trials with an informal procedure before they were able to subsequently pass that level on the AVC test. This suggested that those who passed a particular AVC level were able to make the discrimination being tested at that level and were being taught a simple task in the process of passing that level. Subjects who failed a particular AVC level were unable to make the discrimination being tested and were requiring a large number of trials to learn the discrimination.

Confirmation and Extension of AVC

Several studies have been performed to both verify and extend the results of Kerr et al. (1977). Several researchers have demonstrated that the discriminations which are tested in the six levels of the AVC test are acquired hierarchically (Martin, Yu, Quinn, & Patterson, 1983; Tharinger, Schallert, & Kerr, 1977; Wacker, 1981; Wacker, Kerr, & Carroll, 1983; Wacker, Steil, & Greenbaum, 1983; Yu & Martin, 1980; Yu, Martin, & Williams, 1989). In other words, the highest discrimination level passed by a subject usually includes passage of all lower levels as well. For example, when a subject's highest passed level is level IV, lev-

els I through III have usually been passed as well.

The AVC test can be used to assess the performance of the developmentally disabled for placement into training groups (Wacker, Kerr & Carroll, 1983; Wacker, Steil & Greenbaum, 1983; Yu et al., 1989). Further, the results of the AVC test can be used to determine which training method might be most productive in teaching a failed level. It has been very difficult to teach failed discriminations (Witt & Wacker, 1981; Yu & Martin, 1980) but the results of the AVC test make placement into vocational and learning groups more accurate. The result has been better success in those training groups because subjects can make the discriminations required for the training (Martin et al., 1983; Tharinger et al., 1977; Wacker, Kerr & Carroll, 1983; Wacker, Steil & Greenbaum, 1983). Training for higher failed levels can be carried out with other more specialized procedures.

The AVC test has been used with hearing impaired clients where manual signs were used at levels V and VI instead of auditory stimuli (Kerr & Meyerson, 1977; Wacker, 1981). Wacker discussed prior signing experience of his subjects who were considered candidates for ongoing sign language programming. In both studies, the same hierarchy which emerged with the normal hearing subjects also emerged in the hearing impaired when manual signs were substituted for auditory stimuli. In these investigations, the modality of the controlling stimulus (discriminative stimulus—S^D) in levels V and VI was visual rather than auditory.

Kerr and Meyerson (1977) observed that the similar results could be due to the possibility that both the auditory S^Ds and the manual sign S^Ds represent a higher level of symbolism than matching like objects. In AVC level IV, the stimulus

that evokes the behavior of placing the object is physically similar to the object itself—this is an instance of identity matching. In AVC levels V and VI, there is no physical similarity between the stimulus that evokes the behavior of placing the object and the object itself—it is an arbitrary stimulus. This is true regardless of whether the stimulus is auditory or a visual sign—these are instances of nonidentity matching. Kerr and Meyerson (1977) have suggested that what is occurring in levels V and VI is symbolic matching.

The suggestion that both the auditory S^Ds and the manual sign S^Ds represent a higher level of symbolism than matching like objects should not necessarily imply that the task would be more difficult. Pigeons can easily learn symbolic match-to-sample. Carter and Eckerman (1975) found that identity between a sample and one of the comparison stimuli appeared to play no role for pigeons that were being taught conditional discriminations. In other words, pigeons did not require more trials to learn symbolic matching than to learn match-to-sample. It was hypothesized that with those subjects, all matching problems whether symbolic or match-to-sample, involved the learning of "if...then" rules.

The difficulty of AVC levels V and VI, whether the stimuli are auditory or manual signs may be due to the complexity of the stimuli rather than whether they are symbolic. In both cases, the stimulus lasts for several seconds during which time there may be tremendous variability in the stimulus. In the case of the auditory stimulus, there is variability in pitch and intensity that changes in intervals measured in milliseconds. In the case of the manual signs, there is variability in the position of the fingers and shape of the hands that changes in intervals measured

in tens or hundreds milliseconds. While there may be fewer changes over the same time interval with manual signs, this is also a different sense modality which is less well adapted to discriminate changes over very short time intervals. The result is that each may be an equally complex stimulus to the subject and far more complex than the stimuli used in AVC level IV, match-to-sample.

A Comparison of AVC Level IV With AVC Levels V and VI

AVC levels V and VI seem more difficult than AVC level IV for several reasons. First, because the stimulus that evokes the behavior of placing the object is continuously present in level IV but is not continuously present in levels V and VI. That is, the stimulus is present all the while that the subject is behaving in level IV while it is a transitory stimulus in levels V and VI that is available to the subject only briefly at the beginning of the trial. It was not clear from the description of the procedure involving a visual sign whether the visual sign was a transitory stimulus or not. Therefore it is not possible to infer that the same apparent difficulty with levels V and VI existed in these studies.

Levels V and VI require the subject to behave under the control of auditory and visual stimuli while level IV requires the subject to behave under the control of visual and tactile stimuli. Specifically, in levels V and VI, an auditory (vocal) stimulus is provided, the instruction, and a visual stimulus is also provided, the color and/or shape of the container. In level IV, the stimuli consist of the color and/or shape of the object, the container, and the shape and texture of the objects. All these levels involve visual stimuli. Level IV additionally involves tactile stimuli

while levels V and VI additionally involve auditory stimuli. It may be that the tactile stimuli available in level IV somehow facilitate the discrimination more than the auditory stimuli available in levels V and VI. This could be due, at least in part, to the conditioning history of the subjects. They may have more experience with tactile stimuli than with auditory stimuli.

The conditional discrimination of the match-to-sample test is not in any way a special skill and has been taught to rats and pigeons without great difficulty. As used in the AVC test, the stimulus that indicates where the object is to be placed has visual stimulus characteristics similar to the object itself, shape and color. In addition, the stimulus that indicates where the object is to be placed, the yellow can or red box, is also the location where the object is to be placed. The subject can easily look at both the object and the stimulus (container) almost continuously while placing the object in the desired location.

Meyerson (1977) notes that auditory discrimination, as measured in the investigation of AVC levels V and VI, is a special skill that few non-humans have and it can be taught to non-humans only with great difficulty. According to Meyerson and Kerr (1977) of all the AVC levels, it is the auditory discrimination that is especially difficult to learn. Kerr and Meyerson (1977), in their study with deaf children, discovered that even though both the match-to-sample and sign tasks required visual discriminations, the signs which replaced the auditory S^Ds as "symbols" for the box and can presented a considerably more difficult task than matching a red cube to a red box or a yellow cylinder to a yellow can.

All these observations would seem to suggest that AVC level V, auditory

discrimination, may be quite a bit more difficult than AVC level IV, match-to-sample. While the reason for this is not clear from the results of these studies, there does seem to be a strong indication that AVC level V requires language skills while it is clear that AVC level IV does not. Language skills require the subject to learn to respond to a variety of arbitrary stimuli, stimuli which bear no relationship to the behavior under control or any objects to be manipulated.

Possible Skills Intermediate to Levels IV and V

Davine (1990) suggested that there may be transitional skills intermediate between level IV and levels V and VI which were overlooked in the rationale for the AVC test. She looked at four experimental steps designed to test whether the AVC scale failed to include steps that are pivotal to the acquisition of skills needed to make auditory discriminations, as used in the AVC scale, when the subject could pass AVC level IV match-to-sample. Her steps were intended to represent a hierarchy of steps which would be transitional between AVC levels IV and V. Each of the steps was intended to be nonidentity matching but additional stimuli were to be available to the subject in Davine's steps that were not available in AVC levels V and VI. These stimuli were also available to the subjects in AVC levels IV and below. The expectation was that since the arbitrariness of AVC levels V and VI was what made them more difficult than level IV, experimental steps that involved arbitrary matching but added additional stimuli that had been available in lower AVC levels and that could aid in the discrimination process could make these steps both easier than AVC levels V and VI, and would also make

them intermediate to AVC levels IV and V. The following are the steps used by Davine and the numbers she assigned to them:

7. Visual (kinesthetic and tactile) nonidentity match-to-sample, in which the subject held objects (a black–haired troll doll and a small black car) that were physically unlike the containers. These objects were the stimuli for the discrimination.

8. Visual, nonidentity match-to-sample which was just like the previous step except that the subject did not hold or touch the objects/stimuli. The experimenter held up the objects/stimuli for the subjects to look at in one case (a black haired troll doll and a small black car in task 8a) and placed the objects/stimuli on the table in front of the subjects in another case (two different pieces of carpet in task 8b).

9. Continuous, nonvocal auditory in which non-word and non-human sounding auditory S^{D}s (a rattling sound from a baby rattle and a squeaky sound from a child's plastic toy) were utilized as stimuli.

The results of this study were that none of the steps were clearly intermediate between AVC level IV and levels V and VI. Task 7 was an intermediate task for three of the 13 subjects, providing weak evidence that it may be intermediate. However, two subjects passed level IV but failed both AVC level VI and task 7, suggesting that task 7 was more difficult than AVC level IV but not that it was more difficult than AVC level VI. Three subjects passed level VI and failed task 7, suggesting that task 7 may have been more difficult than AVC level VI. The mixed results obtained with task 7 do not provide a clear suggestion about its intermedia-

cy between AVC levels IV and V.

Tasks 8 and 9 appeared to be more difficult than any of the AVC levels. Only two subjects passed task 8 and one subject passed task 9. All of the subjects who passed tasks 8 and 9 also passed all AVC levels through VI, providing no suggestion of the relative difficulty of these tasks with respect to any AVC levels. However, none of the subjects who passed AVC levels only through IV or V were able to pass tasks 8 or 9, suggesting that they may have been more difficult than any AVC level.

It was expected that the level of difficulty would be expressed in the same order as the number of the steps. That is, task 7 was expected to be the easiest, task 8 the next hardest and task 9 the hardest. Based on the number of Davine's subjects passing each task, task 7 was the easiest, task 8A was the most difficult, and tasks 8B and 9 were intermediate between tasks 7 and 8A.

Possible Problems With Davine's Study

Davine suggests that the cause of the result, the new steps not falling in between AVC levels IV and V as expected and the steps themselves not displaying the expected order of difficulty, is due to insufficient experience with behavior that must come under the control of an arbitrary stimulus. Arbitrariness occurs a great deal at the auditory level; there is rarely anything about an auditory stimulus that is like its visual counterpart. Most lower functioning individuals have experienced their non-language behavior under the control of auditory stimuli which are the products of language. AVC levels V and VI involve auditory stimuli that are

the products of language while Davine's experimental steps did not involve language based auditory stimuli.

Generally, until people are reading, it is unlikely that they would need to respond to a visual cue that does not look like the task to be performed. Most lower functioning individuals are taught to respond to visual cues that physically resemble what is to be done. For example, an individual may learn to put books on a shelf that has a picture of books on it. The insufficient experience with arbitrary stimuli typical in lower functioning subjects may be another factor governing the poorer than expected performance of Davine's subjects.

Several of the subjects did not perform as expected in terms of the hierarchical nature of the AVC test. Six of the 13 subjects passed a level that followed a level they had failed. Davine accounted for this by suggesting that in previous studies, all six levels were administered in order while in the present study, additional tasks were administered in between the six original levels, possibly altering the hierarchy. This conclusion, if correct, is important for future research because it suggests that the addition of any steps between the six AVC levels could alter the hierarchy and the effects of the additional steps, and this could lead to unexpected results.

Some Additional Problems With Davine's Work

The difficulty of Davine's tasks 7 through 9 compared with AVC levels V and VI may have been due to several additional factors. First, the subjects lacked experience with the particular stimuli she used and those stimuli had a relatively

high degree of complexity compared with the simpler stimuli used in the AVC test. In comparison, the "auditory" stimuli used in the AVC were most likely familiar stimuli or had familiar parts such as individual words, even if the subjects had poor language skills or were not under the control of those particular verbal instructions. These stimuli may have come to control some behavior even if it was as simple as orienting toward the stimulus. This familiarity, while not necessarily present in level IV, may have helped to simplify the task of responding to a complex vocal stimulus.

The stimuli used by Davine were likely to be completely unfamiliar as controlling stimuli and may have been completely unfamiliar altogether. A doll, toy car, or a piece of carpet are stimuli that are seldom used to control behavior except maybe as S^{D}s for engaging in play behavior. Another possibility is that the subjects may even have had a tendency to emit behaviors that were incompatible with the desired behavior because of a history with those type of stimuli. These two factors may have led to an increase in the number of trials required to learn the correct response, making Davine's tasks seem much more difficult than anticipated.

The complexity of the stimuli used by Davine were high compared to those used in the AVC level IV, Match-to-Sample. The toy doll, for instance, has many characteristics such as size, shape, color, texture, and various parts, each with its own characteristics. Only one characteristic of the stimulus needs to be discriminated in order for the subject to make a correct response. With so many stimulus characteristics available in the toy doll for instance, extra learning trials may be required while the subject comes under the control of the relevant stimulus charac-

teristic.

Other Studies

Wilson (1991) also investigated the possibility of an important step—visual nonidentity discrimination—between AVC levels IV and V. She used a modification of Davine's study in which she developed a gradual transition from the relatively easy match-to-sample discrimination of AVC level IV to a more difficult nonidentity discrimination such as Davine's task 8. She hypothesized that nonidentity matching is not greatly more difficult than identity matching but that the nonidentity task is one that the subjects had very little experience with in their ordinary interaction with the environment. Terrace (1963a) performed a study in which pigeons acquired a horizontal/vertical stripe discrimination with essentially no errors by first developing an easy color discrimination and then fading the stripes onto the color stimuli and fading the colors off. Wilson suggested that even if the nonidentity visual discrimination was not intermediate between AVC levels IV and V, assessing the ease of acquiring a visual nonidentity discrimination might still have been useful for 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.

In phase one of her study, Wilson devised a series of four tasks (4a through 4d) designed to gradually fade from stimuli similar to those used in AVC level IV and which provided identity matching, to stimuli that essentially provided a nonidentity matching task. In task 4a, 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. In task 4b, the experimenter help up one of two cards, one painted the same yellow hue as the yellow can and the other the same red hue as the red and white striped box. These stimuli retained the color cues in the pictures of the can and box but eliminated the shape cues. In task 4c, the experimenter again held up one of two cards, one of which was yellow with black vertical stripes and the other was red 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 might become a controlling variable. Task 4d utilized the final set of cues which consisted of white cards with only the black vertical and black horizontal stripes.

The tasks were designed to progressively reduce the number of stimuli that could be used for matching until there was no identity matching in the final step. The results suggested that the step from 4c to 4d was too large. An additional task was devised between tasks 4c and 4d in which three additional variations of task 4c were added that faded the yellow and red colors . In task 4d, the cards contained only the black vertical and horizontal stripes and two additional subjects were tested with the five-step fading procedure. Both subjects passed all tasks except the final task, strongly suggesting that the color fading was unsuccessful. However, Wilson was not able to create stimuli with more subtle changes in color and therefore could not increase the number of fading of steps in that sequence.

She then tried a different series of 6 fading tasks. Steps 4a, 4b and 4d were

used from the previous phase while three new steps were added in between steps 4b and 4d, steps 4x through 4z. In steps 4x through 4z, the width of the color bands on the cards was progressively narrowed to provide fading steps between tasks 4b and 4d. Of the five subjects used in this phase, three passed step 4d and two failed 4d. One of the subjects who passed step 4d also failed AVC level VI.

The extensive number of fading steps required to facilitate learning Wilson's step 4d, a nonidentity match, suggests that nonidentity matching was a difficult discrimination for these subjects. Two of the subjects passed AVC level VI while failing Wilson's step 4d, suggesting nonidentity matching may be as difficult or more difficult than AVC level VI.

The difficulty of Wilson's arbitrary steps may have been due to the nature of the stimuli rather than the arbitrariness of the task. If stimuli other than vertical and horizontal stripes were used, the tasks might have been easier. In other words, lack of prior experience with vertical and horizontal stripes could have made the discrimination more difficult.

Rationale for the Current Research

Wilson's study was illuminating in suggesting that nonidentity matching is a very difficult task for subjects who could pass all six AVC levels. However, the use of a complex fading technique as part of an AVC level seems out of character with all the other AVC levels. The development of an intermediate step between AVC levels IV and V, if one is to be found, must consist of a simpler procedure. A variation of the steps used by Davine might be the best approach to find such a

step.

The present experiment consists of a follow-up to Davine's work using physically simpler stimuli in tasks similar to her tasks 7 through 9. It is intended that reducing the stimulus complexity and using stimuli that are more likely to be novel would bring the tasks more in line with the original intention of Davine's study and would be more in character with the AVC test.

The purpose of this study was to determine if there are steps intermediate to AVC levels IV and V that are critical in the assessment of discrimination skills. That is, are there one or more steps that will aid those who wish to determine the capabilities of developmentally disabled individuals while maintaining all the characteristics of the existing AVC levels. In order to fulfill this requirement, any new steps must be clearly hierarchical. Most of the subjects who pass the new steps should be able to pass all lower steps. At the same time, there should be a clear distinction between any new steps and AVC level V—there should be a significant number of subjects who pass the new step but do not pass AVC level V.

METHOD

Subjects

Subjects were recruited from the Center for Developmentally Disabled Adults in Kalamazoo Michigan. This facility has three centers with clients having a variety of disabilities, and retardation ranging from moderate to profound. The facility provides a day school setting where clients are taught a range of skills from vocational to basic behavioral needs. The Center is affiliated with Western Michigan University. Subjects ranged in age from 26 to 82. Retardation ranged from moderate to severe.

Subject selection was based on several criteria. It was desirable that subjects pass at least AVC level IV. It was also desirable that some subjects also pass AVC levels V and VI. A suggested list of subjects was prepared by a collaboration of several of the staff at CDDA based on the need to pass at least AVC level IV. Next, subjects on that list were given the AVC test and those who passed at least AVC level IV were used as subjects. It was hoped that variability across subjects would result in a number of subjects passing level IV, some but not all of whom pass level V, and a still smaller number who pass all three levels.

Approval was obtained from Western Michigan University's Human Subject Review Board on March 13, 1991. Approval was also obtained from the Kalamazoo County Human Subjects Review Board on July 18, 1991. The Center for Developmentally Disabled Adults received notification approximately August 14,

1991 that the research could commence.

Setting

Subjects were tested at the Center for Developmentally Disabled Adults and during experimental sessions they remained in or near the location where they normally work.

Procedure

Five possible steps were added to the six levels in the AVC test, each of which would be tested individually within the framework of the AVC test. Four of these steps were modified versions of the four steps used by Davine (1990), as described earlier, and one was designed to test the effectiveness of the subject's conditioning history with respect to the auditory stimulus. They are described below. The order in which the five steps were administered may have been important to the outcome. For this reason, each of the five steps was initially administered to only one client and administered after AVC level IV but before level V. If each of the five steps seemed to fall in between AVC levels IV and V, then all of the new steps would have been administered to additional individual clients both after AVC level IV, and in the order of their numbering.

Reinforcement for a correct response consisted of verbal praise which was given for each correct response. In addition, some subjects received backup reinforcers consisting of food or drink. At the Douglass Center, most CDDA participants normally don't receive food or drink as reinforcement for correct responding during

their training but always receive verbal praise. In order to be consistent with the procedures used at CDDA, all subjects at the Douglass Center except one received only verbal praise as reinforcement for a correct response. One subject received a few small pieces of sugarless candy at the completion of her participation in a session at the suggestion of one of the CDDA staff. In preliminary testing, subjects at the other centers received occasional reinforcement of food, drink or other items such as gum or stickers which had been suggested by the staff at CDDA as effective with that particular client and which had been approved by the staff at CDDA so as not to cause any difficulties with food allergies or conflicts with normal CDDA procedures. However, only subjects at the Douglass Center were tested with the experimental procedures and included in the results of this study.

New Tasks

The following tasks were administered in the experiment in a similar order in which they are described below. That is, 7x was administered first, 8Ax was administered next, and 8Bx, 7x1 and 9x followed and were administered in that order. However, during an experimental session only one of the tasks was interposed between the administration of AVC levels IV and V. In other words, during a session subjects were given all the AVC levels in the normal order except for the addition of the experimental task between AVC levels IV and V.

Task 7x: Visual (Kinesthetic and Tactile) Nonidentity Match-to-Sample

The subject held objects that were physically unrelated to the containers (i.e., two irregularly shaped pieces of white foam approximately the same size, but each one having a distinctively different shape). Subjects were asked to place one of the objects into one of the containers (i.e. "Put it in"). This is an arbitrary conditional discrimination in which the sample stimulus, held by the subject as in AVC level IV (Identity Match-to-Sample), is unlike the correct comparison stimulus to be selected. This task was different from AVC level V in that there were two objects in this task which were shaped differently from each other rather than the single object in AVC level V, and the auditory stimulus was the same in all cases rather than the two different auditory stimuli used in AVC level V.

Task 7x1: Visual (Kinesthetic and Tactile) Nonidentity Match-to-Sample

The subject held objects that were physically unrelated to the containers (i.e., two irregularly shaped pieces of white foam approximately the same size, but each one having a distinctively different shape). Subjects were asked to place one of the objects into a specific container (i.e. "Put it in the red box/yellow can"). This procedure differed from AVC level V in the same way that task 7x did except for a difference in the auditory stimulus. In addition, it also differed from the procedure used in AVC levels II through IV in which the experimenter said "Where does it go?" It was felt that this change would make the experimental steps more consistent with AVC levels V and VI. Kerr et al. used the stimulus "Where does it go" instead of "Put it in the red box" in AVC levels II through IV to ensure that the

matching was solely under the control of visual stimuli. However, they also found that subjects responded identically using both auditory stimuli. It was felt that subjects might not respond identically with both auditory stimuli in this experimental step. It was desirable to see if using different auditory stimuli for each correct response would result in the same response from subjects as using the same auditory stimulus for each correct response.

This is an arbitrary conditional discrimination in which the sample stimulus, held by the subject as in AVC level IV (Identity Match-to-Sample), is unlike the correct comparison stimulus to be selected. This task was different from task 7x only in the auditory stimulus that was provided to the subject. If the subject had a conditioning history with respect to the auditory stimuli in this task similar to the population at large, the result would have been different from the result in task 7x—it should have been easier. However, the previous conditioning with the stimuli used in this task, in task 7x, may have also made this task easier than task 7x. However, task 7x1 was administered after tasks 8Ax and 8Bx. The learning that occurred in tasks 8Ax and 8Bx and the extra time between administration of 7x and 7x1 may have reduced any learning effects that occurred in task 7x.

Task 8Ax: Visual, Nonidentity Match-to-Sample

In this step, a piece of neutral foam rubber was handed to the subject. Placement into the correct container was based on which of two objects that were physically unrelated to the containers (i.e., two irregularly shaped pieces of white foam approximately the same size, but each one having a distinctively different shape)

was held up by the experimenter. The sample stimulus was shown to the subject until a response was made. The subject was prompted to look at the sample stimulus. This also was an arbitrary conditional discrimination since the S^D did not physically resemble the correct comparison stimulus. The stimuli were unlikely to have any significance to the subjects in terms of discriminative cues except for any learning that might have occurred in step 7x. In both step 7x and step 8Ax, a particular object was used as a cue to place the neutral foam into a particular container, the cone for the yellow can and the sphere for the red box.

Task 8Bx: Visual, Nonidentity Match-to-Sample

The foam rubber was handed to the subject while a sheet of white cardboard with one of two large (approximately 1.75 inches tall), upper case Greek characters printed on it was held up by the experimenter and the subject was prompted to look at the character. The Greek character was the sample stimulus and a correct response was dependent on which Greek character was held up in front of the subject. This also was an arbitrary conditional discrimination because the Greek characters did not physically resemble either of the containers. This task was similar to Task 8Ax except that in this task the stimulus was an object that may have been similar to other objects that have provided some type of discriminative cue ("symbols").

Task 9x: Continuous, Vocal Auditory

This task differed from Davine's Task 9 in that her task utilized nonvocal

auditory stimuli. The present experiment utilized a tape recording of two different vocal stimuli which were unlikely to have had any significance to the subjects. The vocal stimuli were taken from an LP test record in which an announcer describes tests being performed. Each vocal stimulus was an excerpt from that record. Tape A contained the stimulus "In the following trackability tests" and the correct container was the yellow can, while tape B contained the stimulus "Skating compensation" and the correct container was the red box. The stimuli were repeated with an approximate 3–4 second delay between presentations until the subject made a response.

This task was unlike AVC levels V and VI in primarily two ways: the sounds remained until the subject made a response and the sounds were unlikely to have had any significance to the subjects.

RESULTS

In preliminary testing of subjects with the AVC test, all of the subjects passed through level VI on the AVC test. One subject made a large number of errors on all the levels but did pass through level VI. Another subject was tested and initially only passed through level III but was retested at the suggestion of one of the staff members and passed through level IV on the second testing. However, this subject was not used due to inconsistencies in his responses during the pretesting. Other subjects that were not used were unable to pass AVC levels above II in pretesting.

During experimental testing, all the subjects passed all of the AVC levels through level VI. However, not all of the experimental steps were passed by all the subjects. Specifically, at least half of the subjects failed each of the experimental steps except task 7x1. All the subjects except one passed task 7x1 and that subject also failed all the experimental steps and made a large number of errors throughout the AVC test, although she did pass all the AVC levels through level VI in pretesting. All of the subjects except one failed task 9x and that subject also passed all the experimental steps easily. Table 1 details the results of each experimental step.

Table 1

Subject Success Per Experimental Task

Subjects	Task 7x	Task 7x1	Task 8Ax	Task 8Bx	Task 9x
1	Pass	Pass	Pass	Pass	Pass
2	Fail	Pass	Fail	Pass	Fail
3	Pass	Pass	Pass	Pass	Fail
4	Pass	Pass	Fail	Fail	Fail
5	Pass	Pass	Fail	Fail	Fail
6	Fail	Pass	Fail	Fail	Fail
7	Fail	Fail	Fail	Fail	Fail
8	Pass	Pass	Fail	Pass	Fail
9	Fail	Pass	Pass	Fail	Fail
10	Pass	Pass	Fail	Pass	Fail
11	Fail	Pass	Fail	Fail	Fail
12	Pass	Pass	Fail	Pass	Fail
Total Passed	7	11	3	6	1

It can be seen from the totals of subjects who passed the various experimental steps that task 7x1 was the easiest, 7x and 8Bx were the next most difficult, 8Ax was more difficult yet, and 9x was the most difficult.

DISCUSSION

All of the experimental steps in this study used nonidentity matching. As in previous studies (Davine, 1990; Wilson, 1991), nonidentity matching was generally more difficult than AVC levels V and VI. The intent of this study, with the exception of step 7x1, was to require the subjects to learn a new arbitrary discrimination and see if such a discrimination was more difficult than match-to-sample but less difficult than AVC level V or VI. An additional purpose of this study was to determine whether the auditory stimuli used on AVC levels V and VI were novel stimuli. If they were not novel, then the assumptions underlying the previous studies and even some of the assumptions behind the AVC test itself may be incorrect.

The subjects in this study were all able to pass AVC levels through level VI. In preliminary testing subjects fell into two categories, those who passed only through AVC levels II and those who passed through AVC level VI. Subjects who were unable to pass AVC levels as high as III and were unsuitable for this study, were not used.

The studies by Davine (1990) and Wilson (1991) utilized some subjects that passed AVC levels only through IV. That places subjects in this study at the upper end of functioning in comparison to other studies looking for transitional skills between AVC levels IV and V. Yet none of the tasks in this study were passed by all the subjects. Task 7x1 was passed by all subjects except one and this subject consistently made a large number of errors on all AVC levels through

out testing. However, task 7x1 was devised to help clarify some of the variables controlling subject behavior on other tasks rather than to become an intermediate step between levels IV and V. Only seven of the 12 subjects passed task 7x, the next easiest task. Six subjects passed task 8Bx and only three and one subjects passed tasks 8Ax and 9x respectively. This suggests that these tasks were difficult in comparison to AVC levels V and VI. Rather than falling in between AVC levels IV and V, they seem to be at least as difficult as AVC level VI. Yet they were designed to be easier than those used by Davine (1990) by utilizing simpler stimuli which were more likely to be novel.

The purpose of step 7x1 was to make a comparison of two conditions, one of which (7x1) included the vocal stimulus "Put it in the red box/yellow can" and one which (7x) did not. The subjects may have done better on 7x1 because the auditory/vocal stimuli were not novel and in fact, the subjects may have had a long history of behaving in a particular way with respect to those stimuli. If this is true, then the use of those same stimuli in AVC levels V and VI may have had a completely different function than the one proposed by Kerr et al. (1977) who suggested that it was the discrimination of the auditory stimuli that made those AVC levels difficult. In fact, the subjects may typically have a history of conditioning with respect to those stimuli and other similar vocal stimuli which makes their discrimination quite easy. Furthermore, such a history of conditioning could have facilitated making a difficult discrimination. In other words, it is possible that the variable or variables that make AVC levels V and VI difficult were not the auditory discrimination but some other variable and in fact, the auditory stimuli may have

actually facilitated making that discrimination.

In previous studies of this type (Davine, 1990; Wilson, 1991), the experimental steps were also typically more difficult than AVC level VI. The results of this study, which was consistent with earlier studies in this regard, in combination with the results of Davine (1990) and Wilson (1991) cast doubt on the assumption that a step that would empirically fall between AVC levels IV and V, would involve discriminating a novel arbitrary stimulus. In all of these studies, the stimuli used for the experimental steps, with one exception, were designed and intended to be novel arbitrary stimuli. In none of these studies did the experimental steps involving arbitrary stimuli clearly fall in between AVC levels IV and V, and in all of the studies, all the experimental steps involving nonidentity matching except step 7x1 in the current study were generally at least as difficult as AVC level VI. The stimuli used in the current study were designed to be simpler and more likely to be novel than those used by Davine, both reducing the possibility that a previous conditioning history could be a factor, and to make the steps easier.

It is instructive to look at the results of this study in understanding why none of these experimental steps has fallen between AVC levels IV and V. Some of the experimental steps were more difficult than others and one was considerably easier. This gradient of difficulty across experimental steps in combination with the characteristics of each step can shed some light on exactly what types of discriminations are or are not being made in this study and the two previous studies of Davine (1990) and Wilson (1991). These results may also prove useful in better understanding the discriminations being made in AVC levels V and VI.

Excluding for the moment step 7x1, the easiest step in this study was step 7x followed closely by step 8Bx. In step 7x, the subject must place each object, which is also the stimulus, into a specific container. The subject can hold the stimulus, feel it and look at it, while placing it into the container. In step 8Bx, the experimenter held up two large Greek characters, each one of which was intended to serve as a stimulus for placing one of two neutral stimuli into a particular container. The Greek characters, while most likely novel to the subjects, were not unlike other stimuli that are used for the same purpose, to control specific responses in those who see them. In that regard, they may not have been completely novel. The subjects may have been making the generalization that "symbols" control some of their behavior and these were "symbols," making the task easier than if the stimuli were completely novel. However, the subjects could not feel or touch the stimuli and could not be in sensory contact with the stimuli continuously as in step 7x. This factor could make that discrimination more difficult than in step 7x.

It is not unusual for humans in advanced cultures that objects are placed into containers based on characteristics of the objects to be placed—garbage goes into one container while dirty laundry goes into another. There may be signs above containers with either letters/words or pictures indicating what goes into the container. In all these cases except where a picture is used, an arbitrary discrimination must be made since the stimuli bear little or no resemblance to the container or the objects to be placed into it. The subjects in this study may have had a history of reinforcement for behaving with respect to such containers and objects making the behaviors in AVC levels V and VI somewhat familiar rather than com-

pletely novel.

Step 8Ax which was more difficult than 7x or 8Bx, used a slightly different paradigm. In this step, the experimenter held up one of two simple foam objects and the subject had to place a neutral stimulus into one of two containers, where each stimulus was to control the response for a specific container. Unlike step 7x but like step 8Bx, the subject could not hold or feel the stimulus and could not look at it while placing the neutral stimulus into the container. Unlike the Greek characters used in step 8Bx, these stimuli are not normally used for controlling responses (are not "symbols") and therefore may have been completely novel to the subjects in that regard. In other words, step 8Ax provided fewer stimuli over a shorter period of time than in step 7x, and the subjects' conditioning history was probably less important in step 8Ax than in step 8Bx. Step 8Ax might have been more difficult if the subjects did have a significant conditioning history with respect to the stimuli used in step 8Bx but it should also have been more difficult as a result of the reduction in stimuli available—the stimuli may have been more similar to each other than the Greek characters.

Step 9x used what was most likely completely novel auditory stimuli but which were also vocal stimuli and were therefore similar in complexity and character to the auditory stimuli used in AVC levels V and VI. Despite the possibility of a highly relevant conditioning history with respect to vocal stimuli, they are extremely complex stimuli and therefore new learning with respect to them could be relatively slow in adults (Lenneberg, 1966, 1969). If these stimuli were novel compared to the auditory stimuli used in AVC levels V and VI and new learning

with respect to complex auditory stimuli is relatively difficult in adults, step 9x should have been more difficult than AVC levels V or VI. Step 9x was the most difficult step of all.

In looking across all the experimental steps, as the steps become more likely to be novel to the subjects and approach the stimuli used in levels V and VI on the AVC test in complexity and character, they become progressively more difficult. In fact, they become at least as difficult as AVC levels V and VI. This suggests that the vocal auditory stimuli used as used in AVC levels V and VI may not be novel to those who are able to pass AVC levels V and VI but were novel for those who failed step 9x in this study.

Step 7x1 was identical to step 7x except that an auditory stimulus was used that was identical to the one used in AVC levels V and VI. Step 7x1 was the easiest step and all subjects except one passed that step. This suggests that the auditory stimulus used in AVC levels V and VI may have been already somewhat effective in controlling behavior and therefore was not the basis for the difficulty of those steps. However, it was not determined if step 7x1 was easier than AVC levels V or VI. It should be noted that the single subject who failed step 7x1 also failed all the other experimental steps and made a large number of errors on all of the AVC levels.

Taken together, the results of all the experimental steps in this study and the results of the studies by Davine (1990) and Wilson (1991) suggest that the auditory stimulus used in AVC levels V and VI is not novel for the subjects who pass those levels and therefore that the auditory discrimination is not, by itself,

what makes AVC levels V and VI more difficult than the previous levels.

If the results of Step 7x1 are considered, it could be additionally argued that the auditory stimuli used in AVC levels V and VI actually facilitates the correct response. If this is the case, then it may be that there is some other factor than the auditory stimulus in AVC levels V and VI that makes them difficult. If this is true, the nature of AVC levels V and VI may be quite different than what was proposed by the authors of the AVC test (Kerr et al., 1977).

Additional Observations

Some of the subjects would provide a vocal response for which container s/he was about to place the object into. One subject would do this on every trial. For instance, he would say "yellow can" or "red Box" just before placing the object into that container. The container named was always the container he placed the object into, even if it was the incorrect container. Sometimes subjects would name a container with a voice inflection suggesting a question and then pause and look at the experimenter. The experimenter's response was to simply repeat the previous prompt of "Put it in."

The vocal responses of these subjects suggest that they may have been providing themselves with self–prompts which served to aid in making the correct choice. These subjects may also have been covertly answering the question "Where does it go?" in AVC levels II through IV. These instances of self talk may be examples of subjects providing themselves with instructions which improve the chance of making a correct response.

Methodological Issues

Stimulus Selection

All of the stimuli used in this study were selected arbitrarily and this is a variable that could have affected the results. The foam sphere and cone were chosen out of convenience—they could be purchased at a nearby crafts store. They were different in size and shape while not seeming to resemble the can or box. The two Greek characters were chosen to minimize the chance that subjects would have a history of reinforcement with those particular stimuli. Further, the particular two stimuli seemed different from each other while not seeming to resemble the box or can. Finally, the vocal stimuli were chosen out of convenience. The voice should be unfamiliar, so a recording of a man's voice describing variables that seemed as though they should be unfamiliar to the subjects was chosen. The recording was slowed to make it somewhat more unfamiliar than otherwise. The two spoken utterances were chosen because they seemed to be sufficiently different from each other to the experimenter.

It would seem that the ideal method for selecting stimuli would be an empirical method in which various stimuli are tried with a variety of subjects to see which ones consistently provide the greatest discrimination across a variety of subjects. Such a method could be relatively time consuming but would optimize the experimental procedure. However, given that this study and those performed by Davine (1990) and Wilson (1991) all suggest that nonidentity matching is as difficult or more difficult than AVC levels V and VI, the need for a time consuming stim-

ulus selection process may not be important.

Subject Errors in the Experimental Steps

Several of the subjects exhibited a different pattern of errors than what is typical of the type of error with the AVC test. When making errors on the AVC test, subjects tended to make very few errors, four or less, when they passed a level and many errors when they failed it. The criterion for failure, eight cumulative errors, seems to be a well chosen criterion as the failure pattern suggests that subjects who fail would not have passed by chance, and would not have passed given a more liberal failure criterion such as 10 or 15 cumulative errors. However, several of the subjects passed an experimental step after making six or seven cumulative errors. This suggests several things. First, the experimental steps were somehow different than the AVC levels in terms of what was being tested and/or learned by the subjects. There may have been more learning being required of the subjects in the experimental steps than in the AVC levels. Second, it might have been useful to try using a more liberal failure criterion such as 15 or 25 cumulative errors to see if more subjects would have passed the experimental steps. Subjects who initially failed an AVC level typically required several hundreds of trials to pass. If subjects passed the experimental steps with a 25 error criterion, the experimental steps might have been more likely to fall in between AVC levels IV and V. Of course even if this was the result of such a procedural change, this would not argue for changing the failure criterion of the AVC test from eight to 25 errors. Further research would need to be conducted to understand why the error

criterion was different.

Suggestions for Further Research

It would be useful to know if, in fact, it is the auditory discrimination that is being tested in AVC levels V and VI, if the auditory discrimination only plays a small part in the discrimination process, or if the auditory discrimination actually facilitates the discrimination. The current study suggests the latter but more data are required to confirm that hypothesis.

If the auditory/vocal stimulus does facilitate the discrimination, it could be argued that the subjects are engaging in Rule Governed Behavior (Skinner, 1969), and if they are, then the function of the auditory stimuli throughout the test may be playing a more complex role than to function simply as auditory stimuli. For instance, the stimulus "Where does it go?" may lead to the subject answering the question covertly with "The yellow can" or "The red box" and providing him/herself with a self prompt for the correct behavior. The type of discrimination being made in AVC levels V and VI might be entirely different than the simple auditory and auditory visual discrimination proposed by Kerr et al. (1977).

Many of the subjects in this and previous studies who were classified as severely mentally retarded were able to pass AVC levels V and even VI. This suggests that the AVC test, when used with developmentally disabled adults, is not comprehensive enough. It would be useful if the test had levels above AVC level VI that could only be passed by subjects with mild to moderate mental retardation. The development of one or more new AVC levels above level VI would extend the

utility of the test, making it applicable to a larger population.

If AVC levels V and VI are not, in fact, auditory and auditory visual discriminations, then an extension of the AVC test with levels higher than VI would require an analysis of what type of discrimination is being made in levels V and VI so that higher levels would be a consistent extension of the existing test.

APPENDICES

Appendix A

Summary of Learning-to-Learn Tasks

TABLE 1
Summary of Learning-to-Learn Tasks

Task	*Visual S^{D}s (Containers)*	*Position of Containers*	*Correct Response*	*Auditory S^{D}s**	*Manipulanda*
I. Imitation	1 at a time	1 in front of subject	**a)** Put foam in can (2 trials) **b)** Put foam in box (2 trials) **c)** Put cube in box (2 trials) **d)** Put cylinder in can (2 trials)	"Put it in"	rubber foam, cylinder, cube
II. Position Discrimination	2	2 containers in front of child *stable* position	Puts the foam in the yellow can	"Where does it go?"	neutral (rubber foam)
III. Visual Discrimination	2	*alternate* position *randomly*	Puts the foam in the yellow can	"Where does it go?"	neutral (rubber foam)
IV. Match-to-Sample	2	*alternate* position *randomly*	**a)** Puts the yellow cylinder in the yellow can **b)** Puts the red cube in the red box	"Where does it go?"	**a)** Yellow cylinder **b)** Red cube
V. Auditory Discrimination	2	*stable* position	**a)** Puts the foam in the yellow can **b)** Puts the foam in the red box	**a)** "Put it in the yellow can." **b)** "Put it in the red box." (presented *randomly*)	neutral (rubber foam)
VI. AVC Auditory-Visual Combined Discrimination	2	*alternate* position *randomly*	**a)** Puts the foam in the yellow can **b)** Puts the foam in the red Box	**a)** "Put it in the yellow can." **b)** "Put it in the red box." (presented *randomly*)	neutral (rubber foam)

Note: During the demonstration phase, no reference should be made to the red box or yellow can in levels II through IV. For levels II and III, say *"Now I'll put it in here."* For level IV, make comparisons between the object and the container. Begin scoring after the subject has successfully placed the object into the correct container.

Correction Procedure

1. The experimenter says: "No, that's not the _____. This is the _____." The subject is physically guided in making a correct response if needed.
2. The experimenter says: "Now do it all by yourself. Put it in the _____."
3. A successful correction trial is not counted as a correct trial but an error on a correction trial is counted as an error.

Pass = 8 consecutive correct trials
Fail = 8 cumulative incorrect trials

TABLE 2
Summary of Learning-to-Learn *Experimental* Tasks

Task	*Visual S^{D}s*	*Position of Containers*	*Correct Response*	*Auditory S^{D}s**	*Manipulanda*
7x	Two pieces of white foam, A=cone and B=sphere (presented *randomly*)	Two containers in front of child *stable* position	**a)** Put A into Yellow can **b)** Put B into Red box	"Put it in"	Two pieces of white foam, A=cone and B=sphere
8Ax	Two pieces of white foam, A=cone and B=sphere (presented *randomly*)	Two containers in front of child *stable* position	**a)** Put into Yellow can when shown A **b)** Put into Red box when shown B	"Look at what I'm holding" ***—and—*** "Put it in"	neutral (rubber foam)
8Bx	Two large Greek characters Ω and Φ (presented *randomly*)	Two containers in front of child *stable* position	**a)** Put into Yellow can when shown Ω **b)** Put into Red box when shown Φ	"Look at this" ***—and—*** "Put it in"	neutral (rubber foam)
9x	None	2 containers in front of child *stable* position	**a)** Put it into the Yellow can after playing tape A **b)** Put it into the Red box after playing tape B	"Put it in" ***—and—*** Tape recordings of a human voice: **a)** "In the following trackability tests..." **b)** "Skating compensation." (presented *randomly*)	neutral (rubber foam)

Correction Procedure

1. The experimenter says: "No, that's not the _____. This is the _____." The subject is physically guided in making a correct response if needed.
2. The experimenter says: "Now do it all by yourself. Put it in the _____."
3. A successful correction trial is not counted as a correct trial but an error on a correction trial is counted as an error.

Pass = 8 consecutive correct trials
Fail = 8 cumulative incorrect trials

Appendix B

Data Recording Forms

DATA RECORDING FORM — Experimental Task

Learning To Learn

Name _____ Time Start_____

Teacher _____ Finish _____

Date _____

Instructions: If the response is correct, circle the trial number. If the response is incorrect, place X on trial number. The task is complete when eight (8) consecutive correct trials are made. Discontinue when eight (8) errors have accumulated. Errors that occur as part of correction trial (see procedures) should be underlined, X. If a child corrects an error during a correction trial, do *not* record a correct trial.

Task #_____(Experimental)

Correct stimulus is the one you ask for as indicated below. (Containers remain stable.)

Trials:

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

Notes:

Appendix C

Research Protocol Approval

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: March 13, 1991

To: Chuck Butler

From: Mary Anne Bunda, Chair Mary Anne Bunda

Re: HSIRB Project Number 91-02-06

This letter will serve as confirmation that your research protocol, "An Arbitrary Matching Training Supplement to the AVC Discrimination 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: March 13, 1992

KALAMAZOO COUNTY GOVERNMENT

HUMAN SERVICES DEPARTMENT

201 WEST KALAMAZOO AVENUE•KALAMAZOO, MICHIGAN 49007
PHONE (616) 384-8000

TO: Donn Montgomery, CDDA

FROM: A. Roger Vander Schie

DATE: July 18, 1991

RE: Research Proposal: "An Arbitrary Matching Training Supplement to the AVC Discrimination Test"

It is my understanding that the Recipient Rights Research Review Committee's concerns have been addressed concerning the research proposal titled, "An Arbitrary Matching Training Supplement to the AVC Discrimination Test". Therefore, I am authorizing commencement of this research contingent on full compliance with recommendations made by the Research Review Committee.

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

ARV/cd

cc: Patricia Davis Baker, Recipient Rights Officer

BIBLIOGRAPHY

Carter, D. E., & Eckerman, D. A. (1975). Symbolic matching by pigeons: Rate of learning complex discriminations predicted from sample discriminations. Science, 187, 662–664.

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

Davine, V. (1990). Extension of the audio–visual combination discrimination test. Unpublished master's thesis, Western Michigan University, Kalamazoo.

Kerr, N., & Meyerson, L. (1977). Further evidence on ordering, generalization and prediction from the AVC scale: AVC skills in deaf–retarded adults. Rehabilitation Psychology, 24, 129–131.

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

Lenneberg, E. H. (1966). Biological foundations of language. New York: Wiley.

Lenneberg, E. H. (1969). On explaining language. Science, 164, 635–643.

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.

Skinner, B.F. (1969). Contingencies of reinforcement: A theoretical analysis. Englewood Cliffs, NJ: Prentice–Hall.

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

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

Wacker, D P., Kerr, N J., & Carroll, J. L. (1983). Discrimination skill as a predictor of prevocational performance of institutionalized mentally retarded clients. Rehabilitation Psychology, 28, 45–58.

Wacker, D. P., Steil, D. A., & Greenbaum, 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, 2, 175–189.

Wilson, M. (1991). Nonidentity matching training as a supplement to the audio–visual combination test. Unpublished master's thesis, Western Michigan University, Kalamazoo.

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.

Yu, D., & Martin, G. (1980). Comparison of two procedures to teach visual discriminations to severely mentally handicapped persons. Journal of Practical Approaches to Developmental Handicaps, 10, 7–12.

Yu, D., Martin, G. L., & Williams, L. (1989). Expanded assessment for discrimination learning with the developmentally handicapped: A practical strategy for research and training. American Journal of Mental Retardation, 94, 151–169.