# A DEVELOPMENTAL ANALYSIS OF THE EFFECTS OF MATERIAL REWARDS ON LEARNING IN YOUNG CHILDREN: A TEST OF THE REGRESSION MODEL

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# PREFACE

This study focused on providing further information on the regression model as a theoretical explanation of the adverse effects of rewards on immediate task performance. Specifically this study examined what effects material rewards have on classical learning tasks in the age range of 5 to 7 years.

This dissertation departs from the format called for in the Graduate College Style Manual (1987). The body of this dissertation consists of a complete manuscript prepared for submission to a technical journal according to the Third Edition of the Publication Manual of the American Psychological Association (1983). In order that the dissertation be complete in terms of Oklahoma State University's standards, materials which are usually present in the body of the report are presented in the appendixes. The appendixes include a review of relevant literature, human subject correspondence, research design, methodology, raw data, and selected statistical analyses.

I would like to express appreciation to all who have assisted me in this project and during my graduate study at Oklahoma State University. First I wish to express my gratitude to two senior researchers, the late Dr. Elizabeth K. Starkweather and Dr. John McCullers for their patient guidance, and joy and enthusiasm in research. I thought of Dr. Starkweather frequently as I collected the data. Dr. McCullers was helpful at each phase of the project, but his approach with statistical application and the SYSTAT program has

inspired me to work further with research. Also his advice, early in my graduate program "to remember that adults are in developmental stages" has helped me not only then, but as I have advised students. I am also grateful to Dr. Frances Stromberg, who served as my department head until her retirement and then continued to serve as a committee member, has given invaluable assistance throughout my career. Appreciation is also expressed to the other members of my committee, Dr. Kathryn Castle, for sensitivity to my needs and opportunities to grow professionally, Dr. Marguerite Scruggs, for her encouragement toward excellence, and Dr. Althea Wright, for her assistance in helping me see the "total picture."

Special thanks and appreciation also go to Barbara Heister, Bob Heister, and Wayne Matthews who assisted in the making of the apparatus. Also I am grateful to Alice McCullers for her humor, artistic skills, and willingness to take the photographs of the apparatus. Thanks goes to Nancy Banks who assisted in the procurement of subjects. Appreciation is expressed to Donna Couchenour, Director, Oklahoma State University Child Development Laboratories and to the teachers for their helpful assistance and cooperation during the pilot phase of the project. Gratitude is expressed to the following directors of early childhood programs in Tulsa: Karen Droms, Audubon Child Development Center; Peggy Hedges, Broken Arrow Clubhouse, Judy Lee, St. John's Child Care Center, and Carol McClure, the summer program of St. Francis at Key Elementary School; to the following director in Edmond: Franza Schrader, Children's World; and the directors in Stillwater: Opal Collins, Kollins Kiddie Kollege, Peggy Emde, Kids Under Construction, and Jan Johnson, KinderCare; for the opportunity to use their early

childhood programs; to the teachers for their cooperation while the data were being collected; and to the children for the great joy they provided to me while working with them. Special thanks to those directors who went "above and beyond" normal expectations to help me procure subjects at a difficult time of data collection: Marty Clark, Riverfield Country Day School of Tulsa; Jane Hellwege, Children's Day Out of Southern Hills Christian Church in Edmond; and Joyce Jech, Marrs Elementary School of Skiatook.

Also, I thank the College of Home Economics for financial support for the rewards and the faculty of the Department of Family Relations and Child Development for their interest and support and especially Ann Mills, Kay Murphy, and Elaine Wilson for proctoring my classes in the final stages of data collection and to Jane Jacob for her patience and assistance in teaching computer skills to me. Appreciation is expressed to Mary Lou Wheeler for the typing of the manuscript.

Finally, I would like to say Merry Christmas to my family; i.e., mother, dad, Collen, Eddie, Pam, and Charlotte; here's the Christmas gift you've supported me in making.

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## Abstract

To further test the regression model as a theoretical explanation of the adverse effects of rewards on immediate task performance and to determine what effects material rewards may have on learning tasks in the 5 to 7 age range, this study used a two conditions (reward/nonreward) x three tasks (transposition/reversal shift/nonreversal shift) factorial design. The sample consisted of 242 subjects at each of four age levels (5, 6, 7, 8). The subjects were given one of three tasks.

Analysis indicated that there was no consistent effect of reward, sex, and age. However, all ages performed well on both the near and far tests in the transposition task, and all ages performed better on form discrimination than on color in the discrimination tasks. Results were examined in the context of White's (1965) review of the 5 to 7 year age transition. The present study was attempting to get the child who was just making the transition so that under reward his behavior might display temporary regression, but if the five-year-old is already showing the transition, then the four-year-old child would be the logical age for future study.

# A Developmental Analysis of the Effects of Material Rewards on Learning in Young Children: A Test of the Regression Model

It is generally accepted that rewards enhance behavior; however, this has not been found to be the case in all situations. Sometimes rewards produce adverse effects on human behavior (see Lepper & Greene, 1978 for reviews of related literature). It has been found that rewards can undermine interest in an activity (Csikszentmihalyi, 1975; Deci, 1975; Lepper, Greene, & Nisbett, 1973) and can have detrimental effects on immediate task performance (Condry, 1977; Kruglanski, Friedman, & Zeevi, 1971; McGraw, 1978).

Research has focused on the relationship between extrinsic rewards and intrinsic motivation, and theoretical explanations have hypothesized the offer of rewards can undermine subsequent interest in an activity, but they do not explain the effect of extrinsic incentives on immediate task performance (Fabes, Moran, & McCullers, 1981).

An alternative explanation of these adverse effects on task performance is based on the concept of developmental regression (McCullers, Fabes, & Moran, 1987). According to this view, material rewards produce a temporary regression in psychological organization and functioning; i.e., people perform more primitively under reward than under nonreward conditions, and this effect has been found to be a short-term one that does not persist when rewards are no longer present.

Several studies have demonstrated that rewards can produce a regression in performance on intelligence tests (Fabes et al., 1981; Moran et al., 1984; Fabes et al., 1986; McCullers et al., 1987), perceptual projective techniques (Fabes et al., 1985), moral reasoning tasks (O'Malley, 1986), and creativity tasks (Vafaie, 1985). There also have been a few attempts to determine if reward can shift the subject back into a lower developmental stage or pattern of behavior (Buse, 1983; Mickle, 1979; Wilson, 1985). However, these latter studies did not provide clear evidence that the temporary regression in psychological functioning was due to the subject's being shifted to a younger developmental level. If rewards produce regression, as they have been shown to do, then it should be possible to demonstrate regression across developmental stages. Previous efforts may have failed because stages could not be easily, reliably, and objectively measured. If we could find a period in development where clear-cut, qualitative developmental changes have been shown to occur, and if these occurred in a narrow age span and could be readily measured, it should be possible to demonstrate regression across developmental stages as a consequence of reward.

One age span that has not been thoroughly explored and might lend some insight into the regression model is the 5 to 7 year age range. White (1965) reviewed the literature involving subjects in this age range, and found both empirical evidence and theoretical reasons to describe this period as a critical transitional time in development. White discovered that subjects in a variety of tasks displayed quite different patterns of behavior, depending upon their level of development, during this period from 5 to 7 years of age. That is, quite

different "younger" and "older" patterns of responding were evident in many tasks at this time. For example, the child's behavior before the transition (prior to 5 years of age) resembles that of animals. After the transition (after 7 years of age), the child's behavior begins to resemble that of human adults. This change has been documented in two classic learning studies with young children, Kuenne (1946) and Kendler and Kendler (1959).

Since previous explorations of the regression model have not provided clear evidence that the temporary regression in psychological functioning involved a shift across well-established developmental stages, the aim of the present study was to further pursue that possibility. Therefore, the intent was to assess the regression hypothesis in learning tasks.

It would be expected in a study along these lines that the older pattern of behavior should be formed in children older than seven years of age, and the younger pattern in children under five years of age. Those children who are in the 5 to 7 year period should be in transition or have just moved into the older pattern. If rewards cause regression, then older children should revert to the younger pattern under rewards. Under nonreward, the older children should display the normal, older pattern of behavior. If rewards do not produce regression, then the children should respond as reported in White's review.

In the transposition task, older children under nonreward should learn the initial discrimination faster than older children under reward, and be able to do both the near and far test. The older children under reward should be able to do the near but not the far test, as

would be predicted for younger children under nonreward. Though younger children may perform more poorly under reward, the basic younger pattern should still be present.

In the discrimination shift task, the older children under nonreward again should learn the initial discrimination faster than the older children under reward and perform better on the reversal shift task. Older children under reward should perform better on the nonreversal shift, as would be predicted for younger children under nonreward. Again, the pattern of behavior of younger children would not be expected to be affected by reward. (Refer to Appendix A for a fuller explanation of the logic behind these predictions.)

## Method

### Subjects

A total of 283 subjects began the study but for various reasons 41 children did not complete the entire experiment and had to be eliminated from the sample. The final sample of 242 subjects consisted of 74 5-year-olds (age range: 59 to 71 months); 72 6-year-olds (age range: 72 to 83 months); 72 7-year-olds (age range: 84 to 95 months); and 24 8-year-olds (age range: 96 to 107 months). The subjects were predominantly middle-class children, and there were equal numbers of males and females at each age level. The children were selected from early childhood programs in Tulsa, Edmond, Skiatook, and Stillwater, Oklahoma. (Letters to parents are presented in Appendix B.)

### Design

At each age level, equal numbers of males and females were randomly assigned to one of six experimental groups that differed in terms of task and whether or not the subjects were rewarded. The research design

was of a 4 Ages (5-,6-,7-,8-year-olds) x 2 Conditions (Reward/Nonreward) x 3 Tasks (Transposition/Reversal Shift/Nonreversal Shift) factorial design.

In the transposition task, the near vs. far test was manipulated for the purpose of counterbalancing. That is, equal numbers of males and females were randomly assigned to one of two groups that differed in terms of the stimulus pair that was administered during the test session. Group I received the near test (stimulus pair 5 vs. 6) first, and Group II received the far test (stimulus pair 1 vs. 2) first. The other tests (near vs. far) was administered during the second test session.

In the discrimination shift tasks, two dimensions were employed to increase the generalizability of the findings. In the reversal shift, equal numbers of males and females were randomly assigned to one of two dimensions, either color or height. Half of the subjects assigned to color were initially trained on "blue" and half on "yellow;" half of the subjects assigned to height were initially trained on "short" and half on "tall." Then during the shift, the subjects were shifted to the opposite value within the same dimension. That is, those trained on "blue" were shifted to "yellow," and those trained on "short" had "tall." In the nonreversal shift, the initial discrimination tasks was the same as for the reversal shift, and subjects were assigned in the same way. However, during the shift, the relevant dimension was changed, i.e., subjects trained on color were shifted to height, and those trained on height were shifted to color. (The research designs for these three tasks are presented in Appendix C.)

## Apparatus

Transposition. The transposition task was a modification of that used by Kuenne (1946). Kuenne's apparatus stood upright, while the one used in this study was placed horizontally on a table. The apparatus was a variation of the Wisconsin General Test Apparatus that consisted of a wooden circle, 40 in. in diameter, placed on a swivel base, and divided in half by a perpendicular 1/4 in. plywood board 12 in. high and 40 in. wide. On each side of the plywood divider were two holes, 3 3/4 in. diameter. The holes were 8 1/8 in. apart with centers 12 in. apart. Beneath these openings, pans were attached. Two 10 in., hinged wooden plywood squares covered the openings. The entire apparatus was painted black. Reinforcements could be placed in the pan beneath the positive stimulus. The stimuli were five white-enameled 1/2 in. plywood wooden squares with areas of 2.0, 3.6, 21.0, 37.8, and 68.0 sq. in. These were designated as numbers "1," "2," "5," "6," "7," respectively. Numbers 3 and 4 were omitted to emphasize the links needed to complete the stimulus series, whose successive members have areas maintaining a ratio of 1.8:1 between them. (A picture of the transposition task, stimuli, and scoring form is presented in Appendix D.)

Discrimination Shift. The shift task was a modification of the Kendler apparatus (Kendler & Kendler, 1959). The turntable used in the transposition task was used for the shift tasks. However, the holes (and reinforcers) were covered by plastic cups 2 1/2 in. in diameter that varied in height and color. These were two tall (T) cups, 5 1/4 in. high, and two short (S) cups, 3 3/4 in. high. One of each size was yellow (Y), and the other was blue (B). (Pictures of the discrimination

shift tasks, stimuli, and scoring form are presented in Appendix E.)

Procedure

Children performed individually in a room in which the experimenter and the subject were alone. The subject sat facing the experimenter (who was standing) with the apparatus on a card table between them. All data were collected by the first author, a white, female graduate student experienced in testing and working with young children.

Transposition. The transposition task was conducted in two sessions: (a) initial discrimination training and test (either near or far) for transposition and (b) retraining on the original discrimination and test on the opposite (near or far) stimuli. When the child was comfortably seated, the experimenter gave the following instructions, "First, I'll tell you how the game is played, and then we'll play. See, there are two doors here. When we start the game, you will pick one. If you are correct, you will find a chip under it. If you are wrong, you won't find anything under it. Each time you may pick only one. Then I will turn it around like this, and then you will have another turn. But on each turn you may pick only one. The game is to figure out where the chip is each time. If you get a white chip, put it in one of these holes in this rack." The reward children were also told, "If you do well enough, you can choose a toy from those over there on the shelf, and next "Tuesday," (appropriate day) I'll give it to your teacher for you to take home at the end of the day." No incentives were mentioned to the nonreward group. The subject was reminded periodically, "Try to figure out where the chip is each time."

During initial discrimination, the subjects were trained to choose the smaller of the two longest stimuli, 6 and 7. In the event of a correct response, a chip was found in the well under the stimulus, while in the event of an incorrect response, no reward was found. The first session began with a preliminary set of two trials during which the experimenter demonstrated the response. Instructions, uniform for all subjects, included no mention of the stimuli. On the first practice trial, the (positive) smaller stimulus appeared on the left door, and the (negative) larger on the right. The positions were reversed on the second trial. Following the demonstration, the training session began. In no case was the preliminary series repeated. The position of the correct stimulus for each 10 trials was LRLLRLRRLR. Training continued until the subject reached a criterion of 9 consecutive correct responses, or until a maximum of 100 trials was reached. In a few cases, where the child was near criterion at 100 trials, testing continued after 100 for another 10 trials or so.

Immediately following the discrimination training phase, the subject was given a transposition test of 10 trials, during which all choices were rewarded. Group I was tested on stimulus pair 5 vs. 6 (near test) while Group II was tested on pair 1 vs. 2 (far test). On the next day, the subject was retrained on pair 6 vs. 7 to the original learning criterion. Immediately following retraining, the subject was tested with the other pair of transposition stimuli. For this second test, Group I had the far test (stimulus pair 1 vs. 2), while Group II had the near test (pair 5 vs. 6).

Discrimination Shift. The reversal and nonreversal shift tasks were conducted in one session, training and shift. When the child was

comfortably seated, the experimenter said, "First I'll tell you how the game is played and then we will play the game. There are two cups. When we start the game, you will pick up one of the cups. If you are correct, you will find a chip under it. If you are wrong, you won't find anything under it. Each time you may pick up only one cup. Then I will turn it around like this, and then you will have another turn. But on each turn you may pick up only one. The game is to figure out where the chip is each time. If you get a white chip, put it in one of these holes in this rack." The reward children were also told, "If you do well, you can choose a toy from those on the shelf."

For the training phase, the subjects were randomly assigned to one of two groups. For one group, color was the relevant dimension. For half the subjects in this group, blue (B) was positive, for the other half, yellow (Y) was positive. For the other group, height was the relevant dimension. For half of these, the positive stimulus was the tall (T) one and for half, the short (S) one. The subjects were taken to a criterion of 9 successive correct responses.

As soon as the training criterion was reached, the shift task began immediately, with no change in instructions or interruption in the procedure. The same cups were used in the shift task, but the procedure of the Kendlers (1959) was modified. In the Kendlers' study, the cups differed on only one dimension; whereas in the present study, the cups continued to differ in two dimensions as they had in training. The reversal shift subjects whose initial training was on the color dimension were reinforced now on the opposite color; i.e., "B" children were shifted to "Y" and vice versa. The versal shift subjects whose initial training was on the height dimension were now reinforced on the

opposite value; i.e., "S" children were shifted to "T" and vice versa. For the nonreversal shift, subjects whose initial training was on the height dimension were not reinforced for color, and those who had been reinforced for color were now reinforced for height.

## Results

The results of the transposition task will be presented first, then the results of the reversal shift task, and finally results of the nonreversal shift task. All data were analyzed via the SYSTAT computer program (Wilkinson, 1989). Raw data are presented in Appendix F.

Transposition Task. Mean numbers of trials required to reach criterion on the discrimination task, and their standard deviations, and mean numbers of transposition responses on the transposition test and standard deviations are presented by reward condition, sex, and age for both of the training and test sessions in Table 4 (Appendix G). As may be seen in Table 4, there was no consistent effect of reward. The rewarded males were the slowest to learn, both on training and retraining ($M$ = 34.50 on T/C-1; $M$ = 13.55 on T/C-2). The nonrewarded males performed the poorest on both transposition tests ($M$ = 7.85 on Test-1; $M$ = 7.75 on Test-2). Here it is important to note that lower scores reflect faster learning (better performance) on the training and retraining, and high scores reflect more transposition responses (choices of the smaller stimulus) on both tests.

There was no consistent effect of ages. Sometimes scores improved with age, other times, they resembled a U-shaped curve.

A two-way analyses of variance was performed on the training and test scores respectively. The scores were analyzed in terms of reward

group and sex. The results indicated no main effects of sex or reward condition.

A three-way analyses of variance in terms of reward group, sex, and type of test (near vs. far), was conducted, and no significant main effects were found on the training or test scores.

In White's (1965) review, the far test was generally harder for the younger child; whereas, the near test was easy for both younger and older children. It is interesting that in this study, females ($\underline{M}$ = 8.90), tended to perform better on the far test than males ($\underline{M}$ = 7.63), and females are believed to be a little more advanced developmentally than males. (Refer to Table 5, Appendix G.)

Discrimination Reversal Task. Primary analyses involved the consideration of the variables reward condition, sex, and age. Secondary analyses involved the ancillary variable of dimension. Mean numbers of trials required to reach criterion on the discrimination task, and their standard deviations, and mean numbers of trials to reach criterion on the shift task and standard deviations are presented by reward condition, sex, and age for both discrimination and shift sessions in Table 6 (Appendix G).

Females performed better than males on the initial discrimination tasks, but the nonrewarded males and the rewarded females did better on the shift.

In comparing performance on the two dimensions, color vs. height, there was a tendency for height to be easier than color. (See Table 7, Appendix G.)

Discrimination-Nonreversal Task. Again the primary analyses involved the variables reward condition, sex, and age. Secondary

analyses involved the ancillary variable of dimension. Mean numbers of trials required to reach criterion on the discrimination task, and their standard deviations, and mean numbers of trials required to reach criterion on the shift tasks are presented by reward condition, sex, and age for both discrimination and shift tasks in Table 8 (Appendix G). As may be seen in Table 8, there was no consistent effect of rewards, age, or sex; however, dimension did reveal an effect. Again, color was harder to learn than height. (See Table 9, Appendix G.) The children who were reinforced on the height dimension during discrimination performed better than those reinforced for color.

## Discussion

The major hypothesis of this study was that in tasks in which developmental stages are evident, rewards would cause older children to perform in a manner resembling the younger child. Although this study did not reveal that rewards shift older children to a younger pattern of behavior, the question is why are these findings different from White's, why wasn't the hypothesis proven? One reason might be that this study was not an exact replication of the classic studies. In the Kuenne study, children were given 10 trials a day, some were given as many as 400 trials in the complete study. Due to the time limitations this was not possible in the current study. Also children were matched according to mental tests scores to form a baseline. This information was not available to the current researcher. In the Kendler study, when children were given the shift, the cups only differed on one dimension, whereas in the present study, the cups continued to differ on two dimensions in order that the shift would not be obvious to the subject.

On the transposition task, all ages performed the near and far tests, whereas in White's review, only the older children were able to do both tests. Also on the discrimination tasks, all ages performed better on form discrimination than on color which again resembles the behavior of the older children in White's review. This finding that all ages tended to display the behavior pattern of the older child might be indicating that today's children are making the transition at an earlier age, possibly as a result of the many resources; such as, media, that are available now as compared with the children used in White's study. If this is the case, then a future study using a younger age; such as the 4-year-old, might reveal this. The present study was attempting to get the child who was just making the transition so that under reward his behavior might regress, but if the child is making the transition at an earlier age, then the four-year-old child would be the logical age to use in the next study.

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# APPENDIXES

# APPENDIX A

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

It is generally accepted that rewards enhance behavior; however, this has not been found to be the case in all situations. Sometimes rewards produce adverse effects on human behavior (see deCharms & Muir, 1978; Lepper & Greene, 1978 for reviews of related literature). It has been found that rewards can undermine interest in an activity (Cxikszentmihalyi, 1975; Deci, 1975; Lepper, Greene, & Nisbett, 1973) and can have detrimental effects on immediate task performance (Condry, 1977; Kruglanski, Friedman, & Zeevi, 1971; McGraw, 1978).

Research has focused on the relationship between extrinsic rewards and intrinsic motivation, and theoretical explanations have hypothesized the offer of rewards can undermine subsequent interest in an activity; they do not explain the effect of extrinsic incentives on immediate task performance (Fabes, Moran, & McCullers, 1981).

## Regression: An Alternative Explanation of the Adverse Effects of Reward

For several years, McCullers and his research group (Fabes, McCullers, & Hom, 1986; Fabes, Moran, & McCullers, 1981; Fabes, McCullers, & Moran, 1985; McCullers, Fabes, & Moran, 1987; Mickle, 1979; Moran, McCullers, & Fabes, 1984; O'Malley, 1986; Vafaie, 1985; Wilson, 1985) have been working on an alternative explanation of these adverse effects on task performance that is based on the concept of developmental regression. According to this view, material rewards produce a temporary regression in psychological organization and functioning;

i.e., people perform more primitively under reward than under nonreward conditions, and this effect is a short-term one that does not persist when rewards are no longer present. This research group has explored the concept of developmental regression through the study of reward effects on intelligence tests, perceptual techniques, cognitive tasks, moral reasoning scales, creativity tasks, and internal control of behavior questionnaires.

Evidence that rewards produce regression. In one of the early studies of this group, Fabes et al., (1981) explored the detrimental effects of rewards on intelligence test performance. Six subscales of the Wechsler Adult Intelligence Scale were presented to female university undergraduate students under either reward or nonreward conditions. The nonreward subjects performed significantly better than subjects in the reward group on subscales of the WAIS that require more insight and discovery; there were no significant differences in performance between reward and nonreward subjects on subscales that require rather straightforward, well-rehearsed skills. These results were consistent with a developmental regression interpretation; i.e., given that IQ scores are considered to be resistant to change, the poorer performance observed under reward conditions, compared with nonreward conditions, amounted to a lower level of intellectual functioning, a level that normally would have been expected of less mature subjects.

Moran et al., (1984) further explored the effects of reward on intelligence test performance. They presented Wechsler subscales to subjects at each of three ages (5, 10, and 18 years) under reward or nonreward conditions. For adults, consistent with earlier findings,

reward had an adverse effect on performance on those subscales that require more complex thinking but tended to facilitate performance on subscales that require mechanical responses. However, rewards generally had no effect at the 10-year-old level and had a reverse effect at the 5-year-old level, i.e., rewards facilitated complex thinking and hampered mechanical thinking. These findings again seen as consistent with an explanation based on developmental regression.

Continuing with intelligence tests and the developmental regression model, Fabes et al., (1986) administered the mazes and block design subscales of the Wechsler Intelligence Scale for Children-Revised to 48 third grade children under reward or nonreward conditions. Results revealed that rewards adversely affected immediate task performance on both tasks, supporting the idea that rewards may affect the developmental level at which a subject approaches the task.

McCullers et al., (1987) demonstrated regression on intelligence test performance both within and between subjects. The Peabody Picture Vocabulary Test and Goodenough's Draw-a-Man Test were administered to 48 children, ranging in age from 42 to 68 months under reward and nonreward conditions. Subjects performed at a lower level under reward than under nonreward conditions on both the Draw-a-Man Test and the Peabody Picture Vocabulary Test. When the rewarded children were shifted to a nonreward condition, there was a dramatic improvement in performance. The results were consistent with another prediction of the regression hypothesis, namely, that the adverse effects of reward would be temporary in nature. Regression in the purely descriptive sense that poorer performance (in the form of developmentally lower scores) occurred under reward on both measures in this study.

The McCullers group has also investigated the regression model with measures that tap perceptual organization. Fabes et al., (1985) administered the Holtzman Inkblot Technique (HIT) to 40 undergraduate university students under reward and nonreward conditions and examined the effects of reward on 10 HIT variables that have been found to be sensitive to developmental change. Although reward/nonreward differences reached significance only on Form Definiteness, Form Appropriateness, Shading, and Response Time, the differences on all 10 HIT variables were in the predicted direction of a lower level of functioning under reward. This was an especially interesting finding in light of the fact that some of these variables show increases and others show decreases with increasing maturity.

O'Malley (1986) explored the regression model with moral reasoning tasks. The Sociomoral Reflection Measure (Gibbs, Widaman, & Colby, 1982) was administered to 120 undergraduate students under reward and nonreward conditions. The results are consistent with the developmental regression interpretation; i.e., material rewards had an immediate and temporary adverse effect on the SRM scores.

Vafaie (1985) assessed the effects of monetary reward on artistic creativity. Fifty-one undergraduate art students were asked to produce an artwork, answer a questionnaire designed to measure intrinsic motivation, and respond to the Holtzman Inkblot Technique under reward or nonreward conditions. These tasks involved cognitive and affective processes. It was found that rewards may enhance artistic creativity but cognitive, logical functioning was lower under reward for some subjects so there was some support for the regression model.

The search for evidence that rewards can shift the subject to a less mature stage of development. There have been a few attempts to determine if reward can shift the subject to a lower developmental stage or pattern of behavior. Mickle (1979) administered Piagetian tasks to 130 seventh grade students under reward and nonreward conditions. The findings indicated that performance did not improve under rewards but actually declined; however, due to the global nature of the tasks, it was not clear what was being measured. These results may be supporting the regression model; however, the Piagetian cognitive tasks measure complex situations and broad stages that are vague, global, and difficult to assess in an unambiguous way.

Wilson (1985) used Kagan's Matching Figures test to study the effects of material rewards on the performance of 92 public school girls in the third, fifth, and seventh grades under reward and nonreward conditions. Although impulsivity scores decreased under reward and increased with reward, and reflective students were unaffected, there were no significant differences by grade level so it was not possible to detect regression in performance due to reward effects. In order to detect regression, Wilson recommended using a more sensitive measure.

Buse (1983) explored the effects of rewards on six age levels using an internal control of behavior questionnaire. She found that younger children (4-6 years) and the elderly (70-85 years) responded in a similar fashion to rewards thus supporting the regression model.

The 5-7 Year Age Period

White (1965) reviewed literature related to the 5-7 age range and concluded that before age five, children's responses on learning tasks resemble those observed when animals are given similar tasks. After

age seven, children's learning begins to resemble the pattern of adults. This transition is associated with a change in cognition, the child is beginning to use language as a guide in his thinking. While White substantiates this important developmental period with evidence from many researchers, two classical studies, Kuenne (1946) and Kendler and Kender (1959) may be cited as being very important in confirming performance in this 5-7 age period. These studies have had extensive follow-up work (Hebert & Krantz, 1965; Reese, 1962, 1968).

Kuenne's (1946) work focused on transposition which is a discrimination task that involves first learning a simple discrimination between two stimuli, and then being presented with a new set of two stimuli that resemble the original stimuli in their relationship to each other. The chief interest was theoretical, whether the subject learns a cognitive relationship (gestalt) or is controlled by the selective strengthening of classically conditioned (S-R) responses. Kuenne's results showed that young children's behavior could be explained best by S-R mechanisms, in the same way as nonverbal animals. Older children, on the other hand followed the pattern generally observed in adults, which pattern was best explained by means of cognitive, linguistic mechanisms rather than S-R conditioning. There has been interest in transposition in part because it represents the ability to generalize, which is of concern to those who are trying to influence learning in new situations. Kuenne's classic demonstration of transposition has shown that the younger child, having learned to choose the smaller of two stimuli, will choose the smaller stimulus on a "near" test but not on a "far" test. The near test consisting of stimuli close in size to the training stimuli; i.e., areas of 21.0 and 37.8 sq. in. as compared to 37.8 and 68.0 sq. in. in

training, and the far stimuli being far removed in size from the training stimuli; i.e., 2.0 and 3.6 sq. in. as compared to 37.8 and 68.0 sq. in. The older child will choose the smaller stimulus on both a near and far test.

The Kendlers' (1950) studies dealt with reversal and nonreversal shifts in simple discrimination learning. A reversal shift may be described as a discrimination task in which the subject is reinforced first on one value (e.g., blue) of a dimension such as color, then after the task is learned, the reinforcement shifts to another value of this same dimension, e.g., red. In a nonreversal shift, the reinforcement again is on one value of a dimension such as color; then the reinforcement changes to a different dimension, such as height, with one value such as "tall" being reinforced. The Kendlers' work has shown that younger children do better with nonreversal shifts, and older children do better with reversal shifts. Both Kuenne and the Kendlers' work confirm the importance of the 5-7 year period as a time of transition; i.e., the child younger than five years has a different pattern of behavior than the child seven years and older, the younger pattern being more easily accounted for in terms of simple S-R mechanism, and the older in terms of cognitive, linguistic processes.

Theoretical background. These two classical studies have a rich theoretical background. Gestalt theorists argued that transposition (then tested only by means of the near test) gave evidence that even animal subjects responded to the relationships that exist among stimuli, rather than the bias of chemically conditioned responses. In transposition, when the young child is trained to choose the smaller of two stimuli, he often responds in a near test by choosing the smaller

stimulus. This suggests that he has responded to the relationship between the two stimuli. However, when the stimuli are greatly different in size from the training stimuli (the far test), the young child does not make the transposition choice, indicating that he has not learned a general relationship; thus, the gestalt explanation is weakened.

Spence (1937), a stimulus-response researcher, proposed a theoretical model to explain the young child's inability to transpose when the stimuli are far different in size from the training set. He assumed that discrimination learning is a cumulative process and that reward strengthens the tendency to choose the correct stimulus (excitatory tendency) and nonreinforcement increases the tendency to avoid the incorrect response (inhibitory tendency). By summing the excitatory and inhibitory tendencies along the stimulus generalization gradient, it is possible to predict that transposition will occur when test stimuli are closely related to the training stimuli but occur only at a chance level when stimuli are distantly related to the training set.

## Conclusion

Support for the regression model has been found, but clear evidence that a younger developmental pattern of behavior emerges under reward is lacking. Regression under reward, as demonstrated in earlier studies, need not require a shift to a clearly defined younger pattern or stage of behavior. More work is needed on this problem using tasks where clear stages of behavior have been outlined, such as in the 5-7 age transition period. If well-defined "younger" and "older" patterns of behavior can be identified within a fairly narrow age range, as is the case with the transposition and discrimination

shift work described above, then it may be possible to determine if rewards can produce regression across stage-like developmental levels. Learning tasks would seem to be a good place to begin because they yield objective and straightforward data. Also classical studies such as these should be useful for present purposes because they have been studied extensively, and they have a rich thoretical background.

Hypotheses

It would be expected in a study along these lines that the older pattern of behavior should be found in children older than seven years of age, and the younger pattern in children under five years of age. Those children who are in the 5 to 7 year period should be in transition or have just moved into the older pattern. If rewards cause regression, then older children should revert to the younger pattern under rewards. Under nonreward, the older children should display the normal, older pattern of behavior. If rewards do not produce regression, then the children should respond as reported in White's review.

In the transposition task, older children under nonreward should learn the initial discrimination faster than older children under reward, and be able to do both the near and far test. The older children under reward should be able to do the near but not the far test, as would be predicted for younger children under nonreward. Though younger children may perform more poorly under reward, the basic younger pattern should still be present.

In the discrimination shift task, the older children under nonreward again should learn the initial discrimination faster than the older children under reward and perform better on the reversal shift task. Older children under reward should perform better on the

nonreversal shift, as would be predicted for younger children under nonreward. Again, the pattern of behavior of younger children would not be expected to be affected by reward.

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# APPENDIX B

## HUMAN SUBJECT CORRESPONDENCE

OSU

*Oklahoma State University*

DEPARTMENT OF FAMILY RELATIONS
AND CHILD DEVELOPMENT
COLLEGE OF HOME ECONOMICS

*STILLWATER, OKLAHOMA 74078-0337*
*241 HOME ECONOMICS WEST*
*(405) 744-5057*

May 31, 1989

Dear Parent:

I am a graduate student at Oklahoma State University in the Department of Family Relations and Child Development. In cooperation with the staff of (name of after-school program or day care program). I am conducting research as part of the requirements for my doctoral dissertation.

This study is a continuation of the research project that Dr. McCullers and his staff have been exploring for several years, e.g., the effects of material rewards on children's performance. Additional details are described on the enclosed consent form.

I would like to work with your child individually at the (name of children's program) for about 30 minutes which will occur in approximately two 10 minute sessions. These sessions are planned for the week (date). The time will be determined by the teacher so as not to interfere with the ongoing program. To study the effects of reward, all the children in some programs will be rewarded with a small toy having a value of $2 or less; other programs will not be rewarded. Whether or not your child's group will be rewarded will be determined randomly at the time data collection begins. Because all children will not receive toys, we ask that you not mention the possibility of getting a toy to your child.

In order for your child to participate we need for you to fill out the enclosed consent form and return it to (the director), by (date). Thank you very much.

Respectfully,

John C. McCullers, Professor
Department of Family Relations &
Child Development

Mona Lane
Graduate Student

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Celebrating the Past . . . Preparing for the Future

OSU

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DEPARTMENT OF FAMILY RELATIONS
AND CHILD DEVELOPMENT
COLLEGE OF HOME ECONOMICS

*STILLWATER, OKLAHOMA 74078-0337*
*241 HOME ECONOMICS WEST*
*(405) 744-5057*

## CONSENT TO PARTICIPATE IN RESEARCH PROJECT

I, _____, agree for my child, _____, to participate in the doctoral dissertation research project of Mona Lane, which has been approved by the Department of Family Relations and Child Development and the OSU Institutional Review Board.

I understand that this research will be carried out by Mona Lane, principal investigator, under the supervision of Dr. John C. McCullers. The purpose of this study is to determine what effects material rewards have on children's learning in the 5-7 year age range. All the children at one site will receive each a small reward, and all the children at another site, will not.

I have been made aware of the research procedure, which will involve asking my child to perform a simple learning task; i.e., choosing the correct stimulus under which a small toy will be hidden. The task will take about 10 minutes per session, and there will be approximately 2-4 sessions during the week.

I recognize that my child's participation in this study is voluntary. The child will be asked if he/she would like to play a game and if the child agrees, he/she has the right to discontinue the game at any time if he/she becomes disinterested. I also understand that I have not waived any of my legal rights or released this institution from liability for negligence. I may revoke my consent and withdraw my child from this study at any time. Records and results of this study will protect my family's confidentiality by not identifying me or my child by name.

I have read this consent form and understand its contents, and I freely consent for my child to participate in this study under the conditions described. I understand that I will receive a copy of this signed consent form.

If I have questions about my child's rights as research subjects, I may consult with Mona Lane or Dr. John McCullers, FRCD, by calling 405-744-5061, or Terry Maciula, Office of University Research Services, 001 Life Sciences East, Oklahoma State University, 405-744-9991.

| | |
|---|---|
| Signature of Parent | Date |
| (Signed) Mona Lane | 5-31-89 |
| Signature of Principal Investigator | Date |

OSU

*Oklahoma State University*

DEPARTMENT OF FAMILY RELATIONS
AND CHILD DEVELOPMENT
COLLEGE OF HOME ECONOMICS

*STILLWATER, OKLAHOMA 74078-0337*
*241 HOME ECONOMICS WEST*
*(405) 744-5057*

July 24, 1989

Dear Parent:

I am writing this letter to let you know that I am through with the research study at (name of early childhood program and to thank you and your child for your cooperation. All the children seemed to enjoy participating, and they were a pleasure to be around and work with on the research task. It was easy to carry out the task with the capable assistance of (director's name) and her staff.

Your role in this research was as important as any other aspect. Without your help and support, this research would not have been possible. It was especially nice to have such a large response and such prompt attention paid to the return of your child's permission slip.

I have enclosed a copy of the signed consent form for your records. Again, I thank you and your child for your support.

Sincerely,

(Signed)

Mona Lane

# APPENDIX C

# THE RESEARCH DESIGN

# APPENDIX C-1

# THE RESEARCH DESIGN-TRANSPOSITION TASK

Table 1

The Research Design-Transposition Task

| Condition | Age | Training | Test 1 | Training 2 | Test 2 |
|---|---|---|---|---|---|
| Nonreward (n=40) | 5 (n=12) | Stimuli | 1 vs. 2, Far (n=6) | Stimuli | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 6 (n=12) | | 1 vs. 2, Far (n=6) | | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 7 (n=12) | 6 vs. 7 | 1 vs. 2, Far (n=6) | 6 vs. 7 | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 8 (n=4) | | 1 vs. 2, Far (n=2) | | 5 vs. 6, Near (n=2) |
| | | | 5 vs. 6, Near (n=2) | | 1 vs. 2, Far (n=2) |

Table 1 (Continued)

| Condition | Age | Training | Test 1 | Training 2 | Test 2 |
|---|---|---|---|---|---|
| Reward (n=40) | 5 (n=12) | Stimuli | 1 vs. 2, Far (n=6) | Stimuli | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 6 (n=12) | | 1 vs. 2, Near (n=6) | | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 7 (n=12) | 6 vs. 7 | 1 vs. 2, Far (n=6) | 6 vs. 7 | 5 vs. 6, Near (n=6) |
| | | | 5 vs. 6, Near (n=6) | | 1 vs. 2, Far (n=6) |
| | 8 (n=4) | | 1 vs. 2, Far (n=2) | | 5 vs. 6, Near (n=2) |
| | | | 5 vs. 6, Near (n=2) | | 1 vs. 2, Far (n=2) |

# APPENDIX C-2

## THE RESEARCH DESIGN-DISCRIMINATION SHIFT-REVERSAL

Table 2

The Research Design-Discrimination Shift-Reversal

| | | Training | | | Shift | | |
|---|---|---|---|---|---|---|---|
| Condition | Age | Dimension | Value (+) | n | Dimension | (+) Value (+) | n |
| Nonreward (n=41) | 5 (n=13) | Color (n=9) | Blue | 7 | Color (n=9) | Yellow | 7 |
| | | | Yellow | 2 | | Blue | 2 |
| | | Height (n=4) | Short | 2 | Height (n=4) | Tall | 2 |
| | | | Tall | 2 | | Short | 2 |
| | 6 (n=12) | Color (n=7) | Blue | 2 | Color (n=7) | Yellow | 2 |
| | | | Yellow | 5 | | Blue | 5 |
| | | Height (n=5) | Short | 2 | Height (n=5) | Tall | 2 |
| | | | Tall | 3 | | Short | 3 |
| | 7-8 (n=16) | Color (n=10) | Blue | 8 | Color (n=10) | Yellow | 8 |
| | | | Yellow | 2 | | Blue | 2 |
| | | Height (n=6) | Short | 3 | Height (n=6) | Tall | 3 |
| | | | Tall | 3 | | Short | 3 |

Table 2 (Continued)

| Condition | Age | Training | | | Shift | | |
|---|---|---|---|---|---|---|---|
| | | Dimension | Value (+) | n | Dimension | (+) Value (+) | n |
| Reward (n=40) | 5 (n=12) | Color (n=7) | Blue | 4 | Color (n=7) | Yellow | 4 |
| | | | Yellow | 3 | | Blue | 3 |
| | | Height (n=5) | Short | 2 | Height (n=5) | Tall | 2 |
| | | | Tall | 3 | | Short | 3 |
| | 6 (n=12) | Color (n=6) | Blue | 2 | Color (n=6) | Yellow | 2 |
| | | | Yellow | 4 | | Blue | 4 |
| | | Height (n=6) | Short | 4 | Height (n=6) | Tall | 4 |
| | | | Tall | 2 | | Short | 2 |
| | 7-8 (n=16) | Color (n=10) | Blue | 8 | Color (n=10) | Yellow | 8 |
| | | | Yellow | 2 | | Blue | 2 |
| | | Height (n=6) | Short | 2 | Height (n=6) | Tall | 2 |
| | | | Tall | 4 | | Short | 4 |

# APPENDIX C-3

## THE RESEARCH DESIGN-DISCRIMINATION SHIFT-NONREVERSAL

Table 3

The Research Design-Discrimination Shift-Nonreversal

| Condition | Age | Training | | | Shift | | |
|---|---|---|---|---|---|---|---|
| | | Dimension | Value (+) | n | Dimension (+) | Value | n |
| Nonreward (n=40) | 5 (n=12) | Color (n=6) | Blue | 4 | Height (n=6) | Short | 2 |
| | | | | | | Tall | 2 |
| | | | Yellow | 2 | | Short | 0 |
| | | | | | | Tall | 2 |
| | | Height (n=6) | Short | 2 | Color (n=6) | Blue | 1 |
| | | | | | | Yellow | 1 |
| | | | Tall | 4 | | Blue | 1 |
| | | | | | | Yellow | 1 |
| | 6 (n=12) | Color (n=6) | Blue | 2 | Height (n=6) | Short | 0 |
| | | | | | | Tall | 2 |
| | | | Yellow | 4 | | Short | 2 |
| | | | | | | Tall | 2 |
| | | Height (n=6) | Short | 4 | Color (n=6) | Blue | 2 |
| | | | | | | Yellow | 2 |
| | | | Tall | 2 | | Blue | 1 |
| | | | | | | Yellow | 1 |
| | 7-8 (n=16) | Color (n=8) | Blue | 6 | Height (n=8) | Short | 1 |
| | | | | | | Tall | 5 |
| | | | Yellow | 2 | | Short | 2 |
| | | | | | | Tall | 0 |
| | | Height (n=8) | Short | 4 | Color (n=8) | Blue | 2 |
| | | | | | | Yellow | 2 |
| | | | Tall | 4 | | Blue | 3 |
| | | | | | | Yellow | 1 |

Table 3 (Continued)

| Condition | Age | Training | | | Shift | | |
|---|---|---|---|---|---|---|---|
| | | Dimension | Value (+) | n | Dimension (+) | Value | n |
| Reward (n=41) | 5 (n=13) | Color (n=7) | Blue | 4 | Height (n=7) | Short | 1 |
| | | | | | | Tall | 3 |
| | | | Yellow | 3 | | Short | 3 |
| | | | | | | Tall | 0 |
| | | Height (n=6) | Short | 2 | Color (n=6) | Blue | 2 |
| | | | | | | Yellow | 0 |
| | | | Tall | 4 | | Blue | 3 |
| | | | | | | Yellow | 1 |
| | 6 (n=12) | Color (n=6) | Blue | 2 | Height (n=6) | Short | 2 |
| | | | | | | Tall | 0 |
| | | | Yellow | 4 | | Short | 2 |
| | | | | | | Tall | 2 |
| | | Height (n=6) | Short | 4 | Color (n=6) | Blue | 3 |
| | | | | | | Yellow | 1 |
| | | | Tall | 2 | | Blue | 1 |
| | | | | | | Yellow | 1 |
| | 7-8 (n=16) | Color (n=8) | Blue | 6 | Height (n=8) | Short | 2 |
| | | | | | | Tall | 4 |
| | | | Yellow | 2 | | Short | 0 |
| | | | | | | Tall | 2 |
| | | Height (n=8) | Short | 4 | Color (n=8) | Blue | 1 |
| | | | | | | Yellow | 3 |
| | | | Tall | 4 | | Blue | 1 |
| | | | | | | Yellow | 3 |

# APPENDIX D

# TRANSPOSITION METHODOLOGY

## Explanatory Note

Appendix D contains a photograph of the Transposition Task, the Transposition Stimuli, the actual size reduced by 50 percent for presentation purposes, and the Transposition Scoring Form.

Contents

# APPENDIX D-1

# TRANSPOSITION TASK

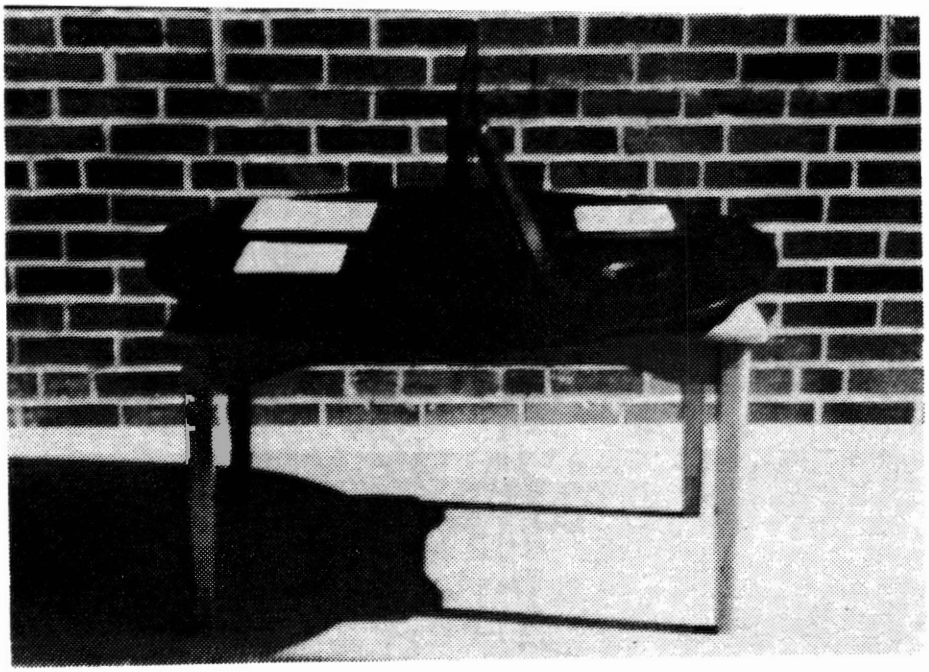

Figure 1. Transposition Task

# APPENDIX D-2

## TRANSPOSITION STIMULI

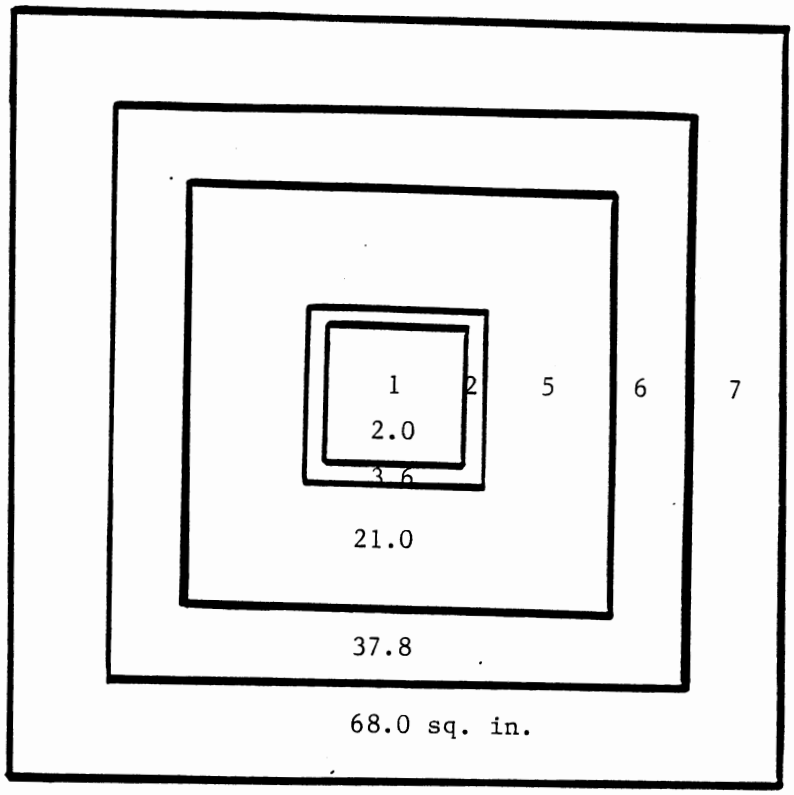


Figure 2. Transposition Stimuli

APPENDIX D-3

TRANSPOSITION SCORING FORM

TRANSPOSITION

Subject Number _____ Sex _____ Birthdate _____ Age _____ Grade _____

School _____ Race _____ Experimental Condition R N Est Socio-Econ _____

Grade Level Below At Above Score _____

Training: 6 vs. 7 Demonstration, Trial 1 - Positive Left Trial 2 - Positive Right

| | | | | |
|---|---|---|---|---|
| Date: _____ | | Date: _____ | Date: _____ | |
| Session: _____ | | Session: _____ | Session: _____ | |
| 1 - L _____ | 21 - L _____ | 41 - L _____ | 61 - L _____ | 81 - L _____ |
| 2 - R _____ | 22 - R _____ | 42 - R _____ | 62 - R _____ | 82 - R _____ |
| 3 - L _____ | 23 - L _____ | 43 - L _____ | 63 - L _____ | 83 - L _____ |
| 4 - L _____ | 24 - L _____ | 44 - L _____ | 64 - L _____ | 84 - L _____ |
| 5 - R _____ | 25 - R _____ | 45 - R _____ | 65 - R _____ | 85 - R _____ |
| 6 - L _____ | 26 - L _____ | 46 - L _____ | 66 - L _____ | 86 - L _____ |
| 7 - R _____ | 27 - R _____ | 47 - R _____ | 67 - R _____ | 87 - R _____ |
| 8 - R _____ | 28 - R _____ | 48 - R _____ | 68 - R _____ | 88 - R _____ |
| 9 - L _____ | 29 - L _____ | 49 - L _____ | 69 - L _____ | 89 - L _____ |
| 10 - R _____ | 30 - R _____ | 50 - R _____ | 70 - R _____ | 90 - R _____ |
| Date: _____ | Date: _____ | | Date: _____ | Date: _____ |
| Session: _____ | Session: _____ | | Session: _____ | Session: ___ |
| 11 - R _____ | 31 - R _____ | 51 - R _____ | 71 - R _____ | 91 - R _____ |
| 12 - L _____ | 32 - L _____ | 52 - L _____ | 72 - L _____ | 92 - L _____ |
| 13 - L _____ | 33 - L _____ | 53 - L _____ | 73 - L _____ | 93 - L _____ |
| 14 - R _____ | 34 - R _____ | 54 - R _____ | 74 - R _____ | 94 - R _____ |
| 15 - L _____ | 35 - L _____ | 55 - L _____ | 75 - L _____ | 95 - L _____ |
| 16 - R _____ | 36 - R _____ | 56 - R _____ | 76 - R _____ | 96 - R _____ |
| 17 - L _____ | 37 - L _____ | 57 - L _____ | 77 - L _____ | 97 - L _____ |
| 18 - R _____ | 38 - R _____ | 58 - R _____ | 78 - R _____ | 98 - R _____ |
| 19 - R _____ | 39 - R _____ | 59 - R _____ | 79 - R _____ | 99 - R _____ |
| 20 - L _____ | 40 - L _____ | 60 - L _____ | 80 - L _____ | 100 - L _____ |

Transposition (1):

Date: _____

Session: _____

| Group I, 5 vs. 6 | Group II, 1 vs. 2 |
|---|---|
| 1 - L _____ | 1 - L _____ |
| 2 - R _____ | 2 - R _____ |
| 3 - L _____ | 3 - L _____ |
| 4 - L _____ | 4 - L _____ |
| 5 - R _____ | 5 - R _____ |
| 6 - L _____ | 6 - L _____ |
| 7 - R _____ | 7 - R _____ |
| 8 - R _____ | 8 - R _____ |
| 9 - L _____ | 9 - L _____ |
| 10 - R _____ | 10 - R _____ |

Training (2):

Experimental Condition: R N

Date: _____

Transposition (2):

Date: _____

Session: _____

| Group I, 1 vs. 2 | Group II, 5 vs. 6 |
|---|---|
| 1 - L _____ | 1 - L _____ |
| 2 - R _____ | 2 - R _____ |
| 3 - L _____ | 3 - L _____ |
| 4 - L _____ | 4 - L _____ |
| 5 - R _____ | 5 - R _____ |
| 6 - L _____ | 6 - L _____ |
| 7 - R _____ | 7 - R _____ |
| 8 - R _____ | 8 - R _____ |
| 9 - L _____ | 9 - L _____ |
| 10 - R _____ | 10 - R _____ |

# APPENDIX E

# DISCRIMINATION SHIFT METHODOLOGY

## Explanatory Note

Appendix E contains a photograph of the Discrimination Shift Task, the Discrimination Shift Stimuli, and the Discrimination Shift Task-Reversal and Nonreversal Scoring Form.

Contents

# APPENDIX E-1

# DISCRIMINATION SHIFT TASK

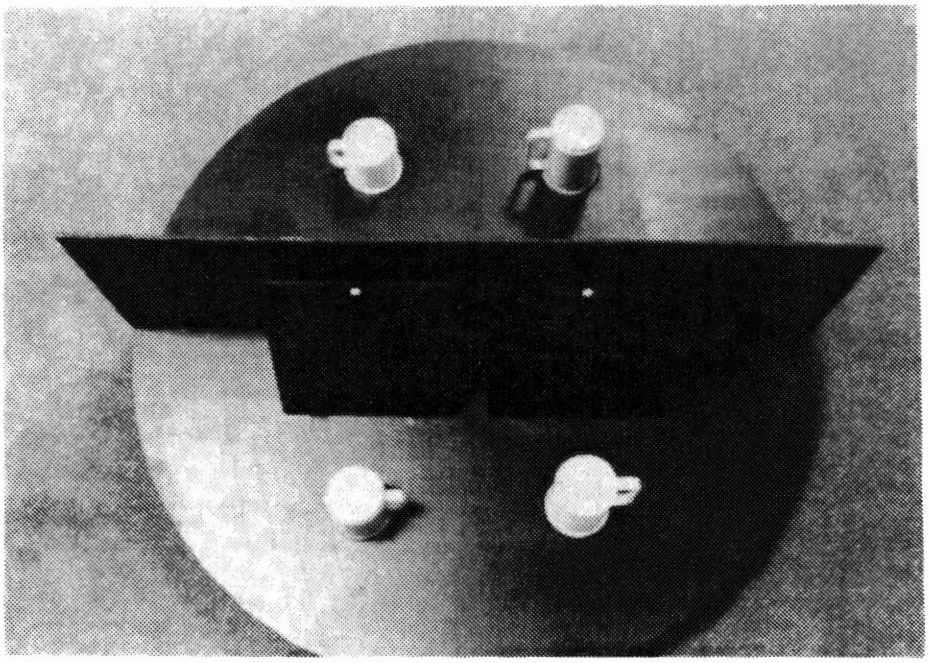

Figure 3. Discrimination Shift Task

# APPENDIX E-2

## DISCRIMINATION SHIFT TASK STIMULI

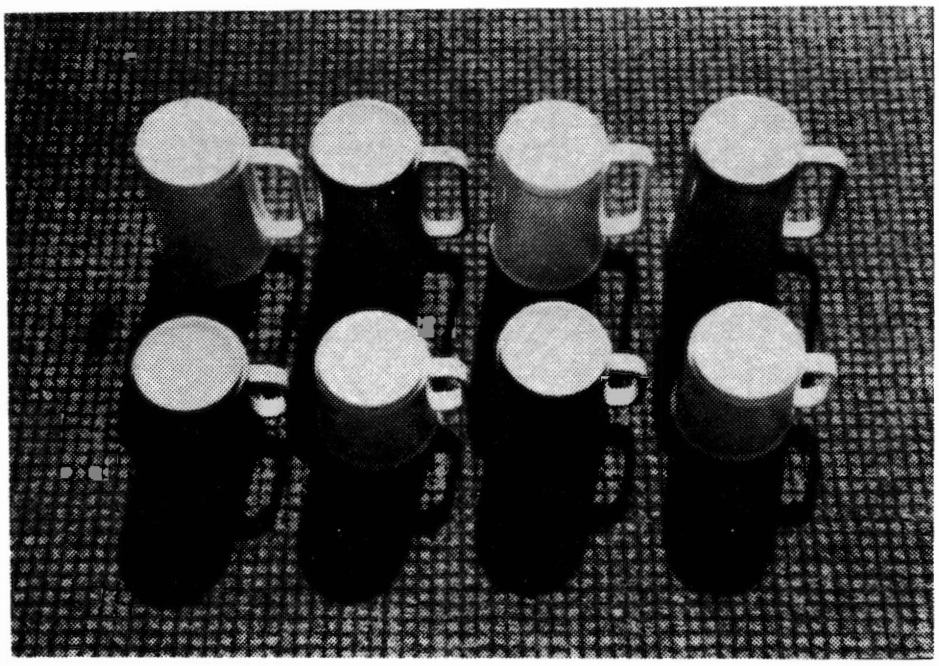

Figure 4. Discrimination Shift Task Stimuli

APPENDIX E-3

DISCRIMINATION SHIFT TASK SCORING FORM

DISCRIMINATION SHIFT Subject Number _____ Sex ____ Birthdate _____ Age _____ Race_____

Date _____ School _____ Grade _____ Est Soc-econ Level _____ Grade level Below At Above

Score _____ Experimental Condition R N D. Shift Reversal Nonreversal

Training: _____

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. SB TY _____ | 21. SB TY _____ | 41. SB TY _____ | 61. SB TY _____ | 81. SB TY _____ | 1. SB TY _____ |
| 2. TB SY _____ | 22. TB SY _____ | 42. TB SY _____ | 62. TB SY _____ | 82. TB SY _____ | 2. TB SY _____ |
| 3. TY SB _____ | 23. TY SB _____ | 43. TY SB _____ | 63. TY SB _____ | 83. TY SB _____ | 3. TY SB _____ |
| 4. SB TY _____ | 24. SB TY _____ | 44. SB TY _____ | 64. SB TY _____ | 84. SB TY _____ | 4. SB TY _____ |
| 5. SY TB _____ | 25. SY TB _____ | 45. SY TB _____ | 65. SY TB _____ | 85. SY TB _____ | 5. SY TB _____ |
| 6. SB TY _____ | 26. SB TY _____ | 46. SB TY _____ | 66. SB TY _____ | 86. SB TY _____ | 6. SB TY _____ |
| 7. TB SY _____ | 27. TB SY _____ | 47. TB SY _____ | 67. TB SY _____ | 87. TB SY _____ | 7. TB SY _____ |
| 8. TB SY _____ | 28. TB SY _____ | 48. TB SY _____ | 68. TB SY _____ | 88. TB SY _____ | 8. TB SY _____ |
| 9. TY SB _____ | 29. TY SB _____ | 49. TY SB _____ | 69. TY SB _____ | 89. TY SB _____ | 9. TY SB _____ |
| 10. SY TB _____ | 30. SY TB _____ | 50. SY TB _____ | 70. SY TB _____ | 90. SY TB _____ | 10. SY TB _____ |
| 11. TY SB _____ | 31. TY SB _____ | 51. TY SB _____ | 71. TY SB _____ | 91. TY SB _____ | 11. TY SB _____ |
| 12. SY TB _____ | 32. SY TB _____ | 52. SY TB _____ | 72. SY TB _____ | 92. SY TB _____ | 12. SY TB _____ |
| 13. SB TY _____ | 33. SB TY _____ | 53. SB TY _____ | 73. SB TY _____ | 93. SB TY _____ | 13. SB TY _____ |
| 14. TY SB _____ | 34. TY SB _____ | 54. TY SB _____ | 74. TY SB _____ | 94. TY SB _____ | 14. TY SB _____ |
| 15. TB SY _____ | 35. TB SY _____ | 55. TB SY _____ | 75. TB SY _____ | 95. TB SY _____ | 15. TB SY _____ |
| 16. TY SB _____ | 36. TY SB _____ | 56. TY SB _____ | 76. TY SB _____ | 96. TY SB _____ | 16. TY SB _____ |
| 17. SY TB _____ | 37. SY TB _____ | 57. SY TB _____ | 77. SY TB _____ | 97. SY TB _____ | 17. SY TB _____ |
| 18. SY TB _____ | 38. SY TB _____ | 58. SY TB _____ | 78. SY TB _____ | 98. SY TB _____ | 18. SY TB _____ |
| 19. SB TY _____ | 39. SB TY _____ | 59. SB TY _____ | 79. SB TY _____ | 99. SB TY _____ | 19. SB TY _____ |
| 20. TB SY _____ | 40. TB SY _____ | 60. TB SY _____ | 80. TB SY _____ | 100. TB SY _____ | 20. TB SY _____ |

# APPENDIX F

## RAW DATA

## Explanatory Note

Appendix F contains the raw data for all subjects for the three tasks.

Appendix F-1 contains information concerning the variable code and measurement key.

Appendix F-2 contains the raw data sample for the Transposition Task.

Appendix F-3 contains the raw data sample for the Discrimination Task-Reversal.

Appendix F-4 contains the raw data sample for the Discrimination Task-Nonreversal.

Contents

# APPENDIX F-1

## VARIABLE CODE AND MEASUREMENT KEY

Subject Identification Information

| Code | Variable Name | Key |
|---|---|---|
| Case | Subject Number | |
| Sex | Sex of Subject | M=Male<br>F=Female |
| Age | Age of Subject in Months | |
| Cond | Reward | R=Reward<br>N=Nonreward |

Transposition Data

| | | |
|---|---|---|
| Group | First Transposition Test | N=Near<br>F=Far |
| TC1 | Trials to Criterion<br>Initial Training | |
| Test 1 | Number of Transpositions, First<br>Transposition Test | |
| TC2 | Trials to Criterion<br>Re-Training | |
| Test 2 | Number of Transpositions, Second<br>Transposition Test | |

Discrimination Data-Reversal

| | | |
|---|---|---|
| Disc | Trials to Criterion<br>Initial Training | |
| Shift | Trials to Criterion<br>Reversal Shift | |
| Cat 2 | Relevant Dimension Initial Training | C=Color<br>H=Height |
| Cat 4 | Positive Values for Training<br>and Test | BY=Blue/Yellow<br>YB=Yellow/Blue<br>ST=Short/Tall<br>TS=Tall/Short |

Discrimination Data-Nonreversal

| Code | Variable | Key |
|---|---|---|
| Disc | Trials to Criterion Initial Training | |
| Shift | Trials to Criterion Nonreversal Shift | |
| Cat 2 | Relevant Dimension Initial Training | C=Color<br>H=Height |
| Cat 4 | Positive Values for Initial Training | B=Blue<br>Y=Yellow<br>S=Short<br>T=Tall |
| Cat 8 | Positive Values for Training and Test | BS=Blue/Short<br>BT=Blue/Tall<br>YS=Yellow/Short<br>YT=Yellow/Tall<br>SB=Short/Blue<br>ST=Short/Tall<br>TB=Tall/Blue<br>TS=Tall/Short |

# APPENDIX F-2

## RAW DATA: TRANSPOSITION

| | | SEX$ | AGE | COND$ | GROUP$ | TC1 |
|---|---|---|---|---|---|---|
| | | TEST1 | TC2 | TEST2 | | |
| CASE | 1 | M | 61 | R | F | 86 |
| CASE | 1 | 10 | 31 | 10 | | |
| CASE | 2 | M | 62 | R | N | 117 |
| CASE | 2 | 9 | 9 | 10 | | |
| CASE | 3 | M | 62 | R | N | 61 |
| CASE | 3 | 10 | 9 | 10 | | |
| CASE | 4 | M | 66 | R | N | 33 |
| CASE | 4 | 10 | 9 | 5 | | |
| CASE | 5 | M | 69 | R | F | 9 |
| CASE | 5 | 7 | 51 | 10 | | |
| CASE | 6 | M | 70 | R | F | 26 |
| CASE | 6 | 10 | 9 | 10 | | |
| CASE | 7 | M | 73 | R | N | 9 |
| CASE | 7 | 10 | 9 | 10 | | |
| CASE | 8 | M | 76 | R | F | 71 |
| CASE | 8 | 6 | 9 | 9 | | |
| CASE | 9 | M | 78 | R | F | 13 |
| CASE | 9 | 10 | 9 | 10 | | |
| CASE | 10 | M | 78 | R | N | 33 |
| CASE | 10 | 10 | 9 | 10 | | |
| CASE | 11 | M | 82 | R | F | 18 |
| CASE | 11 | 0 | 9 | 10 | | |
| CASE | 12 | M | 83 | R | N | 46 |
| CASE | 12 | 10 | 9 | 9 | | |
| CASE | 13 | M | 85 | R | N | 24 |
| CASE | 13 | 9 | 9 | 0 | | |
| CASE | 14 | M | 88 | R | F | 14 |
| CASE | 14 | 10 | 9 | 10 | | |
| CASE | 15 | M | 89 | R | F | 21 |
| CASE | 15 | 10 | 9 | 10 | | |
| CASE | 16 | M | 91 | R | N | 18 |
| CASE | 16 | 10 | 9 | 10 | | |
| CASE | 17 | M | 93 | R | N | 13 |
| CASE | 17 | 9 | 9 | 10 | | |
| CASE | 18 | M | 95 | R | F | 49 |
| CASE | 18 | 10 | 9 | 10 | | |
| CASE | 19 | M | 98 | R | N | 18 |
| CASE | 19 | 0 | 9 | 10 | | |
| CASE | 20 | M | 102 | R | F | 11 |
| CASE | 20 | 2 | 36 | 10 | | |
| CASE | 21 | F | 60 | R | N | 41 |
| CASE | 21 | 10 | 9 | 5 | | |
| CASE | 22 | F | 61 | R | N | 17 |
| CASE | 22 | 10 | 14 | 7 | | |
| CASE | 23 | F | 66 | R | F | 18 |
| CASE | 23 | 3 | 18 | 4 | | |
| CASE | 24 | F | 66 | R | F | 39 |
| CASE | 24 | 10 | 11 | 10 | | |
| CASE | 25 | F | 66 | R | N | 21 |
| CASE | 25 | 5 | 9 | 10 | | |
| CASE | 26 | F | 67 | R | F | 65 |
| CASE | 26 | 10 | 9 | 10 | | |
| CASE | 27 | F | 73 | R | F | 37 |
| CASE | 27 | 10 | 9 | 9 | | |
| CASE | 28 | F | 75 | R | F | 29 |
| CASE | 28 | 10 | 9 | 10 | | |
| CASE | 29 | F | 76 | R | N | 16 |
| CASE | 29 | 10 | 18 | 10 | | |
| CASE | 30 | F | 76 | R | N | 40 |
| CASE | 30 | 10 | 10 | 10 | | |
| CASE | 31 | F | 79 | R | F | 21 |
| CASE | 31 | 10 | 10 | 10 | | |
| CASE | 32 | F | 80 | R | N | 37 |
| CASE | 32 | 10 | 9 | 10 | | |
| CASE | 33 | F | 84 | R | N | 38 |
| CASE | 33 | 10 | 9 | 10 | | |
| CASE | 34 | F | 89 | R | F | 11 |
| CASE | 34 | 10 | 9 | 10 | | |
| CASE | 35 | F | 92 | R | N | 12 |
| CASE | 35 | 5 | 14 | 10 | | |
| CASE | 36 | F | 92 | R | F | 9 |
| CASE | 36 | 10 | 9 | 10 | | |
| CASE | 37 | F | 93 | R | N | 15 |
| CASE | 37 | 10 | 18 | 10 | | |
| CASE | 38 | F | 93 | R | F | 19 |
| CASE | 38 | 10 | 9 | 10 | | |
| CASE | 39 | F | 102 | R | N | 16 |
| CASE | 39 | 5 | 43 | 4 | | |
| CASE | 40 | F | 104 | R | F | 12 |
| CASE | 40 | 10 | 9 | 10 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CASE | 41 | M | 66 | N | F | 26 |
| CASE | 41 | 5 | 17 | 10 | | |
| CASE | 42 | M | 66 | N | F | 34 |
| CASE | 42 | 9 | 29 | 8 | | |
| CASE | 43 | M | 69 | N | N | 19 |
| CASE | 43 | 10 | 9 | 4 | | |
| CASE | 44 | M | 69 | N | F | 22 |
| CASE | 44 | 4 | 18 | 6 | | |
| CASE | 45 | M | 70 | N | N | 18 |
| CASE | 45 | 5 | 21 | 10 | | |
| CASE | 46 | M | 71 | N | N | 14 |
| CASE | 46 | 9 | 10 | 10 | | |
| CASE | 47 | M | 73 | N | N | 11 |
| CASE | 47 | 10 | 9 | 9 | | |
| CASE | 48 | M | 73 | N | N | 32 |
| CASE | 48 | 10 | 9 | 0 | | |
| CASE | 49 | M | 75 | N | F | 9 |
| CASE | 49 | 7 | 9 | 10 | | |
| CASE | 50 | M | 82 | N | N | 12 |
| CASE | 50 | 10 | 10 | 10 | | |
| CASE | 51 | M | 82 | N | F | 102 |
| CASE | 51 | 8 | 24 | 8 | | |
| CASE | 52 | M | 83 | N | F | 12 |
| CASE | 52 | 10 | 9 | 10 | | |
| CASE | 53 | M | 84 | N | N | 59 |
| CASE | 53 | 10 | 12 | 10 | | |
| CASE | 54 | M | 85 | N | N | 22 |
| CASE | 54 | 10 | 9 | 10 | | |
| CASE | 55 | M | 86 | N | F | 9 |
| CASE | 55 | 10 | 9 | 10 | | |
| CASE | 56 | M | 91 | N | N | 9 |
| CASE | 56 | 8 | 9 | 10 | | |
| CASE | 57 | M | 93 | N | F | 59 |
| CASE | 57 | 0 | 9 | 0 | | |
| CASE | 58 | M | 93 | N | F | 22 |
| CASE | 58 | 10 | 9 | 10 | | |
| CASE | 59 | M | 104 | N | N | 27 |
| CASE | 59 | 2 | 9 | 0 | | |
| CASE | 60 | M | 105 | N | F | 14 |
| CASE | 60 | 10 | 9 | 10 | | |
| CASE | 61 | F | 61 | N | F | 32 |
| CASE | 61 | 5 | 20 | 10 | | |
| CASE | 62 | F | 61 | N | N | 13 |
| CASE | 62 | 8 | 10 | 7 | | |
| CASE | 63 | F | 67 | N | F | 43 |
| CASE | 63 | 4 | 11 | 8 | | |
| CASE | 64 | F | 68 | N | N | 59 |
| CASE | 64 | 10 | 9 | 10 | | |
| CASE | 65 | F | 68 | N | F | 41 |
| CASE | 65 | 10 | 9 | 10 | | |
| CASE | 66 | F | 69 | N | N | 33 |
| CASE | 66 | 9 | 19 | 7 | | |
| CASE | 67 | F | 80 | N | N | 38 |
| CASE | 67 | 10 | 9 | 10 | | |
| CASE | 68 | F | 82 | N | F | 12 |
| CASE | 68 | 10 | 9 | 10 | | |
| CASE | 69 | F | 82 | N | F | 11 |
| CASE | 69 | 10 | 9 | 10 | | |
| CASE | 70 | F | 83 | N | N | 50 |
| CASE | 70 | 10 | 9 | 10 | | |
| CASE | 71 | F | 83 | N | F | 12 |
| CASE | 71 | 10 | 9 | 10 | | |
| CASE | 72 | F | 83 | N | N | 22 |
| CASE | 72 | 10 | 9 | 10 | | |
| CASE | 73 | F | 84 | N | F | 12 |
| CASE | 73 | 5 | 24 | 6 | | |
| CASE | 74 | F | 87 | N | F | 9 |
| CASE | 74 | 10 | 9 | 10 | | |
| CASE | 75 | F | 87 | N | N | 29 |
| CASE | 75 | 10 | 9 | 10 | | |
| CASE | 76 | F | 90 | N | F | 17 |
| CASE | 76 | 9 | 9 | 10 | | |
| CASE | 77 | F | 94 | N | N | 14 |
| CASE | 77 | 10 | 9 | 10 | | |
| CASE | 78 | F | 94 | N | N | 15 |
| CASE | 78 | 10 | 9 | 10 | | |
| CASE | 79 | F | 97 | N | F | 29 |
| CASE | 79 | 10 | 23 | 10 | | |
| CASE | 80 | F | 107 | N | N | 44 |
| CASE | 80 | 0 | 9 | 10 | | |

# APPENDIX F-3

## RAW DATA: DISCRIMINATION TASK-REVERSAL

| | | SEX$ | AGE | COND$ | DISC | SHIFT |
|---|---|---|---|---|---|---|
| | | CAT2$ | CAT4$ | | | |
| CASE | 1 | M | 62 | R | 9 | 10 |
| CASE | 1 | C | BY | | | |
| CASE | 2 | M | 67 | R | 9 | 10 |
| CASE | 2 | H | ST | | | |
| CASE | 3 | M | 67 | R | 123 | 17 |
| CASE | 3 | C | YB | | | |
| CASE | 4 | M | 67 | R | 14 | 10 |
| CASE | 4 | H | TS | | | |
| CASE | 5 | M | 68 | R | 9 | 111 |
| CASE | 5 | C | BY | | | |
| CASE | 6 | M | 70 | R | 12 | 27 |
| CASE | 6 | C | YB | | | |
| CASE | 7 | M | 78 | R | 12 | 22 |
| CASE | 7 | H | ST | | | |
| CASE | 8 | M | 80 | R | 19 | 11 |
| CASE | 8 | C | YB | | | |
| CASE | 9 | M | 80 | R | 12 | 10 |
| CASE | 9 | H | ST | | | |
| CASE | 10 | M | 81 | R | 13 | 10 |
| CASE | 10 | H | TS | | | |
| CASE | 11 | M | 81 | R | 19 | 19 |
| CASE | 11 | C | YB | | | |
| CASE | 12 | M | 82 | R | 14 | 10 |
| CASE | 12 | C | BY | | | |
| CASE | 13 | M | 85 | R | 77 | 10 |
| CASE | 13 | H | ST | | | |
| CASE | 14 | M | 86 | R | 38 | 37 |
| CASE | 14 | H | TS | | | |
| CASE | 15 | M | 86 | R | 9 | 37 |
| CASE | 15 | C | YB | | | |
| CASE | 16 | M | 90 | R | 33 | 13 |
| CASE | 16 | C | BY | | | |
| CASE | 17 | M | 91 | R | 37 | 10 |
| CASE | 17 | C | BY | | | |
| CASE | 18 | M | 95 | R | 15 | 27 |
| CASE | 18 | C | BY | | | |
| CASE | 19 | M | 99 | R | 14 | 13 |
| CASE | 19 | H | TS | | | |
| CASE | 20 | M | 105 | R | 12 | 28 |
| CASE | 20 | C | BY | | | |
| CASE | 21 | F | 66 | R | 19 | 15 |
| CASE | 21 | C | YB | | | |
| CASE | 22 | F | 67 | R | 52 | 12 |
| CASE | 22 | C | BY | | | |
| CASE | 23 | F | 68 | R | 26 | 15 |
| CASE | 23 | H | ST | | | |
| CASE | 24 | F | 69 | R | 49 | 10 |
| CASE | 24 | C | BY | | | |
| CASE | 25 | F | 70 | R | 12 | 16 |
| CASE | 25 | H | TS | | | |
| CASE | 26 | F | 71 | R | 19 | 20 |
| CASE | 26 | H | TS | | | |
| CASE | 27 | F | 74 | R | 31 | 66 |
| CASE | 27 | C | BY | | | |
| CASE | 28 | F | 76 | R | 12 | 10 |
| CASE | 28 | H | ST | | | |
| CASE | 29 | F | 77 | R | 9 | 10 |
| CASE | 29 | C | YB | | | |
| CASE | 30 | F | 78 | R | 12 | 10 |
| CASE | 30 | H | TS | | | |
| CASE | 31 | F | 80 | R | 16 | 12 |
| CASE | 31 | H | ST | | | |
| CASE | 32 | F | 82 | R | 18 | 14 |
| CASE | 32 | C | YB | | | |
| CASE | 33 | F | 85 | R | 13 | 49 |
| CASE | 33 | C | YB | | | |
| CASE | 34 | F | 86 | R | 21 | 12 |
| CASE | 34 | H | TS | | | |
| CASE | 35 | F | 87 | R | 11 | 15 |
| CASE | 35 | C | BY | | | |
| CASE | 36 | F | 87 | R | 36 | 11 |
| CASE | 36 | C | BY | | | |
| CASE | 37 | F | 93 | R | 39 | 10 |
| CASE | 37 | C | BY | | | |
| CASE | 38 | F | 93 | R | 39 | 10 |
| CASE | 38 | H | ST | | | |
| CASE | 39 | F | 96 | R | 12 | 16 |
| CASE | 39 | C | BY | | | |
| CASE | 40 | F | 99 | R | 16 | 10 |
| CASE | 40 | H | TS | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CASE | 41 | M | 62 | N | 89 | 16 |
| CASE | 41 | C | YB | | | |
| CASE | 42 | M | 62 | N | 27 | 72 |
| CASE | 42 | C | BY | | | |
| CASE | 43 | M | 64 | N | 12 | 10 |
| CASE | 43 | C | BY | | | |
| CASE | 44 | M | 69 | N | 13 | 14 |
| CASE | 44 | H | ST | | | |
| CASE | 45 | M | 70 | N | 28 | 21 |
| CASE | 45 | H | TS | | | |
| CASE | 46 | M | 70 | N | 74 | 10 |
| CASE | 46 | C | BY | | | |
| CASE | 47 | M | 74 | N | 40 | 32 |
| CASE | 47 | C | YB | | | |
| CASE | 48 | M | 76 | N | 15 | 10 |
| CASE | 48 | C | BY | | | |
| CASE | 49 | M | 79 | N | 16 | 10 |
| CASE | 49 | C | YB | | | |
| CASE | 50 | M | 79 | N | 34 | 46 |
| CASE | 50 | C | YB | | | |
| CASE | 51 | M | 80 | N | 9 | 22 |
| CASE | 51 | H | ST | | | |
| CASE | 52 | M | 81 | N | 22 | 10 |
| CASE | 52 | H | TS | | | |
| CASE | 53 | M | 84 | N | 16 | 12 |
| CASE | 53 | H | ST | | | |
| CASE | 54 | M | 84 | N | 12 | 10 |
| CASE | 54 | C | YB | | | |
| CASE | 55 | M | 86 | N | 55 | 10 |
| CASE | 55 | C | BY | | | |
| CASE | 56 | M | 86 | N | 14 | 10 |
| CASE | 56 | C | BY | | | |
| CASE | 57 | M | 93 | N | 40 | 15 |
| CASE | 57 | C | BY | | | |
| CASE | 58 | M | 94 | N | 12 | 19 |
| CASE | 58 | H | TS | | | |
| CASE | 59 | M | 99 | N | 35 | 28 |
| CASE | 59 | H | ST | | | |
| CASE | 60 | M | 103 | N | 70 | 13 |
| CASE | 60 | C | BY | | | |
| CASE | 61 | F | 61 | N | 37 | 12 |
| CASE | 61 | H | ST | | | |
| CASE | 62 | F | 61 | N | 70 | 44 |
| CASE | 62 | C | YB | | | |
| CASE | 63 | F | 61 | N | 22 | 39 |
| CASE | 63 | C | BY | | | |
| CASE | 64 | F | 63 | N | 9 | 13 |
| CASE | 64 | C | BY | | | |
| CASE | 65 | F | 66 | N | 13 | 13 |
| CASE | 65 | H | TS | | | |
| CASE | 66 | F | 66 | N | 29 | 59 |
| CASE | 66 | C | BY | | | |
| CASE | 67 | F | 66 | N | 54 | 10 |
| CASE | 67 | C | BY | | | |
| CASE | 68 | F | 72 | N | 9 | 10 |
| CASE | 68 | C | YB | | | |
| CASE | 69 | F | 74 | N | 9 | 15 |
| CASE | 69 | C | BY | | | |
| CASE | 70 | F | 76 | N | 9 | 18 |
| CASE | 70 | H | ST | | | |
| CASE | 71 | F | 76 | N | 47 | 13 |
| CASE | 71 | C | YB | | | |
| CASE | 72 | F | 76 | N | 18 | 19 |
| CASE | 72 | H | TS | | | |
| CASE | 73 | F | 80 | N | 18 | 10 |
| CASE | 73 | H | ST | | | |
| CASE | 74 | F | 84 | N | 18 | 22 |
| CASE | 74 | H | ST | | | |
| CASE | 75 | F | 85 | N | 37 | 16 |
| CASE | 75 | H | TS | | | |
| CASE | 76 | F | 86 | N | 15 | 87 |
| CASE | 76 | C | BY | | | |
| CASE | 77 | F | 88 | N | 19 | 11 |
| CASE | 77 | C | YB | | | |
| CASE | 78 | F | 88 | N | 9 | 10 |
| CASE | 78 | C | BY | | | |
| CASE | 79 | F | 95 | N | 15 | 10 |
| CASE | 79 | C | BY | | | |
| CASE | 80 | F | 103 | N | 9 | 24 |
| CASE | 80 | H | TS | | | |
| CASE | 81 | F | 105 | N | 11 | 16 |
| CASE | 81 | C | BY | | | |

# APPENDIX F-4

## RAW DATA: DISCRIMINATION TASK-NONREVERSAL

| | | SEX$ | AGE | COND$ | DISC | SHIFT |
|---|---|---|---|---|---|---|
| | | CAT2$ | CAT4$ | CAT8$ | | |
| CASE | 1 | M | 59 | R | 12 | 108 |
| CASE | 1 | C | B | BT | | |
| CASE | 2 | M | 61 | R | 18 | 60 |
| CASE | 2 | C | Y | YS | | |
| CASE | 3 | M | 63 | R | 38 | 34 |
| CASE | 3 | C | B | BT | | |
| CASE | 4 | M | 64 | R | 20 | 32 |
| CASE | 4 | C | Y | YS | | |
| CASE | 5 | M | 69 | R | 17 | 47 |
| CASE | 5 | H | S | SB | | |
| CASE | 6 | M | 70 | R | 12 | 20 |
| CASE | 6 | H | T | TB | | |
| CASE | 7 | M | 70 | R | 19 | 38 |
| CASE | 7 | H | T | TY | | |
| CASE | 8 | M | 73 | R | 9 | 34 |
| CASE | 8 | C | Y | YT | | |
| CASE | 9 | M | 73 | R | 12 | 25 |
| CASE | 9 | C | Y | YT | | |
| CASE | 10 | M | 76 | R | 12 | 35 |
| CASE | 10 | C | B | BS | | |
| CASE | 11 | M | 76 | R | 31 | 22 |
| CASE | 11 | H | S | SB | | |
| CASE | 12 | M | 81 | R | 9 | 28 |
| CASE | 12 | H | T | TY | | |
| CASE | 13 | M | 83 | R | 13 | 23 |
| CASE | 13 | H | S | SB | | |
| CASE | 14 | M | 86 | R | 12 | 22 |
| CASE | 14 | C | Y | YT | | |
| CASE | 15 | M | 88 | R | 28 | 20 |
| CASE | 15 | C | B | BS | | |
| CASE | 16 | M | 94 | R | 24 | 43 |
| CASE | 16 | C | B | BT | | |
| CASE | 17 | M | 95 | R | 11 | 54 |
| CASE | 17 | H | T | TB | | |
| CASE | 18 | M | 95 | R | 13 | 45 |
| CASE | 18 | H | S | SB | | |
| CASE | 19 | M | 95 | R | 26 | 13 |
| CASE | 19 | H | T | TY | | |
| CASE | 20 | M | 97 | R | 16 | 23 |
| CASE | 20 | C | B | BT | | |
| CASE | 21 | M | 103 | R | 9 | 18 |
| CASE | 21 | H | S | SY | | |
| CASE | 22 | F | 62 | R | 26 | 74 |
| CASE | 22 | C | Y | YS | | |
| CASE | 23 | F | 62 | R | 9 | 19 |
| CASE | 23 | C | B | BT | | |
| CASE | 24 | F | 68 | R | 12 | 35 |
| CASE | 24 | C | B | BS | | |
| CASE | 25 | F | 69 | R | 9 | 70 |
| CASE | 25 | H | S | SB | | |
| CASE | 26 | F | 69 | R | 16 | 69 |
| CASE | 26 | H | T | TB | | |
| CASE | 27 | F | 70 | R | 16 | 27 |
| CASE | 27 | H | T | TB | | |
| CASE | 28 | F | 72 | R | 102 | 23 |
| CASE | 28 | C | Y | YS | | |
| CASE | 29 | F | 74 | R | 9 | 77 |
| CASE | 29 | C | Y | YS | | |
| CASE | 30 | F | 77 | R | 12 | 52 |
| CASE | 30 | H | S | SB | | |
| CASE | 31 | F | 78 | R | 9 | 31 |
| CASE | 31 | H | T | TB | | |
| CASE | 32 | F | 78 | R | 87 | 25 |
| CASE | 32 | C | B | BS | | |
| CASE | 33 | F | 80 | R | 12 | 22 |
| CASE | 33 | H | S | SY | | |
| CASE | 34 | F | 85 | R | 29 | 24 |
| CASE | 34 | C | B | BT | | |
| CASE | 35 | F | 87 | R | 9 | 91 |
| CASE | 35 | H | T | TY | | |
| CASE | 36 | F | 89 | R | 19 | 17 |
| CASE | 36 | C | Y | YT | | |
| CASE | 37 | F | 90 | R | 13 | 13 |
| CASE | 37 | H | T | TY | | |
| CASE | 38 | F | 95 | R | 18 | 13 |
| CASE | 38 | C | B | BS | | |
| CASE | 39 | F | 95 | R | 15 | 18 |
| CASE | 39 | H | S | SY | | |
| CASE | 40 | F | 96 | R | 34 | 35 |
| CASE | 40 | H | S | SY | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CASE | 41 | F | 102 | R | 12 | 15 |
| CASE | 41 | C | B | BT | | |
| CASE | 42 | M | 62 | N | 12 | 23 |
| CASE | 42 | C | Y | YT | | |
| CASE | 43 | M | 63 | N | 12 | 65 |
| CASE | 43 | H | S | SB | | |
| CASE | 44 | M | 64 | N | 11 | 27 |
| CASE | 44 | C | B | BT | | |
| CASE | 45 | M | 64 | N | 70 | 13 |
| CASE | 45 | C | B | BS | | |
| CASE | 46 | M | 67 | N | 9 | 25 |
| CASE | 46 | H | T | TB | | |
| CASE | 47 | M | 69 | N | 12 | 108 |
| CASE | 47 | H | T | TY | | |
| CASE | 48 | M | 74 | N | 97 | 11 |
| CASE | 48 | C | Y | YT | | |
| CASE | 49 | M | 77 | N | 16 | 104 |
| CASE | 49 | H | T | TB | | |
| CASE | 50 | M | 79 | N | 68 | 39 |
| CASE | 50 | C | B | BT | | |
| CASE | 51 | M | 80 | N | 9 | 60 |
| CASE | 51 | C | Y | YS | | |
| CASE | 52 | M | 82 | N | 12 | 54 |
| CASE | 52 | H | S | SY | | |
| CASE | 53 | M | 82 | N | 18 | 28 |
| CASE | 53 | H | S | SY | | |
| CASE | 54 | M | 84 | N | 14 | 22 |
| CASE | 54 | C | Y | YS | | |
| CASE | 55 | M | 88 | N | 22 | 34 |
| CASE | 55 | H | S | SB | | |
| CASE | 56 | M | 91 | N | 20 | 49 |
| CASE | 56 | H | T | TY | | |
| CASE | 57 | M | 92 | N | 24 | 12 |
| CASE | 57 | C | B | BT | | |
| CASE | 58 | M | 92 | N | 28 | 31 |
| CASE | 58 | H | T | TB | | |
| CASE | 59 | M | 94 | N | 46 | 14 |
| CASE | 59 | C | B | BT | | |
| CASE | 60 | M | 97 | N | 29 | 25 |
| CASE | 60 | H | S | SB | | |
| CASE | 61 | M | 105 | N | 92 | 21 |
| CASE | 61 | C | B | BT | | |
| CASE | 62 | F | 61 | N | 12 | 108 |
| CASE | 62 | H | T | TY | | |
| CASE | 63 | F | 62 | N | 72 | 36 |
| CASE | 63 | C | Y | YT | | |
| CASE | 64 | F | 64 | N | 12 | 14 |
| CASE | 64 | H | S | SY | | |
| CASE | 65 | F | 65 | N | 12 | 80 |
| CASE | 65 | H | T | TY | | |
| CASE | 66 | F | 68 | N | 9 | 69 |
| CASE | 66 | C | B | BS | | |
| CASE | 67 | F | 71 | N | 76 | 26 |
| CASE | 67 | C | B | BT | | |
| CASE | 68 | F | 74 | N | 20 | 37 |
| CASE | 68 | H | S | SB | | |
| CASE | 69 | F | 75 | N | 11 | 18 |
| CASE | 69 | H | S | SB | | |
| CASE | 70 | F | 75 | N | 20 | 19 |
| CASE | 70 | H | T | TY | | |
| CASE | 71 | F | 78 | N | 22 | 71 |
| CASE | 71 | C | Y | YS | | |
| CASE | 72 | F | 80 | N | 9 | 14 |
| CASE | 72 | C | Y | YT | | |
| CASE | 73 | F | 83 | N | 61 | 31 |
| CASE | 73 | C | B | BT | | |
| CASE | 74 | F | 88 | N | 9 | 18 |
| CASE | 74 | C | Y | YS | | |
| CASE | 75 | F | 89 | N | 10 | 13 |
| CASE | 75 | H | T | TB | | |
| CASE | 76 | F | 91 | N | 9 | 20 |
| CASE | 76 | C | B | BT | | |
| CASE | 77 | F | 91 | N | 17 | 16 |
| CASE | 77 | H | S | SY | | |
| CASE | 78 | F | 91 | N | 18 | 51 |
| CASE | 78 | H | T | TB | | |
| CASE | 79 | F | 95 | N | 14 | 12 |
| CASE | 79 | C | B | BS | | |
| CASE | 80 | F | 102 | N | 13 | 41 |
| CASE | 80 | C | B | BT | | |
| CASE | 81 | F | 104 | N | 19 | 31 |
| CASE | 81 | H | S | SY | | |

# APPENDIX G

# SUMMARY TABLES

Table 4

Transposition: Mean Trials to Criterion on Discrimination Learning and Numbers of Transposition Responses by Condition, Sex, Age, and Session

| | | | | | Scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T/C-1 | | Test-1 | | T/C-2 | | T-2 | |
| Condition | Sex | n | Age | n | M | SD | M | SD | M | SD | M | SD |
| Reward | Male | 20 | | | 34.50 | 29.22 | 8.10 | 3.40 | 13.55 | 11.61 | 9.15 | 2.43 |
| | | | 5 | 6 | 55.33 | 40.70 | 9.33 | 1.21 | 19.67 | 17.69 | 9.17 | 2.04 |
| | | | 6 | 6 | 31.67 | 23.68 | 7.67 | 4.08 | 9.00 | 0.00 | 9.67 | 0.52 |
| | | | 7 | 6 | 23.17 | 13.32 | 9.67 | 0.52 | 9.00 | 0.00 | 8.33 | 4.08 |
| | | | 8 | 2 | 14.50 | 4.95 | 1.00 | 1.41 | 22.50 | 19.09 | 10.00 | 0.00 |
| Reward | Female | 20 | | | 25.65 | 14.46 | 8.90 | 2.29 | 12.75 | 7.86 | 8.95 | 2.11 |
| | | | 5 | 6 | 33.50 | 18.69 | 8.00 | 3.16 | 11.67 | 3.67 | 7.67 | 2.73 |
| | | | 6 | 6 | 30.00 | 9.76 | 10.00 | 0.00 | 10.83 | 3.54 | 9.83 | 0.41 |
| | | | 7 | 6 | 17.33 | 10.71 | 9.17 | 2.04 | 11.33 | 3.83 | 10.00 | 0.00 |
| | | | 8 | 2 | 14.00 | 2.83 | 7.50 | 3.54 | 26.00 | 24.04 | 7.00 | 4.24 |
| Nonreward | Male | 20 | | | 26.45 | 22.71 | 7.85 | 3.05 | 12.45 | 6.01 | 7.75 | 3.70 |
| | | | 5 | 6 | 22.17 | 7.05 | 7.00 | 2.61 | 17.33 | 7.39 | 8.00 | 2.53 |
| | | | 6 | 6 | 29.67 | 36.43 | 9.17 | 1.33 | 11.67 | 6.06 | 7.83 | 3.92 |
| | | | 7 | 6 | 29.50 | 22.47 | 8.00 | 4.00 | 9.50 | 1.22 | 8.33 | 4.08 |
| | | | 8 | 2 | 20.50 | 9.19 | 6.00 | 5.66 | 9.00 | 0.00 | 5.00 | 7.07 |
| Nonreward | Female | 20 | | | 26.75 | 15.17 | 8.50 | 2.78 | 11.65 | 5.16 | 9.40 | 1.27 |
| | | | 5 | 6 | 36.83 | 15.18 | 7.67 | 2.58 | 13.00 | 5.10 | 8.67 | 1.51 |
| | | | 6 | 6 | 24.17 | 16.33 | 10.00 | 0.00 | 9.00 | 0.00 | 10.00 | 0.00 |
| | | | 7 | 6 | 16.00 | 6.93 | 9.00 | 2.00 | 11.50 | 6.12 | 9.33 | 1.63 |
| | | | 8 | 2 | 36.50 | 10.61 | 5.00 | 7.07 | 16.00 | 9.90 | 10.00 | 0.00 |

Table 5

Transposition Performance by Sex

| | | Near Test | | Far Test | |
|---|---|---|---|---|---|
| Sex | n | M | SD | M | SD |
| Males | 40 | 8.80 | 2.60 | 7.63 | 3.59 |
| Females | 40 | 8.98 | 2.24 | 8.90 | 2.12 |

Table 6

Trials to Criterion on Initial Discrimination and on the Reversal Shift Task by Condition, Sex, and Age

| | | | | | Scores | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Discrimination | | Shift | |
| Condition | Sex | n | Age | n | M | SD | M | SD |
| Reward | Male | 20 | | | 25.00 | 28.16 | 22.10 | 22.86 |
| | | | 5 | 6 | 29.33 | 45.93 | 30.83 | 39.84 |
| | | | 6 | 6 | 14.83 | 3.31 | 13.67 | 5.39 |
| | | | 7 | 6 | 34.83 | 23.90 | 22.33 | 12.99 |
| | | | 8 | 2 | 13.00 | 1.41 | 20.50 | 10.61 |
| Reward | Female | 20 | | | 23.10 | 13.29 | 17.15 | 14.35 |
| | | | 5 | 6 | 29.50 | 16.88 | 14.67 | 3.44 |
| | | | 6 | 6 | 16.33 | 7.87 | 20.33 | 22.43 |
| | | | 7 | 6 | 26.50 | 13.08 | 17.83 | 15.38 |
| | | | 8 | 2 | 14.00 | 2.83 | 13.00 | 4.24 |
| Nonreward | Male | 20 | | | 31.65 | 23.49 | 19.50 | 15.52 |
| | | | 5 | 6 | 40.50 | 32.81 | 23.83 | 23.95 |
| | | | 6 | 6 | 22.67 | 11.99 | 21.67 | 14.88 |
| | | | 7 | 6 | 24.83 | 18.25 | 12.67 | 3.67 |
| | | | 8 | 2 | 52.50 | 24.75 | 20.50 | 10.61 |
| Nonreward | Female | 20 | | | 22.71 | 17.05 | 22.43 | 19.62 |
| | | | 5 | 7 | 33.43 | 22.13 | 27.14 | 19.84 |
| | | | 6 | 6 | 18.33 | 14.72 | 14.72 | 3.87 |
| | | | 7 | 6 | 18.83 | 9.56 | 26.00 | 30.25 |
| | | | 8 | 2 | 10.00 | 1.41 | 20.00 | 5.66 |

Table 7

Trials to Criterion on Initial Discrimination and Reversal Shift Task by Dimension

| | | Scores | | | |
|---|---|---|---|---|---|
| | | Discrimination | | Shift | |
| Dimension | n | M | SD | M | SD |
| Color | 49 | 28.90 | 24.33 | 23.45 | 22.35 |
| Height | 32 | 20.50 | 13.89 | 15.53 | 6.47 |

Table 8

Trials to Criterion on Initial Discrimination and Nonreversal Shift Task by Condition, Sex, and Age

| | | | | | Scores | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Discrimination | | Shift | |
| Condition | Sex | n | Age | n | M | SD | M | SD |
| Reward | Male | 21 | | | 17.19 | 8.02 | 35.43 | 20.78 |
| | | | 5 | 7 | 19.43 | 8.79 | 48.43 | 29.10 |
| | | | 6 | 6 | 14.33 | 8.33 | 27.83 | 5.56 |
| | | | 7 | 6 | 19.00 | 7.80 | 32.83 | 16.58 |
| | | | 8 | 2 | 12.50 | 4.95 | 20.50 | 3.54 |
| Reward | Female | 20 | | | 23.40 | 25.41 | 37.50 | 24.94 |
| | | | 5 | 6 | 14.67 | 6.38 | 49.00 | 24.68 |
| | | | 6 | 6 | 38.50 | 43.66 | 38.33 | 21.98 |
| | | | 7 | 6 | 17.17 | 6.82 | 29.33 | 30.48 |
| | | | 8 | 2 | 23.00 | 15.56 | 25.00 | 14.14 |
| Nonreward | Male | 20 | | | 31.05 | 28.05 | 38.25 | 27.95 |
| | | | 5 | 6 | 21.00 | 24.03 | 43.50 | 36.30 |
| | | | 6 | 6 | 36.67 | 36.80 | 49.33 | 32.11 |
| | | | 7 | 6 | 25.67 | 10.98 | 27.00 | 13.91 |
| | | | 8 | 2 | 60.50 | 44.55 | 23.00 | 2.83 |
| Nonreward | Female | 20 | | | 22.25 | 21.00 | 36.25 | 26.66 |
| | | | 5 | 6 | 32.17 | 32.45 | 55.50 | 36.09 |
| | | | 6 | 6 | 23.83 | 18.97 | 31.67 | 21.14 |
| | | | 7 | 6 | 12.83 | 4.07 | 21.67 | 14.68 |
| | | | 8 | 2 | 16.00 | 4.24 | 36.00 | 7.07 |

Table 9

Trials to Criterion on Initial Discrimination and Nonreversal Shift Task by Dimension

| | | Scores | | | |
|---|---|---|---|---|---|
| | | Discrimination | | Shift | |
| Dimension | n | M | SD | M | SD |
| Color | 41 | 30.76 | 28.62 | 32.63 | 21.72 |
| Height | 40 | 15.85 | 6.46 | 41.15 | 27.06 |

# APPENDIX H

# SELECTED STATISTICAL ANALYSES

## Explanatory Note

Appendix H contains selected statistical analyses for all subjects for all three tasks.

Appendix H-1 contains tests for the Transposition Task.

Appendix H-2 contains tests for the Discrimination Shift-Reversal Task.

Appendix H-3 contains tests for the Discrimination Shift-Non-reversal Task.

Contents

# APPENDIX H-1

# TRANSPOSITION TASK ANALYSES

TOTAL OBSERVATIONS: 20

**TRANSPOSITION REWARD MALE**

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 20 | 20 | 20 | 20 | 20 |
| MINIMUM | 61.000 | 9.000 | 0.000 | 9.000 | 0.000 |
| MAXIMUM | 102.000 | 117.000 | 10.000 | 51.000 | 10.000 |
| MEAN | 80.050 | 34.500 | 8.100 | 13.550 | 9.150 |
| STANDARD DEV | 12.576 | 29.217 | 3.401 | 11.614 | 2.434 |

TOTAL OBSERVATIONS: 20

**TRANSPOSITION REWARD FEMALE**

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 20 | 20 | 20 | 20 | 20 |
| MINIMUM | 60.000 | 9.000 | 3.000 | 9.000 | 4.000 |
| MAXIMUM | 104.000 | 65.000 | 10.000 | 43.000 | 10.000 |
| MEAN | 79.700 | 25.650 | 8.900 | 12.750 | 8.950 |
| STANDARD DEV | 13.389 | 14.463 | 2.292 | 7.860 | 2.114 |

TOTAL OBSERVATIONS: 20

**TRANSPOSITION NON-REWARD MALE**

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 20 | 20 | 20 | 20 | 20 |
| MINIMUM | 66.000 | 9.000 | 0.000 | 9.000 | 0.000 |
| MAXIMUM | 105.000 | 102.000 | 10.000 | 29.000 | 10.000 |
| MEAN | 81.000 | 26.450 | 7.850 | 12.450 | 7.750 |
| STANDARD DEV | 11.859 | 22.705 | 3.048 | 6.013 | 3.697 |

TOTAL OBSERVATIONS: 20

**TRANSPOSITION NON-REWARD FEMALE**

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 20 | 20 | 20 | 20 | 20 |
| MINIMUM | 61.000 | 9.000 | 0.000 | 9.000 | 6.000 |
| MAXIMUM | 107.000 | 59.000 | 10.000 | 24.000 | 10.000 |
| MEAN | 81.350 | 26.750 | 8.500 | 11.650 | 9.400 |
| STANDARD DEV | 12.402 | 15.169 | 2.782 | 5.163 | 1.273 |

**TRANSPOSITION REWARD MALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 5.00 | 9.00 | 7.00 | 9.00 | 5.00 |
| MAXIMUM | 5.00 | 117.00 | 10.00 | 51.00 | 10.00 |
| MEAN | 5.00 | 55.33 | 9.33 | 19.67 | 9.17 |
| STANDARD DEV | 0.00 | 40.70 | 1.21 | 17.69 | 2.04 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 0.00 | 9.00 | 9.00 |
| MAXIMUM | 6.00 | 71.00 | 10.00 | 9.00 | 10.00 |
| MEAN | 6.00 | 31.67 | 7.67 | 9.00 | 9.67 |
| STANDARD DEV | 0.00 | 23.68 | 4.08 | 0.00 | 0.52 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 7.00 | 13.00 | 9.00 | 9.00 | 0.00 |
| MAXIMUM | 7.00 | 49.00 | 10.00 | 9.00 | 10.00 |
| MEAN | 7.00 | 23.17 | 9.67 | 9.00 | 8.33 |
| STANDARD DEV | 0.00 | 13.32 | 0.52 | 0.00 | 4.08 |

TRM

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 2 | 2 | 2 | 2 | 2 |
| MINIMUM | 8.00 | 11.00 | 0.00 | 9.00 | 10.00 |
| MAXIMUM | 8.00 | 18.00 | 2.00 | 36.00 | 10.00 |
| MEAN | 8.00 | 14.50 | 1.00 | 22.50 | 10.00 |
| STANDARD DEV | 0.00 | 4.95 | 1.41 | 19.09 | 0.00 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR TR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 8.119

APPROXIMATE F = 2.370 DF = 3, 171 PROBABILITY = .072

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 4223.00 | 3 | 1407.67 | 1.878 | .174 |
| WITHIN GROUPS | 11996.00 | 16 | 749.75 | | |

---

SUMMARY STATISTICS FOR COR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 18.265

APPROXIMATE F = 5.623 DF = 3, 171 PROBABILITY = .001

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 125.80 | 3 | 41.93 | 7.138 | .003 |
| WITHIN GROUPS | 94.00 | 16 | 5.88 | | |

---

```
TRM

SUMMARY STATISTICS FOR      TR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

SUMMARY STATISTICS FOR      COR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.
```

**TRANSPOSITION REWARD FEMALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 5.00 | 17.00 | 3.00 | 9.00 | 4.00 |
| MAXIMUM | 5.00 | 65.00 | 10.00 | 18.00 | 10.00 |
| MEAN | 5.00 | 33.50 | 8.00 | 11.67 | 7.67 |
| STANDARD DEV | 0.00 | 18.69 | 3.16 | 3.67 | 2.73 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 6.00 | 16.00 | 10.00 | 9.00 | 9.00 |
| MAXIMUM | 6.00 | 40.00 | 10.00 | 18.00 | 10.00 |
| MEAN | 6.00 | 30.00 | 10.00 | 10.83 | 9.83 |
| STANDARD DEV | 0.00 | 9.76 | 0.00 | 3.54 | 0.41 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

TRR.

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 5.00 | 9.00 | 10.00 |
| MAXIMUM | 7.00 | 38.00 | 10.00 | 18.00 | 10.00 |
| MEAN | 7.00 | 17.33 | 9.17 | 11.33 | 10.00 |
| STANDARD DEV | 0.00 | 10.71 | 2.04 | 3.83 | 0.00 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 2 | 2 | 2 | 2 | 2 |
| MINIMUM | 8.00 | 12.00 | 5.00 | 9.00 | 4.00 |
| MAXIMUM | 8.00 | 16.00 | 10.00 | 43.00 | 10.00 |
| MEAN | 8.00 | 14.00 | 7.50 | 26.00 | 7.00 |
| STANDARD DEV | 0.00 | 2.83 | 3.54 | 24.04 | 4.24 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR TR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 4.812

APPROXIMATE F = 1.381 DF = 3, 171 PROBABILITY = .250

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 1169.72 | 3 | 389.91 | 2.224 | .125 |
| WITHIN GROUPS | 2804.83 | 16 | 175.30 | | |

---

TRF

SUMMARY STATISTICS FOR COR1

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR TR2

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 16.774

APPROXIMATE F = 5.123 DF = 3, 171 PROBABILITY = .002

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 392.25 | 3 | 130.75 | 2.677 | .082 |
| WITHIN GROUPS | 781.50 | 16 | 48.84 | | |

---

SUMMARY STATISTICS FOR COR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

TRANSPOSITION NON-REWARD MALE

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 5.00 | 14.00 | 4.00 | 9.00 | 4.00 |
| MAXIMUM | 5.00 | 34.00 | 10.00 | 29.00 | 10.00 |
| MEAN | 5.00 | 22.17 | 7.00 | 17.33 | 8.00 |
| STANDARD DEV | 0.00 | 7.05 | 2.61 | 7.39 | 2.53 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 7.00 | 9.00 | 0.00 |
| MAXIMUM | 6.00 | 102.00 | 10.00 | 24.00 | 10.00 |
| MEAN | 6.00 | 29.67 | 9.17 | 11.67 | 7.83 |
| STANDARD DEV | 0.00 | 36.43 | 1.33 | 6.06 | 3.92 |

INM

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 0.00 | 9.00 | 0.00 |
| MAXIMUM | 7.00 | 59.00 | 10.00 | 12.00 | 10.00 |
| MEAN | 7.00 | 29.50 | 8.00 | 9.50 | 8.33 |
| STANDARD DEV | 0.00 | 22.47 | 4.00 | 1.22 | 4.08 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 2 | 2 | 2 | 2 | 2 |
| MINIMUM | 8.00 | 14.00 | 2.00 | 9.00 | 0.00 |
| MAXIMUM | 8.00 | 27.00 | 10.00 | 9.00 | 10.00 |
| MEAN | 8.00 | 20.50 | 6.00 | 9.00 | 5.00 |
| STANDARD DEV | 0.00 | 9.19 | 5.66 | 0.00 | 7.07 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR TR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 11.124

APPROXIMATE F = 3.298 DF = 3, 171 PROBABILITY = .022

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 298.78 | 3 | 99.59 | .168 | .917 |
| WITHIN GROUPS | 9496.17 | 16 | 593.51 | | |

---

TNM

SUMMARY STATISTICS FOR COR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 6.557

APPROXIMATE F = 1.899 DF = 3, 171 PROBABILITY = .132

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 21.72 | 3 | 7.24 | .748 | .539 |
| WITHIN GROUPS | 154.83 | 16 | 9.68 | | |

SUMMARY STATISTICS FOR TR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

SUMMARY STATISTICS FOR COR2

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 2.551

APPROXIMATE F = .724 DF = 3, 171 PROBABILITY = .539

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 17.58 | 3 | 5.86 | .387 | .764 |
| WITHIN GROUPS | 242.17 | 16 | 15.14 | | |

**TRANSPOSITION NON-REWARD FEMALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 5.00 | 13.00 | 4.00 | 9.00 | 7.00 |
| MAXIMUM | 5.00 | 59.00 | 10.00 | 20.00 | 10.00 |
| MEAN | 5.00 | 36.83 | 7.67 | 13.00 | 8.67 |
| STANDARD DEV | 0.00 | 15.18 | 2.38 | 5.10 | 1.51 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 6.00 | 11.00 | 10.00 | 9.00 | 10.00 |
| MAXIMUM | 6.00 | 50.00 | 10.00 | 9.00 | 10.00 |
| MEAN | 6.00 | 24.17 | 10.00 | 9.00 | 10.00 |
| STANDARD DEV | 0.00 | 16.33 | 0.00 | 0.00 | 0.00 |

TNF

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 6 | 6 | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 5.00 | 9.00 | 6.00 |
| MAXIMUM | 7.00 | 29.00 | 10.00 | 24.00 | 10.00 |
| MEAN | 7.00 | 16.00 | 9.00 | 11.50 | 9.33 |
| STANDARD DEV | 0.00 | 6.93 | 2.00 | 6.12 | 1.63 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | TR1 | COR1 | TR2 | COR2 |
|---|---|---|---|---|---|
| N OF CASES | 2 | 2 | 2 | 2 | 2 |
| MINIMUM | 8.00 | 29.00 | 0.00 | 9.00 | 10.00 |
| MAXIMUM | 8.00 | 44.00 | 10.00 | 23.00 | 10.00 |
| MEAN | 8.00 | 36.50 | 5.00 | 16.00 | 10.00 |
| STANDARD DEV | 0.00 | 10.61 | 7.07 | 9.90 | 0.00 |

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INF
SUMMARY STATISTICS FOR      AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.
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SUMMARY STATISTICS FOR      TR1

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES =       3.643

  APPROXIMATE F =       1.040 DF =  3,    171 PROBABILITY =  .376

                          ANALYSIS OF VARIANCE

SOURCE          SUM OF SQUARES  DF  MEAN SQUARE       F     PROBABILITY

BETWEEN GROUPS        1533.58   3       511.19      2.882      .068
WITHIN GROUPS         2838.17  16       177.39
```

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```
SUMMARY STATISTICS FOR      COR1

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.
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SUMMARY STATISTICS FOR      TR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.
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SUMMARY STATISTICS FOR      COR2

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.
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---

THE FOLLOWING RESULTS ARE FOR:
SEX = 1.000

TOTAL OBSERVATIONS: 40

| | SEX | AGE | COND | NEAR | FAR |
|---|---|---|---|---|---|
| N OF CASES | 40 | 40 | 40 | 40 | 40 |
| MINIMUM | 1.000 | 5.000 | 1.000 | 0.000 | 0.000 |
| MAXIMUM | 1.000 | 8.000 | 2.000 | 10.000 | 10.000 |
| MEAN | 1.000 | 6.200 | 1.500 | 8.800 | 7.625 |
| STANDARD DEV | 0.000 | 0.992 | 0.506 | 2.604 | 3.585 |

THE FOLLOWING RESULTS ARE FOR:
SEX = 2.000

TOTAL OBSERVATIONS: 40

| | SEX | AGE | COND | NEAR | FAR |
|---|---|---|---|---|---|
| N OF CASES | 40 | 40 | 40 | 40 | 40 |
| MINIMUM | 2.000 | 5.000 | 1.000 | 0.000 | 3.000 |
| MAXIMUM | 2.000 | 8.000 | 2.000 | 10.000 | 10.000 |
| MEAN | 2.000 | 6.200 | 1.500 | 8.975 | 8.900 |
| STANDARD DEV | 0.000 | 0.992 | 0.506 | 2.236 | 2.122 |

---

SUMMARY STATISTICS FOR SEX

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR AGE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .000 DF= 1 PROBABILITY = 1.000

OVERALL MEAN = 6.200 STANDARD DEVIATION = 0.986
POOLED WITHIN GROUPS STANDARD DEVIATION = 0.992
T STATISTIC = .000 PROBABILITY = 1.000

---

SUMMARY STATISTICS FOR COND

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .000 DF= 1 PROBABILITY = 1.000

OVERALL MEAN = 1.500 STANDARD DEVIATION = 0.503
POOLED WITHIN GROUPS STANDARD DEVIATION = 0.506
T STATISTIC = .000 PROBABILITY = 1.000

---

SUMMARY STATISTICS FOR NEAR

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .890 DF= 1 PROBABILITY = .346

OVERALL MEAN = 8.888 STANDARD DEVIATION = 2.413
POOLED WITHIN GROUPS STANDARD DEVIATION = 2.427
T STATISTIC = -.322 PROBABILITY = .748

---

SUMMARY STATISTICS FOR FAR

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 10.143 DF= 1 PROBABILITY = .001

OVERALL MEAN = 8.263 STANDARD DEVIATION = 2.997
POOLED WITHIN GROUPS STANDARD DEVIATION = 2.946
T STATISTIC = -1.935 PROBABILITY = .057

---

TWO-WAY ANALYSIS OF VARIANCE
NUMBER OF CASES PROCESSED: 80

DEPENDENT VARIABLE MEANS

| TRIAL(1) | TRIAL(2) | TRIAL(3) | TRIAL(4) |
|---|---|---|---|
| 28.375 | 12.600 | 8.338 | 8.813 |

---

UNIVARIATE AND MULTIVARIATE REPEATED MEASURES ANALYSIS

**********
* BETWEEN SUBJECTS EFFECTS *
**********

TEST FOR EFFECT CALLED:
SEX

TEST OF HYPOTHESIS

| SOURCE | SS | DF | MS | F | P |
|---|---|---|---|---|---|
| HYPOTHESIS | 68.450 | 1 | 68.450 | 0.532 | 0.468 |
| ERROR | 9779.675 | 76 | 128.680 | | |

---

TEST FOR EFFECT CALLED:
REWARD

TEST OF HYPOTHESIS

| SOURCE | SS | DF | MS | F | P |
|---|---|---|---|---|---|
| HYPOTHESIS | 140.450 | 1 | 140.450 | 1.091 | 0.299 |
| ERROR | 9779.675 | 76 | 128.680 | | |

---

TEST FOR EFFECT CALLED:
SEX
BY
REWARD

TEST OF HYPOTHESIS

| SOURCE | SS | DF | MS | F | P |
|---|---|---|---|---|---|
| HYPOTHESIS | 143.113 | 1 | 143.113 | 1.112 | 0.295 |
| ERROR | 9779.675 | 76 | 128.680 | | |

---

Three-Way ANOVA

DEP VAR: COR2 N: 80 MULTIPLE R: .310 SQUARED MULTIPLE R: .096

ANALYSIS OF VARIANCE

| SOURCE | SUM-OF-SQUARES | DF | MEAN-SQUARE | F-RATIO | P |
|---|---|---|---|---|---|
| SEX | 10.513 | 1 | 10.513 | 1.609 | 0.209 |
| COND | 4.513 | 1 | 4.513 | 0.691 | 0.409 |
| NF | 12.013 | 1 | 12.013 | 1.839 | 0.179 |
| SEX* COND | 17.113 | 1 | 17.113 | 2.620 | 0.110 |
| SEX* NF | 3.613 | 1 | 3.613 | 0.553 | 0.459 |
| COND* NF | 2.113 | 1 | 2.113 | 0.323 | 0.571 |
| SEX* COND* NF | 0.013 | 1 | 0.013 | 0.002 | 0.965 |
| ERROR | 470.300 | 72 | 6.532 | | |

**Three-Way ANOVA**

DEP VAR: COR1 N: 80 MULTIPLE R: .214 SQUARED MULTIPLE R: .046

ANALYSIS OF VARIANCE

| SOURCE | SUM-OF-SQUARES | DF | MEAN-SQUARE | F-RATIO | P |
|---|---|---|---|---|---|
| SEX | 10.513 | 1 | 10.513 | 1.209 | 0.275 |
| COND | 2.112 | 1 | 2.112 | 0.243 | 0.624 |
| NF | 4.513 | 1 | 4.513 | 0.519 | 0.474 |
| SEX* COND | 0.112 | 1 | 0.112 | 0.013 | 0.910 |
| SEX* NF | 9.113 | 1 | 9.113 | 1.048 | 0.309 |
| COND* NF | 1.512 | 1 | 1.512 | 0.174 | 0.678 |
| SEX* COND* NF | 2.113 | 1 | 2.113 | 0.243 | 0.624 |
| ERROR | 625.900 | 72 | 8.693 | | |

# APPENDIX H-2

# DISCRIMINATION SHIFT-REVERSAL ANALYSES

TOTAL OBSERVATIONS: 20

REVERSAL REWARD MALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 62.000 | 9.000 | 10.000 |
| MAXIMUM | 105.000 | 123.000 | 111.000 |
| MEAN | 81.000 | 25.000 | 22.100 |
| STANDARD DEV | 11.684 | 28.157 | 22.856 |

TOTAL OBSERVATIONS: 20

REVERSAL REWARD FEMALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 66.000 | 9.000 | 10.000 |
| MAXIMUM | 99.000 | 52.000 | 66.000 |
| MEAN | 80.200 | 23.100 | 17.150 |
| STANDARD DEV | 10.242 | 13.286 | 14.346 |

TOTAL OBSERVATIONS: 20

REVERSAL NON-REWARD MALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 62.000 | 9.000 | 10.000 |
| MAXIMUM | 103.000 | 89.000 | 72.000 |
| MEAN | 79.750 | 31.650 | 19.500 |
| STANDARD DEV | 11.783 | 23.486 | 15.524 |

TOTAL OBSERVATIONS: 21

REVERSAL NON-REWARD FEMALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 21 | 21 | 21 |
| MINIMUM | 61.000 | 9.000 | 10.000 |
| MAXIMUM | 105.000 | 70.000 | 87.000 |
| MEAN | 77.714 | 22.714 | 22.429 |
| STANDARD DEV | 13.383 | 17.047 | 19.618 |

**REVERSAL REWARD MALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.00 | 9.00 | 10.00 |
| MAXIMUM | 5.00 | 123.00 | 111.00 |
| MEAN | 5.00 | 29.33 | 30.83 |
| STANDARD DEV | 0.00 | 45.93 | 39.84 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 12.00 | 10.00 |
| MAXIMUM | 6.00 | 19.00 | 22.00 |
| MEAN | 6.00 | 14.83 | 13.67 |
| STANDARD DEV | 0.00 | 3.31 | 5.39 |

RRM

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 10.00 |
| MAXIMUM | 7.00 | 77.00 | 37.00 |
| MEAN | 7.00 | 34.83 | 22.33 |
| STANDARD DEV | 0.00 | 23.90 | 12.99 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 12.00 | 13.00 |
| MAXIMUM | 8.00 | 14.00 | 28.00 |
| MEAN | 8.00 | 13.00 | 20.50 |
| STANDARD DEV | 0.00 | 1.41 | 10.61 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 25.082

APPROXIMATE F = 8.017 DF = 3, 171 PROBABILITY = .000

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 1601.00 | 3 | 533.67 | .634 | .604 |
| WITHIN GROUPS | 13463.00 | 16 | 841.44 | | |

RRM

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 17.324

APPROXIMATE F = 5.307 DF = 3, 171 PROBABILITY = .002

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 889.80 | 3 | 296.60 | .525 | .671 |
| WITHIN GROUPS | 9036.00 | 16 | 564.75 | | |

**REVERSAL REWARD FEMALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.00 | 12.00 | 10.00 |
| MAXIMUM | 5.00 | 52.00 | 20.00 |
| MEAN | 5.00 | 29.50 | 14.67 |
| STANDARD DEV | 0.00 | 16.88 | 3.44 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 10.00 |
| MAXIMUM | 6.00 | 31.00 | 66.00 |
| MEAN | 6.00 | 16.33 | 20.33 |
| STANDARD DEV | 0.00 | 7.87 | 22.43 |

RRF

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 11.00 | 10.00 |
| MAXIMUM | 7.00 | 39.00 | 49.00 |
| MEAN | 7.00 | 26.50 | 17.83 |
| STANDARD DEV | 0.00 | 13.08 | 15.38 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 12.00 | 10.00 |
| MAXIMUM | 8.00 | 16.00 | 16.00 |
| MEAN | 8.00 | 14.00 | 13.00 |
| STANDARD DEV | 0.00 | 2.83 | 4.24 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 4.761

APPROXIMATE F = 1.366 DF = 3, 171 PROBABILITY = .255

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 755.47 | 3 | 251.82 | 1.551 | .240 |
| WITHIN GROUPS | 2598.33 | 16 | 162.40 | | |

**RRF**

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 13.725

APPROXIMATE F = 4.125 DF = 3, 171 PROBABILITY = .007

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 135.05 | 3 | 45.02 | .191 | .901 |
| WITHIN GROUPS | 3775.50 | 16 | 235.97 | | |

REVERSAL NON-REWARD MALE
THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.00 | 12.00 | 10.00 |
| MAXIMUM | 5.00 | 89.00 | 72.00 |
| MEAN | 5.00 | 40.50 | 23.83 |
| STANDARD DEV | 0.00 | 32.81 | 23.95 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 10.00 |
| MAXIMUM | 6.00 | 40.00 | 46.00 |
| MEAN | 6.00 | 22.67 | 21.67 |
| STANDARD DEV | 0.00 | 11.99 | 14.88 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 12.00 | 10.00 |
| MAXIMUM | 7.00 | 55.00 | 19.00 |
| MEAN | 7.00 | 24.83 | 12.67 |
| STANDARD DEV | 0.00 | 18.25 | 3.67 |

RNM
THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 35.00 | 13.00 |
| MAXIMUM | 8.00 | 70.00 | 28.00 |
| MEAN | 8.00 | 52.50 | 20.50 |
| STANDARD DEV | 0.00 | 24.75 | 10.61 |

---

SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

---

SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 4.964

APPROXIMATE F = 1.426 DF = 3, 171 PROBABILITY = .237

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 2102.38 | 3 | 700.79 | 1.338 | .297 |
| WITHIN GROUPS | 8378.17 | 16 | 523.64 | | |

---

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 12.469

APPROXIMATE F = 3.723 DF = 3, 171 PROBABILITY = .013

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 423.00 | 3 | 141.00 | .543 | .660 |
| WITHIN GROUPS | 4156.00 | 16 | 259.75 | | |

---

**REVERSAL NON-REWARD FEMALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 7

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 7 | 7 | 7 |
| MINIMUM | 5.00 | 9.00 | 10.00 |
| MAXIMUM | 5.00 | 70.00 | 59.00 |
| MEAN | 5.00 | 33.43 | 27.14 |
| STANDARD DEV | 0.00 | 22.13 | 19.84 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 10.00 |
| MAXIMUM | 6.00 | 47.00 | 19.00 |
| MEAN | 6.00 | 18.33 | 14.17 |
| STANDARD DEV | 0.00 | 14.72 | 3.87 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 10.00 |
| MAXIMUM | 7.00 | 37.00 | 87.00 |
| MEAN | 7.00 | 18.83 | 26.00 |
| STANDARD DEV | 0.00 | 9.56 | 30.25 |

RNF

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 9.00 | 16.00 |
| MAXIMUM | 8.00 | 11.00 | 24.00 |
| MEAN | 8.00 | 10.00 | 20.00 |
| STANDARD DEV | 0.00 | 1.41 | 5.66 |

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SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

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SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 7.439

APPROXIMATE F = 2.169 DF = 3, 178 PROBABILITY = .093

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 1332.40 | 3 | 444.13 | 1.685 | .208 |
| WITHIN GROUPS | 4479.88 | 17 | 263.52 | | |

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SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 15.510

APPROXIMATE F = 4.708 DF = 3, 178 PROBABILITY = .003

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 653.45 | 3 | 217.82 | .526 | .671 |
| WITHIN GROUPS | 7043.69 | 17 | 414.33 | | |

---

THE FOLLOWING RESULTS ARE FOR:
CAT2$ = C

TOTAL OBSERVATIONS: 49

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 49 | 49 | 49 |
| MINIMUM | 61.000 | 9.000 | 10.000 |
| MAXIMUM | 105.000 | 123.000 | 111.000 |
| MEAN | 79.163 | 28.898 | 23.449 |
| STANDARD DEV | 12.311 | 24.325 | 22.349 |

THE FOLLOWING RESULTS ARE FOR:
CAT2$ = H

TOTAL OBSERVATIONS: 32

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 32 | 32 | 32 |
| MINIMUM | 61.000 | 9.000 | 10.000 |
| MAXIMUM | 103.000 | 77.000 | 37.000 |
| MEAN | 80.375 | 20.500 | 15.531 |
| STANDARD DEV | 10.814 | 13.891 | 6.466 |

SUMMARY STATISTICS FOR AGE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .611 DF= 1 PROBABILITY = .434

OVERALL MEAN = 79.642 STANDARD DEVIATION = 11.688
POOLED WITHIN GROUPS STANDARD DEVIATION = 11.746
T STATISTIC = .454 PROBABILITY = .651

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SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 10.334 DF= 1 PROBABILITY = .001

OVERALL MEAN = 25.580 STANDARD DEVIATION = 21.139
POOLED WITHIN GROUPS STANDARD DEVIATION = 20.863
T STATISTIC = 1.771 PROBABILITY = .080

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SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 41.139 DF= 1 PROBABILITY = .000

OVERALL MEAN = 20.321 STANDARD DEVIATION = 18.195
POOLED WITHIN GROUPS STANDARD DEVIATION = 17.885
T STATISTIC = 1.948 PROBABILITY = .055

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# APPENDIX H-3

# DISCRIMINATION SHIFT-NONREVERSAL ANALYSES

TOTAL OBSERVATIONS: 21 NONREVERSAL REWARD MALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 21 | 21 | 21 |
| MINIMUM | 59.00 | 9.00 | 13.00 |
| MAXIMUM | 103.00 | 38.00 | 108.00 |
| MEAN | 79.57 | 17.19 | 35.43 |
| STANDARD DEV | 13.40 | 8.02 | 20.78 |

TOTAL OBSERVATIONS: 20 NONREVERSAL REWARD FEMALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 62.00 | 9.00 | 13.00 |
| MAXIMUM | 102.00 | 102.00 | 91.00 |
| MEAN | 79.90 | 23.40 | 37.50 |
| STANDARD DEV | 11.91 | 25.41 | 24.94 |

TOTAL OBSERVATIONS: 20 NONREVERSAL NON-REWARD MALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 62.00 | 9.00 | 11.00 |
| MAXIMUM | 105.00 | 97.00 | 108.00 |
| MEAN | 80.30 | 31.05 | 38.25 |
| STANDARD DEV | 12.70 | 28.05 | 27.95 |

TOTAL OBSERVATIONS: 20 NONREVERSAL NON-REWARD FEMALE

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 20 | 20 | 20 |
| MINIMUM | 61.00 | 9.00 | 12.00 |
| MAXIMUM | 104.00 | 76.00 | 108.00 |
| MEAN | 80.35 | 22.25 | 36.25 |
| STANDARD DEV | 13.14 | 21.00 | 26.66 |

**NONREVERSAL REWARD MALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 7

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 7 | 7 | 7 |
| MINIMUM | 5.00 | 12.00 | 20.00 |
| MAXIMUM | 5.00 | 38.00 | 108.00 |
| MEAN | 5.00 | 19.43 | 48.43 |
| STANDARD DEV | 0.00 | 8.79 | 29.10 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 22.00 |
| MAXIMUM | 6.00 | 31.00 | 35.00 |
| MEAN | 6.00 | 14.33 | 27.83 |
| STANDARD DEV | 0.00 | 8.33 | 5.56 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

NRM

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 11.00 | 13.00 |
| MAXIMUM | 7.00 | 28.00 | 54.00 |
| MEAN | 7.00 | 19.00 | 32.83 |
| STANDARD DEV | 0.00 | 7.80 | 16.58 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 9.00 | 18.00 |
| MAXIMUM | 8.00 | 16.00 | 23.00 |
| MEAN | 8.00 | 12.50 | 20.50 |
| STANDARD DEV | 0.00 | 4.95 | 3.54 |

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SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

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SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = .462

APPROXIMATE F = .130 DF = 3, 178 PROBABILITY = .942

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 147.69 | 3 | 49.23 | .734 | .546 |
| WITHIN GROUPS | 1139.55 | 17 | 67.03 | | |

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NRM

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 13.183

APPROXIMATE F = 3.954 DF = 3, 178 PROBABILITY = .009

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 2015.26 | 3 | 671.75 | 1.725 | .200 |
| WITHIN GROUPS | 6621.88 | 17 | 389.52 | | |

**NONREVERSAL NON-REWARD MALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.00 | 9.00 | 13.00 |
| MAXIMUM | 5.00 | 70.00 | 108.00 |
| MEAN | 5.00 | 21.00 | 43.50 |
| STANDARD DEV | 0.00 | 24.03 | 36.30 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 11.00 |
| MAXIMUM | 6.00 | 97.00 | 104.00 |
| MEAN | 6.00 | 36.67 | 49.33 |
| STANDARD DEV | 0.00 | 36.80 | 32.11 |

NNM

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 14.00 | 12.00 |
| MAXIMUM | 7.00 | 46.00 | 49.00 |
| MEAN | 7.00 | 25.67 | 27.00 |
| STANDARD DEV | 0.00 | 10.98 | 13.91 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 29.00 | 21.00 |
| MAXIMUM | 8.00 | 92.00 | 25.00 |
| MEAN | 8.00 | 60.50 | 23.00 |
| STANDARD DEV | 0.00 | 44.55 | 2.83 |

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SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

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SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 6.840

APPROXIMATE F = 1.984 DF = 3, 171 PROBABILITY = .118

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 2703.78 | 3 | 901.26 | 1.177 | .349 |
| WITHIN GROUPS | 12247.17 | 16 | 765.45 | | |

NNM

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 7.834

APPROXIMATE F = 2.284 DF = 3, 171 PROBABILITY = .081

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 2126.92 | 3 | 709.97 | .892 | .467 |
| WITHIN GROUPS | 12718.83 | 16 | 794.93 | | |

**NONREVERSAL NON-REWARD FEMALE**

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.00 | 9.00 | 14.00 |
| MAXIMUM | 5.00 | 76.00 | 108.00 |
| MEAN | 5.00 | 32.17 | 55.50 |
| STANDARD DEV | 0.00 | 32.45 | 36.09 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.00 | 9.00 | 14.00 |
| MAXIMUM | 6.00 | 61.00 | 71.00 |
| MEAN | 6.00 | 23.83 | 31.67 |
| STANDARD DEV | 0.00 | 18.97 | 21.14 |

NNF

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.00

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.00 | 9.00 | 12.00 |
| MAXIMUM | 7.00 | 18.00 | 51.00 |
| MEAN | 7.00 | 12.83 | 21.67 |
| STANDARD DEV | 0.00 | 4.07 | 14.68 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.00

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.00 | 13.00 | 31.00 |
| MAXIMUM | 8.00 | 19.00 | 41.00 |
| MEAN | 8.00 | 16.00 | 36.00 |
| STANDARD DEV | 0.00 | 4.24 | 7.07 |

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SUMMARY STATISTICS FOR AGE

ONE OR MORE OF YOUR GROUPS HAS NO VARIANCE.

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SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 16.517

APPROXIMATE F = 5.038 DF = 3, 171 PROBABILITY = .002

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 1215.25 | 3 | 405.08 | .905 | .461 |
| WITHIN GROUPS | 7164.50 | 16 | 447.78 | | |

NNF

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES = 5.652

APPROXIMATE F = 1.629 DF = 3, 171 PROBABILITY = .184

ANALYSIS OF VARIANCE

| SOURCE | SUM OF SQUARES | DF | MEAN SQUARE | F | PROBABILITY |
|---|---|---|---|---|---|
| BETWEEN GROUPS | 3625.58 | 3 | 1208.53 | 1.958 | .161 |
| WITHIN GROUPS | 9874.17 | 16 | 617.14 | | |

THE FOLLOWING RESULTS ARE FOR:
AGE = 5.000

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 5.000 | 9.000 | 19.000 |
| MAXIMUM | 5.000 | 26.000 | 74.000 |
| MEAN | 5.000 | 14.667 | 49.000 |
| STANDARD DEV | 0.000 | 6.377 | 24.682 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 6.000

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 6.000 | 9.000 | 22.000 |
| MAXIMUM | 6.000 | 102.000 | 77.000 |
| MEAN | 6.000 | 38.500 | 38.333 |
| STANDARD DEV | 0.000 | 43.657 | 21.979 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 7.000

TOTAL OBSERVATIONS: 6

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 6 | 6 | 6 |
| MINIMUM | 7.000 | 9.000 | 13.000 |
| MAXIMUM | 7.000 | 29.000 | 91.000 |
| MEAN | 7.000 | 17.167 | 29.333 |
| STANDARD DEV | 0.000 | 6.824 | 30.481 |

THE FOLLOWING RESULTS ARE FOR:
AGE = 8.000

TOTAL OBSERVATIONS: 2

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 2 | 2 | 2 |
| MINIMUM | 8.000 | 12.000 | 15.000 |
| MAXIMUM | 8.000 | 34.000 | 35.000 |
| MEAN | 8.000 | 23.000 | 25.000 |
| STANDARD DEV | 0.000 | 15.556 | 14.142 |

**Discrimination - Nonreversal**

THE FOLLOWING RESULTS ARE FOR:
CAT2$ = C

TOTAL OBSERVATIONS: 41

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 41 | 41 | 41 |
| MINIMUM | 59.000 | 9.000 | 11.000 |
| MAXIMUM | 105.000 | 102.000 | 108.000 |
| MEAN | 78.951 | 30.756 | 32.634 |
| STANDARD DEV | 13.249 | 28.621 | 21.717 |

THE FOLLOWING RESULTS ARE FOR:
CAT2$ = H

TOTAL OBSERVATIONS: 40

| | AGE | DISC | SHIFT |
|---|---|---|---|
| N OF CASES | 40 | 40 | 40 |
| MINIMUM | 61.000 | 9.000 | 13.000 |
| MAXIMUM | 104.000 | 34.000 | 108.000 |
| MEAN | 81.125 | 15.850 | 41.150 |
| STANDARD DEV | 11.904 | 6.455 | 27.063 |

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SUMMARY STATISTICS FOR AGE

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = .446 DF= 1 PROBABILITY = .504

OVERALL MEAN = 80.025 STANDARD DEVIATION = 12.572
POOLED WITHIN GROUPS STANDARD DEVIATION = 12.603
T STATISTIC = .776 PROBABILITY = .440

---

SUMMARY STATISTICS FOR DISC

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 65.395 DF= 1 PROBABILITY = .000

OVERALL MEAN = 23.395 STANDARD DEVIATION = 22.049
POOLED WITHIN GROUPS STANDARD DEVIATION = 20.865
T STATISTIC = 3.215 PROBABILITY = .002

---

SUMMARY STATISTICS FOR SHIFT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 1.877 DF= 1 PROBABILITY = .171

OVERALL MEAN = 36.840 STANDARD DEVIATION = 24.723
POOLED WITHIN GROUPS STANDARD DEVIATION = 24.502
T STATISTIC = 1.564 PROBABILITY = .122

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VITA

Mona Lane

Candidate for the Degree of

Doctor of Philosophy

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