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The effects of model's skil level and model's knowledge of results on the acquisition of an aiming task.

Patricia Lynn. Weir
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THE EFFECTS OF MODEL'S SKILL LEVEL AND MODEL'S KNOWLEDGE OF RESULTS ON THE ACQUISITION OF AN AIMING TASK

by

Patricia Lynn Weir

A Thesis
submitted to the
Faculty of Graduate Studies and Research
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ABSTRACT

A question that has recently received considerable attention is whether modeling provides as rich a cognitive representation as knowledge of results. Equivocal findings have been reported, with Ross, Bird, Doody and Zoeller (1985) citing model superiority, and McCullagh and Little (1987) citing physical practice-knowledge of results superiority. Further study is needed to examine this issue. With the exception of Landers and Landers (1973), and Martens, Burwitz and Zuckerman (1976), no study has attempted to evaluate the performance differences resulting from observing an unskilled model versus a skilled model. The purpose of this study was to assess the effects of model's skill level, model's knowledge of results and physical practice on the acquisition of an aiming task, specifically dart throwing.

Thirty female subjects who had never thrown a dart were assigned to one of six experimental conditions in a randomized fashion with five subjects per condition. All subjects, with the exception of the controls, observed a videotape of a skilled or an unskilled model and either received or did not receive vicarious knowledge of results related to the accuracy of the model's eight throws. This resulted in four modeling conditions: Skilled Model-Knowledge of Results (SKR), Skilled Model No-Knowledge of Results (SNKR), Unskilled Model-Knowledge of Results (USKR), and Unskilled Model No-Knowledge of Results (USNKR). Following the eight observation trials, these subjects performed 60 throws. Two control groups, one performing 60 throws (C60) and the other performing 68 throws (C68), completed the design. During the performance trials, every subject received verbal knowledge of results about the accuracy of the throw but no visual information regarding body movement or dart-location. Following a 24 hour retention interval, all subjects performed one block of four no-knowledge of results trials.

The dependent variables were absolute constant error (ACE), variable error (VE), and total error (E).

The results indicated that on the first block of trials, all experimental groups had equivalent accuracy and consistency measures, suggesting equivalent conceptual representations. When the independent effects of model's skill level and model's knowledge of results were examined, viewing an unskilled model resulted in a lower total error score for the first block, and significantly better consistency over the acquisition period. Subjects who viewed a skilled model required knowledge of results to form a conceptual representation equal to that formed by the unskilled model subjects on the first trial. No improvement in performance occurred over the practice period, and there was no decrement in performance following the 24 hour retention interval. In terms of social learning theory, those subjects who viewed the unskilled model were able to form a stronger conceptual representation for the task within the first block, than those who viewed the skilled model. The physical practice period did not help the subjects to improve their performance of the dart throwing.

As a result, a second experiment was carried out to determine if the type of knowledge of results received during the performance trials was a crucial variable in learning this task. Fifteen female subjects were divided into one of three experimental conditions. All subjects observed the unskilled model and received verbal knowledge of results regarding the accuracy of the model's performance during the observation trials. During the performance trials, the first group received verbal knowledge of results following each trial; the second group received visual-knowledge of results of the dart's location on the board following each trial, and the third group received both verbal and visual knowledge of results following each trial. The analyses from this follow-up experiment revealed no significant differences among the groups. The addition of visual knowledge of results had no significant effect on performance. Thus, in the learning and performance of the present aiming task, providing visual knowledge of results in addition to verbal

knowledge of results provided no advantage in terms of developing a schema for the performance of the task.

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Chapter I

INTRODUCTION

It is generally believed that observing a model facilitates the acquisition of motor skills, and although verbal instructions can also convey task demands, language is limiting when describing complex movements. Modeling as an instructional technique is commonly employed in industry and education, including such activities as demonstrating the use of machinery (eg. power saw), or the performance of motor skills (eg. basketball foul shot). This technique is beneficial not only for the novice but also for the skilled, as a model can quickly and efficiently convey an image of the act (Whiting & den Brinker, 1982), or what Gentile (1972) refers to as "getting the idea" (p.5). Thus, instructors and educators rely heavily on demonstration as a means of communicating movement patterns. Research dealing with modeling and skill acquisition also support its worth (Adams, 1986; Carroll & Bandura, 1982, 1985, 1987; Doody, Bird, & Ross, 1985; Landers & Landers, 1973; Little & McCullagh, 1987; Martens, Burwitz, & Zuckerman, 1976; McCullagh & Little, 1987; Ross, Bird, Doody, & Zoeller, 1985).

In motor skill learning, information can be provided prior to, during, and/or after movement. Researchers have focused on the role of information provided during movement and augmented information following the movement (See Appendix C for Definitions of Types of Information used in the present thesis). However, Carroll and Bandura (1982) and Adams (1986) have pointed out the dependence on this instrumental learning paradigm, and have suggested a shift of attention to information provided prior to performance, namely the observational learning paradigm.

In using an observational learning paradigm there are two concerns. First, those concerns related to the model's skill level and use of the model's knowledge of results, and second those concerns related to the type of task exposure - physical practice versus modeling. Two studies have claimed to manipulate skill level of the model. Landers and Landers (1973) used skilled versus unskilled teacher and peer models, and in 1976, Martens et al. employed a correct, incorrect, and learning sequence model. However, in both studies all models were skilled at performing the task, but were performing under different instruction conditions. Subsequent to these studies only correct models have been used (Carroll & Bandura, 1982, 1985, 1987; Doody et al., 1985; Little & McCullagh, 1987; McCullagh & Little, 1987; Ross et al., 1985). In 1986 Adams reversed this trend by having a novice learn the task while being observed by the subjects.

The other issue related to the model is use of the model's knowledge of results. Receiving knowledge of results following performance of a motor skill is thought to be a critical variable for learning to occur (Irion, 1966). The guidance function of knowledge of results presumes that the knowledge of results aids in the detection and correction of movement errors which will lead to improved performance on the next trial. In observational learning, the detection and correction of errors can be linked to the theoretical framework of Carroll and Bandura's (1982) social learning theory. This theory states that motor learning involves the construction of a conceptual representation that provides the internal model for response production. This internal model serves as the standard for response correction from feedback accompanying response execution. The conceptual representation is formed by transforming observed sequences of behavior into symbolic codes that are centrally processed before the movement is performed. Initially, response patterns are organized at the cognitive level and the conceptual representation of the behavior enables the learner to produce a rough approximation of the movement. If the movement is a novel one, overt performance is necessary to detect mismatches between the conceptual representation and performance feedback, and to make appropriate corrections in response execution. Adams (1986) expanded upon this idea by stating that when the movement sequence to be learned is complex,

information provided in addition to observation may be beneficial to the learning of the task. Employing a timing task Adams hypothesized that the observer would benefit not only from observing the model, but also from receiving the model's knowledge of results. He felt an observer who viewed the model's action and received the model's knowledge of results would form a conceptual representation and also become experienced in response appraisal and error correction techniques by performing the same cognitive activities as the model. However, there was no significant difference between the observers who received the model's knowledge of results and those who did not; although, descriptively, the knowledge of results group performed more accurately.

While Adams (1986), Landers and Landers (1973) and Martens, Burwitz and Zuckerman (1976) have provided evidence in support of skill learning through observation, little is known about the relative potency of modeling as compared to the traditional knowledge of results approach to learning a motor skill. Thus, receiving information prior to practice is beneficial, but is this information more beneficial than the practice itself? This second concern was addressed by Ross et al. in 1985, who added knowledge of results as a variable in the observational learning of a knock-down barrier timing task to test the hypothesis that the acquisition of a motor skill through observational learning should generate better retention than physical practice with knowledge of results. Over acquisition, all groups performed with equivalent accuracy and consistency, but over the retention interval all groups, with the exception of those who observed a correct model, displayed a significant loss in accuracy of performance. Ross et al. concluded that observing a correct model throughout the acquisition period resulted in a stronger conceptual representation. In 1987, using the same task, Little and McCullagh failed to replicate this finding, as their correct model group also experienced a loss in accuracy over the retention interval. Because the subjects in these two studies also received their own knowledge of results accompanying each physical practice trial, it is not clear whether they could construct an adequate conceptual representation based on modeling alone. This was addressed by McCullagh and Little (1987) who

provided subjects with no knowledge of results during the physical practice trials. Over acquisition their Physical Practice No-Knowledge of Results Group was significantly more accurate than the modeling groups. However, on immediate transfer the modeling groups were significantly more consistent, while following the retention interval all groups were equal. Thus, it would appear that for acquisition physical practice with/without knowledge of results is best, but for retention, modeling with/without knowledge of results practice may be better. However, these results should be viewed with some skepticism, as the designs are not without weaknesses. There was confounding of modeling and physical practice trials, there were unequal task exposures, there were unequal numbers of physical practice trials, and there was inconsistent use of dependent variables. The only way to eliminate the confounding effects of modeling and physical practice would be to follow the procedure employed by Adams (1986) where all modeling trials occurred prior to physical practice.

1.1 Statement of the Problem

The purpose of this study was to assess the effects of observing a skilled versus an unskilled model, and either receiving or not receiving the model's knowledge of results, on an observer's subsequent performance of an aiming task involving dart throwing. It was hypothesized that physical practice with knowledge of results would result in a stronger conceptual representation being formed for the task than that formed through modeling (McCullagh & Little, 1987); that observing an unskilled model would result in better initial performance than when viewing a skilled model; and that receiving the model's knowledge of results would produce better initial performance than when not receiving the model's knowledge of results (Adams, 1986) (See Appendix B for Formal Hypotheses).

Chapter II

METHODOLOGY

2.1 Subjects and Models

Thirty adult female volunteers (mean age: 19.47 years S.D.:2.09) participated in the present experiment. All subjects were right handed and said they had never thrown a dart. Subjects had normal or corrected vision (ie. glasses, contact lenses), and all wore a short-sleeved shirt while performing.

The two dart throwing models were adult female volunteers from the Windsor community. Both were right handed and wore a short-sleeved shirt while performing. The skilled model had 15 years of recreation and tournament experience, while the unskilled model had never thrown before. On eight performance trials, the skilled model had an absolute constant error (accuracy) score of 1.69 cm and was three times more accurate than the unskilled model, and had a variable error score of 5.70 cm which was 2.6 times more consistent (See Appendix D).

2.2 Experimental Design

The experimental design was mixed, with Skill Level of the Model x Model's Knowledge of Results x Practice Blocks (2 x 2 x 15), with repeated measures on the last factor. The subjects in the modeling conditions observed a skilled or an unskilled model and either received or did not receive vicarious knowledge of results related to the model's eight dart throwing trials. Thus, the four experimental modeling conditions were Skilled Model-Knowledge of Results (SKR), Skilled Model No-Knowledge of Results (SNKR), Unskilled Model-Knowledge of

Results (USKR), and Unskilled Model No-Knowledge of Results (USNKR). Two control groups completed the design with the Control-60 (C60) Group performing 60 throws, and the Control-68 (C68) Group performing 68 throws. The C(60) Group was equated to the modeling conditions in terms of the number of physical practice trials performed, and the C(68) Group was equated to the modeling conditions by providing eight initial practice trials rather than an initial eight observation trials. The last factor was practice blocks of which there were 15. Each block was comprised of four trials, for a total of 60 performance trials. Subjects were assigned to one of the six experimental conditions in a randomized fashion with the proviso of five subjects per condition. The dependent variables were absolute constant error (ACE), variable error (VE), and total error (E). Thus, measures of both accuracy and consistency were obtained.

2.3 Apparatus

A regulation size NODOR bristle dart board was used, with a diameter of 45 centimeters, and a bull's-eye of diameter 1.5 centimeters. Located in the center of the bull's-eye was a light emitting diode (LED) 0.50 centimeters in diameter which was the target for the physical practice trials. The dart board was mounted on fiberboard, and the center of the bull's-eye was 1.73 meters from the floor. Using 24 gram darts, the models and all subjects threw from a toe-line 2.37 meters from the face of the target, attempting to hit the LED (See Appendix E for View of Apparatus and Testing Room).

2.4 Measurement System

The measurement of the dart's location from the LED (bull's-eye) was accomplished using a Numonics Corporation numonics graphic calculator (digitizer) Model 234113. The digitizer consisted of a sliding arm which could be positioned anywhere on the face of, and a limited area surrounding the dart board. The position was marked and fed on-line to an Apple IIe computer through a serial input board. The data point was measured in terms of (x,y) co-ordinates from the (0,0) point of the LED. Software transformed the (x,y) co-ordinate into distance of the dart from the LED in centimeters (See Appendix I). The distance information and the section number of the dart board in which the dart landed were available immediately to be used as knowledge of results (ie.) "Section 19, 6 centimeters from the bull's-eye."

2.5 Procedure

All subjects in the modeling conditions were required first to observe a videotape of their respective model performing eight throws at the LED. Subjects were seated and observed from the filming angle of 47 degrees on an 18 inch Panasonic television using a JVC, VHS video playback unit. The subjects were naive with respect to the skill level of the model they were observing, and viewed the body and arm action of the model. They were not told what aspects of the throw to observe so as not to bias their observation. Subjects never saw the dart land, but received auditory knowledge of results from hearing the dart hit the board. Because the sound was the same regardless of the dart's position on the board, this knowledge of results was not a reliable indicator of its location. Immediately following each throw by the model, the television screen went blank for an inter-trial interval of 20 seconds. During the inter-trial interval, subjects either received or did not receive vicarious knowledge of results related to the model's performance. Subjects who did not receive the model's knowledge of results remained facing the blank

screen; whereas those who received vicarious knowledge of results were required to turn and face a dart board located on the wall beside them (hereafter referred to as the "viewing-dart-board") and to visualize the location of the dart. Following these eight observation trials, all subjects were required to perform 60 throws.

During the subjects' practice trials, vision was reduced by having them perform in a dark room, with only the LED located in the bull's-eye illuminated. Subjects began each trial by facing the illuminated LED, and the beginning of each trial was signalled by a 30 second timer. Once subjects heard the start signal they were free to throw when ready. The experimenter could monitor the throw as each subject wore a luminous bracelet, which was visible in the dark, on her throwing arm. The LED was turned off by the experimenter at the start of the forward motion of the throw following the backswing. This was done to prevent the subjects from seeing where the dart landed. Immediately following the release of the dart, subjects turned to face the viewing-dart-board at the back of the room. At this time, a light was turned on above the target-dart-board to which the subjects threw, in order to provide sufficient light to measure the dart's landing location, and to allow the subjects to see the viewing-dart-board. The position of the dart was measured, recorded, and knowledge of results was given to the subjects which was used to visualize the dart's location on the viewing-dart-board. Following measurement and the receipt of knowledge of results, the room was darkened. Subjects turned to face the target-dart-board and waited for the next start signal. This procedure took 30 seconds, and was maintained for all trials, for all subjects. At the end of this first testing session subjects were debriefed to obtain information regarding what they observed from the model's performance. It was evident that they were attending to important aspects of the model's performance (ie) how she stood, how she moved her arm, and how she held the dart.

Following a 24 hour retention interval, all subjects performed one block of four no-knowledge of results trials. The same procedure was followed as during the 60 practice trials.

Chapter III

RESULTS AND DISCUSSION

The data were analyzed by dividing the 60 performance trials into 15 blocks of four trials, and calculating the accuracy and variability (ACE, VE, E) scores. The results and discussion are presented in four sections: a) comparison of the control groups' initial performance, b) the effect of prior experimental conditions (observation and practice) on initial performance, c) the interaction of prior experimental conditions and subsequent physical practice on acquisition, and d) the performance level retained following the 24 hour retention interval. (See Appendix F for ANOVA and Means Summary Tables). Alpha = .05 was used for all tests of significance. Due to the large amount of variance in the data, a Hartley F-max test of homogeneity of variance was performed on the variable error data to determine the appropriateness of using analysis of variance. Homogeneity of variance was supported with $F(6, 4) = 6.06$, $p>.05$.

Comparison of the Control Groups' Initial Performance

Randomly assigning subjects to groups assures in a statistical sense that the groups are equal in the attribute under investigation (Kerlinger, 323). To assist in confirming this assumption a one-way analysis of variance (ANOVA) was performed for the two control groups who began the testing session with physical practice trials. No significant difference was found in absolute constant error between the two groups for the first trial of dart throwing with $F(1, 8) = 5.00$. The results of this ANOVA provide support for the group equivalence attained through random assignment.

The Effects of Prior Experimental Conditions on Initial Performance

To determine whether no practice, eight physical practice trials, or eight observation trials under the different model and knowledge of results combinations resulted in different conceptual representations for dart throwing, a one-way ANOVA was performed using all six groups on the first block of trials for all dependent variables. The analyses failed to locate any significant differences among the groups, with ACE: $F(5, 24) = .60$, VE: $F(5, 24) = .82$, and E: $F(5, 24) = 2.02$. As can be seen in Table 1, although the differences among the means is very large, the values for between subject variability are also large, which is probably why there are no statistically significant differences. Unlike the results of the present experiment, Adams (1986) reported that over the first five trials of his timing task, there was a significant difference between the observer groups and the control group with both observation groups exhibiting superior performance, while not being different from one another. These observation groups can be compared to the unskilled modeling groups of the present experiment, who were also not significantly different from one another over the first block of four trials. Although no significant differences existed in either study, subjects who received the model's knowledge of results during the observation trials formed a stronger conceptual representation in both studies.

Table 1 - Mean and Between Subject Variability (SD) values for the six experimental groups on the first block of acquisition for dart throwing.

Group	ACE (cm)	VE (cm)	E (cm)
SKR	15.01 (13.06)	22.15 (12.03)	29.75 (10.18)
SNKR	22.21 (17.96)	24.00 (20.48)	38.31 (15.63)
USKR	13.75 (6.90)	15.89 (8.60)	21.91 (8.56)
USNKR	10.83 (5.15)	19.62 (9.65)	23.56 (7.33)
C(60)	20.98 (17.77)	16.14 (9.45)	30.91 (9.33)
C(68)	18.29 (9.78)	10.72 (5.63)	22.91 (5.74)

mean (SD)

Because the control groups were equivalent to the modeling groups further analyses were done to assess the independent effects of model's skill level and model's knowledge of results. A 2 x 2 (Skill Level of the Model x Model's Knowledge of Results) ANOVA was performed on the first block for all dependent variables. The analysis for total error revealed a significant main effect for model's skill level with $F(1, 16) = 5.37$. As seen in Figure 1, subjects who viewed the unskilled model had significantly less total error than those who viewed the skilled model. The subjects were apparently able to derive more meaningful cues from the variable performance of the unskilled model.

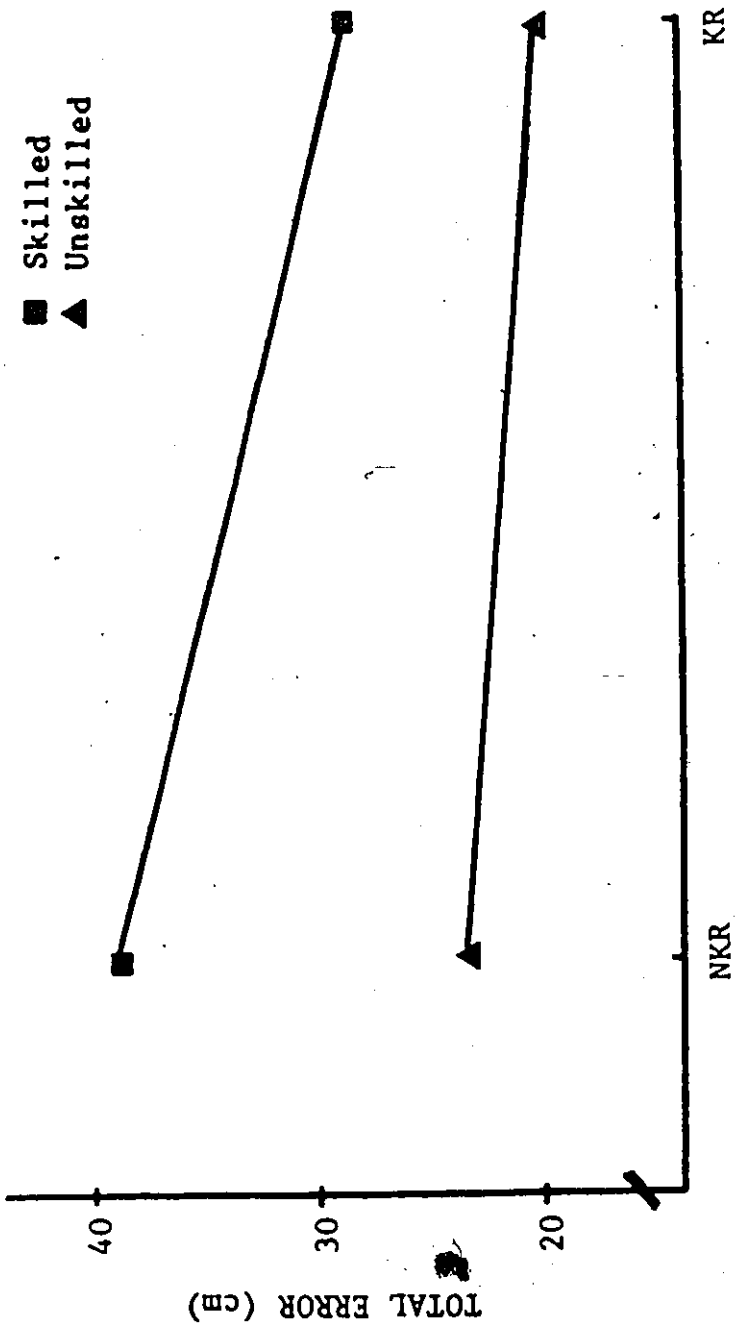

Figure 1 - The effects of skill level of the model and model's knowledge of results on the Total Error in dart throwing for the first block.

Because total error is comprised of both ACE and VE, neither of which was significant over the first block, accuracy on the first trial was analyzed by performing a 2 x 2 (Skill Level of the Model x Model's Knowledge of Results) ANOVA. By doing this, accuracy could be assessed independent of variability and the influence of practice. A significant interaction emerged with $F(1, 16) = 5.18$. As can be seen in Figure 2, subjects who viewed the unskilled model formed equivalent conceptual representations regardless of whether or not they received the model's knowledge of results. Thus, knowledge of results provided redundant information. To develop a conceptual representation equal to those viewing the unskilled model, the skilled model subjects required knowledge of results.

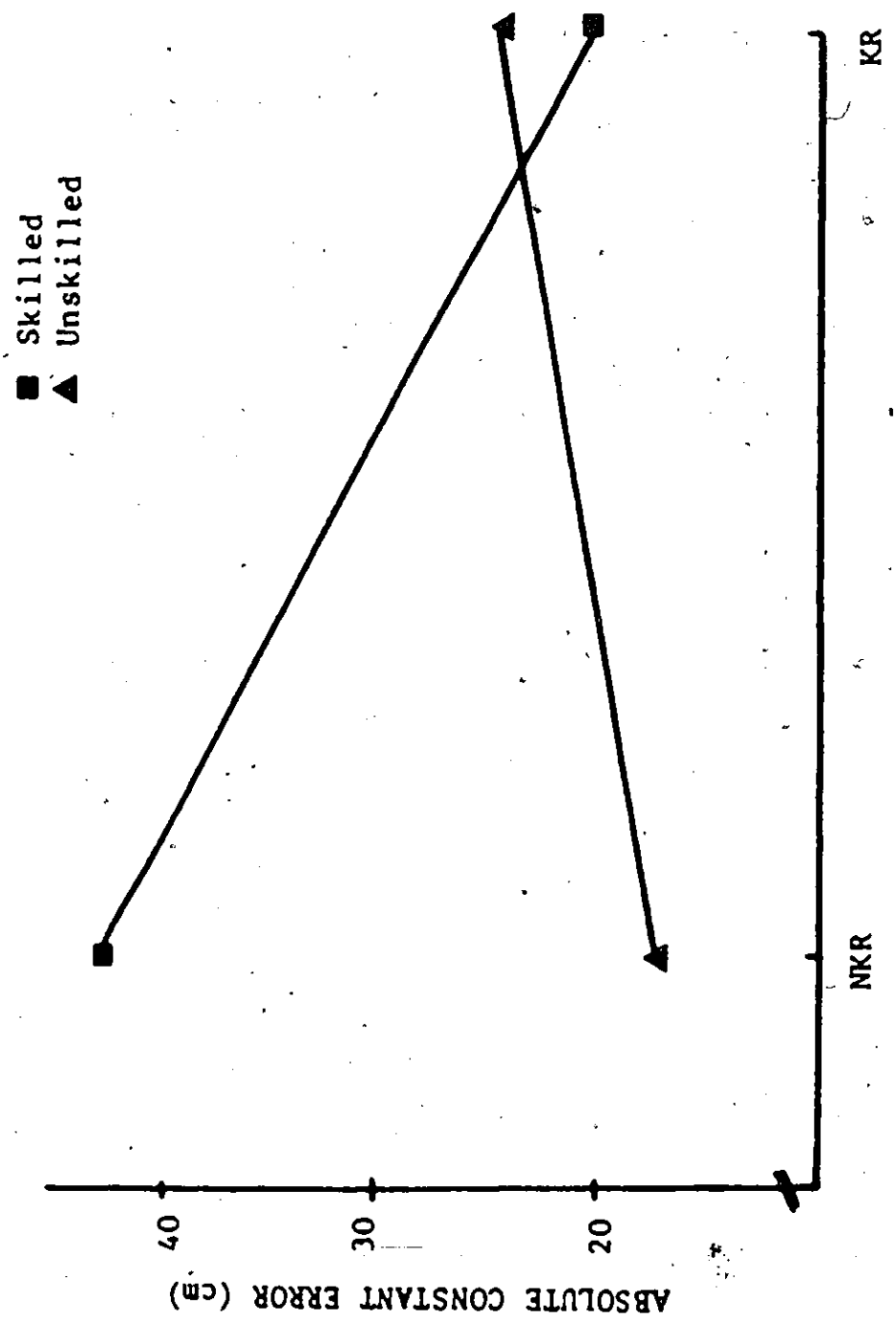

Figure 2 - The effects of skill level of the model and model's knowledge of results on the Absolute Constant Error in dart throwing for the first trial.

To complete the analyses, a one-way ANOVA between the C(60) and C(68) groups was performed on the first trial. This allowed two comparisons; first, a comparison of the control groups independent of the effects of the other conditions, and second, a direct comparison of whether or not physical practice was better than no practice. This differed from the original control analysis in that the trial being used for the C(68) Group was the first one following the initial eight physical practice trials (C(68) = trial 9; C(60) = trial 1). The analysis revealed a significant difference between the groups $F(1, 8) = 9.26$, with the C(68) Group being significantly more accurate. Thus, the initial eight throws resulted in a stronger conceptual representation for this task compared to those subjects who received no prior task exposures.

Little and McCullagh (1987) concluded that the effects of modeling must be studied independently of other variables that may affect performance. It is unfortunate that this was not done in the previous studies, making it difficult to compare the initial performance findings of the present study to other modeling literature. Past studies (Doody et al., 1985; Ross et al., 1985; Little & McCullagh, 1987; McCullagh & Little, 1987) averaged performance over the acquisition period, during which time the physical practice was interacting with the modeling trials. Thus, the initial effects of modeling were never assessed. In the present study, when the independent effects of model's skill level was evaluated on the first trial, viewing an unskilled model resulted in significantly more accurate initial performance. Regardless of whether or not knowledge of results was received, observing an unskilled model resulted in the formation of a superior conceptual representation. This is in opposition to the findings of Landers and Landers (1973) and Martens et al. (1976) who reported no significant differences in model ability. Their findings may be due to the skilled performer using the same movement pattern to achieve both accurate and errorful performances according to the different model roles, or to the confounding of modeling and physical practice.

The Interaction of Prior Conditions and Subsequent Physical Practice on Acquisition

Because the groups were similar on the first block of trials following different prior experiences, but received identical treatment during the practice period, perhaps an interaction between prior exposures and the practice period would uncover differences among the groups. This was assessed using a 6 x 15 (Group x Block) ANOVA with repeated measures on the last factor for all three dependent variables. These analyses indicated no significant main effects and no significant interactions. Unexpectedly, no improvement occurred over the physical performance blocks as evidenced by the nonsignificant block main effects. Although not significant, in all three analyses the C(68) and USKR groups exhibited the most accurate and consistent performances. The fact that no improvement occurred is inconsistent with the modeling literature where significant improvements in performance have been shown for the Bachman Ladder task, a ball roll-up task, and timing tasks (Carroll & Bandura, 1982, 1985; Doody et al., 1985; Landers & Landers, 1973; Little & McCullagh, 1987; Martens, 1976; McCullagh & Little, 1987; Ross et al., 1985). Perhaps the subjects in the current experiment were "real" novices performing in the positive acceleration segment of a sigmoidal learning curve (Woodworth and Schlosberg, 1938) where changes in performance were so infinitesimal they were not detected by the current measurement system or were not detected by accuracy or variability measures.

Landers and Landers (1973), Martens et al. (1976), and Little and McCullagh (1987) found that physical practice control groups exhibited the poorest performances, possibly as a result of not receiving the same number of task exposures as the modeling groups. However, although not significant, in the present study where task exposures were equated, the C68 Group was the most accurate and consistent. This is supported by McCullagh and Little (1987) who reported their Physical Practice No-Knowledge of Results Group was superior in acquisition.

The effects of physical practice with knowledge of results coupled with prior task experiences did not differentially affect the groups based on their prior experiences, as evidenced

by the nonsignificant interactions. This is supported by Martens et al. (1976) and McCullagh and Little (1987).

The 6 x 15 RM ANOVA allowed a comparison of groups, but did not allow a factoring of the independent variables. To assess the separate effects of the model's skill level, model's knowledge of results, and physical practice blocks on acquisition, a 2 x 2 x 15 (Skill Level of the Model x Model's Knowledge of Results x Block) ANOVA with repeated measures on the last factor was performed for all dependent variables. The analysis for variable error revealed a significant main effect for skill level of the model $F(1, 16) = 4.89$, with subjects who viewed the unskilled model forming a superior representation for consistency (14.34 cm) than the subjects who observed a skilled model (21.21 cm). The main effects of knowledge of results and block were not significant, thus receiving the model's knowledge of results had no effect on consistency, and consistency did not improve with practice. This nonsignificant main effect for model's knowledge of results is supported by the findings of Adams (1986) who reported no significant differences between the observer groups in either initial performance or final performance. It must be kept in mind that the present aiming task differed greatly from Adams' timing task, and that Adams' conclusions are based on a delay period. Because all subjects in the present experiment received the same treatment during the physical practice trials, it is not surprising there were no significant interactions for the dependent variables.

The Performance Level Retained

Since performance is not always a measure of acquisition, the performance over the 15 blocks may have been depressed by some unknown variable whose effects disappeared over retention. To evaluate this, 6 x 2 (Group x Block) ANOVA's with repeated measures on the block factor between the last block of practice and the first block of retention were performed for all dependent variables. The analyses revealed a significant group main effect with the F-values being $F(5, 24) = 2.65$, and $F(5, 24) = 3.15$, for accuracy and consistency respectively. As can be

seen in Table 2, the between subject variability values are large which may explain why no significant differences between the groups emerged in post-hoc testing. There were no other significant main effects or interactions for accuracy and consistency indicating that accuracy and consistency were maintained over the retention interval. The analysis for total error revealed no significant main effects or interactions.

Table 2 - Mean and Between Subject Variability (SD) values for the six experimental conditions for the last block of practice (15) and the first block of retention (1) for dart throwing.

	ACE (cm)		VE (cm)		E (cm)	
Block	15	1	15	1	15	1
Group						
SKR	12.72	8.53	30.26	33.69	33.31	37.75
	(9.75)	(8.15)	(16.45)	(27.28)	(18.05)	(23.20)
SNKR	16.23	18.74	15.23	22.18	25.21	28.23
	(13.62)	(11.72)	(6.18)	(15.57)	(6.99)	(13.02)
USKR	12.84	14.64	6.20	13.32	15.46	21.81
	(10.30)	(10.30)	(3.29)	(4.76)	(8.50)	(4.83)
USNKR	14.90	13.20	11.26	20.27	21.46	26.29
	(13.34)	(7.02)	(6.49)	(13.95)	(8.97)	(11.46)
C(60)	27.15	27.02	12.46	17.33	33.73	34.10
	(17.97)	(9.41)	(11.01)	(15.11)	(11.76)	(12.21)
C(68)	8.24	17.34	13.02	8.97	15.48	19.84
	(2.33)	(10.86)	(4.08)	(7.63)	(4.40)	(12.67)
mean(15) =	15.35		14.74		24.11	
	(12.59)		(11.25)		(12.34)	
mean(1) =	16.58		19.36		28.00	
	(10.56)		(16.38)		(14.25)	
mean (SD)						

Since there was a significant main effect for skill level of the model over acquisition it was necessary to assess whether this effect persisted over the retention interval. To examine this a 2 x 2 x 2 (Skill Level of the Model x Model's Knowledge of Results x Trial) ANOVA with repeated measures on the last factor was performed between the last trial of practice and the first trial of retention. The analysis revealed no significant main effects or interactions. Thus, regardless of model's skill level and model's knowledge of results, performance accuracy was equivalent between the skilled and unskilled modeling subjects. The nonsignificant trial main effect indicates that the performance level was maintained following retention.

The present findings for retention are in opposition to those of Ross et al. (1985) who found that all the groups with the exception of the Correct Model Group experienced a significant increase in absolute error following the retention period. This is similar to the findings of Little and McCullagh (1987) who reported that although not significant, all groups experienced an increase in absolute error from immediate to delayed retention.

Similarly, like McCullagh and Little (1987), the C(68) Group had the lowest error score in retention, and supportive of Little and McCullagh (1987) was the SKR Group who had the most accurate performance in retention. These effects however were not significant.

In summary, the major findings of this experiment are, first, subjects who viewed an unskilled model had significantly less total error on the first practice block, and were more consistent over the practice period than subjects who observed the skilled model. Second, the unskilled model subjects formed an equal conceptual representation for accuracy on the first trial regardless of whether or not model's knowledge of results was received. For the skilled model subjects to form a representation equal to that of the unskilled model subjects, they required knowledge of results. Third, there was no decrement in performance over a 24 hour retention interval.

A primary concern was whether subjects were performing at the lower end of a sigmoidal curve, or whether the null effects obtained were due to the type of knowledge of results provided, since 60 trials should have been sufficient for learning to occur. To examine this concern, a second experiment was designed to determine the effectiveness of visual knowledge of results and verbal knowledge of results in acquiring the dart throwing skill. The same unskilled model was chosen for this experiment because of the significant model main effects in Experiment One. Although there were no significant main effects for model's knowledge of results, subjects who received the knowledge of results had lower error scores, thus, this was included during the observation trials.

Chapter IV

EXPERIMENT TWO

4.1 Methodology

Fifteen adult female volunteers participated in the present experiment (mean age: 27.13 years, S.D.:11.83). All subjects said they had never thrown a dart, had normal or corrected vision, and wore a short-sleeved shirt while performing. The apparatus, task, and procedures were identical to those outlined in Experiment One with the following exceptions. First, all subjects viewed the unskilled model and received vicarious knowledge of results, and second the type of information provided after each physical practice trial was manipulated. The subjects were assigned in a randomized fashion to one of three experimental conditions with the provision of equal group size (n=5). The first group was the Verbal-Knowledge of Results Group who received verbal information following each physical performance trial. The second group, the Visual-Knowledge of Results Group, received visual information immediately following each trial, and the third group received both Verbal and Visual Knowledge of Results following each trial. Following each throw to the target-dart-board subjects turned to face the back of the room while the measurement was taken. When the ready signal was given subjects turned to face the target-dart-board. The Verbal-Knowledge of Results Group was given the section number in which the dart landed and the distance from the LED which they were to visualize on the board. The Visual-Knowledge of Results Group saw the dart in the board, and the Verbal plus Visual Knowledge of Results Group received both types of information. In both the visual and visual plus verbal knowledge of results groups, the dart was left in the board for the subjects to view, but was removed prior to them viewing their next throw. It was hypothesized that the Visual-

Knowledge of Results Group and the Verbal plus Visual Knowledge of Results Group would exhibit more accurate and consistent performances than the Verbal-Knowledge of Results Group, and that there should be no significant differences between the visual and visual plus verbal groups because the verbal information is thought to be redundant to the visual information (See Appendix G for Formal Hypotheses).

4.2 Results and Discussion

The 60 performance trials were divided into 15 blocks of four trials, and the error scores for accuracy, variability, and total error calculated (ACE, VE, E). This section will be divided into three areas: a) group equality test, b) the effects of knowledge of results type and physical practice on acquisition, and c) the performance level retained. The 0.05 level of significant was used for all analyses (See Appendix H for ANOVA and Means Summary Tables). In order for a legitimate comparison of the experimental conditions it is imperative that the three groups commence practice at the same skill level. To examine this requirement a one-way ANOVA was performed on the first trial. This trial was chosen because it was the only one common to the groups, as after Trial One the groups were influenced by the type of knowledge of results received. This analysis failed to show a significant difference among the groups with $F(2, 12) = 0.73$ therefore the groups were equivalent at the onset of testing, which is important in terms of both random subject assignment and in providing a baseline for knowledge of results influence comparisons. This is the expected finding for the trial analysis, because on Trial One the only factor which could affect performance was the eight observation trials. Since all subjects observed the same model, there should have been no difference among the groups.

The Effects of Knowledge of Results Type and Physical Practice on Acquisition

Because the analysis for the first trial revealed that all groups were performing with comparable accuracy, it was possible to assess the effects of the different types of knowledge of results and physical practice on the acquisition of the dart throwing task. To evaluate these effects a 3 x 15 (Group x Block) ANOVA with repeated measures on the last factor was performed for all three dependent variables. The three analyses revealed no significant main effects or interactions, indicating that regardless of the knowledge of results received the groups were not differentially affected, and that no learning occurred. Thus, in acquiring this task neither visual knowledge of results, verbal knowledge of results, nor their combination was beneficial. However, while not statistically significant, the Verbal-Knowledge of Results Group was the most consistent.

The Performance Level Retained

The performance level retained following the 24 hour retention interval was analyzed using a 3 x 2 (Group x Block) ANOVA with repeated measures on the last factor between the last block of practice and the first block of retention for all three dependent variables. The analysis for consistency (VE) revealed a significant block main effect, $F(1, 12) = 5.67$ with the mean of the last block of practice equal to 9.38 cm and the mean of the first block of retention equal to 16.63 cm, indicating a decrease in consistency. The analyses for accuracy and total error revealed no significant main effects or interactions indicating that regardless of the type of knowledge of results subjects received, they were still performing with equivalent proficiency following the retention interval. The accuracy of the experimental groups was not affected by the retention interval, but the variability of the performance increased.

4.3 General Discussion of Experiments One and Two

The general purpose of these investigations was to evaluate the effectiveness of modeling as a means of acquiring a dart throwing task. Building on the work of other researchers (Adams, 1986; Doody et al., 1985; Landers & Landers, 1973; Little & McCullagh, 1987; Martens, 1976; McCullagh & Little, 1987; Ross et al., 1985) model's skill level and model's knowledge of results were manipulated. Social learning theory purports that observed events are symbolically coded to form a conceptual representation for the observed event that is cognitively rehearsed prior to overt performance. However, equivocal findings have been reported as to whether modeling is in fact superior to physical practice with knowledge of results. In the present studies, practice in combination with modeling did not aid dart throwing performance with each modeling group being equivalent to the Physical Practice-Knowledge of Results Group during both initial performance, and the practice period. When the independent effects of model's skill level and model's knowledge of results were analyzed, observing an unskilled model resulted in less total error within the first block, and more consistent performance over the practice period. Model's knowledge of results had no effect on performance. Regardless of the type of knowledge of results received following each practice trial, performance did not improve.

In understanding the results of the present research, the following points deserve consideration. First, unlike many of the recent observational learning studies, the dart throwing task did not involve timing per se. In the timing studies of Adams (1986), Carroll and Bandura (1982, 1985), Doody et al. (1985), Little and McCullagh (1987), McCullagh and Little (1987), and Ross et al. (1985), the subjects were able to observe the rhythmical pattern the model used while performing the task segments, making these tasks receptive to learning through observation. The present task contained only a single movement segment, and was ballistic in nature; consequently rhythmical pattern information was minimal. Possibly the differences in findings between the present studies and those involving timing are the result of subjects acquiring the "rhythm".

Second, procedurally, the previous research confounded the modeling effect with practice, making it difficult to compare the independent effects of modeling on performance. Were the results of past studies due to modeling effects or a combination of modeling and physical practice? The answer may help explain the equivocal findings reported by the various researchers.

Third, through the lack of skill improvement it can be assumed that neither verbal nor visual knowledge of results, coupled with physical practice, enabled the subjects to modify the recall and recognition schemas formed initially (Schmidt, 1975). Perhaps the present results are best explained by Fitts and Posner's (1967) stages of motor learning. The first stage, early or cognitive, is when demonstrations and instructions are the most effective, and can be considered to be the first step in the development of a schema or executive program for the task. At this stage, behavior is considered to be "truly a patchwork of old habits ready to be put together into new patterns and supplemented by a few new habits" (p.12). Subjects may be developing a series of subroutines to perform the task, with no improvement being seen while these are being modified. The next phase, intermediate or associative, is the stage in which subroutines are refined and errors are gradually eliminated. In the present studies, apparently subjects never reached this phase. Evidently, the length of the practice period was insufficient to allow subjects to make associations between the perceptual system codes and the subsequent motor system codes from trial to trial. The failure to attain this second phase may be the result of impoverished communication between the perceptual and motor systems. Bandura (1977) suggests that through demonstration a person may learn what to do, but if he does not have the motor capacity to make the response required for correct performance, he may be incapable of demonstrating what has been learned.

While each of these explanations can be used to explain the results of the present studies (Carroll & Bandura, 1982; Fitts & Posner, 1967; Schmidt, 1975) they are related in the sense that

all rely on cognitive processes and physical practice. Carroll and Bandura's social learning theory relies on practice the least, as the conceptual representation is assumed to be formed through the observation trials and is modified throughout the observation period, and finally through practice if the action to be performed is complex. Once practice begins it is not known what really happens to this representation. Perhaps it becomes part of a generalized motor program which is the heart of Schmidt's schema theory. The representation itself may be a schema. Both Fitts and Posner's stages of learning and Schmidt's schema theory rely on practice and the formation of rules and/or associations to learn the task. Only with a substantial amount of practice does the subject reach the autonomous phase of Fitts and Posner's stages, or have a highly refined recall and recognition schema for performing the task. In the present studies, subjects never reached these levels.

In summary, only when procedural and statistical analyses are standardized, and the complete range of factors influencing observational learning identified, will valid comparisons between studies be possible. The current research provides some evidence suggesting that model's skill level, model's knowledge of results, and performance knowledge of results may interact to determine performance and learning, supporting the assertion by McCullagh and Little (1987) that modeling must be studied independently of other factors which may influence performance. Because no improvement occurred, and because knowledge of performance was intentionally eliminated it is hypothesized to be a crucial variable in the learning of the dart throwing task.

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Appendix A

REVIEW OF LITERATURE

In 1973, Landers and Landers studied modeling effects with subjects observing either a teacher or peer model who performed with either high or low performance ability on the Bachman ladder. Subsequent to observation trials, subjects performed in the presence or absence of the observed model. The modeling subjects were compared to a control group in which the subjects performed the task without model demonstration. To analyze the results the control group was contrasted to all other groups within the 2 x 2 x 2 x 6 (Model Type x Model Ability x Model Presence x Block) ANOVA. The results of this analysis indicated that the Control Group differed significantly from all other groups $F(1, 91) = 14.14$, $p<.0001$, and that a significant block main effect was present $F(5, 455) = 30.40$, $p<.0001$, with performance increasing over blocks. There was also a significant interaction of the Control Group versus all others with blocks $F(5, 455) = 12.87$, $p<.0001$. Post - hoc analysis of the interaction showed that the Control Group had significantly lower performance means on each of the six blocks of trials than those who viewed a model's performance. The main effect for model presence was significant, $F(1, 91) = 4.03$, $p<.05$ showing that viewing a skillful teacher model resulted in better performances than those observing an unskilled teacher model $F(1, 91) = 10.44$, $p<.01$, and those observing a skillful peer model $F(1, 91) = 7.51$, $p<.001$. However, observer's watching an unskilled peer model exhibited significantly better performance than observer's in the unskilled teacher model condition $F(1, 91) = 4.66$, $p<.05$.

A possible explanation for the poorer acquisition rate by the Control Group is there was no visual sensory registration relevant to the task to aid in acquiring the motor responses necessary to successfully execute the task. A second explanation offered was that the motivation or incentive to perform in the Control Group may have been lower than compared to the model exposure treatments perhaps due to their lack of contact with the model. The teacher model seems to have been held in higher esteem than the peer model which may explain the superior performance by those subjects observing a teacher model, irrespective of model's skill level. The presence of the model when the observers were performing seemed influential in contributing to the observer attending to, rehearsing, and reproducing the model's behavior. The observers fearing possible ridicule and disapproval, strove to excel in performance with the intention of receiving positive evaluation from the model.

In 1976, Martens, Burwitz, and Zuckerman performed four experiments with the objective of determining whether a model conveyed information about the performance of a motor task, and whether this information facilitated actual performance. These experiments examined the influence of observing a correct model (one that always performed correctly), a learning sequence model (one that progressively improved on the task over the seven trials), or an incorrect model (one that performed the task incorrectly) on the performance of a ball roll - up task. They hypothesized that subjects observing the learning sequence model would perform better than subjects observing either a correct model or an incorrect model. It was also expected that the correct model subjects would perform better than the incorrect model subjects, and that the incorrect model subjects would perform better than the control group who received no observation trials. The task objective was to roll a ball up an incline to hit a target. The film of the model's demonstration was shown on the first trial, the 11th, 21st, 31st, and 41st trials. Interspersed between each observation trial was 10 performance trials. During the intertrial interval the previous trial score was given to the subject, even though the subject received visual feedback of each trial. The model performed seven trials to the target on each observation. The dependent variables of interest were algebraic error, absolute error, and variable error.

The analyses involved a 2 x 4 x 10 (Age x Modeling x Block) repeated measures ANOVA. For all three error terms, the age main effect was significant, with the older boys performing considerably better than younger boys. The block factor was also significant showing that subjects improved with practice and became more consistent in their performance. The modeling main effect and all interactions were not significant. Since the task was fairly simple, the modeling effects occurred only for the initial trials. Thus, an additional 2 x 4 x 10 repeated measures ANOVA was performed on the first 10 trials, as the blocks may have masked the initial trial differences. The results were similar to the blocked trials analyses, with one difference in the algebraic error analysis; the modeling main effect was significant $F(3, 112) = 2.89$, $p<.04$. Post - hoc analyses indicated that both the learning sequence model and correct model groups were significantly better ($p<.05$) over the fist 10 trials than the control group. These results indicate that the correct model and learning sequence model groups benefited from observation when compared to the control group for the first 10 trials when the direction of the error is considered in the analysis. The blocks analysis in contrast to the trials analysis, indicates that the differences occurred early in practice and were not sustained with additional practice.

The results from experiment raise the question as to why the correct model and learning sequence model groups performed better for the first 10 trials but not subsequently. It appears that the model conveyed useful information that facilitated performance. Since performance differences were not observed after trial 10 , suggests, however, that practice may have equalized that initial benefit of observing a model. It also suggests that additional demonstration provided no additional useful information for facilitating performance.

The purpose of experiment 2 was to further understand why modeling effects occurred when they did, and why they did not in later practice. Its primary purpose was to determine if subjects could estimate performance by observing only the model's arm movement and not the

flight of the ball. All subjects observed the same film as was shown for experiment 1. After observing this film all subjects saw a second film with the same model demonstrating 10 shots, but in this film a 10 second blank film was inserted immediately after the model's hand completed the follow through of the arm swing. At this point the projector was stopped and the subject was asked to estimate the performance of the model. After the subject's estimate, the film continued and the subject saw the actual outcome. Subjects then practiced 10 trials as in experiment 1, were shown the original modeling film and finally the second estimate test film.

The estimate data was analyzed using a 4 x 2 (Modeling x Estimate Test) ANOVA. The estimate scores were the difference between the subject's estimate and the model's score. The results of the ANOVA indicated significant main effects for modeling $F(3, 36) = 3.28$, $p<.05$, estimate tests $F(1, 36) = 8.14$, $p<.01$, and a significant modeling x estimate test interaction $F(3, 36) = 3.54$, $p<.05$. Individual comparisons on the interaction revealed that the correct model group estimated significantly better on test 1 than the control group, and that the learning sequence model also estimated significantly better than the control group. Individual comparisons on the test main effect indicated that all four modeling conditions improved significantly in estimating from test 1 to test 2. These results are evidence that the correct model and learning sequence model conditions conveyed information about the force to be applied to the ball before any actual practice on the task.

The performance data was analyzed using a 4 x 10 (Modeling x Trials) ANOVA for algebraic error. This analysis produced a significant modeling effect $F(3, 36) = 2.45$, $p<.08$. Post - hoc analyses indicated that the correct model group was significantly better than the control group. The block effect was also significant $F(9, 324) = 17.23$, $p<.001$, indicating improvement with practice.

These two experiments showed that subjects in the correct model and learning sequence model groups gained information through observation and this information facilitated perform-

ance for the initial 10 trials. They also suggest that the task demands were acquired quite rapidly in terms of knowing what to do. Knowing what to do is considered the cognitive component of a motor skill. Bandura (1977) suggests that through demonstration a person may learn what to do, but if he does not have the motor capacity to make the response required for correct performance, he is incapable of demonstrating what has been learned. In the present experiments, the refinement of the motor skill did not require more information (observation), but practice. Thus, further demonstration of the skill was not beneficial, but additional practice was.

Ross, Bird, Doody, and Zoeller (1985) also examined modeling and videotape feedback, but they added knowledge of results as a variable. They hypothesized that information acquired through model observation could provide as rich a basis for cognitive representation as acquired by means of knowledge of results, and that if Bandura's (1982) hypothesis was correct, observational learning should generate better retention. A barrier knock-down task with a criterion movement time of 2100 ms was used. Subjects were randomly assigned to one of four groups: Correct Model Group where a block of trials consisted of four model presentations followed by two knowledge of results physical practice trials; Combination Model-Videotape Feedback Group in which subjects viewed two correct model presentations, performed a knowledge of results physical trial, viewed videotape feedback of that response, then repeated another knowledge of results physical response followed by videotape feedback. For the Videotape Feedback Group, three knowledge of results practice trials followed by videotape feedback made up a block of trials , and the Physical Practice Control Group performed six knowledge of results physical trials. Following acquisition subjects were transferred to a no-knowledge of results physical practice condition and 48 hours later performed a retention test, without knowledge of results.

The analysis for AE over the acquisition period revealed a significant effect only for block, $F(9, 324) = 21.84$, $p<.0001$, meaning that across conditions, subjects improved their performance.

The main effect for group was not significant indicating that the groups performed similarly prior to transfer. Transfer data revealed a significant group effect, $F(3, 32) = 3.27$, $p<.01$, with Physical Practice and the Correct Model Groups exhibiting superior performance. Retention data showed a significant group effect for AE, $F(3, 32) = 2.50$, $p<.07$ and for total variability (E), $F(3, 32) = 2.43$, $p<.08$, with the Correct Model subjects performing the best. All Groups with the exception of the Correct Model Group experienced a significant retention loss over the 48 hour retention interval, $F(7, 24) = 29.54$, $p<.01$.

Observing a correct model throughout the acquisition period results in the development of a stronger schema (Schmidt, 1975), or cognitive representation (Carroll and Bandura, 1985) for the movement than does the conventional knowledge of results approach. However, this conclusion may not be completely warranted because the subjects received different amounts of physical practice, as well, some subjects received videotape feedback. The subjects in the Correct Model and Combination Groups received 20 physical practice trials, whereas the Videotape subjects received 30 physical practice trials and the Physical Practice subjects received 60 trials. Thus, it is difficult to interpret the results because of confounding of variables. Are the findings the result of physical practice, knowledge of results, videotape feedback, or modeling? Would the results have been the same if a group just modeled for 60 trials during acquisition and then physically performed transfer and retention ? These findings are similar to Zelaznik and Spring (1976) and together support Carroll and Bandura (1982), that vicarious means such as visual and auditory models can be used quite effectively in developing a conceptual representation of a motor skill.

In 1987, Little and McCullagh attempted to replicate the findings of Ross et al. (1985); and with the addition of a Relative-Knowledge of Results Group (20 knowledge of results out of 60 trials), evaluate its effect on the learning of a skill versus knowledge of results on every trial. The task and procedure was the same as that used by Ross et al. (1985), but now subjects were transferred to a novel situation where the movement time was 2500 ms. Subjects were assigned

to either the Correct Model Group where a block of trials consisted of four demonstrations followed by two knowledge of results physical practice trials; the Relative-Knowledge of Results Group who performed six physical practice with two random knowledge of results trials; or the All-Knowledge of Results Group who performed all knowledge of results physical trials. It was hypothesized that the Relative-Knowledge of Results Group would perform better the All-Knowledge of Results Group and the Correct Model Group throughout the task; and it was also hypothesized that the Relative-Knowledge of Results Group would exhibit superior performance on the novel transfer task. Four error terms were used to evaluate performance: constant error (CE), variable error (VE), total error (E), and absolute error (AE). During acquisition, there were no main effects for group for any of the dependent variables. The block effect was significant as was the Group x Block interaction, for AE, CE, and E. In terms of the block main effect, the trend was for groups to decrease error over blocks, with all groups performing similarly prior to immedicate transfer. However, for the interaction, no post-hoc analysis of the data was reported. On immediate transfer the only significant group effect was for CE with the trend being for subjects to undershoot the target time. In terms of accuracy, the All-Knowledge of Results Group exhibited superior performance. The trend over blocks for AE and E was an increase in error, with the Relative-Knowledge of Results Group having the lowest overall error at the end of the fourth block. For delayed transfer, there was a significant block effect for CE and VE; and a significant group effect for CE, with the all-knowledge of results and relative-knowledge of results groups undershooting the target and the Correct Model Group overshooting the target. In terms of accuracy, the Correct Model Group had the best performance. Although not significant, there was an increase in AE for all conditions from immediate to delayed transfer. This is in opposition to the finding of Ross et al. (1985), whose Correct Model Group did not experience an increase in AE over the retention interval. The only significant effect for novel transfer was a block effect for CE, which did not support the hypothesis that the Relative-Knowledge of Results Group would have superior performance. Because the Correct Model Groups suffered no decre-

ment from transfer to retention, the findings of Ross et al. (1985) were not replicated. As well, the Relative-Knowledge of Results Group was not significantly better than the Correct Model and All-Knowledge of Results groups, thus the initial hypotheses were not supported, leaving the worth of knowledge of results intact.

In 1985, Doody, Bird, and Ross tested the hypothesis that the presentation of either an auditory only, or auditory plus visual model would be more effective during the acquisition of a motor task than would presentation of a visual model. The apparatus was identical to that used by Ross et al. (1985). Subjects were randomly assigned to the Control, Audio, Visual, or Audio plus Visual Experimental Groups. The physical Control Group performed 10 trials followed by knowledge of results; and the Modeling Groups were given three presentations of the model performance followed by the performance of 10 knowledge of results physical trials interspersed with 50 presentations of the model. A No-knowledge of results transfer was also performed following the acquisition period. An analysis of the acquisition data for AE revealed significant main effects for trial, $F(9, 396) = 19.6$, $p<.0001$, and group, $F(3, 44) = 3.86$, $p<.025$. All groups improved over acquisition with the Audio and Audio plus Visual Groups having significantly lower error scores.

The transfer data was measured using root mean square error (E), VE, and CE. Because AE was excluded, no comparison is possible between the acquisition and transfer data. The analysis for E revealed superior performance for the Auditory groups with a significant increase in error across trials. The analysis of VE revealed no significant main effects. Similar results were obtained for CE with exception of a significant block effect. The Audio Group was the most accurate, but all Group CE's indicated undershooting of the target. Thus, the presence of an Auditory Model appears to have been a critical factor in the acquisition of the skill.

Again, these results in favour of modeling may be a little premature, as the groups were not equated in terms of total exposure to the skill. Thus, these results may be the result of increased task exposure, rather than an actual modeling effect.

In 1987, McCullagh and Little attempted to extend the findings of Doody et al. (1985) by separating the effects of modeling and knowledge of results. All subjects in the Doody et al. (1985) modeling groups received knowledge of results, thus if is not clear whether subjects can construct an accurate cognitive representation based only on modeling. The subject groups in Doody et al. (1985) were also not equated in terms of task exposures, which McCullagh and Little (1987) tried to achieve.

The three modeling groups were Visual, Auditory, and Visual plus Auditory. All Modeling subjects received 8 blocks of trials with a block consisting of 5 correct demonstration trials followed by 5 physical practice No-knowledge of results trials. The Physical Practice Group also performed 8 blocks of trials, comprised of 5 knowledge of results practice trials followed by 5 No-knowledge of results practice trials. This resulted in 40 trials per subject as only the No-knowledge of results trials data was analyzed. subjects were tested for immediate, delayed and novel transfer. The apparatus was identical to that used by Doody et al. (1985).

The acquisition results for AE revealed a significant group effect with the Physical Practice, No-Knowledge of Results Group exhibiting the lowest error score. The block effect was also significant indicating that subjects improved over practice. There was also a significant block effect for CE and VE, as well as a significant group effect for VE with the Visual plus Auditory Group being the most consistent. On immediate transfer there was a significant group effect for VE with the Visual plus Auditory Group maintaining its superior consistency. There was also a significant block effect for CE with a general trend of undershooting the target. The Group x Block interaction was also significant indicating that the groups did not behave in a similar manner across the blocks. For delayed transfer, the Group x Block interaction was significant for both AE and VE; as well as a significant block effect for VE with the trend being to increase consistency across blocks. The only significant main effect for the novel task was a block effect for CE, with the subjects becoming more positive over trial blocks.

Thus, these results support Doody et al. (1985), in that an Auditory Model did facilitate acquisition for AE and VE. The subjects became more accurate and more consistent in knocking down the barriers in the prescribed time. In opposition to the findings of Doody et al. (1985), the group that received physical practice interspersed with knowledge of results and No-knowledge of results trials performed better than the modeling groups during acquisition. In light of the findings from this experiment and those of the past, the conclusion by Ross et al. (1985) and Doody et al. (1985) that modeling can provide "as rich a basis for a cognitive representation as that acquired by the usual knowledge of results procedure" (p.149) may require some revision. It is now thought, that modeling coupled with knowledge of results provides for better performance and learning. However, these studies have not been without weaknesses. The number of trials have not always been equated, there is not consistent use of dependent variables, confounding of knowledge of results is still taking place, and physical practice and modeling are still being confounded during acquisition. Thus, there is a need to study modeling effects independent of other variables that may modify performance.

In 1986, Adams added to the literature on learning through observation, by using a "learning model" who was a novice performer on the task to be learned. Thus, both the model and the observer were learning the task over the practice trials. This is somewhat similar to the earlier work done by Zelaznik and Spring (1976), in that the observer receives information pertaining to a fellow subject's performance. However, Zelaznik and Spring (1976) only provided subjects with auditory sensory consequences of the task and knowledge of results on only a portion of the trials; whereas, Adams' observers received full sensory consequences as well as the model's knowledge of results.

Adams predicted that in receiving knowledge of results about the learning model's performance on the last trial from an external source, the observer should be able to relate it to his subjectively perceived error and hypothesize the correction that is required on the next trial, just

as the model does. The observer can check the adequacy of the hypothesis on the next trial, again as the model does. On the other hand, an observer who only watches a model learn would presumably be passive in forming a cognitive representation of the model's response. The observer sees the model's behavior change over the learning trials, but has no idea why it changes.

When allowed to practice the task, the observer who watched and received the learning model's knowledge of results, would have a more positive transfer than the observer who did not receive knowledge of results. This is due to the superior cognitive representation and the observer's experience in response appraisal and hypothesis formation.

This prediction was tested using a two-dimensional control stick simulation task. The simulation was based on a mathematical model which allowed the variables to be manipulated experimentally. The task was a three segment movement pattern with each segment having its own timing component.

Subjects were assigned to one of three groups. Group Observer No-Knowledge of Results was a standard observational learning condition in which the observer watched the model perform. The observer watched the model perform in Session 1 and then practiced the task alone in Session 2. The model in Session 1 was provided visual knowledge of results in such a way that the observer could not see it, and the observer received visually presented knowledge of results about his/her own performance in Session 2. Group Observer-Knowledge of Results had the same operations as the subjects in the Observer No-Knowledge of Results Group, except that they received the knowledge of results of the model in Session 1. The subjects in the Control Group practiced alone with visually presented knowledge of results. A session consisted of 50 trials, where a trial was one response.

Means of five-trial blocks were computed for each subject, and these scores were used in all analyses. The segments were analyzed in terms of response time over Trials 1-5 and Trials 46-50. Goal error was also analyzed over those trials as computed from the mathematical model.

The results of the ANOVA for segment 1, Trials 1-5 revealed a significant group effect, $F(2, 86) = 3.79$, $p<.05$. T-tests performed on the significant data indicated that the Observer-Knowledge of Results subjects and the Observer No-Knowledge of Results subjects were significantly different from the Control Group with the t-values being $t(86) = 2.27$, $p<.05$ and $t(86) = 1.99$, $p<.05$ respectively. There was no significant difference between the two Observer groups. The results were identical for segment 2, $F(2, 86) = 5.23$, $p<.01$ with the t-value for the Observer-Knowledge of Results versus Control Group equal to $t(86) = 2.14$, $p<.05$, and Observer No-Knowledge of Results versus Control Group equal to $t(86) = 2.82$, $p<.01$. The analysis on segment 3 revealed no significant differences. A significant effect emerged from the goal error analysis, $F(2, 86) = 8.72$, $p<.01$. Again the Observer-Knowledge of Results Group and the Observer No-Knowledge of Results Group were significantly better than the Control Group with the t-values being $t(86) = 3.37$, $p<.01$ and $t(86) = 3.10$, $p<.01$ respectively. None of the analyses over Trials 46-50 revealed significant effects.

Adams noted that later in trials, the Observer No-Knowledge of Results subjects stabilize at the level of the Control Group thereby losing their initial advantage. Although not significant, the Observer-Knowledge of Results subjects maintain superiority throughout. If the observers were learning from their models, then there should be a relationship between the performance of the observer and the performance of the model. Trials 1-5 for the observers were correlated with Trials 46-50 of their models. All the correlations were significant with the exception of segment 2 for the Observer-Knowledge of Results Group.

Thus, the initial prediction of Observer-Knowledge of Results Group superiority was supported. However, it must be noted that there was no significant difference between the two observer groups on any measure. From this study it is not possible to say whether watching a "learning" model is better than watching a skilled model; further work must be done to examine this idea.

Appendix B

HYPOTHESES FOR EXPERIMENT ONE

Acquisition Hypotheses

Ho1 There will be no difference in initial performance regardless of prior task exposures.

Ha(1) Prior task exposure will result in more accurate/consistent initial performance than no prior task exposure.

Ha(2) An initial eight physical practice trials will result in more accurate/consistent initial performance than viewing a model but not receiving the model's knowledge of results.

Ha(3) An initial eight physical practice trials will result in more accurate/consistent initial performance than viewing a model and receiving the model's knowledge of results.

Ha(4) An initial eight physical practice trials will result in more accurate/consistent initial performance than viewing a skilled model.

Ha(5) An initial eight physical practice trials will result in more accurate/consistent initial performance than viewing an unskilled model.

Ha(6) Viewing an unskilled model will result in more accurate/consistent initial performance than viewing a skilled model.

Ha(7) Receiving the model's knowledge of results will result in more accurate/consistent initial performance than not receiving the model's knowledge of results.

Retention Hypotheses

Ho1 There will be no difference in the accuracy/consistency retained by the six experimental groups following the 24 hour retention interval.

Ha(1) Prior task exposure will result in more accurate/consistent performance following the retention interval than no prior task exposure.

Ha(2) An initial eight physical practice trials will result in more accurate/consistent performance following retention than viewing a model but not receiving the model's knowledge of results.

Ha(3) An initial eight physical practice trials will result in more accurate/consistent performance following retention than viewing a model and receiving the model's knowledge of results.

Ha(4) An initial eight physical practice trials will result in more accurate/consistent performance following retention than viewing a skilled model.

Ha(5) An initial eight physical practice trials will result in more accurate/consistent performance following retention than viewing an unskilled model.

Ha(6) Viewing an unskilled model will result in more accurate/consistent performance following retention than viewing a skilled model.

Ha(7) Receiving the model's knowledge of results will result in more accurate/consistent performance following retention than not receiving the model's knowledge of results.

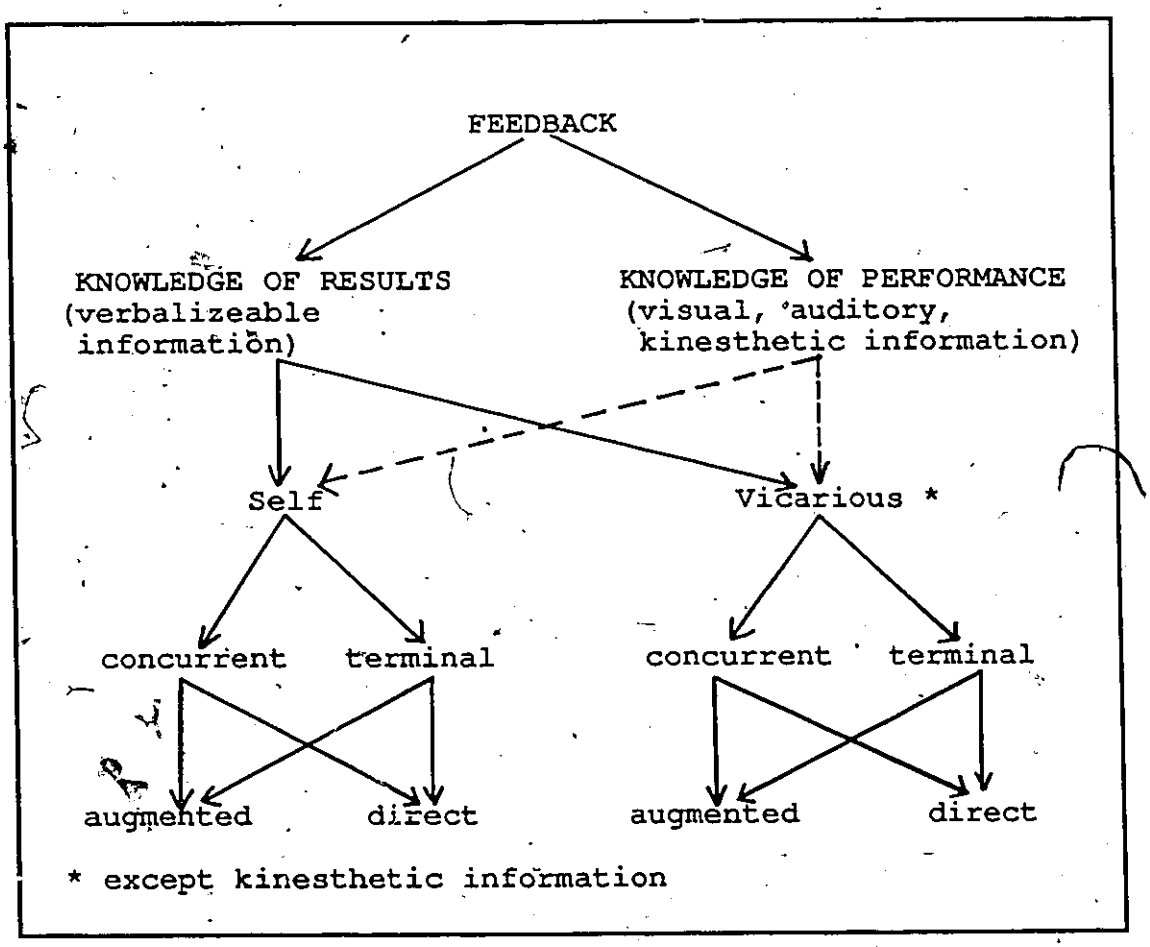
Appendix C

DEFINITIONAL FLOWCHART

In order to fully appreciate and interpret literature that involves knowledge of results, it is essential that one understand the terminology used by the various researchers. In many studies knowledge of results and knowledge of performance are confounded which makes their influence difficult to ascertain (Salmoni, Schmidt, & Walter, 1984). Several researchers have termed visual, auditory, and proprioceptive information "feedback" (Carroll & Bandura, 1982, 1985, 1987; Martens, Burwitz, & Zuckerman, 1976; Newell, 1974; Schmidt & Wrisberg, 1973; Zelaznik & Spring, 1976), while others have maintained that visual, auditory and proprioceptive information is knowledge of results (Adams, 1986; Adams, Goetz, & Marshall, 1972; Church & Camp, 1965; Doody, Bird, & Ross, 1985; Henderson, 1975; Holding, 1965; Little & McCullagh, 1987; McCullagh & Little, 1987; Ross, Bird, Doody, & Zoeller, 1985; Wallace & Hagler, 1979). As well, receiving information vicariously has never been considered a component in the knowledge of results framework.

To avoid confusion, the following definitions have been adopted. Feedback, is the generic expression used to include all exteroceptive and proprioceptive information received by the performer as a result of movement, and is comprised of two general types: knowledge of results and knowledge of performance. The major distinction between them is that knowledge of results relates to response outcome, whereas knowledge of performance relates to the movement per se. In other words, knowledge of results is either the outcome of the movement produced, or the difference between the outcome and the performance goal; knowledge of performance is informa-

tion about the movement pattern used by the performer to produce the outcome. Both knowledge of results (vision/audition) and knowledge of performance (vision/audition/ proprioception) are verbalizable; they can be provided concurrently or terminally; and the information can be either augmented or acquired directly. Except for proprioception (KP) both visual and auditory information can relate to one's own performance, or can be received vicariously relating to the performance of another. Below is a definitional flowchart.



Appendix D

MODEL INFORMATION

The two models used in the present experiment were adult female volunteers from the Windsor community. Each model was required to attend a 30 minute videotaping session, within which time, each model threw eight darts at the dart board with the objective of hitting the bull's-eye. The camera was 4.75 meters from the subject at an angle of 47 degrees which allowed the entire body to be viewed. The landing of each dart on the board was not filmed, in order to make the verbal knowledge of results that the subjects would receive more meaningful. The models performed in a light room, from the regulation distance of 2.37 meters. The models were provided with visual, not verbal knowledge of results during the testing session. One of the models was a skilled performer, while the other was a novice performer throwing for the first time. Their respective information is located in the table below:

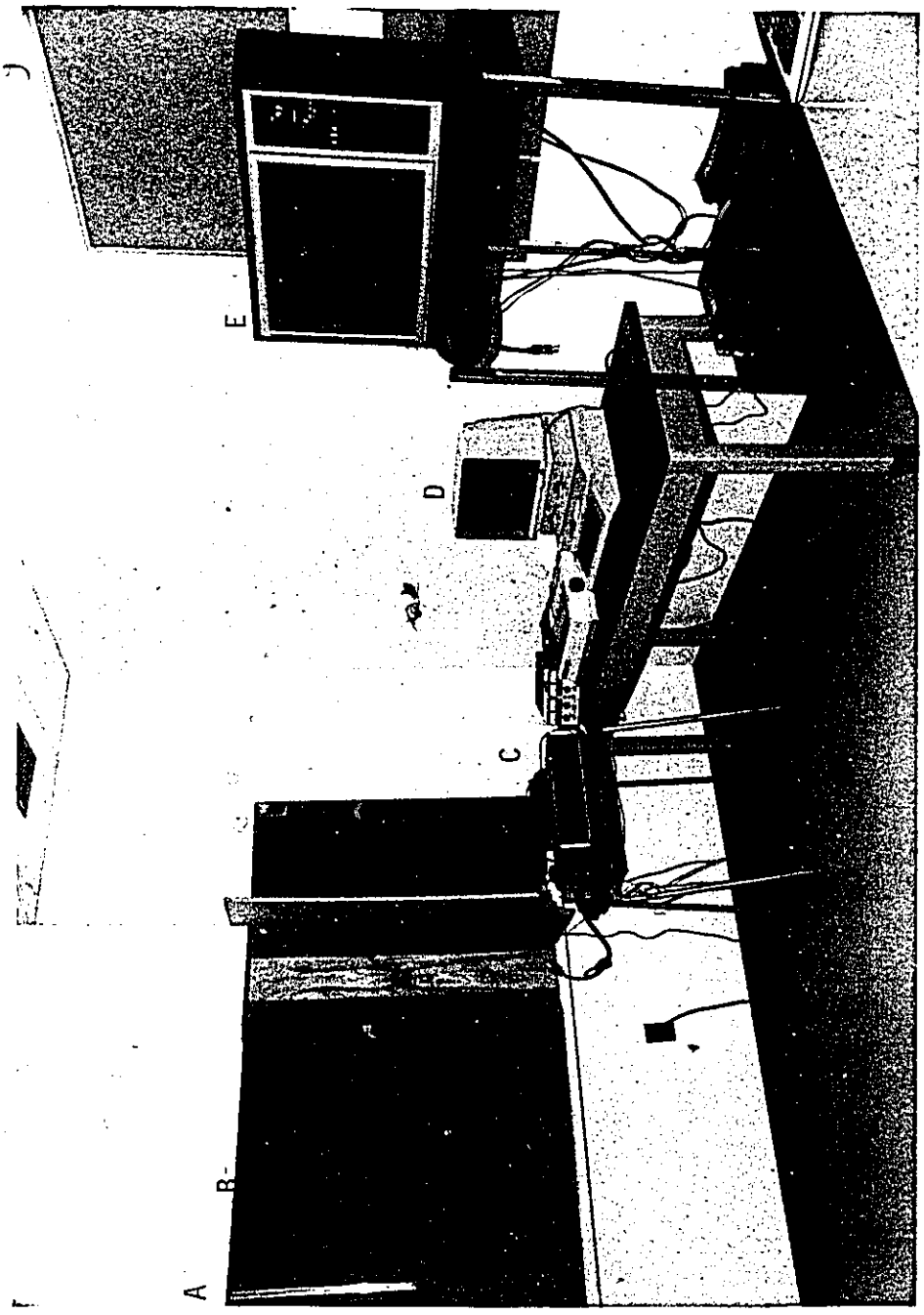
Personal and performance information for the skilled and unskilled model over the eight performance trials for dart throwing

Skilled	Unskilled
Gender: Female	Gender: Female
Age: 32 years	Age: 53 years
Experience: 15 years	Experience: None
Performance measures over the eight trials:	
CE: -1.69 cm	CE: - 5.02 cm
ACE: 1.69 cm	ACE: 5.02 cm
VE: 5.70 cm	VE: 14.84 cm
E: 5.95 cm	E: 15.67 cm
AE: 5.29 cm	AE: 12.53 cm

As is evident from the above table, the skilled model was approximately three times more accurate, and two and a half times more consistent than the unskilled model, over the eight performance trials. In both cases, the majority of the error present was the result of variability and not accuracy.

Appendix E

VIEW OF APPARATUS AND TESTING ROOM



A - Sliding Arm of Digitizer
B - Target-Dart-Board
C - Digitizer Modem
D - Apple Computer
E - Television and VCR

Appendix F

ANOVA AND MEANS TABLES FOR ANALYSES FROM EXPERIMENT ONE

Comparison of Control Groups' Initial Performance

Table 1 - One-way ANOVA for C60 versus C68 for the first trial of practice for dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	576.99	1	576.99	5.00
Within:	923.61	8	115.45	
Total:	1500.60	9		

Table 1a - Means and Standard Deviations for C60 versus C68 on the first trial of acquisition for dart throwing.

Group	ACE (cm)
C(60)	33.71 (14.73)
C(68)	18.52 (3.73)

mean (SD)

Table 2 - One-way ANOVA for the six experimental conditions on the first block of practice for absolute constant error in dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	485.60	5	97.12	0.59
Within:	3915.69	24	163.15	
Total:	4401.29	29		

Table 2a - One-way ANOVA for the six experimental conditions on the first block of acquisition for variable error in dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	582.94	5	116.59	0.82
Within:	3408.88	24	142.04	
Total:	3991.82	29		

Table 2b - One-way ANOVA for the six experimental conditions on block one of acquisition for total error in dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	1001.73	5	200.35	2.02
Within:	2379.18	24	99.13	
Total:	3380.91	29		

Table 2c - Means and Standard Deviations for the six experimental conditions on the first block of acquisition for dart throwing.

Group	ACE (cm)	VE (cm)	E (cm)
SKR	15.01 (13.06)	22.15 (12.03)	29.75 (10.18)
SNKR	22.21 (17.96)	24.00 (20.48)	38.31 (15.63)
USKR	13.75 (6.90)	15.89 (8.60)	21.91 (8.56)
USNKR	10.83 (5.15)	19.62 (9.65)	23.56 (7.33)
C(60)	20.98 (17.77)	16.14 (9.45)	30.91 (9.33)
C(68)	18.29 (9.78)	10.72 (5.63)	22.91 (5.74)

mean (SD)

Table 3 - Skill Level of the Model x Model's Knowledge of Results (2 x 2) ANOVA over the first block of trials for absolute constant error in dart throwing.

Row Variable = Model's Knowledge of Results
Column Variable = Model's Skill Level

	SS	DF	MS	F
Row Variable:	22.79	1	22.79	0.16
Column Variable:	199.90	1	199.90	1.41
Interaction:	128.17	1	128.17	0.90
Error Within:	2269.19	16	141.82	
Total:	2620.05	19		

Table 3a - Skill Level of the Model x Model's Knowledge of Results (2 x 2) ANOVA over the first block of trials for variable error in dart throwing.

Row Variable = Model's Knowledge of Results
Column Variable = Model's Skill Level

	SS	DF	MS	F
Row Variable:	38.98	1	38.98	0.21
Column Variable:	141.30	1	141.30	0.77
Interaction:	4.44	1	4.44	0.02
Error Within:	2924.58	16	182.79	
Total:	3109.30	19		

Table 3b - Skill Level of the Model x Model's Knowledge Results (2 x 2) ANOVA over the first block of trials for total error in dart throwing.

Row Variable = Model's Knowledge of Results
Column Variable = Model's Skill Level

	SS	DF	MS	F	
Row Variable:	130.20	1	130.20	1.10	
Column Variable:	637.66	1	637.66	5.37	*
Interaction:	59.75	1	59.75	0.50	
Error Within:	1899.17	16	118.70		
Total:	2726.78	19			

* p<.05

Table 3c - Means and Standard Deviations for the (Skill Level of the Model x Model's Knowledge of Results) 2 x 2 ANOVA on the first block of acquisition for dart throwing.

Group	ACE (cm)	VE (cm)	E (cm)
Skilled	18.61 (15.28)	23.07 (15.86)	34.03 (13.23)
Unskilled	12.29 (5.95)	17.76 (8.84)	22.74 (7.56)
KR	14.38 (9.87)	19.02 (10.39)	25.83 (9.78)
No-KR	16.52 (13.83)	21.81 (15.27)	30.93 (13.89)

mean (SD)

Table 4 - Skill Level of the Model x Model's Knowledge of Results (2 x 2) ANOVA over the first trial for absolute constant error in dart throwing.

Row Variable = Model's KR
Column Variable = Model's Skill Level

	SS	DF	MS	F	
Row Variable:	279.68	1	279.68	1.42	
Column Variable:	587.85	1	587.85	2.98	
Interaction:	1023.17	1	1023.17	5.18	*
Error Within:	3159.74	16	197.48		
Total:	5050.44	19			

* p<.05

Table 4a - Means and Standard Deviations for the (Skill Level of the Model x Model's Knowledge of Results) 2 x 2 ANOVA on the first trial of acquisition for dart throwing.

Group	ACE (cm)
Skilled	31.87 (18.94)
Unskilled	21.03 (11.72)
KR	22.71 (14.12)
No-KR	30.19 (18.18)

mean (SD)

Table 5 - One-way ANOVA for C60 versus C68 for the first trial of practice subsequent to the initial eight practice trials for absolute error in dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	1142.33	1	1142.33	9.26 *
Within:	986.61	8	123.33	
Total:	2128.94	9		

* p<.05

Table 5a - Means and Standard Deviations for C60 versus C68 on the first trial of practice subsequent to the initial eight practice trials for dart throwing.

Group	ACE (cm)
C(60)	33.71 (14.73)
C(68)	12.33 (5.45)

mean (SD)

Table 6 - Group x Block (6 x 15) RM ANOVA for absolute constant error dart throwing over the practice period.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	25216.67	29		
A (Treatment):	5822.51	5	1164.50	1.44
Subj W.Groups:	19394.16	24	808.09	
Within Subj:	52083.84	420		
Rep Measure:	847.64	14	60.55	0.46
Interaction:	6913.09	70	98.76	0.75
Error Within:	44323.10	336	131.91	
Total:	77300.51	449		

Table 6a - Group x Block (6 x 15) RM ANOVA for variable error in dart throwing over the acquisition period.

Variable A = Groups
Variable B = Blocks

	SS	DF	MS	F
Between Subj.:	18905.28	29		
A (Treatment):	5793.22	5	1158.64	2.12
Subj. W. Groups:	13112.05	24	546.34	
Within Subj.:	42060.69	420		
Rep. Measure:	1790.21	14	127.87	1.32
Interaction:	7820.63	70	111.72	1.16
Error Within:	32449.85	336	96.58	
Total:	60965.97	449		

Table 6b - Group x Block (6 x 15) RM ANOVA for total error in dart throwing over the acquisition period.

Variable A = Groups
Variable B = Blocks

	SS	DF	MS	F
Between Subj.:	40257.06	29		
A (Treatment):	13041.16	5	2608.23	2.30
Subj. W. Groups:	27215.91	24	1134.00	
Within Subj.:	34696.68	420		
Rep. Measure:	733.15	14	52.37	0.59
Interaction:	4258.36	70	60.83	0.69
Error - Within:	29705.17	336	88.41	
Total:	74953.74	449		

Table 6c - Means and Standard Deviations for the six experimental groups over the 15 performance blocks for dart throwing.

Groups	ACE (cm)	VE (cm)	E (cm)
SKR	17.87 (13.11)	20.36 (13.03)	29.59 (13.80)
SNKR	20.16 (15.71)	22.06 (15.71)	33.70 (15.59)
USKR	12.52 (8.79)	12.96 (8.61)	20.52 (7.40)
USNKR	18.74 (14.19)	15.72 (10.02)	27.20 (12.60)
C(60)	20.78 (14.12)	16.39 (10.90)	29.61 (11.66)
C(68)	11.56 (8.31)	12.21 (6.34)	18.34 (7.32)

mean (SD)

Table 7 - Skill Level of the Model x Model's Knowledge of Results x Block (2 x 2 x 15) RM ANOVA for absolute constant error in dart throwing over the practice period.

A = Skill Level of the Model
B = Model's Knowledge of Results
R = Blocks

	SS	DF	MS	F
Between Subj:	17573.52	19		
Variable A:	856.83	1	856.83	0.91
Variable B:	1357.92	1	1357.92	1.44
A X B:	287.85	1	287.85	0.31
Error-Betwn:	15070.92	16	941.93	
Within Subj:	36530.92	280		
Rep Measures:	1307.69	14	93.41	0.67
A X R:	1469.36	14	104.95	0.75
B X R:	1457.11	14	104.08	0.75
A X B X R:	1008.08	14	72.01	0.52
Error Within:	31288.68	224	139.68	
Total:	54104.44	299		

Table 7a - Skill Level of the Model x Model's Knowledge of Results x Block (2 x 2 x 15) RM ANOVA for variable error in dart throwing over the acquisition period.

A = Skill Level of the Model
B = Model's Knowledge of Results
R = Blocks

	SS	DF	MS	F	
Between Subj.:	15511.99	19			
Variable A:	3538.12	1	3538.12	4.89	*
Variable B:	374.93	1	374.93	0.52	
A x B:	21.29	1	21.29	0.03	
Error-Betwn.:	11577.64	16	723.60		
Within Subj.:	31838.88	280			
Rep. Measure:	2331.92	14	166.57	1.59	
A x R:	2306.30	14	164.74	1.57	
B x R:	1507.61	14	107.69	1.03	
A x B x R:	2179.66	14	155.69	1.48	
Error Within:	23513.39	224	104.97		
Total:	47350.87	299			

* $p<.05$

Table 7b - Skill Level of the Model x Model's Knowledge of Results x Block (2 x 2 x 15) RM ANOVA for total error in dart throwing over the acquisition period.

A = Skill Level of the Model
B = Model's Knowledge of Results
R = Block

	SS	DF	MS	F
Between Subj.:	29436.31	19		
Variable A:	4548.66	1	4548.66	3.22
Variable B:	2184.08	1	2184.08	1.55
A x B:	123.19	1	123.19	0.09
Error-Betwn.:	22580.38	16	1411.27	
Within Subj.:	25300.27	280		
Rep. Measure:	1111.44	14	79.39	0.83
A x R:	853.02	14	60.93	0.64
B x R:	505.08	14	36.08	0.38
A x B x R:	1383.59	14	98.83	1.03
Error-Within:	21447.13	224	95.75	
Total:	54736.58	229		

Table 7c - Means and Standard Deviations for the (Skill Level of the Model x Model's Knowledge of Results x Block) 2 x 2 x 15 RM ANOVA over acquisition for dart throwing.

Groups	ACE (cm)	VE (cm)	E (cm)
Skilled	19.01 (14.46)	21.21 (14.34)	31.65 (14.82)
Unskilled	15.63 (12.17)	14.34 (9.41)	23.86 (10.83)
KR	15.19 (11.44)	16.66 (11.61)	25.05 (11.94)
No-KR	19.45 (14.94)	18.89 (13.43)	30.45 (14.50)

mean (SD)

Table 8 - Group x Block (6 x 2) RM ANOVA for absolute constant error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	4871.51	29		
A (Treatment):	1732.60	5	346.52	2.65 *
Subj W.Groups:	3138.90	24	130.79	
Within Subj:	2981.45	30		
Rep Measure:	22.80	1	22.80	0.20
Interaction:	259.11	5	51.82	0.46
Error Within:	2699.53	24	112.48	
Total:	7852.96	59		

* p<.05

Table 8a - Group x Block (6 x 2) RM ANOVA for variable error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	8101.02	29		
A (Treatment):	3210.55	5	642.11	3.15 *
Subj W.Groups:	4890.47	24	203.77	
Within Subj:	3667.21	30		
Rep Measure:	319.89	1	319.89	2.50
Interaction:	278.21	5	55.64	0.44
Error Within:	3069.12	24	127.88	
Total:	11768.23	59		

* p<.05

Table 8b - Group x Block (6 x 2) RM ANOVA for total error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	8794.57	29		
A (Treatment):	2823.31	5	564.66	2.27
Subj W.Groups:	5971.26	24	248.80	
Within Subj:	1737.48	30		
Rep Measure:	227.84	1	227.84	3.75
Interaction:	51.53	5	10.31	0.17
Error Within:	1458.11	24	60.75	
Total:	10532.05	59		

Table 8c - Means and Standard Deviations for the six experimental conditions for the last block of practice (15) and the first block of retention (1) for dart throwing.

	ACE (cm)		VE (cm)		E (cm)	
Block	15	1	15	1	15	1
Group						
SKR	12.72	8.53	30.26	33.69	33.31	37.75
	(9.75)	(8.15)	(16.45)	(27.28)	(18.05)	(23.20)
SNKR	16.23	18.74	15.23	22.18	25.21	28.23
	(13.62)	(11.72)	(6.18)	(15.57)	(6.99)	(13.02)
USKR	12.84	14.64	6.20	13.32	15.46	21.81
	(10.30)	(10.30)	(3.29)	(4.76)	(8.50)	(4.83)
USNKR	14.90	13.20	11.26	20.27	21.46	26.29
	(13.34)	(7.02)	(6.49)	(13.95)	(8.97)	(11.46)
C(60)	27.15	27.02	12.46	17.33	33.73	34.10
	(17.97)	(9.41)	(11.01)	(15.11)	(11.76)	(12.21)
C(68)	8.24	17.34	13.02	8.97	15.48	19.84
	(2.33)	(10.86)	(4.08)	(7.63)	(4.40)	(12.67)
mean(15) =	15.35		14.74		24.11	
	(12.59)		(11.25)		(12.34)	
mean(1) =	16.58		19.36		28.00	
	(10.56)		(16.38)		(14.25)	
mean (SD)						

Table 9 - Skill Level of the Model x Model's Knowledge of Results x Trial (2 x 2 x 2) RM ANOVA for absolute error in dart throwing over the retention interval.

A = Skill Level of the Model
B = Model's Knowledge of Results
R = Trials

	SS	DF	MS	F
Between Subj:	7964.36	19		
Variable A:	1453.95	1	1453.95	3.99
Variable B:	437.71	1	437.71	1.20
A X B:	250.20	1	250.20	0.69
Error-Betwn:	5822.50	16	363.91	
Within Subj:	4672.38	20		
Rep Measures:	298.00	1	298.00	1.10
A X R:	25.00	1	25.00	0.92
B X R:	0.007	1	0.007	0.00003
A X B X R:	15.50	1	15.50	0.06
Error Within:	4333.87	16	270.87	
Total:	12636.74	39		

Table 9a - Means and Standard Deviations for the (Skill Level of the Model x Model's Knowledge of Results x Trial) RM ANOVA between the last trial of acquisition and the first trial of retention.

Group	ACE (cm)
Skilled	30.59 (19.60)
Unskilled	18.53 (14.29)
KR	21.25 (16.99)
No-KR	27.87 (18.80)
Trial 60	21.83 (11.19)
Trial 1	27.29 (22.90)

mean (SD)

Appendix G

HYPOTHESES FOR EXPERIMENT TWO

Acquisition Hypotheses

Ho1 There will be no difference in performance over the 15 practice blocks for each dependent variable, among the three experimental groups.

Ha(1) The Verbal plus Visual Knowledge of Results Group will exhibit the most accurate performance over acquisition.

Ha(2) The Verbal plus Visual Knowledge of Results Group will exhibit the most consistent performance over acquisition.

Ha(3) The Verbal plus Visual Knowledge of Results Group will have the lowest total error over acquisition.

Retention Hypotheses

Ho1 There will be no difference in the accuracy/consistency retained following the 24 hour retention interval among the three experimental groups.

Ha(1) The Verbal plus Visual Knowledge of Results Group will be the most accurate following the retention interval.

Ha(2) The Verbal plus Visual Knowledge of Results Group will be the most consistent following the retention interval.

Ha(3) The Verbal plus Visual Knowledge of Results Group will have the lowest total error following the retention interval.

Appendix H

ANOVA AND MEANS TABLES FOR ANALYSES FROM EXPERIMENT TWO

Group Equivalency Test

Table 1 - One-way ANOVA for the three experimental conditions on the first practice trial for absolute error in dart throwing.

Treatment Variable = Groups	SS	DF	MS	F
Between:	340.29	2	170.14	0.73
Within:	2787.98	12	232.33	
Total:	3128.27	14		

Table 1a - Means and Standard Deviations for the three experimental groups on the first trial of acquisition for dart throwing.

Groups	ACE (cm)
Verbal	22.27 (13.20)
Visual	29.15 (22.17)
Ver/Vis	17.55 (15.60)

mean (SD)

Table 2 - Group x Block (3 x 15) RM ANOVA for absolute constant error in dart throwing over the practice period.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	3161.39	14		
A (Treatment):	13.04	2	6.52	0.02
Subj W.Groups:	3148.35	12	262.36	
Within Subj:	16793.43	210		
Rep Measure:	1478.74	14	105.62	1.30
Interaction:	1640.99	28	58.61	0.72
Error Within:	13673.70	168	81.39	
Total:	19954.82	224		

Table 2a - Group x Block (3 x 15) RM ANOVA for variable error in dart throwing over the practice period.

Variable A = Groups
Variable B = Blocks

	SS	DF	MS	F
Between Subj.:	4543.83	14		
A (Treatment):	375.82	2	187.91	0.54
Subj. W. Groups:	4168.01	12	347.33	
Within Subj.:	11308.61	210		
Rep. Measure:	797.38	14	56.96	1.02
Interaction:	1173.93	28	41.93	0.75
Error Within:	9337.31	168	55.58	
Total:	15852.44	224		

Table 2b - Group x Block (3 x 15) RM ANOVA for total error in dart throwing over the practice period.

Variable A = Groups
Variable B = Blocks

	SS	DF	MS	F
Between Subj.:	6879.80	14		
A (Treatment):	186.17	2	93.08	0.17
Subj. W. Groups:	6693.63	12	557.80	
Within Subj.:	11737.86	210		
Rep. Measure:	1009.08	14	72.08	1.23
Interaction:	850.82	28	30.39	0.52
Error - Within:	9877.95	168	58.80	
Total:	18617.66	224		

Table 2c - Means and Standard Deviations for the three experimental groups over the acquisition period for dart throwing.

Groups	ACE (cm)	VE (cm)	E (cm)
Verbal	14.70 (9.02)	10.89 (7.56)	19.98 (8.56)
Visual	14.70 (10.82)	13.84 (8.22)	22.17 (9.98)
Ver/Vis	14.19 (8.43)	13.37 (9.19)	21.41 (8.72)

mean (SD)

Table 3 - Group x Block (3 x 2) RM ANOVA for absolute constant error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	1487.18	14		
A (Treatment):	178.33	2	89.17	0.82
Subj W.Groups:	1308.85	12	109.07	
Within Subj:	658.97	15		
Rep Measure:	0.05	1	0.05	0.0009
Interaction:	13.44	2	6.72	0.12
Error Within:	645.48	12	53.79	
Total:	2146.15	29		

Table 3a - Group x Block (3 x 2) RM ANOVA for variable error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	967.76	14		
A (Treatment):	17.22	2	8.61	0.11
Subj W.Groups:	950.54	12	79.21	
Within Subj:	1363.14	15		
Rep Measure:	395.02	1	395.02	5.67 *
Interaction:	132.75	2	66.38	0.95
Error Within:	835.37	12	69.61	
Total:	2330.90	29		

Table 3b - Group x Block (3 x 2) RM ANOVA for total error in dart throwing between the last block of practice and the first block of retention.

Variable A = Groups
Variable R = Blocks

	SS	DF	MS	F
Between Subj.:	674.98	14		
A (Treatment):	81.96	2	40.98	0.83
Subj W.Groups:	593.02	12	49.42	
Within Subj:	1036.66	15		
Rep Measure:	235.26	1	235.26	3.85
Interaction:	68.51	2	34.26	0.56
Error Within:	732.89	12	61.07	
Total:	1711.64	29		

Table 3c - Means and Standard Deviations for the three experimental conditions for the last block of practice (15) and the first block of retention (1) for dart throwing.

Group	ACE (cm)		VE (cm)		E (cm)	
Block	15	1	15	1	15	1
Verbal	11.76	13.69	7.69	20.41	16.22	25.96
	(7.91)	(7.85)	(7.20)	(8.66)	(5.68)	(6.98)
Visual	18.90	18.42	11.02	13.51	23.43	26.04
	(11.52)	(8.97)	(5.48)	(13.74)	(8.66)	(8.56)
Ver/Vis	15.70	14.50	9.43	16.00	19.16	23.61
	(8.40)	(8.98)	(4.86)	(8.78)	(7.83)	(6.90)
mean(15) =	15.46		9.38		19.61	
	(9.23)		(5.67)		(7.46)	
mean(1) =	15.54		16.63		25.21	
	(8.26)		(10.30)		(7.06)	

mean
(SD)

Appendix I

COMPUTER PROGRAM FOR MEASUREMENT FROM DIGITIZER

This computer program was used as a link between the digitizer and the Apple IIe computer so that measurement of the dart's position in centimeters could be taken. The program is designed to print out the following information: "X" - the distance of the dart from the bull's-eye in the X-direction; "Y" - the distance of the dart from the bull's-eye in the Y-direction; "L" - the actual distance of the dart from the bull's-eye; "ANG" - the angle of the dart from the bull's-eye measured in radians; and "TIME" - the position of the dart on the board with respect to a clockface. The only measure used in the present studies was "L".

```
10    Z$ = CHR$ (4): REM CTR-Z
50    PRINT Z$;"PR#1"
100   PRINT "SUBJECT'S NAME"
200   INPUT WW$
201   PRINT "BIRTHDATE"
202   INPUT WW$
203   PRINT "GENDER"
204   INPUT WW$
205   PRINT "     X        ""        Y        ""L        ""ANG
            ""TIME
300   PRINT : PRINT
400   PRINT Z$;"IN#2"
401   I = 0
500   GOSUB 6000
600   PRINT Z$;"PR#1"
700   D$ = RIGHT$ (A$,6)
800   E$ = RIGHT$ (B$,5)
900   X = VAL (E$)
1000  IF X > 30 THEN X = X - 100

1100  Y = VAL (D$)
1190  IF Y > 30 THEN Y = Y - 100

1200  PRINT X,Y
1201  PRINT Z$;"PR#0"
1203  PRINT Z$;"PR#1"
1210  L = SQR (( X ¬ 2) + (Y ¬ 2))
1220  X = X * 2.54
1225  Y = Y * 2.54
```

```
1230  L = L * 2.54
1231  IF X = 0 THEN TH = 1.57
1232  IF X = 0 THEN GOTO 1250
1235  TH = ATN (Y / X)
1250  IF X > = 0 AND TH > 0 THEN GOSUB 6200
1251  IF X > = 0 AND TH > 0 THEN GOSUB 6210
1252  IF X > = 0 AND TH > 0 THEN GOSUB 6220
1253  IF X > = 0 AND TH > 0 THEN GOSUB 6230
1254  IF X > = 0 AND TH > 0 THEN GOSUB 6240
1255  IF X > = 0 AND TH > 0 THEN GOSUB 6250
1260  IF X > 0 AND TH < 0 THEN GOSUB 7000
1261  IF X > 0 AND TH < 0 THEN GOSUB 7010
1262  IF X > 0 AND TH < 0 THEN GOSUB 7020
1263  IF X > 0 AND TH < 0 THEN GOSUB 7030
1264  IF X > 0 AND TH < 0 THEN GOSUB 7040
1265  IF X > 0 AND TH < 0 THEN GOSUB 7050
1270  IF X < = 0 AND TH > 0 THEN GOSUB 8000
1271  IF X < = 0 AND TH > 0 THEN GOSUB 8010
1272  IF X < = 0 AND TH > 0 THEN GOSUB 8020
1273  IF X < = 0 AND TH > 0 THEN GOSUB 8030
1274  IF X < = 0 AND TH > 0 THEN GOSUB 8040
1275  IF X < = 0 AND TH > 0 THEN GOSUB 8050
1280  IF X < 0 AND TH < 0 THEN GOSUB 9000
1281  IF X < 0 AND TH < 0 THEN GOSUB 9010
1282  IF X < 0 AND TH < 0 THEN GOSUB 9020
1283  IF X < 0 AND TH < 0 THEN GOSUB 9030
1284  IF X < 0 AND TH < 0 THEN GOSUB 9040
1285  IF X < 0 AND TH < 0 THEN GOSUB 9050
1300  PRINT Z$;"PR#1"
1308  IF T < 1201 AND T > 601 THEN L = L * -1
1309  PRINT " # ";I
1310  X = INT (X * 10 ¬ 2 + .5) / INT (10 ¬ 2 + .5)
1320  Y = INT (Y * 10 ¬ 2 + .5) / INT (10 ¬ 2 + .5)
1330  L = INT (L * 10 ¬ 2 + .5) / INT (10 ¬ 2 + .5)
1340  TH = INT (TH * 10 ¬ 2 + .5) / INT (10 ¬ 2 + .5)
1400  PRINT "    ";X;"      ";Y;"      ";L;"      ";TH;"      ";T
1410  PRINT
1500  GOTO 500
1600  END
6000  PRINT Z$;"PR#0"
6100  INPUT B$,A$
6101  I = I + 1
6102  RETURN
6200  IF TH > = 0 AND TH < = .26 THEN T = 245
6201  RETURN
6210  IF TH > .26 AND TH < .52 THEN T = 215
6211  RETURN
6220  IF TH > .52 AND TH < .78 THEN T = 145
6221  RETURN
6230  IF TH > .78 AND TH < 1.04 THEN T = 115
6231  RETURN
6240  IF TH > 1.04 AND TH < 1.3 THEN T = 1245
6241  RETURN
6250  IF TH > 1.3 AND TH < 1.57 THEN T = 1215
```

```
6255  RETURN
7000  IF TH < = 0 AND TH. > = -.26 THEN T = 315
7001  RETURN
7010  IF TH < -.26 AND TH > = -.52 THEN T = 345
7011  RETURN
7020  IF TH < -.52 AND TH > = -.78 THEN T = 415
7021  RETURN
7030  IF TH < -.78 AND TH > = -1.04 THEN T = 445
7031  RETURN
7040  IF TH < -1.04 AND TH > = -1.3 THEN T = 515
7041  RETURN
7050  IF TH < -13 AND TH > = -1.57 THEN T = 545
7051  RETURN
8000  IF TH > = 0 AND TH < = .26 THEN T = 845
8001  RETURN
8010  IF TH > .26 AND TH < = .52 THEN T = 815
8011  RETURN
8020  IF TH > .52 AND TH < = .78 THEN T = 745
8021  RETURN
8030  IF TH > .78 AND TH < = 1.04 THEN T = 715
8031  RETURN
8040  IF TH > 1.04 AND TH < = 1.3 THEN T = 645
8041  RETURN
8050  IF TH > 1.3 AND TH < = 1.57 THEN T = 615
8051  RETURN
9000  IF TH < = 0 AND TH > = -.26 THEN T = 915
9001  RETURN
9010  IF TH < -.26 AND TH > = -.52 THEN T = 945
9011  RETURN
9020  IF TH < -.52 AND TH > = -.78 THEN T = 1015
9021  RETURN
9030  IF TH < -.78 AND TH > = -1.04 THEN T = 1045
9031  RETURN
9040  IF TH < -1.04 AND TH > = -1.3 THEN T = 1115
9041  RETURN
9050  IF TH < -1.30 AND TH > = -1.57 THEN T = 1145
9051  RETURN
9999  GOTO 1300
```

Appendix J

RAW DATA POINTS AND ERROR SCORES FOR EXPERIMENT ONE

Skilled-KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	-19.71 (19)	43.00 (1)	-9.99 (9)	-19.43 (19)	-12.78 (12)
2	24.93 (17)	42.00 (18)	-47.20 (3)	33.15 (17)	19.90 (6)
3	44.00 (3)	24.56 (13)	27.77 (15)	28.59 (17)	-6.68 (11)
4	40.20 (17)	28.46 (4)	58.00 (6)	-13.06 (7)	-15.45 (12)
5	59.00 (3)	8.51 (1)	18.41 (6)	7.22 (4)	-40.40 (12)
6	18.35 (2)	27.26 (18)	45.00 (2)	7.16 (4)	-23.42 (9)
7	35.37 (2)	6.81 (10)	17.19 (2)	15.93 (18)	-11.77 (11)
8	14.54 (17)	23.38 (4)	15.91 (6)	-8.52 (16)	-29.58 (16)
9	-30.25 (3)	9.15 (15)	57.50 (2)	-16.52 (16)	-36.00 (14)
10	-16.04 (19)	25.30 (6)	18.31 (13)	-33.17 (7)	-24.16 (14)
11	56.00 (3)	15.56 (15)	37.60 (17)	-12.56 (11)	-19.12 (11)
12	7.09 (10)	21.00 (15)	18.29 (2)	-30.05 (16)	-42.00 (11)
13	-22.84 (3)	44.00 (1)	47.00 (15)	-13.46 (9)	-44.50 (8)
14	70.00 (3)	27.97 (1)	21.01 (6)	-13.51 (16)	-4.63 (14)
15	36.78 (15)	9.06 (18)	44.50 (17)	-10.66 (14)	-18.11 (8)
16	-32.26 (3)	6.99 (4)	26.38 (10)	-9.46 (8)	-26.39 (16)
17	-65.50 (3)	-17.08 (5)	29.41 (2)	-19.26 (8)	-13.89 (14)
18	68.00 (17)	11.96 (18)	38.62 (2)	17.61 (2)	29.40 (3)
19	-26.45 (7)	19.00 (4)	20.45 (2)	-9.87 (11)	-9.94 (11)
20	-47.00 (19)	9.47 (20)	29.14 (13)	22.93 (10)	15.52 (1)
21	29.92 (17)	4.83 (2)	16.00 (17)	-14.79 (19)	-6.01 (5)
22	57.00 (3)	29.72 (4)	19.65 (13)	-43.20 (16)	-10.83 (14)
23	11.73 (15)	15.17 (1)	27.65 (17)	-33.03 (3)	9.58 (20)
24	29.18 (17)	10.57 (15)	-30.71 (3)	-27.04 (19)	-14.07 (5)
25	-47.40 (3)	14.26 (15)	30.95 (15)	-39.00 (3)	7.44 (3)
26	44.50 (3)	13.01 (20)	6.61 (6)	6.91 (10)	7.64 (1)

27	-48.00	(19)	-36.00	(12)	29.15	(15)	-27.05	(19)	-17.73	(19)
28	-31.49	(8)	13.81	(17)	-19.94	(19)	-62.00	(19)	-13.55	(16)
29	-24.19	(3)	21.34	(3)	34.90	(2)	-15.82	(19)	10.62	(10)
30	-57.00	(7)	2.03	(10)	29.73	(2)	-8.68	(8)	12.48	(4)
31	-15.32	(16)	36.40	(3)	11.17	(4)	-12.62	(19)	10.49	(6)
32	-39.47	(16)	12.67	(2)	-9.42	(16)	15.11	(6)	13.78	(17)
33	11.97	(3)	-11.40	(18)	11.13	(10)	42.00	(17)	-24.43	(12)
34	-141.00	(3)	28.32	(3)	36.20	(17)	-15.56	(19)	-13.51	(7)
35	-26.14	(7)	15.33	(18)	22.91	(6)	43.00	(17)	17.63	(15)
36	20.70	(3)	-24.40	(19)	-25.97	(7)	-32.36	(3)	-2.30	(14)
37	-17.11	(19)	6.25	(17)	-8.54	(9)	16.00	(4)	3.09	(20)
38	-20.70	(19)	-61.40	(19)	-16.46	(19)	42.00	(2)	14.92	(18)
39	40.50	(2)	10.75	(2)	-33.45	(19)	56.00	(2)	6.09	(10)
40	-33.23	(19)	11.83	(2)	43.60	(17)	90.00	(3)	-24.20	(3)
41	49.00	(2)	-17.15	(3)	38.00	(17)	54.00	(3)	16.87	(2)
42	67.00	(17)	10.53	(17)	-40.20	(3)	70.00	(3)	24.08	(4)
43	41.00	(17)	-8.63	(7)	5.09	(15)	71.00	(17)	28.06	(17)
44	33.25	(17)	-16.95	(3)	-5.90	(19)	52.00	(2)	18.47	(15)
45	52.50	(17)	-7.17	(7)	-21.06	(3)	36.08	(2)	42.00	(4)
46	-57.00	(7)	-20.33	(19)	-27.69	(3)	-16.18	(3)	18.25	(15)
47	-39.13	(7)	-22.35	(14)	-34.72	(3)	60.00	(2)	-16.07	(8)
48	-40.92	(7)	10.45	(1)	-40.00	(7)	83.00	(17)	19.41	(17)
49	51.50	(3)	-14.35	(9)	-34.54	(19)	17.07	(17)	10.17	(4)
50	-21.20	(19)	13.68	(2)	78.50	(3)	53.00	(17)	-16.79	(19)
51	20.15	(15)	-10.18	(3)	11.37	(17)	12.55	(6)	-15.90	(5)
52	-24.28	(3)	-25.65	(16)	19.51	(17)	57.00	(2)	-24.73	(8)
53	26.60	(2)	-15.85	(20)	49.00	(3)	16.03	(17)	16.48	(2)
54	-56.00	(7)	-15.77	(5)	45.50	(3)	-48.00	(3)	22.46	(10)
55	-88.50	(19)	18.18	(1)	9.25	(2)	-10.51	(9)	13.27	(6)
56	16.91	(3)	6.66	(4)	47.00	(17)	-33.90	(19)	17.91	(2)
57	-100.00	(19)	-2.55	(11)	-11.90	(19)	29.03	(10)	15.01	(2)
58	-49.40	(19)	8.60	(6)	-29.97	(3)	-33.49	(19)	40.00	(1)
59	39.00	(3)	13.47	(6)	30.84	(17)	59.00	(17)	20.51	(17)
60	22.74	(3)	-18.52	(19)	32.85	(17)	33.77	(17)	-20.38	(3)

Retention Phase

1	-76.98	(3)	18.24	(4)	43.10	(17)	26.86	(4)	-4.37	(12)
2	76.68	(2)	21.52	(13)	-35.12	(7)	-40.00	(9)	20.82	(18)
3	76.56	(17)	7.46	(10)	-51.50	(19)	24.79	(6)	41.00	(6)
4	-73.03	(19)	21.11	(6)	40.40	(17)	16.71	(3)	10.19	(17)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	7.31	34.51	22.36	7.14	-3.75
2	5.45	16.49	31.82	23.14	-26.29
3	-23.08	17.75	4.20	32.93	-30.32
4	-11.77	22.01	12.92	34.72	-23.41
5	2.85	5.84	-17.74	29.41	5.27
6	-29.52	15.08	31.96	8.15	-5.33
7	-30.29	1.27	-20.60	11.69	-4.05
8	-5.50	18.11	-34.00	16.60	11.84
9	9.27	7.66	-33.62	11.07	-5.65
10	51.00	-8.14	-7.64	-3.71	-0.03
11	61.75	-8.05	47.56	-0.75	21.87
12	40.73	-9.85	-21.14	-30.87	15.90
13	34.91	-9.17	6.54	18.71	-11.81
14	-19.10	-1.70	-25.25	37.69	17.53
15	22.08	0.25	-21.92	5.54	13.79
Retention Phase					
1	7.09	17.09	0.80	-0.78	16.91

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	7.31	34.51	22.36	7.14	3.75
2	5.45	16.49	31.82	23.14	26.29
3	23.08	17.75	4.20	32.93	30.32
4	11.77	22.01	12.92	34.72	23.41
5	2.85	5.84	17.74	29.41	5.27
6	29.52	15.08	31.96	8.15	5.33
7	30.29	1.27	20.60	11.69	4.05
8	5.50	18.11	34.00	16.60	11.84
9	9.27	7.66	33.62	11.07	5.65
10	51.00	8.14	7.64	3.71	0.03
11	61.75	8.05	47.56	0.75	21.87
12	40.73	9.85	21.14	30.87	15.90
13	34.91	9.17	6.54	18.71	11.81
14	19.10	1.70	25.25	37.69	10.53
15	22.08	0.25	21.92	5.54	13.79
Retention Phase					
1	7.09	17.09	0.80	0.78	16.91

Variable Error

The values represent the variable error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	23.72	8.12	25.31	39.56	14.02
2	8.82	8.96	17.55	12.08	10.36
3	8.72	6.05	32.74	16.23	9.11
4	1.76	15.10	42.27	11.22	14.44
5	17.83	13.69	51.39	6.43	17.93
6	10.28	9.22	16.19	22.83	9.07
7	24.88	21.52	38.16	20.63	11.68
8	12.17	12.58	15.84	17.42	1.37
9	33.76	19.54	64.45	23.15	15.55
10	26.70	30.82	28.43	28.76	14.62
11	8.79	11.26	12.53	27.92	4.47
12	36.82	13.09	43.08	7.15	20.74
13	20.21	14.35	31.33	40.20	13.15
14	24.30	14.69	48.51	16.47	3.31
15	34.04	12.29	56.03	27.16	21.80
Retention Phase					
1	27.45	5.70	75.82	42.93	16.53

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	24.82	35.45	33.77	40.19	14.51
2	10.36	18.77	36.33	26.98	28.26
3	24.67	18.75	33.01	36.71	31.66
4	11.90	26.69	44.20	36.49	27.51
5	18.06	14.88	54.37	30.10	18.69
6	21.25	17.67	35.82	24.24	10.53
7	39.19	21.56	43.37	23.71	12.37
8	13.35	22.05	37.51	24.06	11.92
9	35.01	20.99	72.69	25.66	16.55
10	57.57	31.88	29.43	29.00	14.62
11	62.37	13.84	49.18	27.93	22.32
12	54.89	16.38	47.99	31.69	26.13
13	40.33	17.03	32.00	44.34	17.68
14	30.91	14.79	54.68	41.13	17.84
15	40.68	12.30	60.16	27.70	25.79
Retention Phase					
1	28.35	18.01	75.82	42.94	23.65

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	23.56	34.51	32.21	35.74	13.70
2	9.71	16.49	31.82	24.13	26.29
3	23.08	17.75	27.35	32.93	30.32
4	11.77	22.01	40.47	34.72	23.41
5	17.42	14.38	51.74	29.41	17.19
6	29.52	15.07	31.96	23.50	10.12
7	33.74	19.27	42.85	21.66	11.59
8	13.06	18.11	34.00	21.30	11.84
9	33.23	19.86	49.95	24.05	14.47
10	51.00	22.56	27.89	25.51	12.08
11	61.75	13.32	47.56	22.30	21.87
12	48.82	15.08	47.39	30.87	23.93
13	34.91	16.01	29.28	35.98	16.90
14	27.11	14.12	47.00	37.69	17.53
15	38.82	10.79	52.79	26.39	23.98
Retention Phase					
1	27.09	17.08	75.05	42.53	19.10

Skilled No-KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	55.00 (17)	31.63 (2)	56.50 (17)	32.54 (15)	25.16 (2)
2	48.00 (17)	18.32 (18)	37.60 (17)	21.37 (1)	42.10 (17)
3	-49.00 (19)	15.52 (17)	79.50 (17)	18.50 (1)	35.20 (2)
4	-62.00 (3)	20.06 (3)	29.59 (15)	18.16 (18)	-45.50 (3)
5	42.00 (2)	34.07 (2)	53.50 (17)	1.50 (13)	-50.40 (19)
6	65.00 (17)	10.77 (3)	-33.52 (3)	-15.07 (20)	-9.77 (19)
7	62.00 (3)	-19.82 (19)	43.50 (2)	13.11 (18)	13.46 (15)
8	54.00 (3)	20.76 (2)	43.00 (2)	-12.40 (3)	3.34 (18)
9	60.00 (17)	-21.20 (7)	48.50 (2)	-12.83 (12)	-1.62 (5)
10	79.00 (3)	5.58 (1)	54.10 (2)	9.95 (3)	-13.51 (7)
11	66.00 (3)	-21.93 (19)	-40.00 (3)	-12.49 (20)	-9.62 (8)
12	61.00 (17)	-.87 (3)	45.00 (6)	7.18 (18)	2.90 (3)
13	58.00 (3)	14.83 (17)	7.80 (4)	11.40 (13)	-39.00 (3)
14	-49.00 (3)	-35.10 (7)	-14.44 (3)	-10.18 (19)	32.61 (3)
15	-55.00 (3)	-30.28 (19)	-46.50 (19)	-2.26 (8)	-74.10 (7)
16	-50.00 (3)	-29.44 (7)	31.32 (17)	15.33 (17)	-38.08 (16)
17	-50.00 (3)	-45.00 (7)	29.91 (17)	-18.33 (19)	34.65 (17)
18	52.00 (3)	-29.64 (19)	32.83 (2)	-6.02 (8)	-68.50 (7)
19	28.06 (17)	-19.43 (3)	45.60 (2)	12.95 (2)	-72.50 (7)
20	-54.00 (19)	38.40 (3)	-18.24 (3)	17.12 (15)	-51.00 (7)
21	-39.00 (3)	-30.07 (19)	26.61 (17)	12.79 (15)	-68.30 (7)
22	-32.64 (3)	-34.35 (19)	-49.50 (3)	20.37 (15)	-10.18 (16)
23	36.00 (3)	-13.03 (7)	11.55 (2)	10.84 (15)	-61.80 (7)
24	47.00 (2)	-32.44 (19)	38.00 (17)	-5.28 (14)	-60.00 (7)
25	-54.00 (3)	-21.83 (3)	48.00 (3)	21.73 (17)	-57.00 (19)
26	32.89 (17)	-17.98 (8)	30.48 (17)	5.22 (6)	-145.00 (19)
27	-27.46 (3)	-16.79 (3)	-56.00 (19)	13.92 (2)	-21.91 (16)
28	38.00 (17)	-17.56 (3)	56.40 (17)	21.03 (10)	-33.84 (16)
29	24.86 (17)	-29.59 (3)	22.61 (6)	17.49 (17)	-33.14 (3)
30	-22.16 (3)	26.71 (17)	26.43 (10)	-23.49 (19)	-36.28 (7)
31	-43.00 (3)	15.69 (17)	23.72 (2)	17.23 (13)	-46.50 (3)
32	47.00 (17)	-32.36 (19)	32.49 (2)	25.30 (17)	-51.50 (7)
33	-32.61 (3)	-22.65 (16)	32.65 (2)	-10.70 (7)	120.00 (17)
34	-28.53 (19)	-30.45 (7)	41.10 (2)	-29.52 (3)	-30.08 (19)
35	-11.04 (7)	-13.78 (11)	-14.57 (7)	-43.00 (3)	-56.50 (7)
36	18.68 (10)	19.54 (17)	21.67 (2)	-4.15 (12)	-89.00 (3)
37	22.76 (15)	-10.04 (11)	-39.00 (3)	28.74 (17)	-34.67 (19)
38	-22.31 (3)	-18.26 (8)	-31.13 (19)	-27.69 (3)	-45.50 (7)
39	34.99 (2)	-17.81 (16)	50.30 (3)	-8.62 (7)	-62.00 (7)
40	-29.56 (3)	-21.29 (19)	46.40 (3)	12.22 (13)	-55.50 (7)
41	37.00 (17)	-21.08 (8)	4.77 (18)	3.93 (6)	-58.00 (7)

42	-19.42	(3)	48.40	(3)	29.81	(17)	5.09	(10)	-60.00	(3)
43	31.48	(17)	-14.31	(11)	20.48	(17)	18.27	(10)	-40.40	(19)
44	-48.00	(3)	-42.00	(19)	29.09	(17)	12.41	(15)	61.60	(3)
45	35.84	(2)	-20.24	(14)	-66.00	(19)	-33.77	(16)	-68.00	(3)
46	59.00	(17)	-16.99	(19)	-20.90	(3)	-20.63	(3)	-61.00	(19)
47	48.00	(3)	-15.59	(9)	-14.08	(3)	-19.14	(5)	-34.24	(19)
48	-46.00	(3)	-36.03	(16)	27.02	(2)	-19.51	(3)	20.77	(17)
49	42.00	(17)	-43.00	(7)	40.10	(2)	-16.86	(16)	-44.50	(19)
50	41.00	(17)	-22.17	(19)	34.19	(15)	21.53	(17)	-32.88	(3)
51	43.00	(17)	-28.20	(11)	56.00	(2)	-22.47	(19)	-28.89	(19)
52	33.84	(17)	-35.40	(19)	27.26	(6)	-35.52	(19)	-59.00	(3)
53	42.00	(3)	-10.05	(19)	25.44	(17)	1.41	(2)	-46.10	(3)
54	33.38	(17)	-20.60	(16)	34.82	(2)	38.00	(3)	-35.47	(7)
55	32.88	(2)	-21.55	(8)	15.04	(4)	-22.94	(3)	-34.96	(7)
56	38.00	(2)	-25.81	(7)	21.21	(6)	-22.54	(3)	-28.95	(19)
57	47.00	(2)	-19.44	(3)	17.06	(15)	17.89	(17)	-26.04	(7)
58	32.76	(3)	-22.59	(7)	-18.41	(3)	23.03	(17)	-9.42	(8)
59	18.10	(15)	-24.02	(3)	-24.07	(7)	14.86	(15)	-24.10	(16)
60	44.00	(17)	6.92	(15)	29.48	(17)	-28.85	(19)	-33.17	(19)

Retention Phase

1	-68.00	(19)	-15.05	(7)	17.50	(2)	-10.98	(8)	-60.00	(19)
2	47.00	(17)	-18.18	(19)	24.79	(13)	30.93	(15)	-14.81	(12)
3	-71.00	(3)	-3.59	(3)	37.44	(2)	16.45	(17)	7.94	(17)
4	-43.00	(3)	20.93	(2)	19.74	(10)	6.17	(6)	-15.04	(7)

Constant Error

The values represent the constant error scores with four trials comprising one block.

			SUBJECT		
BLOCK	1	2	3	4	5
Acquisition Phase					
1	-2.00	14.24	21.38	50.80	22.64
2	55.75	-10.84	11.45	26.62	-3.22
3	66.50	-5.46	-9.61	26.90	-2.05
4	-24.00	-29.64	-20.00	-5.46	3.57
5	19.02	-39.34	-13.92	22.53	1.43
6	2.84	-50.07	-20.96	6.67	9.68
7	-2.64	-64.44	-18.45	19.72	15.48
8	1.67	-41.86	-4.89	26.31	9.13
9	-13.38	-13.90	-11.84	20.21	-21.84
10	1.47	-49.42	-16.85	6.64	1.16
11	0.27	-24.20	-7.25	21.04	9.93
12	24.21	-35.62	-22.21	-18.49	-23.26
13	39.96	-41.32	-32.19	39.39	-13.33
14	36.57	-36.37	-19.50	24.13	-1.52
15	35.47	-23.18	-14.78	1.01	6.73
Retention Phase					
1	-33.75	-20.48	-3.98	24.87	10.64

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	2.00	14.24	21.38	50.80	22.64
2	55.75	10.84	11.45	26.62	3.22
3	66.50	5.46	9.61	26.90	2.05
4	24.00	29.64	20.00	5.46	3.57
5	19.02	39.34	13.92	22.53	1.43
6	2.84	50.07	20.96	6.67	9.68
7	2.64	64.44	18.45	19.72	15.48
8	1.67	41.86	4.89	26.31	9.13
9	13.38	13.90	11.84	20.21	21.84
10	1.47	49.42	16.85	6.64	1.16
11	0.27	24.20	7.25	21.04	9.93
12	24.21	35.62	22.21	18.49	23.26
13	39.96	41.32	32.19	39.39	13.33
14	36.57	36.37	19.50	24.13	1.52
15	35.47	23.18	14.78	1.01	6.73
Retention Phase					
1	33.75	20.48	3.98	24.87	10.64

Variable Error

The values represent the variable error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	53.75	35.01	6.13	19.24	5.85
2	8.90	24.28	19.85	34.97	11.33
3	7.57	6.46	12.18	38.76	10.66
4	47.40	38.76	20.22	28.69	10.28
5	43.19	43.48	31.55	24.26	14.36
6	38.92	23.24	19.68	33.76	9.34
7	39.27	48.19	1.95	44.71	6.66
8	35.90	7.44	26.40	3.83	19.11
9	20.20	80.07	19.05	21.23	15.36
10	27.86	10.35	4.15	41.82	21.28
11	35.50	50.12	33.71	10.08	5.81
12	41.36	34.91	8.15	32.99	6.09
13	3.60	11.71	7.80	10.61	21.23
14	3.72	6.18	5.80	7.20	24.85
15	11.34	8.63	12.64	22.77	20.75
Retention Phase					
1	47.87	24.65	15.37	7.72	15.27

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	53.79	37.80	22.24	54.32	23.39
2	56.46	26.59	22.92	43.95	11.78
3	66.93	8.46	15.51	47.18	10.85
4	53.13	48.80	28.44	29.21	10.88
5	47.19	58.63	34.48	33.11	14.33
6	39.02	55.20	28.75	34.41	13.45
7	39.36	80.47	18.64	48.86	16.85
8	35.94	42.51	26.84	26.59	21.18
9	24.23	81.27	22.43	29.31	26.70
10	27.90	50.49	17.35	42.35	21.31
11	35.50	55.66	34.48	23.33	11.50
12	47.92	49.87	23.66	37.82	24.05
13	40.12	42.95	33.12	40.91	25.07
14	36.75	36.89	20.35	25.18	24.90
15	37.24	24.74	19.45	22.79	21.81
Retention Phase					
1	48.57	32.05	15.87	26.04	18.61

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	53.50	36.99	21.38	50.80	22.64
2	55.75	19.24	21.36	43.38	10.52
3	66.50	6.91	12.40	46.90	10.61
4	53.00	45.95	27.41	25.02	9.79
5	46.02	56.06	33.12	31.65	13.61
6	38.66	50.07	27.47	31.42	12.32
7	38.09	64.44	18.54	47.72	15.48
8	34.26	41.86	26.09	26.31	20.88
9	22.72	73.90	21.61	27.50	21.84
10	27.41	49.42	16.85	41.71	19.32
11	33.98	55.00	31.45	21.04	9.93
12	47.21	46.00	22.21	32.00	23.26
13	39.96	41.32	32.19	39.39	24.10
14	36.57	36.37	19.50	24.13	21.22
15	35.47	23.18	18.24	22.26	21.16
Retention Phase					
1	57.25	24.45	14.44	24.87	16.13

Unskilled KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	10.82 (15)	10.33 (4)	41.20 (2)	16.47 (2)	-43.40 (7)
2	11.04 (18)	-2.92 (19)	-28.70 (19)	18.17 (17)	-12.58 (19)
3	-10.56 (7)	16.28 (17)	39.60 (3)	31.26 (15)	-4.42 (11)
4	-26.40 (3)	20.33 (4)	32.71 (17)	10.25 (6)	5.43 (4)
5	9.19 (2)	18.74 (2)	-20.75 (19)	31.33 (2)	4.68 (2)
6	-16.31 (3)	15.63 (17)	-41.20 (19)	17.61 (2)	7.92 (3)
7	8.43 (1)	-13.23 (19)	-33.57 (3)	-37.60 (3)	13.99 (18)
8	-8.72 (7)	-17.61 (19)	-11.72 (3)	18.96 (6)	-15.33 (9)
9	-5.59 (8)	-32.40 (3)	31.56 (3)	25.64 (2)	-8.95 (19)
10	-10.63 (7)	-28.31 (3)	-6.25 (17)	42.00 (17)	8.33 (13)
11	-17.35 (19)	-16.28 (19)	-20.93 (7)	3.53 (18)	-30.45 (8)
12	-15.39 (16)	-27.96 (3)	-34.60 (19)	17.08 (2)	11.61 (13)
13	-9.00 (11)	-28.55 (3)	-21.10 (19)	13.58 (10)	9.38 (17)
14	25.97 (2)	-28.79 (3)	7.34 (18)	18.32 (13)	9.09 (13)
15	-16.54 (19)	8.09 (15)	14.39 (17)	10.45 (6)	-26.68 (3)
16	-19.42 (13)	-41.50 (19)	-11.13 (14)	29.53 (2)	32.53 (2)
17	7.46 (4)	38.20 (3)	-32.01 (3)	40.42 (2)	-17.62 (3)
18	-20.00 (7)	-26.81 (19)	9.99 (18)	25.67 (2)	13.69 (2)
19	14.82 (13)	50.00 (3)	-15.06 (8)	29.34 (10)	30.74 (15)
20	19.37 (2)	-14.80 (3)	-21.36 (7)	27.91 (15)	-26.13 (19)
21	21.07 (2)	40.80 (3)	15.43 (2)	21.60 (15)	18.56 (17)
22	20.55 (2)	-36.20 (19)	-21.47 (9)	17.79 (10)	22.59 (17)
23	17.18 (17)	32.05 (17)	-23.13 (16)	28.49 (10)	-37.50 (3)
24	12.12 (13)	-17.07 (7)	-7.80 (7)	19.37 (10)	-19.48 (3)
25	8.39 (2)	43.10 (3)	17.54 (1)	34.86 (15)	30.72 (15)
26	8.01 (13)	37.40 (17)	-4.75 (16)	11.33 (4)	-14.74 (19)
27	19.83 (17)	-32.47 (19)	-14.43 (20)	27.54 (15)	-28.56 (19)
28	11.97 (10)	-53.50 (3)	-9.97 (17)	27.93 (13)	7.89 (2)
29	12.81 (6)	8.27 (17)	-19.58 (9)	15.70 (15)	33.07 (17)
30	31.34 (15)	32.39 (17)	-12.13 (16)	22.15 (15)	-41.00 (16)
31	7.06 (13)	-41.10 (7)	-7.80 (11)	33.69 (2)	-32.58 (19)
32	6.70 (1)	-26.50 (19)	4.76 (3)	21.72 (10)	22.88 (17)
33	4.72 (6)	12.44 (13)	3.92 (2)	22.09 (15)	27.22 (2)
34	9.57 (1)	25.78 (17)	-11.41 (16)	29.73 (15)	28.70 (2)
35	14.77 (2)	11.81 (2)	-24.56 (5)	30.69 (15)	13.79 (15)
36	19.72 (4)	-17.53 (12)	-13.96 (16)	38.00 (4)	30.14 (17)
37	19.99 (17)	29.62 (15)	-13.23 (5)	14.32 (6)	-25.53 (3)
38	44.00 (1)	12.05 (13)	-5.01 (12)	18.85 (10)	-18.22 (19)
39	19.65 (13)	-18.76 (3)	-9.62 (14)	35.12 (15)	-13.06 (19)
40	18.59 (10)	-5.94 (5)	-9.69 (9)	30.18 (6)	-13.29 (3)
41	7.54 (10)	-29.93 (3)	-13.87 (9)	29.78 (6)	-2.59 (11)

42	-8.94	(20)	-8.41	(3)	-23.61	(12)	32.92	(2)	8.06	(6)
43	11.69	(10)	32.64	(2)	-17.88	(5)	19.25	(6)	-21.69	(19)
44	5.22	(15)	6.67	(15)	-10.08	(5)	20.13	(13)	-21.87	(8)
45	4.00	(2)	-15.16	(9)	-7.50	(11)	24.22	(13)	4.46	(13)
46	15.98	(2)	-11.81	(5)	-10.24	(9)	35.88	(2)	16.58	(15)
47	-8.23	(19)	-19.50	(9)	-11.23	(12)	21.39	(4)	15.56	(17)
48	15.22	(10)	33.05	(17)	-14.48	(20)	32.30	(6)	11.03	(15)
49	-13.44	(12)	-12.87	(3)	-16.08	(12)	26.32	(10)	4.93	(1)
50	9.04	(3)	-18.93	(19)	-28.97	(14)	12.73	(6)	16.16	(10)
51	13.11	(20)	1.90	(4)	-7.22	(20)	27.86	(10)	23.56	(2)
52	-15.10	(20)	7.48	(15)	-22.94	(14)	19.48	(6)	11.01	(13)
53	-14.73	(12)	-33.20	(3)	-14.00	(11)	26.36	(10)	-29.70	(3)
54	-4.06	(19)	-28.45	(19)	19.39	(20)	30.22	(6)	20.08	(17)
55	-5.26	(5)	-13.20	(16)	-29.46	(12)	17.52	(15)	9.31	(15)
56	-12.26	(14)	-20.96	(19)	-23.73	(5)	13.53	(2)	18.70	(6)
57	-11.55	(5)	-9.33	(3)	-10.25	(5)	21.34	(6)	-10.91	(3)
58	-7.70	(9)	-31.07	(3)	-15.61	(5)	28.54	(6)	-1.60	(3)
59	1.73	(17)	-30.28	(19)	-17.39	(5)	27.65	(4)	3.20	(13)
60	-7.88	(9)	-7.02	(16)	-5.85	(16)	26.74	(18)	9.60	(10)

Retention Phase

1	6.79	(4)	-7.20	(7)	17.40	(2)	24.92	(18)	-13.81	(7)
2	41.00	(1)	-22.07	(3)	-22.41	(16)	37.00	(13)	-19.59	(19)
3	17.62	(18)	13.71	(2)	-14.14	(11)	26.67	(15)	-38.50	(3)
4	8.96	(4)	20.24	(2)	-15.18	(7)	24.69	(10)	5.84	(1)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	-3.78	11.01	21.20	19.04	-13.74
2	-1.86	0.88	-26.81	7.58	2.81
3	-12.24	-26.24	-7.56	22.06	-4.87
4	4.96	-22.69	-2.63	17.97	6.08
5	5.41	11.65	-14.61	30.84	0.17
6	17.73	4.89	-9.24	21.81	-3.96
7	12.05	-1.37	-2.90	25.42	-1.17
8	14.48	-6.74	-8.69	23.32	-4.41
9	12.20	8.13	-11.50	30.13	24.96
10	25.65	4.24	-9.39	24.62	-17.53
11	3.88	0.24	-16.36	25.52	-9.52
12	6.74	-3.36	-10.86	28.45	11.91
13	-1.60	-5.61	-18.80	21.60	13.92
14	-9.08	-23.95	-11.95	21.91	4.60
15	-6.35	-19.43	-12.28	26.07	0.07
Retention Phase					
1	18.59	1.17	-8.58	28.32	-16.52

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	3.78	11.01	21.20	19.04	13.74
2	1.86	0.88	26.81	7.58	2.81
3	12.24	26.24	7.56	22.06	4.87
4	4.96	22.69	2.63	17.97	6.08
5	5.41	11.65	14.61	30.84	0.17
6	17.73	4.89	9.24	21.81	3.96
7	12.05	1.37	2.90	25.42	1.17
8	14.48	6.74	8.69	23.32	4.41
9	12.20	8.13	11.50	30.13	24.96
10	25.65	4.24	9.39	24.62	17.53
11	3.88	0.24	16.36	25.52	9.52
12	6.74	3.36	10.86	28.45	11.91
13	1.60	5.61	18.80	21.60	13.92
14	9.08	23.95	11.95	21.91	4.60
15	6.35	19.43	12.28	26.07	0.07
Retention Phase					
1	18.59	1.17	8.58	28.32	16,52

Variable Error

The values represent the variable error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	15.74	8.79	28.99	7.65	18.27
2	11.00	16.41	11.37	26.62	11.00
3	4.55	6.01	24.71	13.95	16.71
4	18.07	18.53	14.16	7.24	21.17
5	15.27	32.99	15.44	5.67	23.05
6	3.57	32.40	15.44	4.09	25.39
7	4.75	41.32	12.29	8.64	22.55
8	10.03	28.84	8.83	6.51	32.72
9	5.61	15.83	10.18	5.64	6.53
10	10.60	18.29	2.92	8.37	5.06
11	7.75	22.78	5.01	5.94	12.82
12	9.86	21.19	2.50	5.87	4.78
13	12.77	10.70	8.09	6.01	6.84
14	4.52	7.59	18.92	6.68	20.23
15	4.91	11.28	4.55	2.80	7.48
Retention Phase					
1	13.56	16.82	15.34	5.07	15.81

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	16.18	14.09	35.91	20.52	22.86
2	11.15	16.44	29.12	27.68	11.35
3	13.06	26.92	25.84	26.10	17.40
4	18.74	29.29	14.40	19.37	22.03
5	16.20	34.99	21.26	31.35	23.05
6	18.09	32.76	17.99	22.19	25.69
7	12.95	42.35	12.63	26.84	22.58
8	17.61	29.62	12.39	24.21	33.01
9	13.42	17.79	15.36	30.65	25.80
10	27.75	18.77	9.83	26.00	18.24
11	8.67	22.78	17.11	26.20	15.97
12	11.94	21.46	11.15	29.05	12.83
13	12.87	12.08	20.47	22.42	15.51
14	10.14	25.13	22.38	22.90	20.75
15	8.03	22.46	13.09	26.22	7.48
Retention Phase					
1	23.01	16.86	17.57	28.77	22.86

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	14.71	12.47	35.55	19.04	16.46
2	10.66	16.30	26.81	26.38	10.48
3	12.24	26.24	23.34	22.06	14.84
4	17.73	26.73	13.49	17.97	19.42
5	15.41	32.45	19.61	30.84	22.05
6	17.73	31.53	16.96	21.81	24.53
7	12.05	41.62	11.67	25.42	20.48
8	14.48	27.07	11.07	23.32	32.38
9	12.20	16.89	13.46	30.13	24.96
10	25.65	16.59	9.39	24.62	17.53
11	8.35	19.41	16.36	25.52	13.55
12	10.86	19.88	10.86	28.45	11.91
13	12.67	10.30	18.80	21.60	13.92
14	9.08	23.95	21.65	21.91	19.45
15	7.22	19.43	12.28	26.07	6.33
Retention Phase					
1	18.59	15.81	17.28	28.32	19.44

Unskilled No-KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	21.35 (4)	16.28 (4)	14.64 (17)	-16.23 (17)	19.59 (20)
2	9.30 (4)	17.00 (3)	-36.88 (7)	-30.33 (19)	-16.50 (9)
3	16.33 (2)	-36.00 (3)	-28.36 (8)	38.00 (1)	-14.95 (5)
4	6.21 (10)	30.00 (17)	-24.55 (8)	39.20 (17)	-18.39 (20)
5	13.42 (15)	-2.98 (19)	-26.12 (11)	-47.50 (3)	-12.42 (2)
6	37.02 (2)	-17.00 (3)	-29.41 (8)	53.00 (2)	-5.03 (5)
7	21.64 (17)	34.00 (17)	-12.57 (9)	54.00 (17)	-14.46 (14)
8	37.00 (17)	9.50 (17)	-28.37 (11)	61.20 (2)	13.79 (20)
9	13.37 (17)	14.20 (17)	-16.32 (11)	61.50 (17)	16.34 (18)
10	34.16 (17)	10.30 (2)	-41.00 (12)	88.00 (17)	-17.17 (12)
11	28.34 (17)	-26.50 (7)	-18.25 (9)	83.00 (3)	-13.06 (9)
12	21.35 (2)	34.50 (17)	-17.91 (8)	61.60 (2)	-2.79 (5)
13	-30.70 (3)	34.00 (17)	-20.16 (16)	36.20 (17)	-6.58 (20)
14	10.43 (2)	-37.00 (7)	-16.90 (14)	42.00 (17)	2.91 (13)
15	10.01 (10)	16.20 (17)	-30.73 (8)	51.30 (2)	-7.23 (8)
16	-21.44 (3)	-42.50 (7)	-28.79 (7)	-32.20 (3)	-15.20 (14)
17	29.87 (15)	-39.00 (3)	-24.68 (9)	5.62 (2)	5.54 (15)
18	16.26 (15)	7.70 (15)	-30.97 (8)	16.03 (2)	-13.48 (11)
19	41.00 (2)	-31.50 (7)	-40.00 (16)	49.00 (15)	2.78 (4)
20	-20.09 (19)	-25.00 (19)	-40.20 (19)	35.55 (2)	-12.26 (5)
21	-10.17 (3)	-34.50 (19)	-19.52 (16)	34.26 (2)	5.21 (15)
22	-9.22 (11)	-29.70 (3)	-35.20 (11)	-43.00 (3)	-8.62 (14)
23	-9.50 (7)	-34.50 (3)	-41.30 (19)	11.35 (6)	-5.98 (20)
24	-50.00 (7)	-16.50 (19)	-25.55 (11)	43.50 (17)	3.46 (4)
25	-15.47 (3)	-24.00 (16)	-38.03 (16)	54.00 (3)	13.48 (4)
26	1.99 (6)	-47.50 (19)	-26.02 (8)	105.00 (3)	-6.54 (20)
27	-19.53 (19)	28.80 (17)	-31.30 (8)	-2.44 (19)	-18.68 (7)
28	-8.51 (7)	6.00 (13)	-31.98 (7)	26.50 (10)	-3.76 (3)
29	-4.96 (7)	-21.50 (7)	-30.64 (16)	18.94 (2)	-3.69 (12)
30	-35.55 (19)	-33.00 (19)	-52.00 (16)	-15.12 (19)	4.19 (2)
31	31.99 (2)	-6.20 (16)	-35.40 (7)	32.68 (2)	-8.86 (11)
32	15.54 (15)	-20.50 (19)	-45.00 (16)	28.57 (2)	4.27 (4)
33	-16.42 (7)	19.80 (3)	-31.63 (16)	48.00 (1)	-13.63 (19)
34	-34.00 (3)	34.00 (3)	-42.30 (16)	8.22 (15)	-13.81 (8)
35	-16.67 (3)	-30.50 (19)	-50.40 (7)	47.30 (15)	-26.54 (3)
36	15.18 (15)	-19.50 (19)	-22.54 (16)	83.50 (17)	-32.69 (3)
37	-31.39 (19)	-30.40 (7)	-36.65 (7)	9.93 (6)	-9.99 (5)
38	-28.33 (10)	-25.50 (16)	-42.50 (16)	41.50 (15)	-3.28 (11)
39	-35.00 (3)	-20.00 (16)	-46.20 (7)	13.85 (13)	-11.03 (12)
40	18.67 (10)	-38.00 (19)	-38.39 (7)	30.45 (4)	4.68 (2)
41	6.14 (10)	-26.50 (7)	-22.30 (16)	-48.00 (3)	-4.38 (8)

42	-28.04	(7)	22.50	(3)	-37.76	(7)	-21.04	(3)	2.48 (18)
43	6.71	(3)	-21.00	(7)	-31.00	(11)	67.00	(3)	24.68 (4)
44	-29.90	(7)	-18.00	(8)	-41.50	(8)	-36.53	(16)	-4.32 (9)
45	-35.15	(19)	-49.50	(7)	-43.00	(16)	38.00	(13)	13.58 (17)
46	-25.64	(19)	-23.40	(11)	-13.17	(8)	46.50	(2)	-12.68 (16)
47	33.40	(2)	-9.50	(14)	-38.85	(16)	55.40	(3)	-15.54 (19)
48	-27.96	(7)	-36.00	(7)	-23.92	(7)	29.60	(6)	3.61 (4)
49	18.56	(2)	-17.50	(8)	-33.19	(16)	19.11	(13)	5.98 (3)
50	-33.57	(19)	-20.00	(16)	-22.67	(12)	15.27	(18)	-8.06 (19)
51	-9.22	(8)	-30.00	(7)	-44.00	(11)	31.61	(6)	-19.69 (3)
52	-43.00	(19)	-17.40	(14)	-24.63	(16)	38.80	(6)	-9.92 (8)
53	-30.07	(19)	-25.50	(16)	-27.28	(8)	33.50	(2)	-5.71 (14)
54	10.20	(15)	-9.50	(11)	-29.66	(16)	54.00	(13)	14.30 (2)
55	35.79	(2)	47.00	(17)	-25.39	(11)	70.00	(3)	-13.54 (16)
56	-38.00	(17)	-17.50	(7)	-23.21	(11)	16.30	(10)	4.41 (6)
57	8.42	(15)	-20.00	(8)	-16.13	(16)	11.70	(6)	-12.26 (19)
58	-9.71	(5)	-30.00	(7)	-36.81	(16)	12.62	(4)	9.81 (2)
59	-21.36	(3)	-34.50	(7)	-48.00	(16)	8.14	(17)	13.49 (17)
60	20.18	(2)	-13.50	(7)	-29.38	(7)	13.48	(13)	-32.28 (3)

Retention Phase

1	12.88	(6)	33.00	(3)	12.79	(17)	66.30	(2)	-9.60 (19)
2	28.04	(17)	-53.40	(19)	-31.40	(12)	-4.35	(19)	14.80 (1)
3	15.42	(2)	32.60	(17)	-25.97	(11)	22.61	(4)	13.59 (20)
4	25.42	(17)	-36.06	(7)	-19.52	(7)	-12.14	(5)	3.00 (15)

Constant Error

The values represent the constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	13.30	6.82	-18.79	7.66	-7.56
2	27.27	5.88	-24.12	30.18	-4.53
3	24.35	8.13	-23.37	73.53	-4.17
4	-7.93	-7.33	-24.15	24.33	-6.53
5	16.76	-21.95	-33.96	26.55	-4.36
6	-19.72	-28.81	-30.39	11.53	-1.48
7	-10.38	-9.18	-31.83	45.77	-3.88
8	1.76	-20.30	-40.76	16.27	-1.02
9	-12.98	0.95	-36.72	46.76	-21.67
10	-19.01	-28.48	-40.94	23.93	-4.91
11	-11.27	-10.75	-33.14	-9.64	4.62
12	-13.84	-29.60	-29.74	42.38	-2.76
13	-16.81	-21.23	-31.12	26.20	-7.92
14	-5.52	-1.38	-26.39	43.45	-0.14
15	-0.62	-24.50	-32.58	11.49	-5.31
Retention Phase					
1	20.44	-5.97	-16.03	18.11	5.45

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	13.30	6.82	18.79	7.66	7.56
2	27.27	5.88	24.12	30.18	4.53
3	24.35	8.13	23.37	73.53	4.17
4	7.93	7.33	24.15	24.33	6.53
5	16.76	21.95	33.96	26.55	4.36
6	19.72	28.81	30.39	11.53	1.48
7	10.38	9.18	31.83	45.77	3.88
8	1.76	20.30	40.76	16.27	1.02
9	12.98	0.95	36.72	46.76	21.67
10	19.01	28.48	40.94	23.93	4.91
11	11.27	10.75	33.14	9.64	4.62
12	13.84	29.60	29.74	42.38	2.76
13	16.81	21.23	31.12	26.20	7.92
14	5.52	1.38	26.39	43.45	0.14
15	0.62	24.50	32.58	11.49	5.31
Retention Phase					
1	20.44	5.97	16.03	18.11	5.45

Variable Error

The values represent the variable error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	5.92	25.32	19.81	31.34	15.72
2	10.16	18.75	6.77	44.96	11.14
3	7.76	22.00	10.20	12.10	12.95
4	18.44	33.09	5.77	33.08	6.42
5	23.01	17.28	6.53	16.84	8.58
6	17.48	7.37	8.42	33.59	5.92
7	8.16	28.99	4.26	39.60	11.48
8	25.20	9.51	8.30	18.80	5.56
9	17.75	26.72	10.55	26.63	8.24
10	21.88	6.62	3.79	12.74	6.28
11	17.71	19.44	7.30	45.27	11.92
12	27.50	14.83	11.91	9.60	11.93
13	23.85	5.17	8.42	9.46	9.16
14	30.05	28.50	2.38	20.32	10.49
15	16.02	8.24	11.58	2.03	18.42
Retention Phase					
1	6.42	39.25	17.16	30.67	9.83

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	14.56	26.22	27.30	32.26	17.45
2	29.10	19.65	25.05	54.14	12.03
3	25.56	23.45	25.50	74.51	13.60
4	20.07	33.89	24.83	41.06	9.15
5	28.47	28.77	34.58	31.44	9.62
6	26.36	29.73	31.54	35.51	6.11
7	13.20	30.40	32.14	60.52	12.12
8	25.26	22.42	41.60	24.86	5.65
9	21.99	26.73	38.20	53.81	23.18
10	28.99	29.23	41.10	27.11	7.87
11	20.99	22.21	33.93	46.29	12.78
12	30.78	33.11	32.03	43.45	12.24
13	29.18	21.85	32.24	27.85	12.11
14	30.55	28.53	26.49	47.97	10.49
15	16.04	25.85	34.58	11.66	19.17
Retention Phase					
1	21.42	39.70	23.48	35.61	11.23

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	13.30	24.82	26.11	30.94	17.36
2	27.27	15.87	24.12	53.93	11.43
3	24.35	21.38	23.37	73.53	12.34
4	18.15	32.43	24.14	40.43	7.98
5	26.81	25.80	33.96	26.55	8.52
6	19.72	28.80	30.39	33.03	5.82
7	11.38	26.58	31.83	46.99	10.62
8	22.01	20.30	40.76	23.83	5.25
9	20.57	25.95	36.72	46.76	21.67
10	28.35	28.48	40.94	23.93	7.25
11	17.70	22.00	33.14	43.14	8.97
12	30.54	29.60	29.74	42.38	11.35
13	26.09	21.23	31.12	26.20	10.91
14	28.52	24.88	26.39	43.45	9.49
15	14.92	24.50	32.58	11.49	16.96
Retention Phase					
1	20.44	38.77	22.42	26.35	10.25

Control-60 Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	20.08 (13)	19.71 (17)	34.36 (2)	55.00 (1)	39.40 (17)
2	-4.48 (20)	14.14 (15)	41.00 (4)	22.02 (4)	53.80 (3)
3	-55.00 (19)	-22.40 (16)	20.63 (4)	19.20 (18)	40.00 (17)
4	17.18 (6)	-14.15 (19)	19.77 (6)	6.87 (13)	42.60 (17)
5	-47.00 (16)	36.50 (17)	25.72 (2)	16.37 (2)	-44.00 (3)
6	15.38 (10)	-12.30 (19)	25.38 (6)	7.46 (15)	-26.70 (3)
7	16.45 (10)	-28.95 (11)	12.97 (4)	17.75 (10)	35.40 (3)
8	16.53 (2)	-42.00 (19)	16.59 (2)	11.68 (17)	14.23 (15)
9	19.63 (15)	-26.82 (11)	22.61 (18)	7.82 (10)	42.40 (3)
10	11.62 (2)	-33.78 (19)	14.57 (1)	-12.21 (11)	47.50 (17)
11	37.00 (3)	-28.48 (7)	-12.63 (16)	-18.00 (12)	44.40 (3)
12	9.21 (10)	-35.50 (3)	25.75 (17)	10.42 (13)	-40.40 (3)
13	21.90 (2)	-35.50 (19)	31.71 (2)	13.81 (20)	-63.00 (3)
14	8.43 (10)	-31.60 (19)	-19.06 (19)	-4.80 (9)	-46.00 (19)
15	21.46 (17)	-27.40 (19)	-20.48 (3)	-10.32 (12)	-49.80 (3)
16	11.38 (6)	-46.00 (19)	6.97 (20)	-13.51 (9)	29.47 (3)
17	-12.44 (3)	-36.50 (19)	-7.88 (14)	13.00 (6)	37.20 (3)
18	32.78 (2)	-47.50 (7)	-28.04 (16)	-10.69 (5)	41.00 (17)
19	17.06 (17)	-31.23 (7)	-38.55 (7)	-33.50 (5)	38.00 (17)
20	22.85 (17)	-31.57 (7)	-19.44 (19)	-14.31 (12)	-34.48 (19)
21	35.25 (15)	-39.00 (19)	-23.83 (19)	-12.88 (16)	-30.43 (3)
22	26.84 (10)	-48.00 (19)	-34.47 (3)	-16.00 (11)	43.80 (17)
23	-27.21 (19)	-39.00 (19)	-39.00 (19)	7.71 (15)	2.18 (13)
24	15.43 (10)	-21.56 (7)	-37.60 (19)	-36.34 (7)	14.61 (15)
25	-10.19 (3)	-33.27 (19)	-32.71 (19)	-17.75 (11)	-44.50 (19)
26	12.96 (15)	-26.96 (7)	-42.00 (19)	-19.08 (7)	12.49 (2)
27	27.20 (3)	-13.18 (16)	42.00 (17)	-16.64 (8)	-28.07 (3)
28	30.49 (15)	-30.93 (19)	45.50 (17)	-21.68 (16)	16.95 (17)
29	27.02 (2)	11.80 (3)	34.69 (2)	-19.86 (19)	17.81 (2)
30	15.92 (3)	-56.00 (19)	42.30 (17)	-9.91 (14)	14.90 (17)
31	34.39 (15)	-36.50 (19)	60.00 (17)	-20.51 (9)	-27.96 (19)
32	17.79 (17)	-28.02 (19)	58.20 (17)	-32.82 (7)	33.10 (3)
33	38.26 (2)	-25.07 (16)	56.80 (17)	-14.72 (12)	5.59 (15)
34	-20.01 (19)	-31.78 (3)	50.40 (17)	-23.34 (8)	-23.06 (3)
35	36.54 (15)	-13.25 (8)	67.60 (2)	-38.57 (7)	-6.18 (2)
36	16.17 (17)	-26.00 (19)	54.30 (17)	-24.71 (7)	21.08 (15)
37	35.51 (10)	-37.50 (19)	44.30 (2)	-22.14 (16)	28.24 (3)
38	28.98 (2)	-46.50 (19)	47.00 (17)	-13.79 (16)	9.51 (1)
39	16.80 (17)	-16.05 (3)	44.20 (17)	-28.14 (16)	8.58 (13)
40	-17.45 (3)	-20.78 (19)	24.86 (15)	-32.37 (16)	16.03 (15)
41	-16.91 (19)	-33.75 (19)	58.00 (17)	-7.03 (11)	10.99 (2)

42	30.92	(17)	-14.52	(7)	57.60	(17)	-20.04	(16)	15.45	(10)
43	13.59	(2)	-36.00	(19)	-33.42	(3)	-17.58	(8)	-12.87	(3)
44	27.26	(2)	-20.04	(3)	47.20	(17)	-29.67	(3)	24.71	(17)
45	-14.93	(7)	-40.00	(19)	12.18	(10)	-16.98	(8)	8.34	(10)
46	16.95	(17)	-26.58	(19)	43.00	(17)	-28.25	(16)	15.51	(15)
47	28.02	(2)	-34.66	(7)	-69.70	(3)	-45.50	(19)	14.84	(15)
48	24.67	(17)	42.00	(17)	55.00	(2)	-9.67	(16)	15.36	(15)
49	16.73	(2)	-43.00	(19)	48.40	(2)	-34.68	(16)	36.50	(18)
50	16.14	(2)	29.79	(3)	68.00	(17)	-38.27	(7)	-8.86	(3)
51	12.31	(2)	-34.00	(19)	68.00	(17)	-34.15	(19)	20.04	(17)
52	-20.88	(19)	-35.06	(19)	69.80	(2)	-22.25	(8)	14.60	(2)
53	20.91	(17)	29.63	(17)	58.50	(17)	-16.23	(7)	29.23	(2)
54	-30.24	(3)	56.00	(17)	39.20	(3)	-40.83	(7)	15.55	(6)
55	13.02	(17)	-40.00	(19)	45.00	(17)	-12.62	(19)	18.06	(10)
56	-21.94	(19)	-40.00	(3)	85.00	(17)	-33.61	(19)	13.97	(4)
57	24.83	(10)	-32.00	(3)	53.00	(17)	-32.82	(7)	30.71	(2)
58	25.05	(3)	-34.21	(19)	64.00	(17)	-40.57	(16)	24.07	(15)
59	-20.00	(16)	-27.75	(19)	46.50	(2)	-34.87	(19)	24.31	(10)
60	-8.97	(3)	32.65	(3)	43.00	(3)	-35.14	(7)	31.78	(2)

Retention Phase

1	21.30	(17)	-27.08	(7)	38.50	(17)	-26.56	(19)	27.07	(2)
2	13.40	(2)	-49.00	(19)	-52.30	(19)	-68.20	(19)	17.94	(10)
3	15.90	(15)	-17.47	(7)	56.00	(17)	-21.71	(7)	39.20	(2)
4	8.97	(15)	-48.00	(19)	38.60	(17)	-29.52	(7)	28.32	(6)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	-5.56	0.68	28.94	25.77	43.95
2	0.34	-11.69	20.17	13.32	-5.27
3	19.37	-31.15	12.58	-2.99	23.48
4	15.79	-35.13	-0.22	-3.71	-32.33
5	15.06	-36.70	-23.45	-11.38	20.43
6	12.58	-36.89	-33.73	-14.38	7.54
7	15.12	-26.09	3.20	-18.79	-10.78
8	23.78	-27.18	48.80	-20.78	9.46
9	17.74	-24.03	57.28	-25.34	-0.64
10	15.96	-30.21	40.09	-24.11	15.59
11	13.72	-26.08	32.35	-18.58	9.57
12	13.68	-14.81	10.12	-25.10	13.51
13	6.08	-20.57	63.55	-32.34	15.57
14	-4.56	1.41	56.93	-25.82	19.20
15	5.23	-15.33	51.63	-35.85	27.72
Retention Phase					
1	14.90	-35.39	20.20	-36.50	28.13

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	5.56	0.68	28.94	25.77	43.95
2	0.34	11.69	20.17	13.32	5.27
3	19.37	31.15	12.58	2.99	23.48
4	15.79	35.13	0.22	3.71	32.33
5	15.06	36.70	23.45	11.38	20.43
6	12.58	36.89	33.73	14.38	7.54
7	15.12	26.09	3.20	18.79	10.78
8	23.78	27.18	48.80	20.78	9.46
9	17.74	24.03	57.28	25.34	0.64
10	15.96	30.21	40.09	24.11	15.59
11	13.72	26.08	32.35	18.58	9.57
12	13.68	14.81	10.12	25.10	13.51
13	6.08	20.57	63.55	32.34	15.57
14	4.56	1.41	56.93	25.82	19.20
15	5.23	15.33	51.63	35.85	27.72
Retention Phase					
1	14.90	35.39	20.20	36.50	28.13

Variable Error

The values represent the variable error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	30.08	17.95	9.05	17.81	5.81
2	27.34	29.75	5.54	4.06	31.60
3	10.89	3.60	15.11	12.32	36.92
4	5.98	6.90	21.43	10.58	36.24
5	16.84	6.57	11.26	16.53	31.73
6	24.02	9.58	5.94	15.61	26.62
7	16.03	7.78	40.70	1.88	26.20
8	7.43	24.69	10.67	8.12	22.68
9	23.46	6.73	6.38	8.55	16.15
10	20.42	12.33	8.86	6.98	7.85
11	18.82	9.05	38.22	8.05	13.87
12	16.99	33.15	48.66	13.51	3.00
13	15.65	29.28	8.78	6.04	16.25
14	21.90	42.44	17.66	11.75	5.97
15	20.09	27.80	8.00	2.87	3.55
Retention Phase					
1	4.47	13.55	42.56	18.51	7.54

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	30.59	17.96	30.32	31.33	44.33
2	27.34	31.96	20.91	13.92	32.03
3	22.22	31.35	19.66	12.68	43.75
4	16.89	35.80	21.43	11.21	48.56
5	22.60	37.28	26.04	20.06	37.74
6	27.12	38.11	34.25	21.22	27.67
7	22.03	27.22	40.83	18.88	28.33
8	24.91	36.72	49.95	22.31	24.58
9	29.41	24.95	57.63	26.74	16.17
10	25.92	32.63	41.06	25.10	7.45
11	23.29	27.60	50.07	20.25	16.85
12	21.82	36.30	49.70	28.50	13.84
13	16.79	35.78	64.15	32.90	22.50
14	22.37	42.47	59.60	28.37	20.11
15	20.76	31.74	52.24	35.97	27.94
Retention Phase					
1	15.55	37.89	47.02	40.93	29.13

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	24.19	17.60	28.94	25.77	43.95
2	23.84	29.94	20.17	13.32	30.08
3	19.37	31.15	18.89	12.11	43.68
4	15.79	35.13	19.56	10.61	47.07
5	21.28	36.70	23.48	17.88	37.67
6	26.18	36.89	33.73	18.23	22.76
7	20.21	26.09	40.55	18.79	25.50
8	23.78	33.08	48.80	20.78	23.44
9	27.75	24.03	57.28	25.34	13.98
10	24.69	30.21	40.09	24.11	15.59
11	33.17	26.08	49.05	18.58	16.01
12	31.14	35.81	44.97	25.10	13.51
13	16.52	35.46	63.55	32.34	20.00
14	21.53	41.41	56.93	25.82	19.20
15	19.71	31.65	51.63	35.85	27.72
Retention Phase					
1	14.90	35.39	46.35	36.50	28.13

Control-68 Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Initial Eight Throws					
1	-16.03 (20)	-17.46 (9)	24.41 (10)	15.00 (6)	19.69 (6)
2	13.70 (18)	-8.77 (12)	31.33 (15)	17.01 (17)	15.43 (10)
3	50.00 (1)	-5.81 (5)	52.00 (13)	7.87 (17)	16.87 (13)
4	-41.00 (12)	-22.17 (5)	34.80 (4)	19.25 (15)	28.07 (15)
5	-14.81 (5)	-16.70 (12)	-9.39 (16)	5.96 (18)	5.75 (2)
6	-15.00 (19)	12.24 (15)	44.40 (4)	-14.05 (7)	14.32 (15)
7	-18.22 (20)	15.50 (1)	36.20 (3)	-22.06 (3)	18.25 (2)
8	-22.66 (9)	15.33 (1)	33.09 (4)	-17.43 (3)	-24.65 (19)
Acquisition Phase					
1	-14.30 (11)	-4.00 (7)	16.98 (13)	9.85 (13)	16.54 (2)
2	-28.97 (9)	-12.68 (19)	25.98 (1)	13.86 (17)	34.96 (2)
3	-28.90 (17)	5.35 (1)	17.63 (6)	-29.21 (19)	30.11 (2)
4	-43.00 (5)	-32.50 (5)	14.69 (15)	-19.11 (19)	25.25 (15)
5	-9.27 (11)	-2.45 (11)	24.48 (6)	24.43 (3)	25.66 (17)
6	16.25 (1)	8.91 (10)	22.02 (2)	-10.78 (14)	27.93 (17)
7	-25.41 (9)	-10.78 (14)	4.73 (10)	-27.67 (7)	37.50 (3)
8	-15.65 (5)	-11.71 (11)	-4.80 (3)	25.48 (3)	-17.90 (17)
9	-20.55 (20)	5.46 (2)	31.91 (18)	-25.37 (7)	40.40 (3)
10	10.25 (18)	5.79 (17)	8.41 (6)	-25.97 (19)	-20.66 (19)
11	-10.80 (19)	-5.39 (12)	8.68 (15)	-8.36 (3)	-3.14 (18)
12	-28.94 (14)	7.70 (2)	22.12 (6)	13.75 (17)	40.30 (17)
13	11.85 (17)	-32.57 (3)	20.89 (15)	27.69 (2)	27.88 (17)
14	-22.32 (14)	-2.85 (12)	13.18 (10)	-8.80 (8)	-32.50 (3)
15	-32.17 (3)	-9.28 (8)	21.89 (15)	17.97 (3)	22.43 (17)
16	-11.06 (5)	14.34 (2)	13.96 (6)	15.55 (2)	36.00 (3)
17	-11.91 (11)	5.58 (10)	15.50 (6)	-20.90 (19)	-17.42 (3)
18	45.00 (16)	-15.37 (19)	12.05 (4)	-11.92 (19)	11.73 (17)
19	-22.94 (5)	-6.70 (9)	27.66 (13)	16.24 (17)	14.81 (17)
20	-19.85 (9)	-8.64 (14)	10.61 (4)	5.65 (2)	25.24 (15)
21	-8.61 (14)	-14.15 (19)	16.00 (4)	13.16 (2)	32.67 (17)
22	11.15 (20)	-7.95 (19)	20.51 (13)	-1.63 (15)	59.00 (17)
23	-52.00 (12)	-12.71 (16)	21.86 (4)	21.54 (17)	16.10 (10)
24	9.69 (18)	12.25 (17)	29.54 (18)	15.56 (2)	35.20 (17)
25	-6.43 (7)	-13.89 (19)	-13.88 (16)	27.88 (10)	37.50 (3)
26	11.71 (1)	-14.88 (8)	15.15 (2)	11.31 (17)	14.26 (15)
27	-10.61 (5)	-5.98 (14)	30.00 (6)	27.77 (15)	-13.43 (19)
28	-8.15 (5)	-18.44 (7)	-9.08 (5)	32.70 (17)	-13.37 (3)
29	13.88 (18)	8.94 (6)	13.60 (18)	26.30 (6)	-5.17 (16)
30	-34.81 (19)	-11.72 (12)	41.50 (13)	17.89 (2)	15.10 (17)

31	-14.32	(7)	-20.39	(7)	17.26	(13)	18.92	(2)	-28.40 (3)
32	14.12	(20)	9.72	(13)	11.92	(13)	32.57	(2)	2.72 (13)
33	-20.34	(11)	-3.22	(12)	24.97	(1)	36.00	(6)	17.99 (17)
34	4.94	(4)	-17.38	(3)	12.42	(17)	24.96	(2)	24.88 (2)
35	-11.73	(5)	12.38	(15)	15.41	(13)	27.96	(2)	24.86 (3)
36	9.98	(10)	5.33	(1)	12.72	(6)	21.30	(2)	-10.43 (3)
37	7.29	(15)	6.87	(17)	-17.56	(3)	26.02	(17)	27.36 (17)
38	-21.35	(9)	3.45	(18)	18.77	(15)	33.77	(15)	1.80 (13)
39	-8.83	(5)	-5.26	(11)	-4.14	(3)	37.74	(15)	27.08 (17)
40	19.03	(1)	5.27	(13)	12.30	(10)	26.62	(10)	-5.40 (12)
41	21.08	(17)	8.68	(17)	6.52	(13)	25.51	(15)	8.05 (1)
42	12.81	(6)	-6.69	(11)	18.50	(17)	32.56	(13)	27.38 (17)
43	-6.76	(5)	-22.67	(7)	15.72	(13)	32.37	(2)	15.81 (18)
44	-6.12	(5)	-12.55	(3)	9.08	(6)	40.00	(2)	15.04 (17)
45	-17.59	(9)	-13.12	(17)	7.30	(1)	27.46	(15)	18.10 (18)
46	12.62	(15)	-9.89	(16)	14.24	(17)	30.71	(17)	-16.89 (19)
47	-11.13	(12)	14.41	(15)	7.07	(13)	4.45	(6)	15.53 (15)
48	14.00	(13)	-11.12	(16)	20.10	(6)	16.42	(15)	32.27 (17)
49	-8.13	(20)	-7.32	(5)	12.79	(2)	-29.29	(3)	3.07 (6)
50	-12.00	(19)	-11.00	(9)	.15	(17)	10.23	(17)	11.93 (17)
51	16.00	(4)	-17.55	(16)	11.54	(4)	13.77	(15)	9.58 (1)
52	13.60	(2)	4.55	(4)	15.06	(10)	-32.70	(17)	3.78 (1)
53	1.50	(18)	-9.15	(19)	8.17	(4)	26.12	(6)	13.02 (17)
54	-7.30	(3)	7.68	(17)	14.55	(6)	19.77	(2)	15.14 (6)
55	-10.40	(3)	-7.60	(9)	1.99	(13)	20.84	(3)	-21.84 (3)
56	7.40	(2)	11.12	(10)	6.39	(10)	6.87	(10)	18.51 (2)
57	30.30	(2)	-20.15	(3)	-10.76	(20)	10.97	(17)	31.58 (17)
58	-16.20	(8)	-13.83	(16)	8.71	(18)	-12.43	(3)	15.10 (17)
59	6.10	(18)	4.84	(2)	14.89	(13)	6.24	(6)	-16.26 (3)
60	22.00	(15)	-6.57	(11)	12.91	(2)	16.02	(10)	9.91 (6)

Retention Phase

1	13.70	(20)	-18.25	(7)	8.99	(13)	4.30	(1)	13.04 (17)
2	18.39	(13)	-20.14	(16)	23.19	(1)	7.00	(15)	11.83 (2)
3	11.30	(20)	-20.98	(16)	53.00	(1)	16.00	(3)	8.53 (15)
4	17.67	(13)	8.23	(15)	60.00	(4)	8.00	(13)	20.69 (2)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Initial Two Blocks					
1	14.78	20.02	1.67	-13.55	35.64
2	-11.90	3.42	17.67	6.59	26.08
Acquisition Phase					
1	-6.15	26.72	-28.79	-10.96	18.82
2	2.87	18.30	-8.52	-4.01	11.61
3	-11.49	14.23	-12.51	3.39	17.78
4	13.10	13.45	-13.43	-7.59	17.48
5	-2.73	8.59	-24.93	-6.28	16.45
6	12.16	35.74	-9.94	-5.64	21.98
7	24.92	6.24	-3.37	-13.30	5.55
8	23.92	-3.94	-5.28	-3.36	21.07
9	27.56	14.33	-4.29	-0.72	16.38
10	31.04	12.71	-0.97	2.58	2.34
11	32.61	16.57	5.25	-8.31	12.46
12	19.76	12.25	-0.53	-4.93	12.18
13	-9.50	7.09	2.37	-7.83	9.89
14	18.40	6.21	-2.20	0.51	7.78
15	5.20	10.08	10.55	-8.93	6.44
Retention Phase					
1	8.83	13.52	15.27	-12.79	36.30

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Initial Two Blocks					
1	14.78	20.02	1.67	13.55	35.64
2	11.90	3.42	17.67	6.59	26.08
Acquisition Phase					
1	6.15	26.72	28.79	10.96	18.82
2	2.87	18.30	8.52	4.01	11.61
3	11.49	14.23	12.51	3.39	17.78
4	13.10	13.45	13.43	7.59	17.48
5	2.73	8.59	24.93	6.28	16.45
6	12.16	35.74	9.94	5.64	21.98
7	24.92	6.24	3.37	13.30	5.55
8	23.92	3.94	5.28	3.36	21.07
9	27.56	14.33	4.29	0.72	16.38
10	31.04	12.71	0.97	2.58	2.34
11	32.61	16.57	5.25	8.31	12.46
12	19.76	12.25	0.53	4.93	12.18
13	9.50	7.09	2.37	7.83	9.89
14	18.40	6.21	2.20	0.51	7.78
15	5.20	10.08	10.55	8.93	6.44
Retention Phase					
1	8.83	13.52	15.27	12.79	36.30

Variable Error

The values represent the variable error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Initial Two Blocks					
1	4.26	4.90	33.97	6.56	10.16
2	10.69	16.82	3.18	13.51	20.89
Acquisition Phase					
1	18.41	6.80	10.15	13.98	4.28
2	22.89	21.37	15.41	8.28	12.15
3	16.20	26.85	14.62	5.14	9.86
4	33.44	26.97	16.39	16.81	3.94
5	14.53	15.83	12.27	7.57	6.71
6	8.53	15.30	25.50	10.58	4.88
7	8.10	21.29	8.83	4.55	17.90
8	5.95	15.86	20.60	13.06	11.95
9	5.42	14.57	12.27	11.09	5.09
10	4.93	14.73	15.37	4.69	14.21
11	5.13	6.93	12.05	11.35	4.84
12	10.30	17.99	14.03	11.23	5.41
13	21.57	3.77	12.54	8.03	5.76
14	7.08	16.31	7.06	8.99	4.51
15	10.75	17.18	17.72	9.29	10.18
Retention Phase					
1	4.36	4.46	2.90	12.17	20.97

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Initial Two Blocks					
1	15.38	20.61	34.01	15.06	37.06
2	16.00	17.17	17.96	15.03	33.41
Acquisition Phase					
1	19.41	27.57	30.53	17.76	19.30
2	23.06	28.13	17.61	9.20	16.80
3	19.86	30.38	19.24	6.16	20.33
4	18.77	30.14	21.19	8.44	17.92
5	14.79	18.01	27.78	9.83	17.67
6	14.85	38.88	27.37	11.77	22.51
7	26.20	22.18	9.45	14.06	18.74
8	24.65	16.35	21.26	13.49	22.22
9	28.08	20.43	12.99	11.11	17.15
10	31.43	19.46	15.40	5.35	14.40
11	31.01	17.96	13.15	14.07	13.36
12	22.29	21.77	14.04	22.26	13.32
13	39.57	8.03	12.76	11.22	11.44
14	19.71	17.45	7.39	9.00	8.99
15	11.94	19.92	20.63	12.88	12.04
Retention Phase					
1	9.84	14.24	15.54	17.65	41.91

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Initial Two Blocks					
1	14.78	20.02	30.18	13.55	35.64
2	14.88	15.74	17.67	14.94	30.77
Acquisition Phase					
1	18.01	26.72	28.79	13.63	18.82
2	22.09	27.25	16.65	8.46	14.01
3	18.36	26.13	17.64	6.09	17.78
4	17.50	29.70	19.35	14.76	17.48
5	13.68	17.30	24.93	9.07	16.45
6	12.97	35.74	20.36	11.77	21.98
7	24.92	19.64	9.23	13.30	17.03
8	23.92	12.85	19.28	12.69	21.07
9	27.56	19.54	11.75	9.58	16.38
10	31.04	15.41	14.13	5.21	13.19
11	32.61	16.57	11.69	12.65	12.46
12	19.76	20.70	13.84	12.14	12.18
13	21.50	7.09	12.43	10.11	9.89
14	18.40	17.13	6.65	8.89	7.78
15	11.42	18.21	18.65	11.35	11.82
Retention Phase					
1	8.83	13.52	15.27	16.90	36.30

Appendix K

RAW DATA POINTS AND ERROR SCORES FOR EXPERIMENT TWO

Verbal KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	12.15 (4)	-13.48 (19)	-38.33 (7)	-35.00 (14)	12.41 (13)
2	-14.20 (9)	-3.71 (16)	-14.28 (19)	-20.92 (7)	7.94 (10)
3	-24.65 (19)	6.42 (17)	-14.98 (7)	-27.84 (19)	-16.14 (3)
4	17.38 (1)	-24.10 (3)	-44.40 (19)	-20.45 (19)	6.92 (6)
5	-6.14 (5)	7.03 (2)	13.24 (6)	-44.00 (16)	14.43 (13)
6	-13.99 (19)	13.89 (15)	-20.35 (14)	-38.96 (7)	2.89 (1)
7	-3.66 (11)	12.16 (15)	-2.87 (19)	-36.18 (7)	20.02 (10)
8	-16.13 (7)	-22.78 (14)	-12.62 (8)	-38.82 (7)	22.43 (18)
9	-16.73 (12)	-9.81 (19)	-7.12 (8)	-18.00 (19)	46.00 (18)
10	-9.51 (9)	-2.72 (19)	-7.36 (7)	-25.65 (19)	10.17 (18)
11	-11.38 (11)	12.30 (18)	-22.61 (19)	-30.00 (7)	25.04 (6)
12	21.39 (1)	-4.20 (14)	-26.76 (3)	-49.60 (7)	24.29 (15)
13	-17.40 (16)	-3.13 (14)	-5.45 (9)	-48.50 (7)	11.86 (4)
14	-3.81 (9)	-17.28 (5)	-4.89 (19)	-46.60 (19)	14.99 (6)
15	19.31 (1)	42.00 (1)	-14.99 (7)	-21.55 (14)	2.77 (15)
16	-9.07 (9)	5.49 (17)	-16.57 (8)	-28.24 (7)	12.20 (1)
17	-23.37 (5)	6.24 (4)	-13.59 (11)	-10.89 (7)	17.59 (2)
18	33.00 (20)	-17.50 (16)	4.03 (13)	-36.70 (7)	14.50 (17)
19	-19.17 (16)	-14.09 (8)	-4.70 (8)	-23.79 (19)	6.88 (2)
20	-38.50 (7)	-7.40 (7)	10.12 (17)	-10.55 (3)	9.97 (13)
21	-12.63 (14)	-11.29 (11)	-14.95 (9)	-6.47 (5)	-6.15 (19)
22	-14.75 (8)	-17.23 (16)	-6.96 (7)	6.90 (20)	18.04 (15)
23	-19.99 (16)	-16.04 (5)	-9.84 (16)	16.29 (18)	11.59 (6)
24	-44.10 (7)	-14.53 (8)	-6.10 (14)	12.49 (18)	9.41 (10)
25	-23.66 (16)	-8.91 (20)	-18.65 (11)	11.43 (10)	14.51 (4)
26	-17.86 (14)	-7.41 (5)	-12.09 (7)	28.08 (4)	5.23 (6)

27	-34.31	(7)	1.14	(10)	-12.71	(8)	41.00	(1)	23.53	(10)
28	-32.97	(16)	11.94	(20)	-13.92	(14)	-18.89	(7)	18.18	(10)
29	-39.70	(7)	12.16	(1)	-16.48	(16)	-31.92	(3)	7.21	(4)
30	-28.86	(16)	-15.86	(9)	-28.11	(19)	-45.00	(19)	17.75	(10)
31	-25.71	(8)	-10.20	(12)	-19.89	(14)	-47.50	(19)	16.61	(4)
32	-32.73	(3)	-10.62	(12)	-14.74	(9)	46.00	(17)	9.99	(6)
33	-36.80	(16)	-5.74	(11)	4.57	(2)	29.68	(17)	13.21	(6)
34	-26.15	(7)	-23.60	(20)	-10.15	(12)	-13.34	(7)	11.12	(15)
35	-25.28	(7)	-19.62	(14)	-22.15	(11)	22.75	(15)	19.64	(4)
36	-63.20	(19)	-14.62	(14)	-17.87	(8)	24.03	(3)	16.37	(15)
37	-41.21	(7)	5.23	(1)	-13.33	(8)	-69.50	(3)	17.57	(10)
38	-17.91	(8)	-9.14	(14)	-23.83	(12)	18.20	(15)	22.99	(1)
39	-18.10	(19)	-26.92	(14)	13.72	(17)	-20.49	(19)	20.14	(15)
40	-16.01	(7)	-14.28	(9)	-20.24	(11)	17.33	(2)	23.43	(4)
41	-14.00	(7)	-3.49	(16)	-19.30	(7)	37.50	(17)	6.43	(10)
42	-17.14	(3)	-18.91	(5)	-17.20	(3)	-17.94	(3)	17.07	(6)
43	-30.64	(3)	-20.96	(9)	-26.22	(19)	-39.20	(19)	13.49	(10)
44	11.78	(17)	-18.40	(12)	-26.22	(7)	12.73	(15)	15.37	(6)
45	-30.85	(19)	-3.69	(9)	-8.44	(9)	48.00	(3)	18.24	(10)
46	-43.40	(19)	2.24	(4)	-18.18	(16)	-16.14	(3)	20.55	(13)
47	-3.19	(8)	-17.01	(16)	-24.88	(8)	14.47	(17)	20.11	(6)
48	-16.19	(19)	-6.08	(16)	-14.58	(7)	24.04	(17)	20.28	(13)
49	-36.50	(19)	8.34	(1)	-29.09	(11)	28.25	(17)	17.46	(13)
50	-33.86	(19)	-3.04	(9)	-18.86	(16)	29.24	(15)	20.59	(17)
51	-33.84	(19)	-9.98	(11)	-25.67	(11)	-14.56	(3)	15.22	(6)
52	15.44	(18)	-3.11	(14)	-15.58	(7)	-11.50	(3)	41.00	(1)
53	1.97	(1)	-8.71	(5)	-14.26	(8)	31.97	(17)	6.49	(13)
54	-12.47	(7)	-1.22	(3)	-27.29	(16)	13.61	(17)	12.35	(6)
55	-50.20	(3)	-5.76	(14)	-3.01	(8)	6.05	(13)	27.22	(10)
56	-20.20	(5)	-19.22	(9)	-22.54	(11)	8.10	(15)	15.04	(6)
57	-13.41	(7)	2.73	(17)	-17.82	(11)	18.85	(17)	18.52	(10)
58	-15.83	(16)	-8.11	(7)	-11.26	(11)	29.90	(3)	19.88	(15)
59	-20.34	(19)	3.53	(18)	-24.24	(14)	-10.08	(11)	18.99	(15)
60	-23.88	(7)	8.78	(6)	-12.60	(11)	-19.96	(12)	12.84	(17)

Retention Phase

1	-52.50	(19)	-18.89	(16)	-24.97	(19)	-8.42	(14)	21.90	(17)
2	-17.95	(8)	-43.40	(16)	15.98	(17)	5.55	(20)	39.00	(17)
3	-15.29	(12)	-8.64	(5)	-28.65	(14)	-35.50	(20)	-38.40	(3)
4	-12.77	(9)	-1.50	(7)	-12.09	(19)	4.75	(10)	-42.00	(3)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	-2.33	8.72	-28.00	-26.05	2.78
2	-9.98	2.57	-5.65	-39.49	14.94
3	-4.06	1.11	-15.96	-30.81	26.38
4	-2.74	6.77	-10.48	-36.22	10.46
5	-12.01	8.19	-1.04	-20.48	12.24
6	-22.87	14.77	-9.46	7.30	8.22
7	-27.20	0.81	-14.34	15.41	15.36
8	-31.75	6.13	-19.81	-19.61	12.89
9	-37.86	15.90	-11.40	15.78	15.09
10	-23.31	11.28	-10.92	-13.62	21.03
11	-12.50	15.44	-22.24	-1.73	13.09
12	-23.41	6.14	-16.52	17.59	19.80
13	-22.19	1.95	-22.30	7.86	23.57
14	-20.23	8.73	-16.78	14.93	15.28
15	-18.37	1.73	-16.48	4.68	17.56
Retention Phase					
1	-24.63	-18.11	-12.43	-8.41	-4.88

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	2.33	8.72	28.00	26.05	2.78
2	9.98	2.57	5.65	39.49	14.94
3	4.06	1.11	15.96	30.81	26.38
4	2.74	6.77	10.48	36.22	10.46
5	12.01	8.19	1.04	20.48	12.24
6	22.87	14.77	9.46	7.30	8.22
7	27.20	0.81	14.34	15.41	15.36
8	31.75	6.13	19.81	19.61	12.89
9	37.86	15.90	11.40	15.78	15.09
10	23.31	11.28	10.92	13.62	21.03
11	12.50	15.44	22.24	1.73	13.09
12	23.41	6.14	16.52	17.59	19.80
13	22.19	1.95	22.30	7.86	23.57
14	20.23	8.73	16.78	14.93	15.28
15	18.37	1.73	16.48	4.68	17.56
Retention Phase					
1	24.63	18.11	12.43	8.41	4.88

Variable Error

The values represent the variable error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	17.59	11.33	13.54	5.94	11.12
2	5.21	14.85	12.54	2.83	7.54
3	14.93	8.18	8.85	11.67	12.79
4	13.62	21.90	5.34	11.59	4.60
5	26.96	9.09	8.96	10.78	4.11
6	12.55	2.23	3.46	8.62	8.88
7	6.78	8.30	2.57	22.40	6.67
8	5.22	10.79	5.14	38.34	4.42
9	15.32	6.67	10.17	17.01	3.23
10	10.37	11.52	14.72	35.85	2.36
11	15.35	6.97	4.05	29.22	4.05
12	15.13	6.97	5.95	22.99	0.91
13	21.75	6.57	5.35	20.92	10.24
14	19.05	6.62	9.21	10.22	7.56
15	4.04	6.14	5.11	20.38	2.77
Retention Phase					
1	16.20	15.86	17.52	16.60	35.86

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	17.74	14.30	31.10	26.72	11.46
2	11.26	15.08	13.76	39.59	16.74
3	15.47	8.25	18.25	32.95	29.31
4	13.90	22.93	11.76	38.03	11.42
5	29.52	12.23	9.02	23.15	12.91
6	26.08	14.94	10.07	11.30	12.10
7	28.03	8.34	14.57	27.19	16.75
8	32.18	12.41	20.46	43.06	13.63
9	40.84	17.24	15.28	23.20	15.43
10	25.51	16.12	18.33	38.35	21.16
11	19.79	16.94	22.60	29.27	13.70
12	27.87	9.29	17.56	28.95	19.82
13	31.07	6.86	22.93	22.34	25.70
14	27.78	10.95	19.14	18.09	17.04
15	18.80	6.38	17.25	20.91	17.77
Retention Phase					
1	29.48	24.07	21.48	18.60	36.19

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	17.10	11.93	28.00	26.05	10.85
2	9.98	13.97	12.27	39.49	14.94
3	14.75	7.26	15.96	30.81	26.38
4	12.40	16.98	10.48	36.22	10.46
5	28.51	11.31	8.11	20.48	12.24
6	22.87	14.77	9.46	10.54	11.30
7	27.20	7.35	14.34	24.85	15.36
8	31.75	12.21	19.81	42.61	12.89
9	37.86	15.90	13.69	22.45	15.09
10	23.31	13.89	17.78	31.38	21.03
11	18.39	15.44	22.24	26.84	13.09
12	23.41	7.26	16.52	25.66	19.80
13	29.91	6.12	22.30	20.89	23.57
14	21.21	8.73	16.78	14.93	15.28
15	18.37	5.79	16.48	19.70	17.56
Retention Phase					
1	24.63	18.11	20.42	13.56	35.33

Visual KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	52.00 (18)	54.00 (17)	17.14 (15)	-6.53 (20)	16.10 (17)
2	16.17 (4)	23.60 (17)	-7.91 (9)	29.49 (17)	13.54 (2)
3	-15.50 (16)	28.11 (3)	-13.09 (11)	-14.66 (16)	16.32 (17)
4	22.76 (6)	-24.08 (16)	10.04 (18)	-15.27 (7)	26.29 (17)
5	18.31 (4)	-18.64 (16)	-9.68 (9)	-28.98 (7)	77.00 (2)
6	15.41 (6)	-32.52 (3)	6.02 (2)	-21.16 (19)	16.05 (13)
7	-6.93 (9)	-17.81 (9)	2.71 (2)	-16.80 (8)	42.00 (18)
8	14.34 (10)	-22.83 (19)	-6.89 (8)	-28.17 (19)	11.62 (10)
9	-8.90 (7)	-31.63 (7)	-6.04 (9)	9.06 (1)	18.95 (4)
10	32.50 (2)	-28.98 (19)	14.42 (3)	17.49 (15)	19.21 (6)
11	-24.48 (3)	6.63 (2)	-3.95 (11)	17.88 (17)	15.96 (15)
12	17.35 (3)	6.49 (1)	21.00 (15)	11.23 (17)	8.81 (4)
13	5.89 (2)	-33.96 (7)	-3.09 (8)	22.78 (17)	18.43 (15)
14	14.40 (2)	-13.79 (14)	15.61 (6)	-32.94 (7)	31.49 (15)
15	-27.93 (3)	15.63 (13)	19.22 (6)	28.97 (3)	17.53 (15)
16	18.56 (17)	-14.15 (16)	26.07 (17)	-56.00 (3)	11.08 (10)
17	17.70 (17)	-20.08 (19)	-41.00 (20)	17.03 (17)	9.79 (4)
18	15.30 (10)	24.39 (2)	10.19 (15)	-2.76 (8)	18.88 (2)
19	16.81 (3)	-19.66 (8)	-18.37 (19)	18.41 (15)	11.78 (10)
20	8.14 (2)	-24.97 (7)	-21.95 (20)	-13.60 (19)	9.58 (20)
21	-9.11 (14)	-38.00 (5)	7.25 (15)	23.49 (3)	-7.36 (8)
22	4.69 (4)	15.52 (15)	-6.36 (9)	-28.55 (19)	-5.75 (19)
23	11.29 (6)	-10.62 (7)	-6.29 (12)	-10.28 (12)	-16.50 (9)
24	30.46 (17)	25.99 (3)	-13.69 (12)	-22.67 (7)	15.55 (17)
25	9.57 (2)	8.38 (3)	-33.69 (7)	-24.10 (19)	-30.02 (3)
26	15.06 (17)	-32.55 (3)	4.06 (1)	-13.73 (8)	-13.13 (7)
27	17.08 (3)	19.10 (2)	-9.32 (12)	-33.13 (3)	-6.41 (8)
28	25.34 (15)	19.33 (17)	-8.36 (11)	-48.00 (7)	11.00 (18)
29	-60.30 (19)	19.35 (3)	-8.49 (3)	-29.03 (16)	4.62 (18)
30	12.81 (2)	33.04 (2)	-7.89 (19)	-31.63 (19)	-8.01 (7)
31	35.57 (15)	32.12 (10)	-19.03 (7)	-29.58 (19)	-16.13 (8)
32	43.00 (3)	-32.85 (19)	20.50 (18)	-20.38 (16)	-18.85 (8)
33	21.46 (3)	-28.93 (19)	7.58 (18)	-41.20 (7)	-11.68 (7)
34	56.00 (2)	15.71 (2)	-18.30 (20)	-9.25 (7)	-23.13 (7)
35	49.10 (17)	51.00 (2)	-12.73 (12)	-32.58 (16)	-17.97 (3)
36	27.33 (15)	39.10 (17)	-5.07 (14)	-46.50 (19)	-7.00 (14)
37	70.50 (2)	52.60 (17)	-5.03 (14)	-18.43 (7)	-5.53 (16)
38	50.20 (15)	34.23 (17)	-7.74 (5)	-33.55 (2)	-6.50 (5)
39	68.00 (17)	26.84 (17)	-2.29 (7)	-11.44 (8)	7.07 (10)
40	36.76 (15)	36.01 (2)	-10.57 (14)	-15.33 (7)	-19.34 (19)
41	-17.31 (16)	36.50 (13)	10.60 (10)	-19.47 (16)	-13.96 (8)

42	53.00	(15)	17.11	(17)	-6.64	(5)	-31.41	(7)	-13.46	(5)
43	-32.89	(17)	28.02	(15)	-19.56	(3)	-30.27	(16)	16.60	(17)
44	22.44	(13)	51.00	(3)	-4.88	(12)	-38.00	(19)	-2.52	(16)
45	9.82	(10)	27.97	(17)	13.08	(6)	5.47	(3)	-15.28	(19)
46	18.11	(2)	41.30	(17)	7.82	(17)	-25.15	(3)	-23.54	(16)
47	35.60	(2)	-13.07	(3)	-11.25	(12)	-20.40	(19)	-8.70	(16)
48	25.82	(2)	24.21	(2)	5.47	(17)	-29.72	(19)	-17.78	(3)
49	11.62	(17)	25.58	(2)	31.40	(1)	20.72	(17)	1.80	(17)
50	8.95	(2)	34.24	(2)	6.61	(18)	-16.25	(7)	-19.17	(19)
51	17.07	(6)	31.82	(2)	-14.15	(8)	-16.37	(11)	-8.96	(9)
52	21.86	(17)	-24.34	(3)	-11.56	(8)	13.78	(13)	-14.17	(12)
53	44.20	(1)	12.87	(17)	-26.32	(3)	-12.83	(7)	-6.73	(19)
54	40.30	(3)	28.46	(2)	10.33	(1)	-31.66	(7)	-3.33	(8)
55	5.44	(15)	28.73	(13)	-9.60	(12)	-20.63	(7)	-7.52	(3)
56	-27.98	(3)	29.19	(17)	9.83	(15)	19.44	(3)	-10.78	(9)
57	13.12	(15)	4.08	(13)	8.20	(2)	-25.15	(7)	-18.13	(16)
58	38.50	(13)	-21.64	(19)	-17.38	(20)	-32.43	(7)	-22.83	(19)
59	50.00	(3)	10.30	(17)	-26.19	(7)	-38.00	(3)	-10.48	(7)
60	10.19	(15)	-18.99	(19)	2.09	(13)	-34.40	(5)	-25.27	(7)

Retention Phase

1	3.79	(3)	-32.85	(3)	-23.78	(12)	-20.29	(8)	-27.90	(3)
2	18.18	(2)	51.00	(3)	-20.88	(16)	-14.82	(16)	-22.24	(19)
3	8.37	(17)	-30.74	(19)	-28.00	(11)	-27.06	(16)	-28.15	(7)
4	20.85	(17)	35.21	(17)	-33.50	(11)	-40.40	(19)	-7.53	(3)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	18.86	20.41	1.55	-1.74	18.06
2	10.28	-22.95	-1.96	-23.78	36.67
3	4.12	-11.87	6.36	13.92	15.73
4	2.73	-11.57	14.45	-9.30	19.63
5	14.49	-10.08	-17.78	4.77	12.51
6	9.33	-1.78	-4.77	-9.50	-3.52
7	16.76	3.57	-11.83	-29.74	-9.64
8	7.77	12.92	-3.73	-27.66	-9.59
9	38.47	19.22	-7.13	-32.38	-14.95
10	56.37	37.42	-6.41	-19.69	-6.08
11	22.76	33.16	-5.12	-29.79	-3.34
12	22.34	20.10	3.78	-17.54	-16.33
13	14.88	16.83	3.08	0.47	-10.13
14	15.49	24.81	-3.94	-11.42	-7.09
15	27.95	-6.56	-8.32	-32.50	-19.18
Retention Phase					
1	12.80	5.66	-26.54	-25.64	-21.46

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

			SUBJECT		
BLOCK	1	2	3	4	5
Acquisition Phase					
1	18.86	20.41	1.55	1.74	18.06
2	10.28	22.95	1.96	23.78	36.67
3	4.12	11.87	6.36	13.92	15.73
4	2.73	11.57	14.45	9.30	19.63
5	14.49	10.08	17.78	4.77	12.51
6	9.33	1.78	4.77	9.50	3.52
7	16.76	3.57	11.83	29.74	9.64
8	7.77	12.92	3.73	27.66	9.59
9	38.47	19.22	7.13	32.38	14.95
10	56.37	37.42	6.41	19.69	6.08
11	22.76	33.16	5.12	29.79	3.34
12	22.34	20.10	3.78	17.54	16.33
13	14.88	16.83	3.08	0.47	10.13
14	15.49	24.81	3.94	11.42	7.09
15	27.95	6.56	8.32	32.50	19.18
Retention Phase					
1	12.80	5.66	26.54	25.64	21.46

Variable Error

The values represent the variable error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	23.99	28.18	12.44	18.36	4.87
2	10.04	5.84	6.51	5.05	26.02
3	22.18	18.46	11.61	3.85	4.20
4	18.28	17.70	10.80	36.17	7.41
5	3.76	20.01	18.30	13.51	3.78
6	14.25	24.80	7.56	20.16	11.75
7	5.66	21.32	13.68	12.58	14.70
8	40.84	26.97	14.67	4.31	9.12
9	14.44	30.56	9.71	14.25	6.12
10	13.76	9.41	3.08	8.38	9.34
11	25.61	12.38	10.70	6.65	12.38
12	9.52	20.18	9.10	13.64	5.32
13	4.98	23.98	18.20	16.96	7.77
14	29.28	6.90	15.22	19.03	2.65
15	16.83	13.96	13.99	4.69	5.64
Retention Phase					
1	6.97	37.87	4.75	9.56	8.38

Total Error

The values represent the total error scores with four trials comprising one block.

	SUBJECT				
BLOCK	1	2	3	4	5
Acquisition Phase					
1	30.51	34.79	12.53	18.44	18.71
2	14.37	23.68	6.80	24.31	44.96
3	22.56	21.95	13.24	14.44	16.28
4	18.48	21.14	18.04	37.35	20.98
5	14.97	22.41	25.52	14.33	13.06
6	17.03	24.86	8.94	22.28	12.26
7	17.69	21.61	18.09	32.29	17.58
8	41.58	29.90	15.14	27.99	13.24
9	41.09	36.10	12.04	35.38	16.15
10	58.02	38.59	7.11	21.40	11.14
11	34.26	35.39	11.86	30.52	12.83
12	24.28	28.48	9.86	22.15	17.17
13	15.69	29.29	18.46	16.96	12.76
14	33.13	25.75	15.72	22.19	7.57
15	32.63	15.42	16.28	32.83	19.99
Retention Phase					
1	14.57	38.29	26.96	27.37	23.03

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	26.61	32.45	12.05	16.49	18.06
2	13.75	22.95	6.33	23.78	36.67
3	20.81	18.43	11.35	13.92	15.73
4	16.70	19.38	16.00	35.17	19.63
5	14.49	22.28	22.88	12.95	12.51
6	13.89	22.53	8.40	21.25	11.29
7	16.76	19.84	13.86	29.74	15.14
8	37.92	29.34	13.98	27.66	11.90
9	38.47	33.69	10.92	32.38	14.95
10	56.37	37.42	6.41	19.69	9.61
11	31.41	33.16	10.42	29.79	11.64
12	22.34	26.64	9.41	20.19	16.33
13	14.88	29.00	15.93	16.78	11.03
14	29.48	24.81	14.02	21.14	7.09
15	27.95	13.75	13.47	32.50	19.18
Retention Phase					
1	12.80	37.45	26.54	25.64	21.46

Verbal and Visual KR Group

The values represent the distance from the bull's-eye in centimeters. The number in the parentheses is the section number that the dart landed in. The negative sign (-) indicates that the dart landed to the left of the midline of the board.

	SUBJECT				
TRIAL	1	2	3	4	5
Acquisition Phase					
1	-17.56 (7)	14.25 (1)	23.26 (13)	10.07 (17)	-22.63 (19)
2	-10.98 (3)	17.46 (3)	22.07 (18)	-27.17 (8)	-15.72 (3)
3	-17.34 (7)	8.96 (6)	-20.97 (20)	-7.67 (19)	-14.80 (19)
4	-12.08 (7)	6.77 (15)	13.32 (20)	-8.59 (7)	-20.99 (19)
5	-14.27 (7)	12.65 (3)	-4.05 (12)	-36.00 (8)	-50.50 (20)
6	-19.65 (9)	9.26 (13)	-11.33 (8)	-19.19 (8)	-34.43 (19)
7	8.15 (10)	25.60 (3)	-13.44 (16)	-14.11 (8)	15.73 (3)
8	-10.80 (5)	28.45 (2)	-15.19 (8)	8.62 (2)	-23.74 (3)
9	-10.81 (14)	6.45 (10)	-30.37 (7)	-14.07 (16)	-45.40 (19)
10	-17.53 (3)	-5.99 (3)	-35.99 (7)	-51.00 (7)	-46.00 (3)
11	8.66 (15)	25.11 (17)	-10.88 (19)	-22.40 (19)	-64.00 (19)
12	5.66 (1)	4.78 (10)	14.59 (17)	-19.05 (7)	55.60 (17)
13	-7.96 (9)	7.89 (15)	-32.43 (3)	-9.74 (16)	-70.50 (3)
14	-10.90 (8)	-20.09 (19)	-16.87 (3)	-7.32 (19)	8.79 (17)
15	18.78 (18)	-32.83 (19)	-21.35 (7)	-6.66 (19)	-14.25 (8)
16	-3.87 (9)	-15.00 (16)	-28.56 (7)	-18.89 (19)	-18.82 (7)
17	-9.95 (9)	1.81 (4)	30.34 (17)	-18.54 (19)	2.18 (4)
18	-18.34 (9)	14.72 (10)	-37.71 (19)	-22.65 (3)	17.20 (17)
19	14.12 (4)	-7.56 (16)	26.58 (17)	-14.65 (3)	10.68 (17)
20	-16.78 (8)	11.85 (2)	14.07 (2)	-13.49 (19)	12.62 (4)
21	14.67 (15)	-13.83 (7)	-11.66 (17)	-14.68 (8)	-16.94 (16)
22	12.79 (1)	-13.54 (16)	-29.24 (7)	37.00 (3)	-25.11 (19)
23	17.77 (2)	-33.22 (7)	-30.26 (3)	-32.82 (3)	20.57 (17)
24	-11.29 (20)	-14.83 (19)	-25.44 (19)	16.07 (15)	-9.97 (8)
25	-3.30 (3)	-14.59 (16)	19.83 (3)	-14.79 (11)	-22.88 (19)
26	10.56 (10)	-21.40 (19)	-28.69 (7)	-39.26 (7)	-34.80 (19)
27	10.57 (15)	-17.00 (16)	-33.79 (19)	23.38 (17)	30.68 (17)
28	20.69 (17)	-2.36 (5)	-34.68 (19)	-13.97 (3)	29.35 (3)
29	25.84 (4)	-27.28 (19)	36.45 (15)	-4.62 (19)	-31.33 (19)
30	15.14 (10)	-11.96 (19)	18.52 (15)	-8.88 (11)	-9.03 (19)
31	13.55 (2)	39.00 (3)	-45.00 (19)	-14.15 (19)	-19.12 (19)
32	23.97 (18)	-11.33 (8)	19.77 (17)	10.65 (17)	49.40 (3)
33	-8.68 (20)	-4.43 (16)	12.56 (6)	-13.69 (3)	27.74 (17)
34	22.33 (2)	4.14 (15)	19.92 (2)	-14.25 (7)	-39.00 (19)
35	14.63 (2)	-11.51 (3)	29.20 (2)	-24.62 (3)	-38.00 (3)
36	6.93 (13)	9.37 (13)	-16.41 (8)	-26.65 (3)	-18.34 (17)
37	6.85 (1)	-16.30 (3)	28.87 (6)	19.79 (3)	37.40 (17)
38	13.24 (10)	-16.67 (3)	.88 (17)	-19.63 (7)	44.00 (2)
39	26.87 (17)	16.96 (17)	7.61 (13)	7.41 (17)	44.50 (17)
40	16.72 (18)	-33.17 (7)	16.72 (17)	15.69 (3)	62.00 (17)
41	23.84 (10)	25.05 (15)	14.36 (18)	-18.74 (19)	34.03 (17)

41	23.84	(10)	25.05	(15)	14.36	(18)	-18.74	(19)	34.03 (17)
42	19.95	(10)	30.41	(2)	-8.13	(14)	-10.18	(8)	-23.47 (3)
43	9.38	(2)	25.71	(2)	18.74	(17)	40.00	(17)	32.77 (17)
44	22.01	(15)	28.54	(17)	.79	(10)	11.49	(17)	53.20 (17)
45	17.42	(10)	20.90	(17)	9.67	(4)	14.18	(17)	51.00 (17)
46	14.03	(2)	26.56	(2)	18.88	(18)	14.05	(2)	39.50 (17)
47	36.07	(15)	25.77	(2)	18.23	(2)	17.43	(17)	8.87 (2)
48	15.13	(13)	26.31	(17)	18.50	(2)	-11.46	(7)	-27.67 (7)
49	10.69	(2)	25.31	(2)	21.29	(6)	-10.44	(7)	-33.46 (3)
50	11.70	(15)	46.00	(17)	-5.54	(14)	30.00	(17)	-32.87 (3)
51	15.22	(2)	33.60	(13)	11.65	(10)	6.10	(15)	28.15 (17)
52	18.03	(10)	16.28	(15)	-3.21	(8)	8.12	(2)	-21.02 (7)
53	25.33	(15)	17.57	(3)	4.01	(6)	-15.82	(3)	18.61 (17)
54	30.61	(10)	24.28	(2)	26.47	(18)	26.65	(3)	19.91 (3)
55	24.80	(13)	19.70	(10)	11.13	(3)	11.82	(15)	29.23 (2)
56	32.86	(2)	13.92	(10)	24.66	(17)	15.52	(17)	17.09 (18)
57	12.64	(10)	24.46	(15)	15.61	(2)	-19.29	(19)	12.47 (1)
58	22.97	(10)	8.62	(15)	32.13	(4)	12.56	(10)	10.79 (2)
59	12.65	(6)	12.48	(10)	9.89	(8)	-8.59	(9)	51.00 (18)
60	16.87	(2)	11.31	(15)	13.60	(1)	1.76	(15)	33.03 (10)

Retention Phase

1	4.18	(6)	7.93	(10)	10.97	(2)	16.15	(2)	23.90 (17)
2	-29.57	(3)	23.39	(15)	19.80	(17)	4.52	(3)	-31.43 (3)
3	-34.20	(19)	34.93	(15)	13.24	(6)	-35.99	(7)	-29.27 (3)
4	8.24	(3)	34.35	(15)	11.64	(1)	11.07	(3)	-42.50 (19)

Constant Error

The values represent the constant error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	-14.49	11.86	9.42	-8.34	-18.54
2	-9.14	18.99	-11.00	-15.71	-23.24
3	-3.51	7.59	-15.66	-26.63	-24.95
4	-0.99	15.01	-24.80	-10.65	-23.70
5	-7.74	5.21	8.32	-17.33	10.67
6	8.49	18.86	-24.15	1.39	-7.86
7	9.63	13.84	-19.33	-11.16	0.59
8	19.63	2.89	7.43	-4.25	-2.52
9	8.80	0.61	11.32	-19.80	-16.90
10	15.92	12.30	13.52	5.82	46.98
11	18.80	27.43	6.44	5.64	24.13
12	20.66	24.89	16.32	8.55	17.93
13	13.91	30.30	6.05	8.45	-14.80
14	28.40	18.87	16.57	9.54	21.21
15	16.28	14.22	17.81	-3.39	26.82
Retention Phase					
1	-12.84	25.15	13.91	-1.06	-19.55

Absolute Constant Error

The values represent the absolute constant error scores with four trials comprising one block.

			SUBJECT		
BLOCK	1	2	3	4	5
Acquisition Phase					
1	14.49	11.86	9.42	8.34	18.54
2	9.14	18.99	11.00	15.71	23.24
3	3.51	7.59	15.66	26.63	24.95
4	0.99	15.01	24.80	10.65	23.70
5	7.74	5.21	8.32	17.33	10.67
6	8.49	18.86	24.15	1.39	7.86
7	9.63	13.84	19.33	11.16	0.59
8	19.63	2.89	7.43	4.25	2.52
9	8.80	0.61	11.32	19.80	16.90
10	15.92	12.30	13.52	5.82	46.98
11	18.80	27.43	6.44	5.64	24.13
12	20.66	24.89	16.32	8.55	17.93
13	13.91	30.30	6.05	8.45	14.80
14	28.40	18.87	16.57	9.54	21.21
15	16.28	14.22	17.81	3.39	26.82
Retention Phase					
1	12.84	25.15	13.91	1.06	19.55

Variable Error

The values represent the variable error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	2.99	4.22	17.96	13.17	3.34
2	10.47	8.19	4.24	15.95	24.43
3	10.98	11.19	19.80	14.38	47.10
4	11.68	14.73	6.07	4.89	28.98
5	13.01	8.79	27.25	3.59	5.44
6	11.55	8.31	7.43	26.98	17.27
7	8.53	7.06	22.73	22.38	29.73
8	5.35	25.02	31.09	9.24	31.00
9	11.47	7.99	17.06	5.88	27.06
10	7.25	18.21	10.49	15.35	9.12
11	5.61	2.16	10.70	22.69	28.65
12	8.98	2.32	3.85	11.63	30.50
13	2.91	10.94	11.00	14.38	25.29
14	3.43	3.75	9.36	15.63	4.74
15	4.23	6.08	8.52	11.84	16.48
Retention Phase					
1	19.17	10.95	3.50	20.58	25.79

Total Error

The values represent the total error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	14.80	12.59	20.28	15.59	18.83
2	13.90	20.68	11.79	22.01	33.71
3	11.52	13.52	25.24	30.26	53.30
4	11.72	21.03	25.53	11.72	37.43
5	15.13	10.22	28.49	17.70	11.98
6	14.33	20.60	25.27	27.02	18.97
7	12.87	15.54	29.84	25.01	29.74
8	20.34	25.18	31.97	10.17	31.10
9	14.46	8.02	20.47	20.66	31.90
10	17.49	21.97	17.11	16.42	47.85
11	19.61	27.51	12.49	23.38	37.46
12	22.53	24.99	16.77	14.44	35.37
13	14.21	32.21	12.55	16.67	29.30
14	28.61	19.24	19.03	18.31	21.73
15	16.82	15.46	19.74	12.32	31.48
Retention Phase					
1	23.07	27.43	14.34	20.61	32.60

Absolute Error

The values represent the absolute error scores with four trials comprising one block.

		SUBJECT			
BLOCK	1	2	3	4	5
Acquisition Phase					
1	14.49	11.86	19.91	13.38	18.54
2	13.22	18.99	11.00	19.48	31.10
3	10.67	10.58	22.96	26.63	52.75
4	10.38	18.95	24.80	10.65	28.09
5	14.80	8.99	27.18	17.33	10.67
6	14.13	18.86	24.15	25.14	18.15
7	11.28	13.84	29.25	22.85	29.43
8	19.63	22.39	29.94	9.58	27.22
9	13.14	7.36	19.52	19.80	30.77
10	15.92	20.78	13.52	15.63	46.98
11	18.80	27.43	10.51	20.10	35.87
12	20.66	24.89	16.32	14.28	31.76
13	13.91	30.30	10.42	13.67	28.88
14	28.40	18.87	16.57	17.45	21.21
15	16.28	14.22	17.81	10.55	26.82
Retention Phase					
1	19.05	25.15	13.91	16.93	31.90

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