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Dix, Caryl Louise

TIME-SERIES ANALYSIS OF INTRAINDIVIDUAL PERFORMANCES OF A COMPLEX SERIAL GROSS MOTOR TASK

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TIME-SERIES ANALYSIS OF INTRAINDIVIDUAL PERFORMANCES OF A COMPLEX SERIAL GROSS MOTOR TASK

by

Caryl L. Dix

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Four case studies of time-series motor performances were designed to examine relationships among serial recall, visual and kinesthetic perceptual attributes, and spatial complexity. The task included four nine-element serial sequences and two tossing sequences. Subjects performed a series of movement patterns that included walking, simple hand motions, ducking under or stepping over obstacles, stacking blocks of differing colors, and walking in geometrically shaped floor patterns. Selected perceptual demand characteristics were structured into the four serial sequences, i. e., high-visual (HV) versus low-visual (LV) attributes and a four- versus nine-destination spatial environment. Subjects first completed two perceptual tests, The Rod-and-Frame Test and the Space relations subtest of the Differential Aptitude Test. Fifteen trials were conducted over three weeks. Performances were timed and coded by trained observers. Timed data included total time for each trial and partial times for each element within the trial. Two interventions changed element order within sequences and sequence order within task.

Data were analyzed as individual case studies by the inspection of the time-series profiles for each task element. Findings indicated differing subject strategies and patterns for organizing for performance and prioritizing task performance outcomes. Performance varied in relationship to perceptual demand characteristics. HV sequences had much faster cue times overall, but showed fewer instances of performance memory. LV sequences showed slower cue times and more errors in the early trials but were performed more frequently from memory than the HV sequences.

Evidence of serial recall patterns, the recency and primacy effects, were seen in the data from the multi-element subsequences. No evidence was found to support a recency/primacy effect in the task as a single series. Tentative support was found for the role of vision as the primary modality in early performance and the primary role of kinesthetic abilities in later trial performance.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina at Greensboro.

Dissertation Adviser Pearl Berlin

Committee Members Jerry D. Wilkerson

[illegible]

[illegible]

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CHAPTER I

INTRODUCTION

Since the classic studies of Ebbinghaus at the turn of the century, research concerning verbal memory has been concerned with the pattern of recall exhibited in serial learning tasks (Young, 1968). Consistently, studies of free recall of verbal lists have found a pattern of recall which has come to be known as the serial position curve. This curve demonstrated that the first items, i.e. primacy effect, and the last items, i.e. recency effect, in a list of similar items are recalled more easily than those items in the middle positions of the list. Studies examining this phenomenon in motor memory tasks have reported mixed findings. Magill (1976) found no serial position curve in a three-position motor task. In a second study in 1977, Magill and Dowell found a primacy and recency effect in the same positioning task when the number of items to be recalled was increased. Cratty (1963) found a primacy effect in a gross motor maze task after the initial trials.

The relationship between individual attributes and the demands of a motor task has been studied by Fleishman and others using stationary positioning tasks (Fleishman, 1954,1958,1972,1975; Fleishman & Rich, 1963; Fleishman &

Hempel, 1954). Beitel (1980) and Stallings (1968) examined the relationship between task demands and perceptual abilities using gross motor tasks. The findings concerning the dominance of the visual abilities in early performance and the kinesthetic abilities in later performance have been widely generalized to apply to all forms of motor performance.

The information-processing model describes the individual's memory capacity as approximately seven items (Miller, 1956). The utilization of large amounts of information is facilitated by their combination or "chunking" into larger meaningful units (Marteniuk, 1976). In this way, the number of chunks rather than the number of items is related to the capacity of the memory system.

If one accepts that the serial position curve is an individual memory phenomenon, then it would be expected to apply to serial gross motor information as well as verbal information. If visual and kinesthetic abilities are related to task performance at different stages of practice, it would be expected that task segments with strong visual demands would be performed more easily at first than task segments with low visual and strong spatial/ kinesthetic demands regardless of their position within the total task sequence. If a series of motor elements is sufficiently long, it would be expected that the individual could retain and perform a number of information items related to the capacity of the motor memory.

This study examined the interrelationships of these theoretical positions by the construction of a performance task that is serial and structured to measure the alternative hypotheses of series position versus demand characteristics while examining the individual's chunking of information.

Statement of the Problem

The purpose of this study was to describe intra-individual performances of a complex gross serial motor task having elements with varying demand characteristics.

More specifically, the following questions and subquestions were studied:

1. What is the relationship between performance of a subsequence and the position of that subsequence within the total task?
   a. What is the initial profile of early, middle, and late sequences?
   b. What is the profile of early, middle, and late sequences after reordering?
   c. What are the similarities among the profiles in relation to their position?
   d. What are the differences among the profiles in relation to their position?

2. What is the relationship between performance of a subsequence and the demand characteristics of the subsequence?
    a. What is the initial profile of the high-visual and low-visual sequences.
    b. What is the profile of the high-visual and low-visual sequences after reordering?
    c. What are the similarities of the profiles in relation to their demand characteristics?
    d. What are the differences of the profiles in relation to their demand characteristics?
3. What is the pattern of recall of performance information within each subsequence?
    a. At what points in the subsequences are these changes in performance?
    b. Does the pattern of recall change over time?
    c. Does the pattern change after reordering?
4. What is the profile of the self-pacing intervals over time?
    a. What is the relationship between self-pacing and the position of the subsequence in the total sequence?

b. What is the relationship between self-pacing and the demand characteristics of the subsequences?

Definition of Terms

The following terms are defined with the meanings associated with their use in the current investigation.

Demand characteristics. The set of perceptual, motor, and cognitive abilities required for successful completion of a specified task.

Field dependence/independence. The average displacement error calculated from 21 trials of the Rod-and-Frame Test.

Four-destination environment. An environment in which the four destination points are located symmetrically as the four corners of a square (see Figure 1).

Gross motor task. A serial motor sequence requiring large muscle action to move the body through a stationary environment (see Figure 1). The task consists of six subsequences with differing spatial relationships. Each subsequence contains a series of motor performance elements. Each element is separately cued.

High-visual/manipulative subsequence (HV). The subject is required to move through an environment in which the destinations and the obstacles are clearly visible. The cues are visual cues. Several of the elements within the subsequence require the handling of objects of differing size and color.

<u>Long-distance tossing subsequence</u>. A subsequence requiring the subject to complete a series of 20 tosses for accuracy from a stationary position to a stationary target. The targets are located from 12 to 18 feet from the subject's position.

<u>Low visual/spatial kinesthetic subsequence</u> (<u>LV</u>). The subject is required to move through an environment in which the destinations and the obstacles are not clearly visible. The performance cues are nonvisual.

<u>Nine-destination environment</u>. An environment in which the nine destination points are scattered throughout the environment in no clearly apprehended geometric arrangement (see Figure 1).

<u>Self-pacing interval</u>. The time between completion of one subsequence and the individual's initiation of the following subsequence.

<u>Serial learning task</u>. A set of movements which are to be performed in a specified sequence.

<u>Short-distance tossing subsequence</u>. A subsequence requiring the subject to complete a series of 20 tosses for accuracy from a stationary position to a stationary target. The targets are located from 4 to 10 feet from the subject's position (see Figure 1).

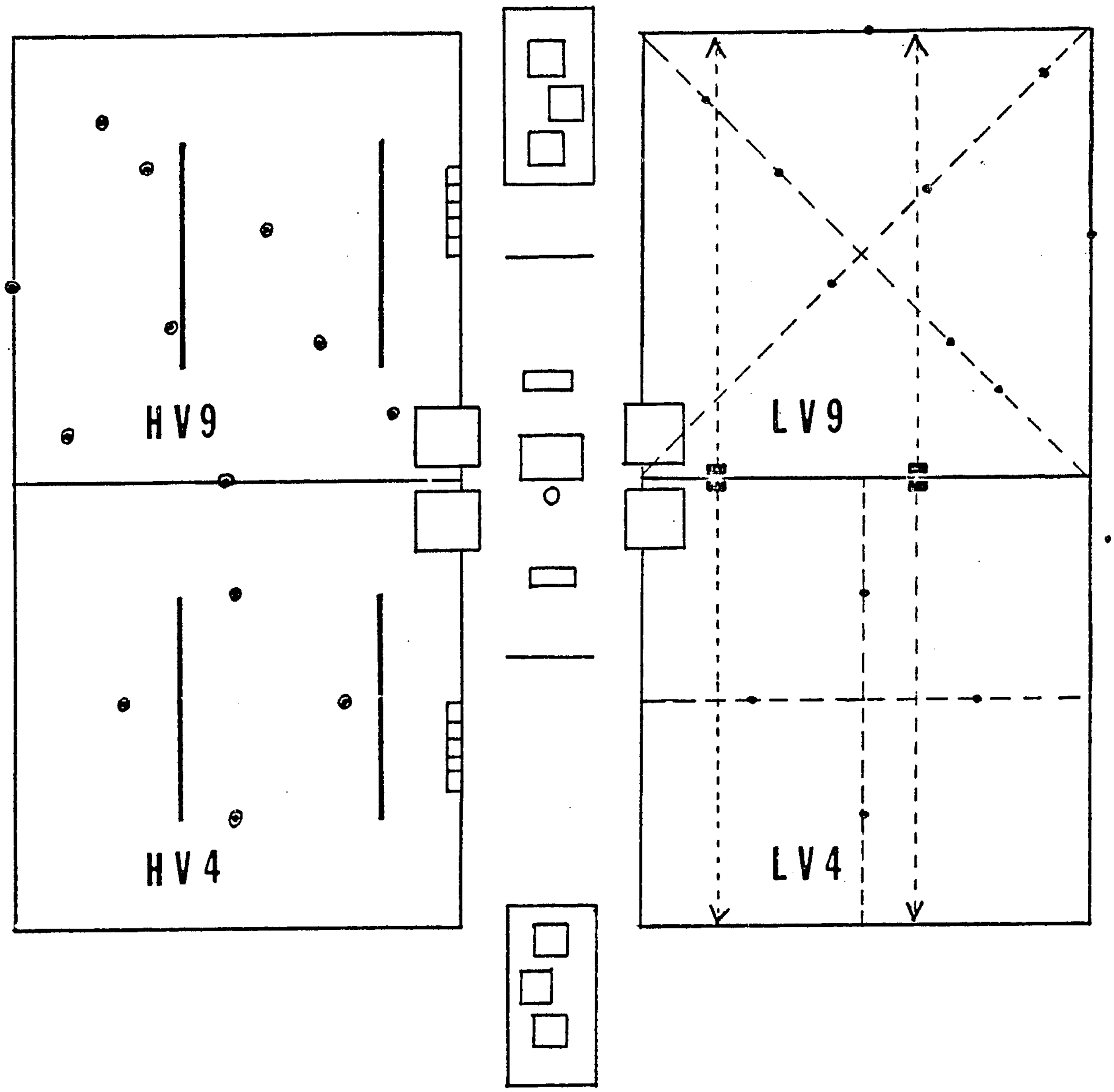

Figure 1. Diagram of gross motor task (See Appendix A for measurements and detailed description).

Spatial perception. The score for the subject obtained from the Spatial Relations subtest of the Differential Aptitude Test (Form T).

Time series. A profile of subject performance across trials.

Assumptions Underlying the Research

The following were accepted as fundamental to the study and were not tested.

1. Time to the nearest 1/10 of a second is a valid measure of the performance of a gross motor task.
2. The number of elements between promptings is a valid and reliable measure of the length of a recalled motor sequence.
3. The Rod-and-Frame Test is a valid and reliable measure of field independence/dependence.
4. Females between the ages of 18 and 21 can understand sequential verbal and nonverbal instructions.
5. The Spatial Relations subtest of the Differential Aptitude Test is a valid and reliable measure of spatial reasoning aptitude.

Scope of the Study

The following were the boundaries of the study:

1. Subjects for the study were four right-handed females (ages 18-21).
2. The subjects were paid for their participation upon completion of the study.
3. Data were collected May 4 through May 22, 1981.
4. The variables examined in the study were
   a. Three task demand characteristics -- low visual/spatial, high visual/manipulative, and stationary.
   b. Three serial positions -- early, middle, and late.
   c. Two interventions -- change of sequence order and change of element order within subsequences.
5. There was no attempt to control for prior motor experience. The nature of the task (novelty and complexity) was such that the type and/or extent of control could not be anticipated.
6. There was no control for visual acuity other than requiring the subjects to wear their usual corrective lenses, if applicable.

Significance of the Study

Superficial empirical observation of the activities subsumed under the rubrics of sport and physical education provides sufficient evidence to support the contention that gross motor activities constitute a large portion of the movement content within these fields. Many of these gross motor activities consist of serial movement patterns which the performer has learned to perform in an appropriate sequential order. Yet, despite the existence of such gross serial movement patterns, an extensive survey of research concerning motor performance yields few studies which investigate the memory for performance of gross serial movement patterns.

This study is a description of four individuals' acquisition performance of a complex serial task. It describes the initial attempt and each subsequent trial over a three-week period as each individual tries to integrate the many pieces of a novel task into a performable series. For the most part, research in skill acquisition reports comparisons involving groups of individuals and groups of trials using either correlational or experimental designs. Although educators recognize and address the existence of great individual variability in motor performance, there is no research evidence available to describe the individual experience of acquiring a complex skill. By trial-and-error methods, practitioners develop functional knowledge of the complex acquisition process. Systematic research efforts need to investigate the individual acquisition profile and offer theoretical explanations to support or refute the body of functional, trial-and-error knowledge developed in the field.

The capacity for memory of gross motor information is relatively unknown. This study was structured to examine memory for gross motor movements by presenting the subjects with long sequences of gross movements to be performed correctly and quickly using as few prompts as possible. The length of sequences performed correctly with no prompting suggests the individual's motor memory capacity. It is not known how closely this approximates the capacities reported from verbal tasks and motor capacities reported for positioning or fine discrete motor tasks.

The findings from this study have implications for advancing theoretical explanations of (a) motor memory for differing types of motor information, (b) motor memory for serial tasks, (c) the capacity for and chunking of motor information from initial to advanced performance trials, and (d) the relationship of visual and kinesthetic abilities to within-task gross motor performance. The design of the study has implications for utilization of time series within-subject designs in describing motor behavior.

CHAPTER II

REVIEW OF LITERATURE

The following review of related literature focuses on a selected set of studies concerning (a) the serial position curve, (b) the relationship between visual and kinesthetic abilities in motor performance, and (c) the concepts of information capacity and chunking in the information-processing model. With the exception of those studies concerned with the serial position curve in verbal learning, only those findings which are related to motor tasks are reviewed. For the most part, the studies represent work completed in the decade previous to the present study with the exception of a few classic studies from an earlier time period.

The review is organized into four major sections: (a) the serial position curve in serial verbal tasks, (b) the serial position curve in motor performance, (c) the relationship between visual and kinesthetic perceptual abilities and motor task performance, and (d) the information-processing model in motor performance with specific emphasis on motor information capacity and the concept of chunking and encoding.

Serial Position Curve in Verbal Tasks

The serial position effect is a major testing ground for theories of memory (Glenberg et al., 1980). When a list of similar items is presented at a regular rate, those easiest to recall usually are the first items in the list, i.e., primacy effect, and the last items i.e. recency effect. Most errors occur in the middle of the series (Helstrup, 1978).

The relationship between the ordinal position of an item in a list and the probability of the recall of that item has been studied extensively using verbal lists with varying characteristics. The findings generally support the existence of a function relating the probability of recall to the ordinal position. This function became known as the "serial position curve". The curve is characterized by a steep primacy effect over the first three or four words in the list, a horizontal asymptote through the middle of the list, and an S-shaped recency effect over the last eight words in the list (Tulving, 1968).

The recency effect has been explained by the shorter time period between exposure to the item and recall of the item. In free recall of a series of homogeneous items, the correlation between recall output order and the probability of recall implies that the recall of terminal items is high because they are recalled earlier than other items in the list (Tulving, 1968). The recency effect is independent of rate of presentation, intratrial retention intervals, and list length.

The primacy effect is not so easily explained. Two main lines of argument were summarized by Tulving (1968). The first suggested that the first items were less subject to intraserial proactive inhibition. The second stated that subjects tend to rehearse early items while being exposed to later items thus harming recall of the later items. Tulving pointed out that there were no experimental data to support either explanation.

A comparison between two frameworks for explaining overall serial position effects was explained by Tulving (1968). The two-stage theory divided recall into two separate mechanisms--primary (short-term) and secondary (long-term) memory. When first perceived, the item entered into primary memory which was of very limited capacity. Unless rehearsed, these items were replaced by incoming items. If rehearsed, they remained in primary memory and were moved into the larger capacity store, secondary memory. Both stores were independent of each other and either might be recalled by an individual. The recency effect was explained by the much easier retrieval from the primary or short-term store.

Tulving (1968) favored a single storage system explanation with differences in recall of early, middle, and late items reflecting differences of accessibility of the items. More recently perceived items still contained certain auxiliary information such as acoustical traces or temporal dating that served as retrieval cues. These cues were not available for items perceived earlier.

Young (1968) in his summary of serial learning of verbal information stated that the bowed serial-position curve may be more general than originally assumed. It was also produced if a subject responded to the ordinal character of a set of items which varied along continuums such as time, color, length, weight, etc..

Jensen (1962) examined ordinal-position curves which were not related to a temporal order of presentation. Subjects were shown a set of randomly arranged and a set of properly arranged geometric forms. The subjects were asked to arrange the shapes in the proper order. When the pattern of errors was examined, the bowed serial-position curve was demonstrated.

Serial Position Curve in Motor Tasks

There is little evidence available to suggest whether the serial position curve is also exhibited in a series of similar items in the motor domain. Cratty (1963) studied the recency versus primacy effect using a large maze. Two groups of 21 male university students completed ten spaced trials while blindfolded. The two groups started at opposite ends of the maze to equate possible differences in the two halves. The recency versus primacy contrast was made by comparing the traversal times for the two halves of the pathway. In both groups, the first half was traversed more quickly than the second half ($p < .01$) for all trials after the third.

Singer (1968) related the order of teaching four volleyball skills to the recency-primacy effect. Four classes (n=25 to 35) were tested for skill after a ten-week quarter. No relationship was found between the order of skill presentation and the level of skill development.

Several studies (Magill, 1976, 1977; Magill & Dowell, 1977; Wrisberg, 1975; Zaichkowsky, 1974; Cratty, 1963; Singer, 1968) investigated the pattern of serial recall using gross or fine body-positioning tasks. Findings indicated that recall of a series of positions was related to developmental age, to length of series, and to within-series continuity.

The developmental pattern of perceptual motor sequencing ability was tested by Zaichkowsky (1974) using a Serial Perceptual-Motor Discriminator (SPMD). Subjects were 120 boys and girls aged five to nine years. Each age group consisted of 20 boys and 20 girls. The SPMD task involved reproducing a series of eight hand or foot pedal responses in the same order as originally presented. Two orders of presentation were utilized, random and ordered. The ordered series had a continuity underlying the pattern of presentation. The random series had any movement order. Findings indicated significant F ratios for the main effect of age ($F(2,108) = 88.9$, $p < .01$) and the effect of order of presentation ($F(1,108) = 364.42$, $p < .01$). An analysis of errors by serial position reveals a significant primacy effect ($F(3,99) = 84.5$, $p < .01$) in the randomly ordered task. This effect held across the three age groups. No recency effect was found.

Wrisberg (1975) investigated the relationship between the length of a sequence, the length of the retention interval, and recall in a serial slide positioning task. Subjects were asked to reproduce either a single position or a five-position sequence at intervals of either five seconds or 50 seconds. No difference in absolute error was found at the five-retention interval. However, the subjects with the five-position task made significantly more errors ($p < .01$) at the 50-second retention interval. A primacy-recency effect over the five positions was shown for the five second retention group. The 50-second retention profile indicated more errors at the end of the sequence.

Magill (1976) tested the presence of the U-shaped curve. One hundred and five male volunteers completed three blocks of four trials of a three-position slide-positioning task. Results indicated that the least amount of variable error occurred in sequence position one. By trial block five, all positions showed similar variable error. Magill concluded that the serial position curve found in serial verbal tasks was not found in serial motor tasks.

Magill and Dowell (1977) took issue with previous studies in serial motor recall, i.e. Cratty, 1963; Zaichkowsky, 1974; Magill, 1976. They suggested that those studies used a learning paradigm which was inconsistent with the memory paradigm found in verbal studies. They hypothesized that the bowed recall curve was a function of list length and was not exhibited in short, i.e. three-item, lists. They tested this relationship using 45 right-handed male and female students who performed a slide positioning task. Subjects were randomly assigned to three groups; a three-movement condition, a six-movement condition, and a nine-movement condition. The resultant pattern of recall was tested for linear and quadratic trend. As predicted, the three-movement curve was linear. A significant quadratic trend was found in both the six-movement and the nine-movement patterns. The profile of these curves indicated a recency effect and a less clear primacy effect.

In the discussion of their findings, Magill and Dowell (1977) suggested that the two-process explanation of serial position effects in verbal literature could also be applied effectively to explain motor recall. They hypothesized that further investigation would show that motor recall followed similar laws to verbal recall.

Visual and Kinesthetic Abilities in Motor Performance

Several studies have examined the perceptual processes underlying the learning of complex perceptual-motor skills. These studies have drawn relationships between patterns of perceptual abilities and motor performance at varying stages of learning and in tasks with varying demand characteristics.

An early study to identify the ability factors underlying certain types of perceptual-motor positioning tasks was completed by Fleishman in 1954. Factor analytic strategies were utilized to examine the intercorrelations between subjects' performances on 38 apparatus and printed psychomotor measures. These measures were designed with varying perceptual demands to facilitate the extraction of factors to explain the complex relationship between abilities and performance. The analysis identified ten relatively independent factors: (1) wrist-finger speed,

(2) finger dexterity, (3) rate of arm movements, (4) manual dexterity, (5) arm-hand steadiness, (6) reaction time, (7) aiming, (8) psychomotor coordination, (9) postural discrimination, and (10) spatial relations.

Fleishman and Hempel (1954) attempted to identify the ability factors involved at different stages of performance on the Complex Coordination Test, Mode E. This task involved positioning an airplane-type stick and rudder in response to patterns of visual signals. Testing consisted of 64 two-minute trials in four sessions over two days. The stages selected for analysis included the first and last ten minutes of the four testing sessions. Eighteen perceptual variables and the performance results from the eight stages were examined using factor analytic techniques. The findings indicated that the factor structure changed as practice was continued. Early in practice there were significant loadings on seven factors while later the loadings were significant on only three. This indicated that the task became less complex with practice. There was more unexplained variance early in practice than in the latter stages.

The major findings pointed to a change in the nature of the factors related to early and late performance. Early stages showed heavy loadings on nonmotor factors (i.e. Coordination, Spatial Relations, Visualization, Mechanical Experience) as well as on Psychomotor Coordination. Later trials showed significant loadings on only psychomotor factors (i.e Psychomotor Coordination, Rate of Movement, and a task-specific factor).

Fleishman and Rich (1963) tested 40 males using a two-hand coordination test. Two ability measures, a spatial orientation test and a kinesthetic sensitivity test were correlated with successive task performances. Significant correlations were found between spatial orientation and task performance in trials one to three and between kinesthetic sensitivity and task performance in trials seven through ten. In their discussion of the findings, they inferred that early in learning exteroceptive cues were important in guiding performance. Later, when the errors were smaller and the performance was more automatic, proprioceptive cues became more important to task performance. Therefore, high spatial ability would be an advantage early in learning but high kinesthetic sensitivity would be related to a higher level of performance in the later stages.

Stallings (1968) investigated the relationship between visual-spatial perception and motor-task performance at successive stages of learning. She related three perceptual variables, perceptual speed, visual-spatial orientation, and visualization to the performance, over time, of three gross motor skills. The motor skills were seen to vary in visual-spatial requirements, a two-hand speed pass, a balance beam routine, and an underhand free throw. Forty-two college women completed the three perceptual tests and were dichotomized for analysis on the basis of their scores on each test. They then completed ten weeks of a practice class that met twice a week with a two-week break between the sixth and seventh week. Findings indicated interaction between visual-spatial orientation and practice. The high spatial-visual group showed higher scores ($p < .05$) in the first three weeks but not in later weeks. No significant differences were found in performances on the other tasks. Perceptual speed and visualization were not related significantly to task performances.

Temple and Williams (1977) explored the relationship between kinesthetic and perceptual attributes of the learner and performances of tasks with differing demand characteristics. Sixty children were selected and classified into three information-processing levels (high, moderate, low) on the basis of their scores on a battery of five visual and six proprioceptive tests. The three groups completed two motor tasks, one fine perceptual-motor task and one of two gross perceptual-motor tasks. No significant differences were found in the rate of task mastery by learners whose information-processing characteristics matched task characteristics and learners whose characteristics did not match task characteristics.

The summary of Temple and Williams' findings indicated the following: (a) significant differences in the level of task mastery were related to both visual and proprioceptive processing preferences in a task requiring both visual and proprioceptive components; (b) no relationship was found between processing capabilities and performance on the two agility tasks; (c) performance on the high proprioceptive task was significantly related to processing capabilities but the differences were not found in the moderate proprioceptive task; (d) differences in task performance between proprioceptive-processing groups remained constant across trials. Differences in visual-processing groups were present in the first trial but was not found after the second trial. These would be consistent with the findings of Fleishman and Rich (1963) who found visual abilities to be more highly related to early performance and proprioceptive abilities to be more related to later performance.

The extension of Fleishman's research strategies to gross motor tasks was done in a study by Beitel (1980). Eighty undergraduate women were measured on five visual-perceptual variables--field dependence/independence, spatial relations, coincidence-anticipation, peripheral range, and perceptual speed. The subjects then completed two sets of six trials of each of two gross motor tasks, a spatial task and a spatial/temporal task. For both tasks, the average of the first three trials was used as a measure of early-task performance and the average of the best three trials on the second day was used as a measure of later trial performance.

A factor analysis of the nine variables yielded five factors. The factor loadings supported earlier findings by Fleishman and Hempel (1954) who found a higher relationship between visual perceptual abilities and early performance. The relationship was consistent whether the individual was stationary or was moving through space.

Support was also found for the differentiation of tasks according to movement and environmental demands. The two motor tasks with their varying demand characteristics loaded on separate factors which were not significantly related.

Motor Information Capacity and Encoding

An information-processing model views the human nervous system as a communications network through which environmental information is processed (Marteniuk, 1976). Thus, the motor performer is seen as a communication system which receives information from the environment and processes it into resultant output which directs the muscles in movement patterns. Hayes & Marteniuk (1976) cited two advantages to viewing motor performance as an information-processing activity: (a) a way to present a descriptive framework for describing the components of skills, and (b) the possibility of using information theory to quantify the complexity of a perceptual-motor skill.

One important concept derived from the application of the information-processing model to perceptual processing is that of the capacity of the processing system as a limiting factor in performance. The ability of the individual to process information from the display and retain this information in short term memory is related to (a) the channel capacity of the observer, (b) the capacity of the short-term memory, and (c) the way in which the information is coded in immediate memory (Welford, 1976).

The classic discussion of the limits of the capacity to process information was presented by George Miller in 1956. Although more recent literature has also addressed the topic (Singer, 1975; Norman, 1976; Welford, 1976; Marteniuk, 1976), there has been no appreciable change in the explanatory framework that Miller proposed. Miller described channel capacity as the "upper extent to which the processor can match his response to the input stimuli" (Miller, 1956). He examined the relationship between the amount of information input to the information output in human performers in many studies. He discovered that as the amount of information was increased, the output information leveled off at an asymptote which he described as the channel capacity of the system. He also concluded that there was a rather small finite limit to the capacity for making unidimensional judgments which did not appear to vary from one sensory modality to another. This limit Miller referred to as the span of absolute judgment and located it "somewhere in the neighborhood of seven bits". A bit is a unit of measurement of information defined as the amount of information necessary to decide between two equally likely alternatives.

The capacity of short-term memory is similarly limited. Welford (1976) states that few individuals can retain more than seven random digits or six random letters. Miller (1956) was careful to distinguish between the two types of capacity, the capacity to make judgments and the capacity to retain information in short-term memory. The first is measured in bits of information while the second is measured in items of information. The amount of information which can be processed with this relatively fixed memory span can be increased by the "chunking" or encoding of information into large units which are evoked by a single bit of information (Norman,1976).

The difficulty in applying Miller's conceptualization to motor performance is the difficulty of determining what an item of motor information is. While verbal information can be coded in terms of its semantic structure, research in motor performance has not yet developed a satisfactory classification framework to describe motor information.

The efficiency with which decisions are made and appropriate actions selected is directly related to the ability of the performer to organize information into larger and larger systems of responses which are invoked by a single cue.

Summary

The preceding review produced the foundation for the formulation of the research questions in this investigation. The review demonstrated:

1. The existence of a position effect in serial verbal memory tasks. No study was found which examined this phenomenon as a memory variable in a gross motor criterion task. The research variables of length of list and varying demand characteristics of the list were selected from those related to memory for serial verbal information. One intervention was structured to examine

the effect of presentation of a derived list upon subject performance.

2. The relationship between kinesthetic and visual perceptual attributes in the performance of motor tasks. The differing relationship of these attributes to performance over time was used as one variable for differing among the task demand characteristics of the criterion task.

3. The adequacy of the information-processing model as an explanatory framework for describing memory for serial information. The concept of capacity as a limiting factor in short-term memory was used when structuring the appropriate number of items in the serial subsequences.

CHAPTER III

PROCEDURES

This study was formulated as a quasi-experimental (Campbell & Stanley,1963) design to describe in depth the performance of four subjects. It applied the descriptive framework of a Multiple N-Multiple I time-series inverted design (Kratochwill, 1978) to a complex novel gross motor task. The overriding consideration in the construction of the criterion task was that it must contain within it the mechanisms for describing each part of the performance in more than one way. This implied the collection of observation data as well as timed data and a structure within the task of isolating and describing performance of each individual element of the total performance.

To develop the criterion motor task, prepilot and pilot studies were conducted to establish performance parameters prior to the final data collection. In addition to the primary descriptive requirements previously stated, these fundamental a priori considerations controlled the construction of the criterion task throughout the developmental process:

1. The task was to be constructed so that all research variables were crossed within the structure of the task.

2. The task was to involve gross motor movement through a stationary environment.

3. The task was to require simple locomotor movements and movement skills which would be considered universally familiar within the target population.

4. The total task was to be serial and contain within it subtasks which were serial and which varied from each other in the hypothesized variables of position within the total task, kinesthetic/visual attributes, and list length. This implied a task of considerable length which initially appeared overwhelming but which was judged to be capable of being mastered within the three-week testing period.

5. The task would involve two interventions: one would vary the position of elements within the serial subtasks and the second would change the position of the serial subtasks so that they occupied both middle of list and beginning or end of list position during the experimental period.

6. Due to the extended length of the task and the focus on motor memory, the task was to have two nonserial segments which would be placed in permanent positions between the serial subtasks which would change. These segments were to require motor patterns differing from the serial segments, stationary body position, and minimal memory usage.

7. The design required that the task be completed each trial. Therefore, performance cues and location maps were necessary to standardize the performance information given to each subject and to provide the means by which the subject could complete the task the first day and each subsequent day whether she was able to recall performance sequences or not.

8. Each part of the task was to be separately timed and observers would code other performance behaviors, i.e., where and what type of errors were made, where and when discontinuities in performance occurred, and when cue and map references were made. This implied the introduction of key contact patterns into the performance pattern of the task and the training of observers to provide verbal feedback of errors.

9. The task would allow the subject to determine her own performance pace. Thus, no characteristic of motor performance, e.g., speed or minimal errors was investigator-imposed on the individual subject.

Prepilot Testing

In the prepilot phase, four main parameters of the final test structure were tested: (a) the length of each multiple element sequence, (b) the forms and clarity of instructions to the subjects, (c) the physical structure of each segment, i.e., distances, height and position of obstacles, size of cues, effectiveness of maps, and (d) the efficiency of the timing apparatus, i.e., key contact patterns, chart speed, etc..

The subjects were volunteer graduate students, faculty, and staff in the School of H.P.E.R.D. at the University of North Carolina at Greensboro. All subjects signed informed consent forms (see Appendix D). The subjects were interviewed upon completion of their participation to determine their perceptions of the clarity of the instructions and specific components of the task segment which they completed.

<u>Tossing Task</u>

Two sets of directions for the tossing segments were tested. Direction Set One required the subject to toss to the near, middle, and far targets in order. Success was scored as a one for a toss landing within the designated square, zero for a toss outside of the designated square, and 1/2 for a toss landing on the line of the designated square. Direction Set Two instructed the subject to try to get as high a score as possible. The target values were one for the near target, two for the middle target, and three for the far target. A toss landing on a line was valued at 1/2 the value of the target. Five subjects completed both the short toss and the long toss under both sets of directions.

The selection of Direction Set Two was made based on (a) the subjects' perceptions that this set of directions required greater attention to the task, and (b) the experimenter's judgment that the second set of directions created the possibility for greater variability in subject performance. To facilitate scoring speed in future testing, the target values were changed to two, four, and six so that all scores, including tosses on the line, would be whole numbers.

High-visual Sequences

Six subjects completed one trial of a subset of the task containing both high-visual sequences performed in the order in which they were to occur in the total task, nine-position, then four-position. The cue for each element consisted of a 5 x 8 inch index card containing the station number and two or three lines of instructions (see Appendix A). Each segment consisted of twelve elements. Each testing area was 20 feet square with the stations positioned as indicated in Figure 1. The obstacles were angled across the testing area. The low obstacles were 3.5 and 1.75 inches high and the high obstacles were 60 inches high.

Based on subject performance, interview data, and experimenter observations, three revisions in task structure were indicated in (a) a decrease in the number of elements in each sequence, (b) a change in the height of the obstacles, and (c) the elimination of several instruction cards containing more or less than the desired amount of information.

Low-visual Sequences

Nine subjects completed one trial of a subset of the task consisting of both low-visual segments performed in the order in which they were to occur in the total task, four-position then nine-position. The cue for each element consisted of a twelve inch geometric form constructed of 3/8-inch plywood. Each sequence consisted of twelve elements. The obstacles were set at 3.5 inches and 60 inches. Each station and each obstacle in the low-visual area was located to correspond exactly to the location of that station and obstacle in the corresponding high-visual sequences previously tested (see Figure 1). Findings verified previous decisions made concerning sequence length and obstacle height. Additional changes were indicated in (a) the location of the obstacles in relation to the stations, (b) the size and texture of the geometric forms, and (c) the arrangement and size of the cue holes.

Total Task

After the individual task sections were pretested, nine subjects completed one trial of the total task. The

Table 1

Outline of Design: Subsequence and Intervention Orders

Subject	Sequence Order Block 1	I1	Sequence Order Block 2	I2	Sequence Order Block 3
1	V9,ST,K4,K9,LT,V4	O	K4,ST,V9,V4,LT,K9	E	same as Block 2
2	K4,ST,V9,V4,LT,K9	O	V9,ST,K4,K9,LT,V4	E	same as Block 2
3	V9,ST,K4,K9,LT,V4	E	same as Block 1	O	K4,ST,V9,V4,LT,K9
4	K4,ST,V9,V4,LT,K9	E	same as Block 1	O	V9,ST,K4,K9,LT,V4

K4 - Low Visual, Four Destination
K9 - Low Visual, Nine Destination
V4 - High Visual, Four Destination
V9 - High Visual, Nine Destination
ST - Short Tossing
LT - Long Tossing

E - Change of element order within subsequences
O - Change of order of subsequences

two patterns of beginning sequence order were randomly assigned to subjects (see Table 1). Each multielement sequence consisted of nine elements. The obstacles were placed parallel to each other across the test area. At this time, no changes were made in obstacle height, or low-visual cue size, texture, or coding. The results verified previous decisions to (a) shorten multi-element sequence length to nine elements, (b) use tossing Direction Set Two, and (c) arrange the obstacles parallel across the space. The necessity for changing the configuration of the low-visual cues to smaller forms with uniform cue hole spacing and for raising the height of the low obstacles was reaffirmed. The results also confirmed that (a) the instructions were clear in describing the task, (b) the low-visual sequences were perceived as having differing demand characteristics from the high-visual sequences, and (c) the timing apparatus and key sequences were effectively integrated into the task performance.

Pilot Study

A three-day pilot study was conducted March 2-4, 1981, (a) to examine the structure and clarity of instructions to subjects, (b) to determine if changes in subject performance were exhibited over time, (c) to train observers in task coding, (d) to check the reliability of the timing apparatus, and (e) to test the physical structure of the modified task and the appropriateness and efficiency of the timing patterns structured into the task. Subjects were two right-handed females ages 19 and 21. Subjects were volunteers from activity classes in the general program at the University of North Carolina at Greensboro. Both subjects completed informed consent forms prior to participation and were paid for their participation upon completion of the study.

Each subject completed one trial each day on three consecutive days. Upon completion of each trial, the total time, number of errors, tossing scores, and number of cues and maps used were recorded on an individual performance chart (see Appendix D). The subject was then given the information concerning her performance and was shown the chart containing the summary of her trials.

Upon completion of the final day's trial, each subject was (a) informed of the research hypotheses, (b) asked her perceptions of task demands and task structure, and (c) invited to express any questions or concerns she might have about her participation and performance.

An analysis of the pilot study data showed (a) subject performance times decreased from 29 minutes to 19 minutes for one subject and from 32 minutes to 22 minutes for the other subject, (b) the subjects understood the instructions on the first day and did not require repetition of all instructions on subsequent days, (c) the observers could distinguish and code correct and incorrect performance patterns in both the high-visual and the low-visual subsequences on the coding sheets and on the time chart, (d) a chart speed of 7.5 inches per minute yielded charts which could be transformed into time data with the desired 1/10 of a second accuracy, and (e) the physical structure of the task was performable in terms of total length, height of obstacles, and key contact/cue/performance patterns (see Figure 1 and Appendix A for task diagrams and specifications). A change in the number of obstacles from three to two pairs was indicated by an analysis of performance patterns which showed the obstacles furthest from the cue tables were not a factor in performance.

Data Collection

Data were collected in two testing periods. The perceptual data were collected in a single one-hour testing session. The experimental data were collected over a three-week period. All tests were administered by trained administrators.

The perceptual testing consisted of the collection of the data for the two perceptual variables. The two tests were administered individually to each subject in one session. The order of testing was the Space Relations Test (25 minutes), then the Rod-and-Frame Test (approximately 15 minutes). The testing times varied according to subjects' schedules.

The three week data collection period consisted of 15 daily testing sessions scheduled between 8 am and 6 pm, Monday through Friday. Each subject performed one trial each day for five days, an intervention was made of either a change in subsequence order (see Table 1) or a change in element order (see Table 2), the subject completed the next five trials, the second intervention was made, and the subject then completed the final five trials. The testing times varied daily according to subjects' schedules. There was a slight variation in collection of data for Subject Two. The first five trials were collapsed. Thereafter, all trials were consistent with those of the other subjects.

Subject Selection

The subjects for the study were four right-handed females ages 18-21. The subjects were undergraduate students at the University of North Carolina at Greensboro and a senior from Page High School, Greensboro, North Carolina. All subjects were volunteers and were paid for their participation upon completion of the study. Each subject was interviewed prior to the study, informed of

Table 2

Element Order-Before and After Reordering

Element Description	Before	After
Nine-Destination HV		
At 5, Stack 2 white, Stack 2 Blue, Clap 1x	1	2
At 9, Stack 2 white, Stack 3 white, Wave 2x	2	7
At 5, Stack 1 white, Stack 1 blue, Clap 1x	3	6
At 4, Stack 2 blue, Stack 3 Blue, Wave 2x	4	5
At 7, Stack 3 blue, Stack 3 white, Salute 3x	5	3
At 8, Stack 2 white, Stack 3 orange	6	9
At 7, Stack 3 orange, Stack 1 orange, Wave 2x	7	1
At 7, Stack 1 blue, Stack 1 orange, clap 1x	8	4
At 3, Stack 2 orange, Salute 1x, Wave 1x	9	8
Four-Destination HV		
At 3, Stack 3 white, Stack 3 blue, Clap 3x	1	2
At 2, Stack 3 orange, Stack 2 white	2	9
At 3, Stack 3 blue, Stack 3 orange, Salute 3x	3	5
At 1, Stack 3 blue, Stack 2 white	4	1
At 2, Stack 1 white, Stack 2 white, Wave 1x	5	8
At 3, Stack 2 orange, Stack 2 blue, Salute 3x	6	6
At 1, Stack 1 blue, Stack 3 Blue, Clap 1x	7	7
At 4, Stack 4 orange, Wave 3x, Clap 1x	8	3
At 1, Stack 3 blue, Stack 2 blue, Wave 2x	9	4
Nine-Destination LV		
At 5, Octagon, 3x	1	2
At 9, Rectangle, 3x	2	7
At 5, Octagon, 2x	3	6
At 4, Triangle, 1x	4	5
At 9, Rectangle, 3x	5	3
At 6, Half Circle, 2x	6	9
At 3, Crescent, 3x	7	1
At 1, Triangle, 1x	8	4
At 4, Crescent, 1x	9	8
Four-Destination LV		
At 1, Triangle, 3x	1	2
At 2, Rectangle, 2x	2	9
At 4, Circle, 3x	3	5
At 4, Half Circle, 3x	4	1
At 2, Crescent, 2x	5	8
At 4, Rectangle, 3x	6	6
At 2, Octagon, 1x	7	7
At 4, Circle, 1x	8	3
At 3, Square, 2x	9	4

the general nature of the study, and signed informed consent forms.

Instruments and Techniques of Measurement.

Perceptual variable 1: Field Dependence/Independence. The degree of field independence was determined by the use of the Rod-and-Frame Apparatus (Research Media, Inc.). Each subject completed 21 trials. The 21 trials consisted of three frame positions (0°, 10°, 350°), each combined with seven rod positions (20°, 15°, 10°, 5°, 355°, 350°, 345°). The order of presentation of the 21 positions was randomly selected prior to testing and was the same for all subjects (see Table 3).

The score for each trial was the number of degrees at which the subject positioned the rod. The difference between the vertical (0°) and the subject's position score was calculated. The mean deviation score for the 21 trials represented field independence/dependence.

The test was administered in a dark room. The subjects were seated at a table in front of the apparatus and were given five minutes to let their eyes adapt to the dark while they were given the following instructions:

> On the apparatus in front of you, the box and the line can be moved to differing positions. Locate the knob on the right side of the apparatus and move it in both directions. See the effect on the position of the line? This test consists of 21 trials. When we are ready to begin, I will ask you to close your eyes while I position the box and the line in the starting position. I will

Table 3

Rod-and-Frame Order of Presentation
(Randomly Drawn)

Trial	Frame Position (in degrees)	Rod Position (in degrees)
1	0	10
2	10	345
3	350	355
4	10	350
5	0	355
6	350	350
7	0	15
8	0	20
9	350	10
10	0	350
11	350	345
12	0	5
13	10	355
14	10	340
15	350	15
16	10	5
17	0	345
18	350	20
19	10	345
20	350	10
21	10	10

> then say "Ready". You then open your eyes and use the control knob to position the line so that it is straight up and down. When you have the line positioned, say "ready" and close your eyes. I will then record your score and position the apparatus for the next trial. Any questions?
> Then close your eyes, please.

The trials were then administered in the specified order.

Perceptual variable 2: Spatial relations. The spatial perceptual variable was the subject's score on the subtest Space Relations of the Differential Aptitude Test. The subject was seated and given the test booklet and an answer sheet. The subject was told to open the booklet to the first page and to read the following directions:

> This test consists of 60 patterns which can be folded into figures. To the right of each pattern there are four figures. You are to decide which one of these figures can be made from the pattern shown. The pattern always shows the outside of the figure.
> (two examples shown)
> Remember: The surface you see in the pattern must always be the outside of the completed figure. Study the pattern carefully and decide which figure can be made from it. Only one of the four figures following the pattern is correct. You will have 25 minutes for this test. Work as rapidly and as accurately as you can. If you are not sure of an answer, mark the choice which is your best guess. (Bennett et al., 1973, pp.1-2)

The subject's score was the number of correct items with a maximum score of 60.

Gross motor task. This task required the subject to perform an extended series of motor performance elements as accurately and quickly as possible. The task consisted of six subsequences which were to be performed in a specified order (see Table 1). The task required the subject to step over and duck under obstacles, to move the body in specified patterns through a stationary environment, to toss for accuracy at stationary targets, to handle and manipulate multi-colored blocks, to perform simple hand and arm movements, and to recall extended lists of motor performance information.

Each trial was initiated by the subject's stepping on a pressure mat. The subject moved to the first multi-element subsequence, checked and/or moved the performance cue, and then contacted the element key to initiate the performance time period. The subject performed the specified movements, returned and contacted the element key, checked and/or moved the next cue, contacted the key and performed the next movement sequence. This pattern of cue, key, performance, key was repeated until all nine elements were completed. Errors in performance were indicated verbally by the observers. Obstacle errors were indicated either by the obstacles being knocked down or by the clicking of the chart recorder when it indicated that the photoelectric beam had been broken. Upon occurrence of a performance error, the subject reperformed the element from the point of the error. Cues were available throughout each trial and could be referred to by the subject at any time.

After the completion of each subsequence, the subject returned to the central timer area and contacted one of the pressure mats. The subject then moved to the next subsequence and contacted the pressure mat corresponding to that subsequence. For the tossing subsequences, the pressure mat was contacted at the beginning and the end of the subsequence. There were no other timing marks within the tossing subsequences. An accuracy score was recorded for each tossing subsequence.

The total time, the total number of errors, the tossing score, and the total number of cues required were reported to the subject after each trial. The total time reported to the subject was an approximation taken from a stop watch which had been started by an observer at the beginning of the task and stopped by the observer when the subject stepped on the pressure mat at the end of the task.

Each subject completed one trial each day in three five-day blocks (see Table 1). After each block, a change was made in either subsequence order (see Table 1) or element order (see Table 2) within multi-element sequences. All subjects received the same instructions prior to each trial.

Instructions. On the first day, each subject was given a complete explanation of the task. At the same time, subjects were walked to each subsequence in performance order (see copy of instructions and accompanying charts in Appendixes A and C). The subject was shown the location of all stations, maps, and element keys. She was also shown examples of the performance cues and a chart which depicted all the possible geometric shapes which could be present in the low-visual cue box. After the explanation was completed, the subject was allowed to ask questions and/or review any information which she had been shown during the walk-through. The subject was instructed to take as much time as she needed and, when ready, to contact the mat and begin. The instructions were intended to provide the gross framework idea of the task and its demands.

On subsequent days, the subject was allowed to ask questions and/or examine maps prior to beginning the trial. Additional emphasis was given to the need to try to perform as much as possible without referring to any cues. Beginning with trial six, additional instructions were added to emphasize the performance sequence which was correct for performing an element sequence when a cue was not necessary. To provide consistency, all instructions were administered by the same observer for all trials and all subjects.

Timing apparatus. A diagram of the wiring harness is shown in Appendix B. The signal inputs consisted of (a) two pressure mats which were contacted at the beginning and the end of each of the six subsequences, (b) four element keys which were contacted at the beginning and the end of each element in the multi-element subsequences, and (c) two pairs of photoelectric cells in each of the two low-visual/kinesthetic subsequences. All signal inputs were wired into a junction box with a built-in amplifier. This junction box produced a single output signal which was wired into an Esterline Angus Speed Servo II Chart Recorder. The chart speed was set at 7.5 inches per minute. The timed data were obtained by measuring the distance between the timing marks made on the calibrated recording paper. An observer was located at the recorder during each trial to code the chart output as it came off the recorder.

Error-handling procedures. Obstacle errors were recorded by the observers on the coding sheets in both the high-visual and the low-visual subsequences. The photoelectric cells which comprised the low-visual obstacles were wired into the junction box such that a mark was recorded on the chart recorder when a beam was interrupted. This also made a click which could be heard by the subjects and indicated to them that an error had been made. The chart observer coded this as an error and it was used to verify the low-visual obstacle errors recorded by the observers.

Performance errors were verbally indicated to the subject by one of the two performance observers, i.e., wrong station, figure, number of repetitions, hand signal, number of blocks, etc.. The subject then corrected the error by properly performing from the point of the error.

Low-visual cues. In the low-visual subsequences, the performance cues consisted of wooden geometric figures (see specifications in Appendix A). The box containing these figures was located on the table with the element key on top. The forms were stacked in order of performance on the left side of the box. To obtain a cue, the subject reached into the box without raising the curtain and felt the top shape in the stack. Three items of information were available from each form: (a) the shape of the movement to be executed corresponded to the shape of the form, (b) the number of the destination point corresponded to the number of holes in the form, and (c) the number of repetitions of the movement to be executed corresponded to the number of notches in the right edge of the form. Although the subject was not required to check the cue, it had to be moved from the left stack to the right stack before contacting the element key to begin performance of that element.

High-visual cues. In the high-visual subsequences, the performance cues consisted of 5 X 8 inch cards containing (a) the destination point, (b) the number and color of the blocks to be stacked, and (c) the hand or arm movement to be made, if any (see specifications in Appendix A). Although the subject was not required to check the cue, it had to be placed in the completion stack before contacting the element key to begin performance of that element.

Coding sheets. Error, cue reference, and map reference information was recorded on coding sheets by two observers (see Appendix D). The position and type of error were marked with a check in the appropriate column. A check was recorded each time the subject used a cue or consulted a map. One observer coded both four-destination subsequences and the other coded both nine-destination subsequences. Tossing scores were calculated by the observer who was not involved in coding the sequence following the tossing.

Analysis of Data. The chart from each trial was converted to timed data by measuring the distance between contact spikes to the closest tenth of an inch and multiplying the resultant distance by 8 seconds (60 seconds/chart speed of 7.5 inches per minute).

The raw data were then graphed to produce time series performance profiles. The profiles were then inspected for obvious fluctuations. Changes were considered with respect to prior and subsequent performance. The coded observations, i.e., errors, cues, and map references, were compared to the profiles to help explain fluctuations in performance.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This study was designed to provide a comprehensive description of four individual motor performances structured to encompass specific task demands and serial subsequences. To retain the individuality of the data, this summary discusses the performance of each subject as a separate case study. Each case study presents:

1. A profile of total task times.

2. Four cue profiles by sequence type and position. Each profile presents the time across the three blocks of five trials for one of the multi-element subsequences. Across the bottom of each profile is a baseline graph which depicts the number of cue references made during the cue period using a baseline value of one cue reference preliminary to performance.

3. Four performance profiles by sequence type and position. Each profile presents the performance times across the three blocks of five trials for one of the multi-element subsequences. Across the bottom of each profile is a baseline graph which depicts the number of cue referents made during the performance phase using a baseline value of zero cues during performance.

4. A map reference table by sequence type and trial. The references are presented in three categories: (a)initial references made during the cue period, (b)references made during the performance period, and (c)references made during the performance period following an error in performance.

5. Two performance error tables: (a) sequence type by trial and (b)sequence type by position. The errors are reported in four categories: (a) obstacle, (b) destination, (c) performance, and (d) other, e.g., key contact errors.

6. A profile of tossing scores and times.

7. A table of pacing intervals by position in task.

Subject One

Subject One was a twenty-year-old student at the University of North Carolina at Greensboro. Her scores for the two perceptual tests were 1.4 degrees average displacement for the RFT and 53 (95th percentile) on the Space Relations scale.

Total Times

The profile of total task times organized according to blocks for Subject One is shown in Figure 2. As hypothesized, the subject was able to decrease her time as she became familiar with the task and was able to organize

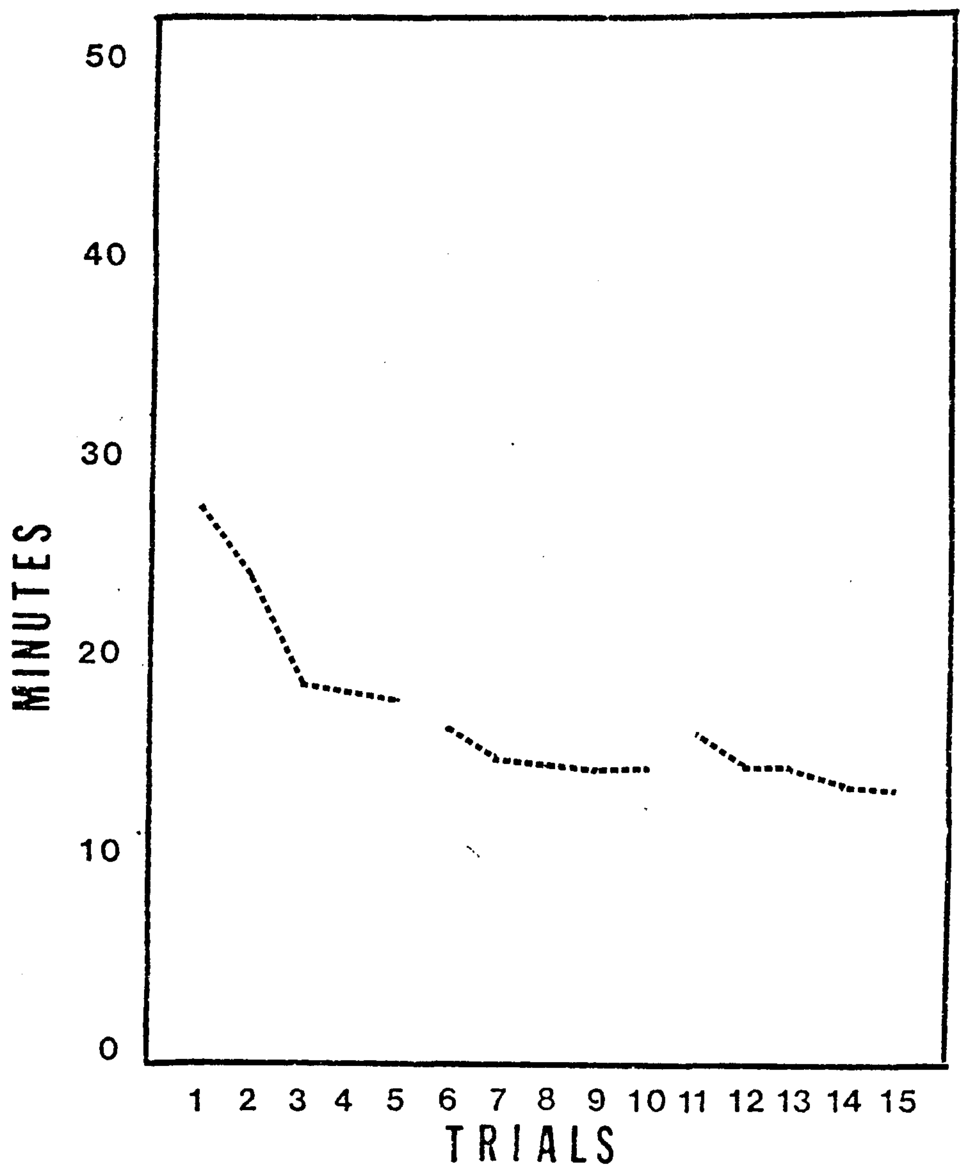

Figure 2. Total Task Times - Subject One.

task information more efficiently. However, the decrease was not linear. The performance profile shows distinct plateaus toward the end of each block of trials. The breaks in the time line occur at the beginning of each block of trials. The first two trials in Block 1 show a steep decline in time which would be expected as the subject became familiar with the task demands and task flow. The first two trials in Block 2 show a less distinct decrease after the first intervention which changed the order of the four multi-element subsequences within the task. The first trial in Block 3 shows an increase in time after the second intervention which changed the order of the individual elements within each multi-element subsequence.

Cues

The cue time profiles for Subject One, Figures 3 through 6, show a decreasing trend in cue times across all elements in all trials. There are observable differences in the profiles which may be related to differences in demand characteristics and positions in the sequences.

Times for the four-position subsequences started faster than the nine-position times in both HV and LV segments. In the HV segments, the times show only slight decreases across the 15 trials. The HV9 times become equivalent to the HV4 times by the third trial.

In the LV segments, the contrast between the four-position and nine-position segments is more marked through the first block of trials. The nine-position segment shows slower cue times and wider variations in individual element times. By Trial 5, the times were more equivalent. However, by Trial 8, the first three elements of the HV9 segment dropped sharply faster. By Trial 9, the same drop was seen for HV9 element nine. The baseline graph indicates that the subject performed the first and last elements in the HV9 segment without a cue reference in Trials 9 and 10 which explains the time decrease for these elements. The time decrease for elements two and three to the same level at the same time suggests that, although the subject referred to the cue, it was likely a quick verification not a search for information.

The LV9 segment shows an increase in times and a wide variation in individual element times after the second intervention which changed the order of the elements within the sequences. Times decrease to previous levels by Trial 13. In Trial 15, the time for element nine was sharply decreased;no cue referent was used.

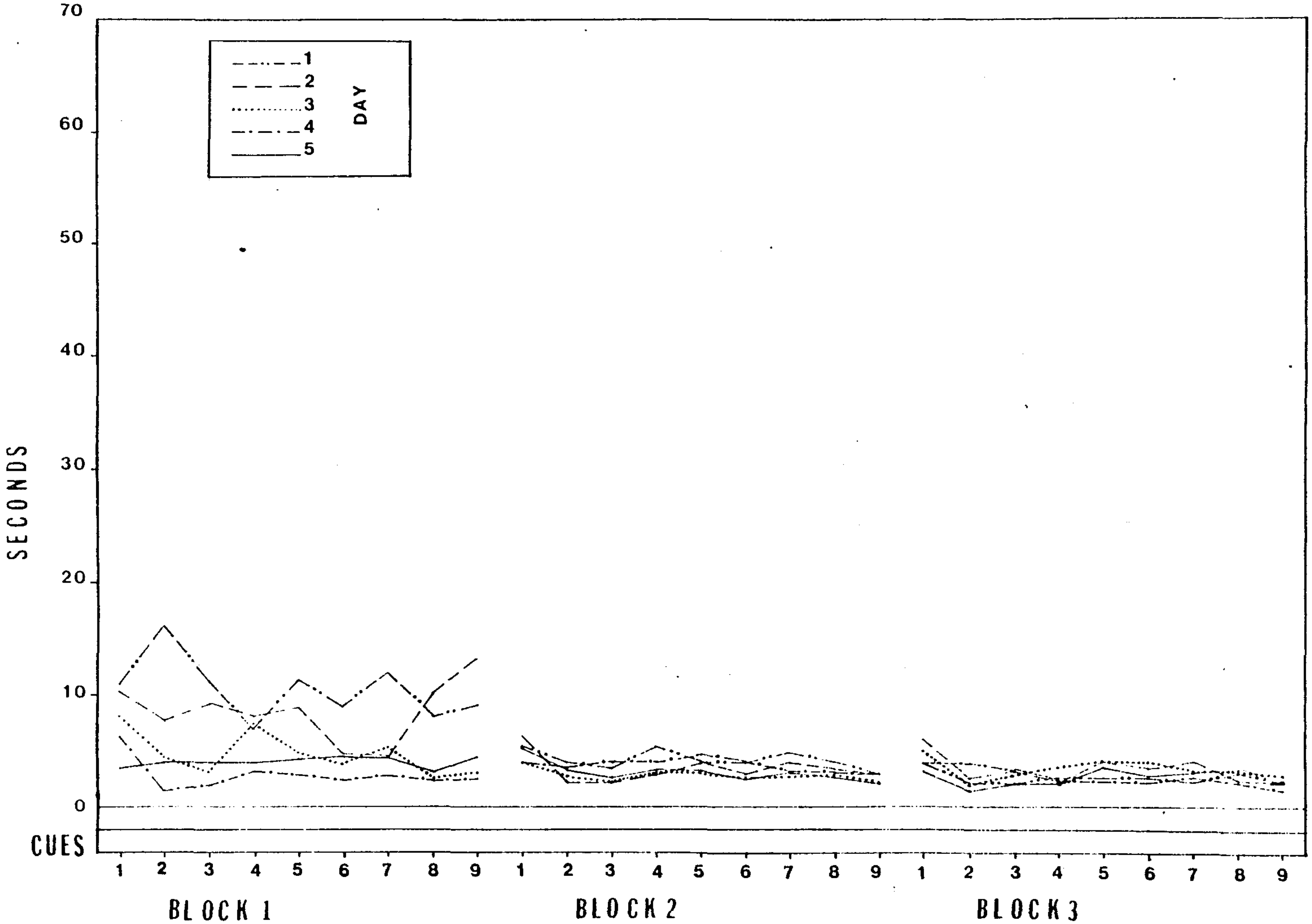

Figure 3. Cue Times - HV9 - Subject One.

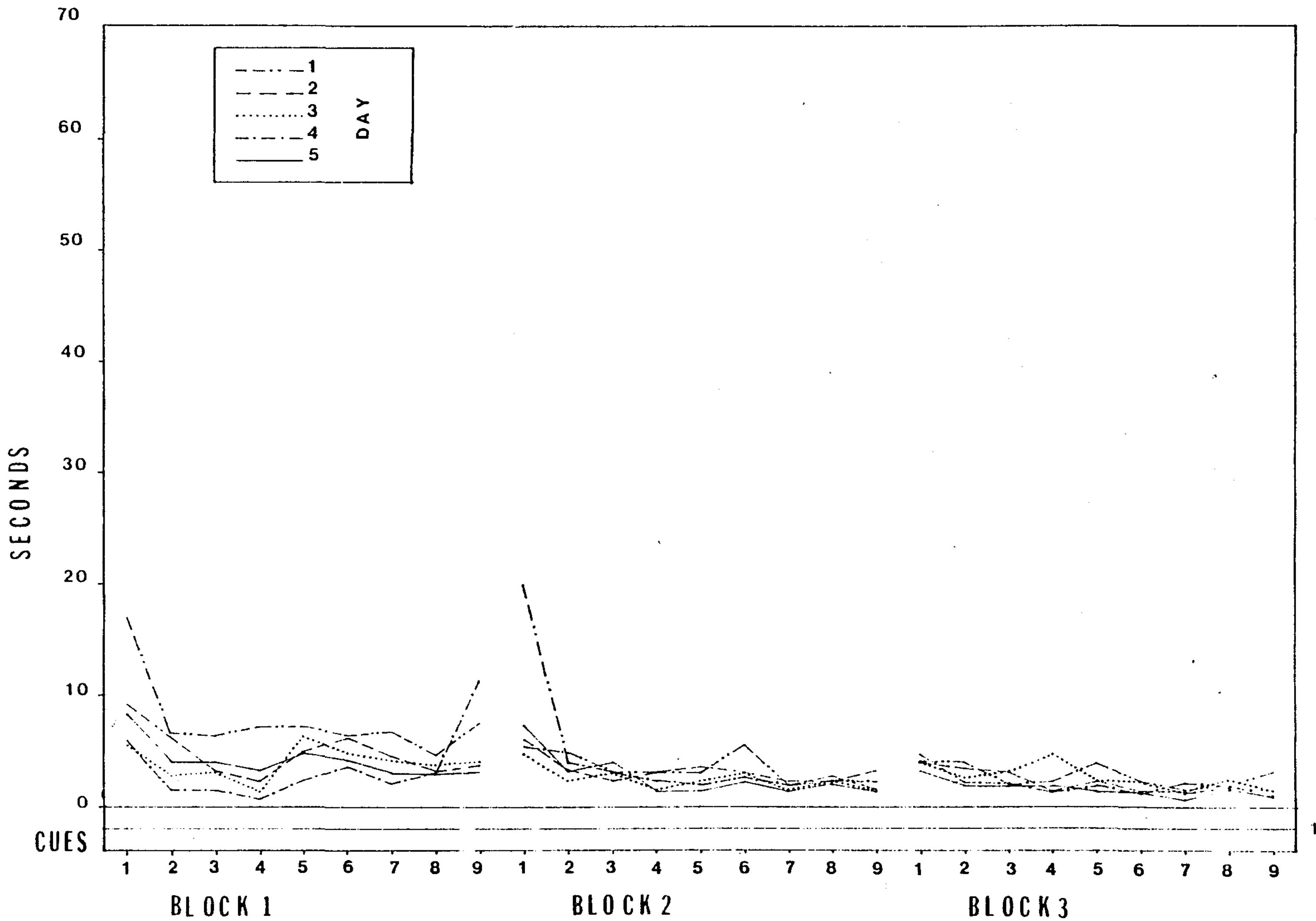

Figure 4. Cue Times - HV4 - Subject One.

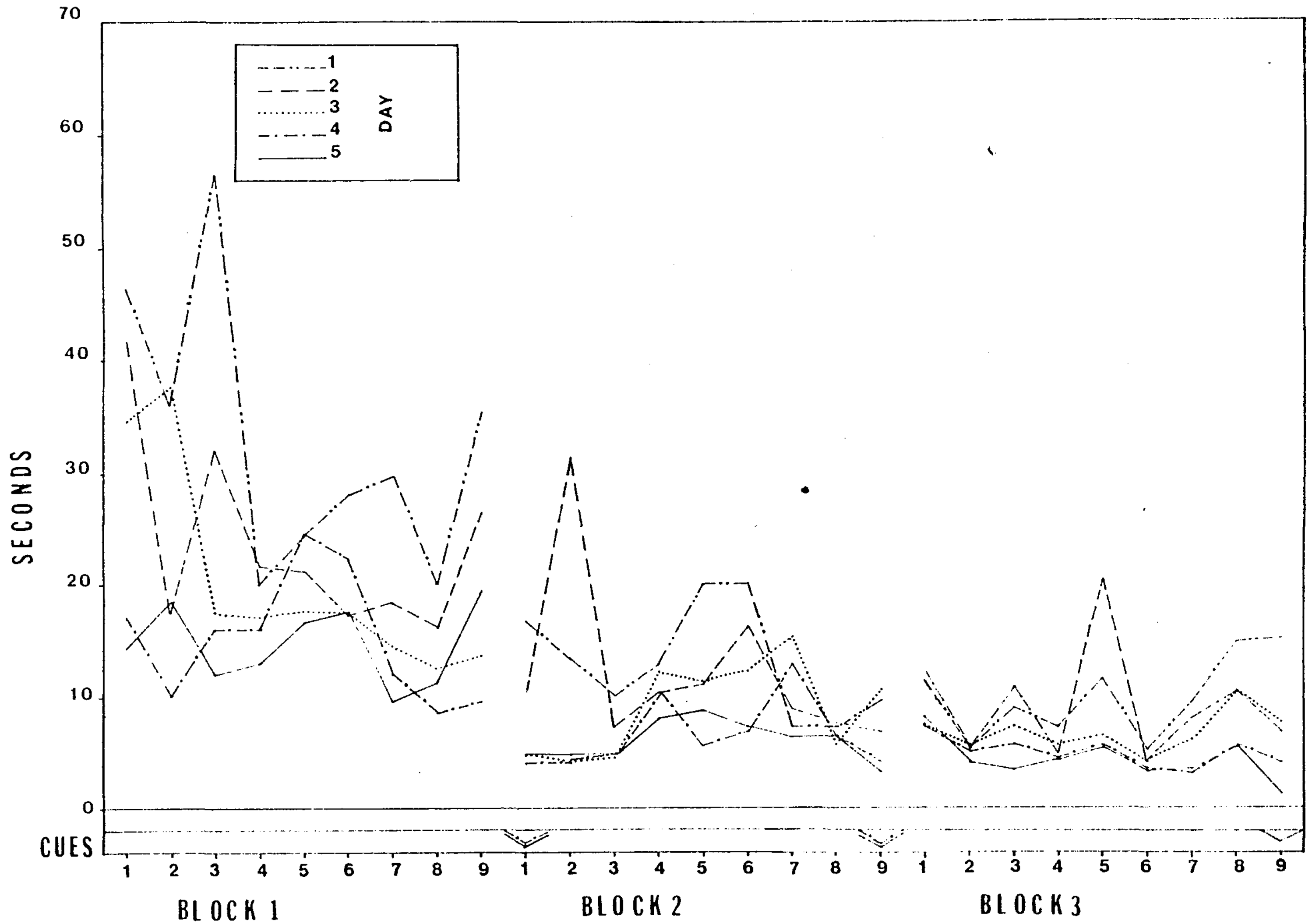

Figure 5. Cue Times - LV9 - Subject One.

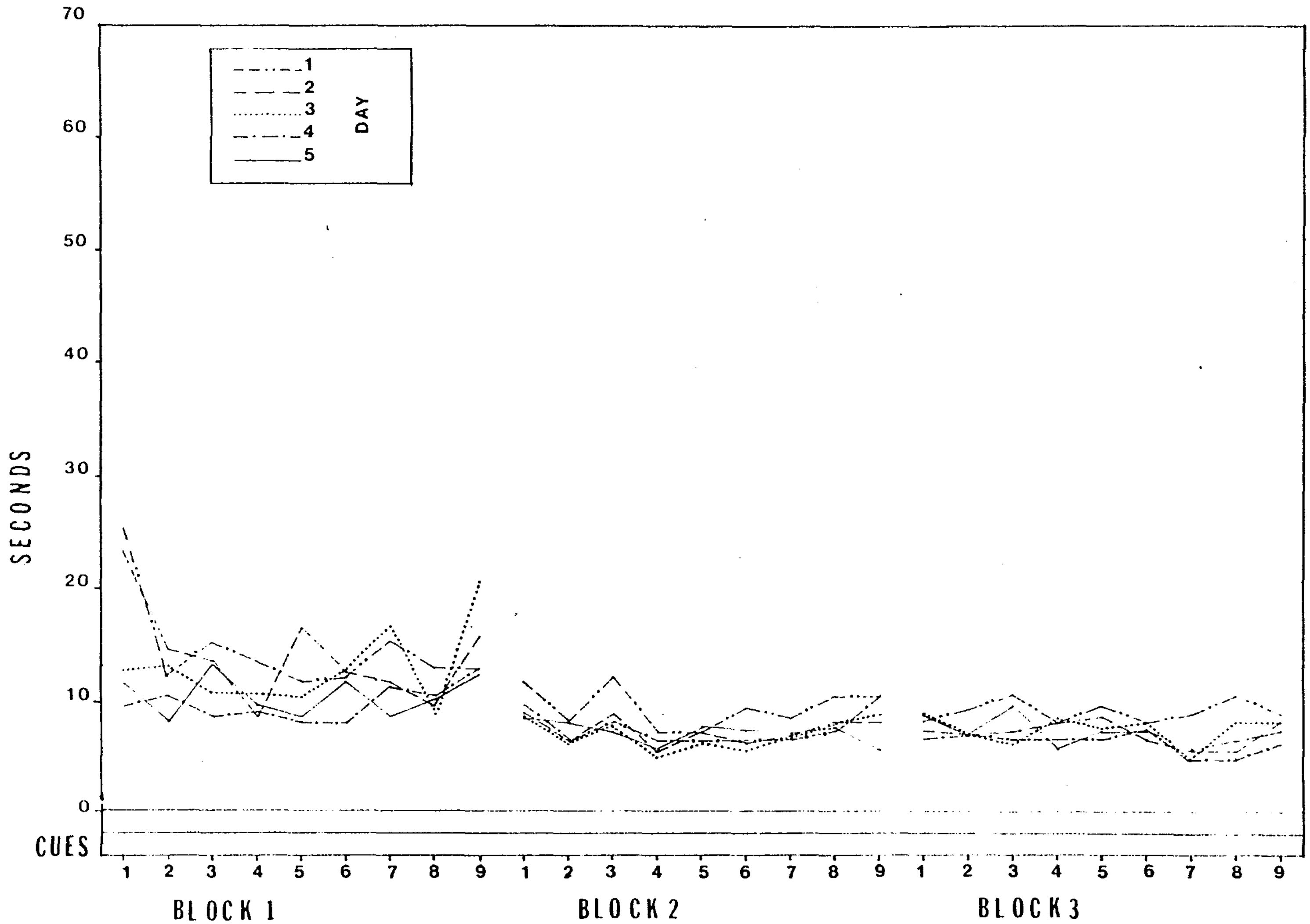

Figure 6. Cue Times - LV4 - Subject One.

Performance

The performance profiles for Subject One are shown in Figures 7-10. With respect to time, performances show little variation The decreases are similar across elements but the absolute times differ due to differences in the distances travelled and the performance demands of that element. An examination of the baseline graph in relation to major variations in performance times indicates a strong relationship between the necessity for returning to check a cue and an element performance time that varies widely from previous and subsequent times for the same element.

The HV4 sequence shows more variability early in the first block than the HV9. But, little difference is evident after the third trial. The LV segments show slower times than the HV segments at the start; they are relatively stable after the second trial.

The second intervention which changed the element order within the subsequences was followed by some slowing in performance, particularly in the HV segments.

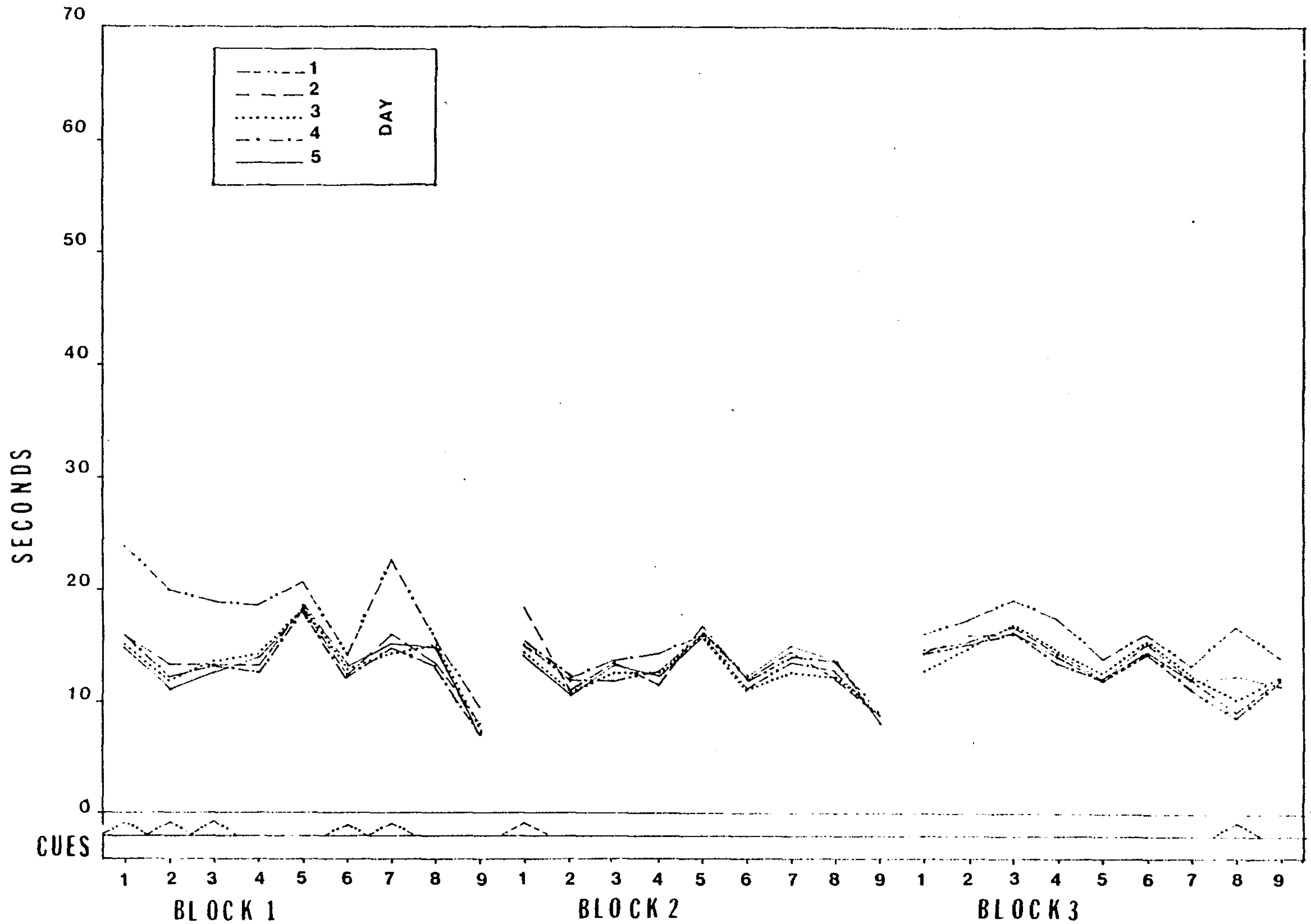

Figure 7. Performance Times - HV9 - Subject One.

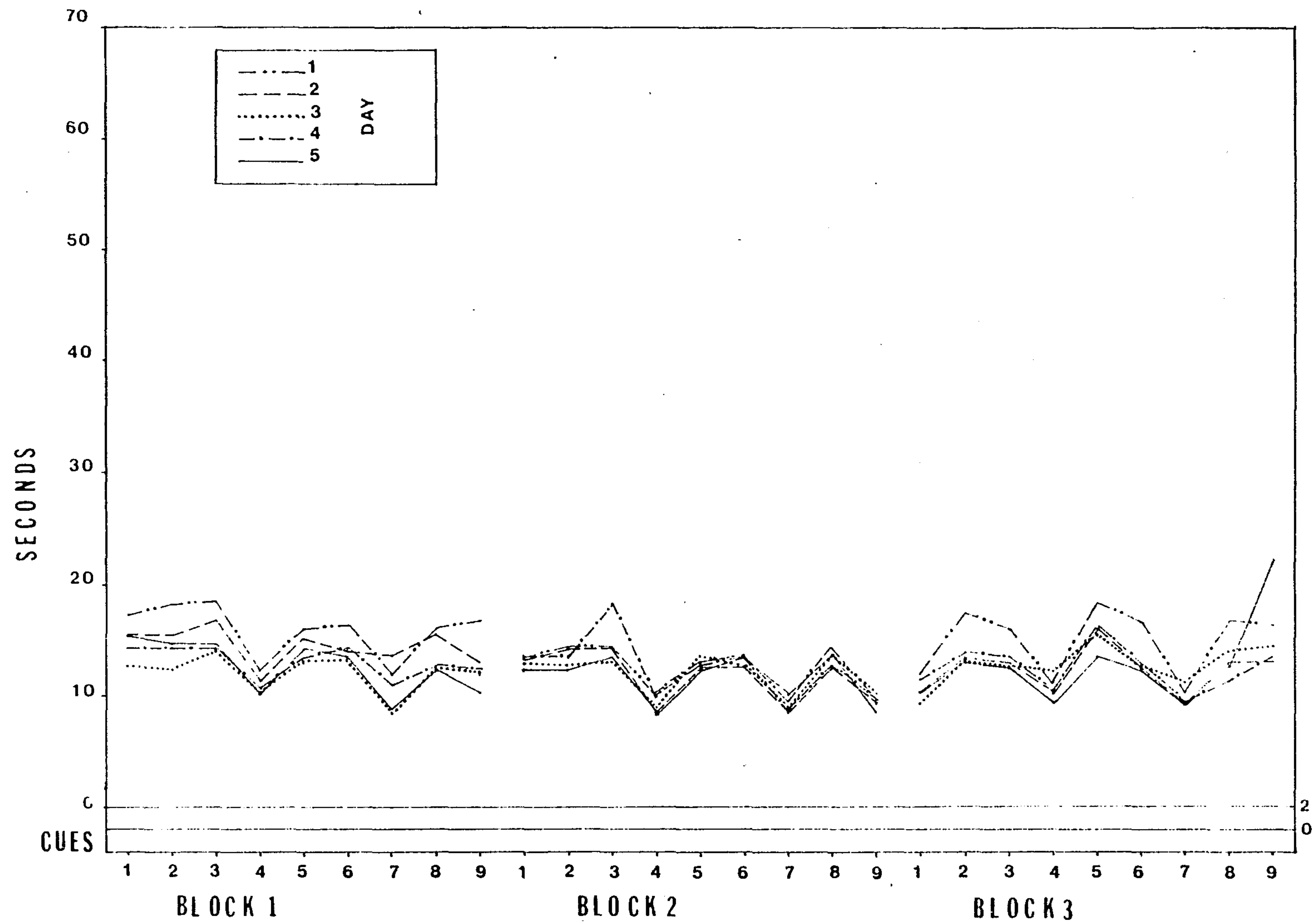

Figure 8. Performance Times - HV4 - Subject One.

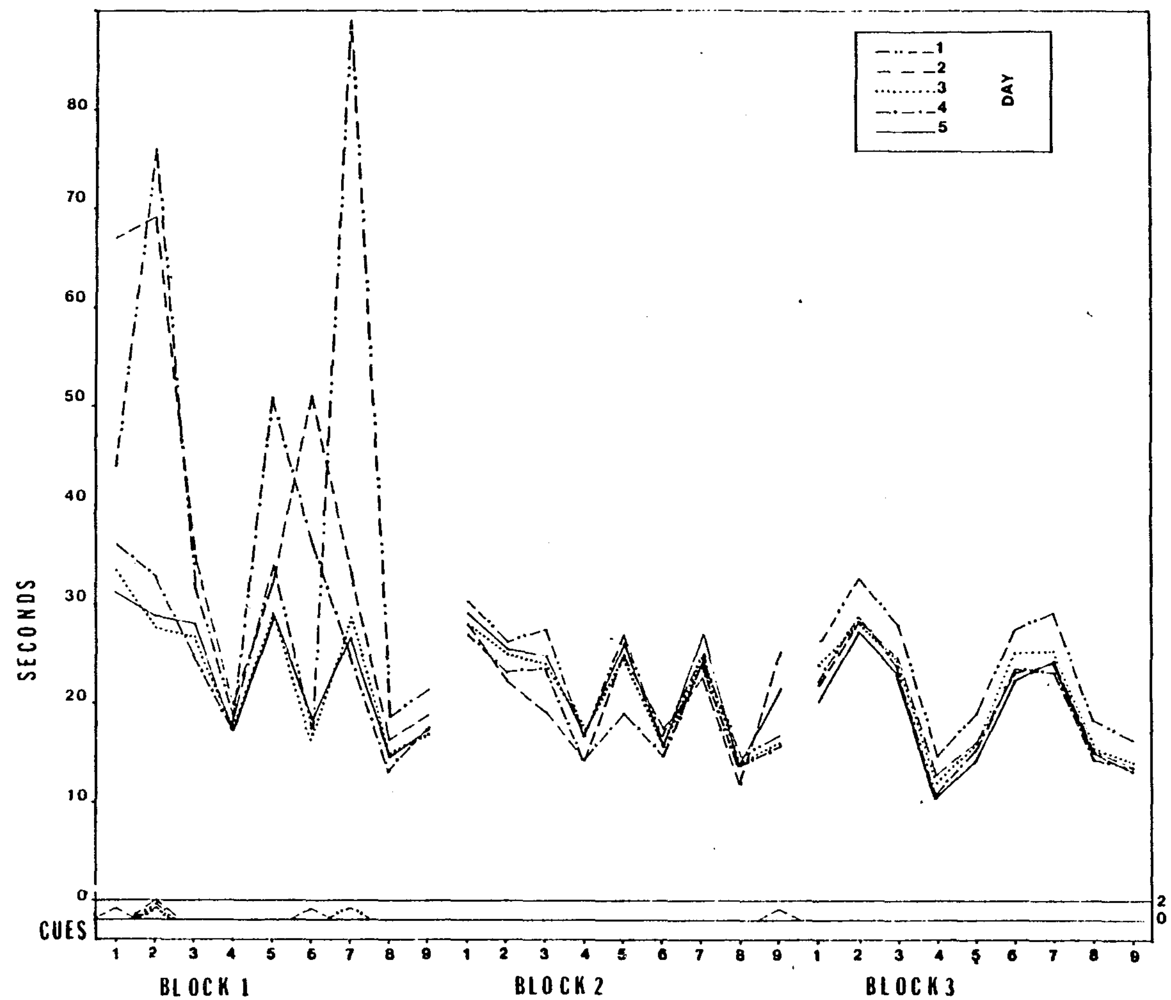

Figure 9. Performance Times - LV9 - Subject One.

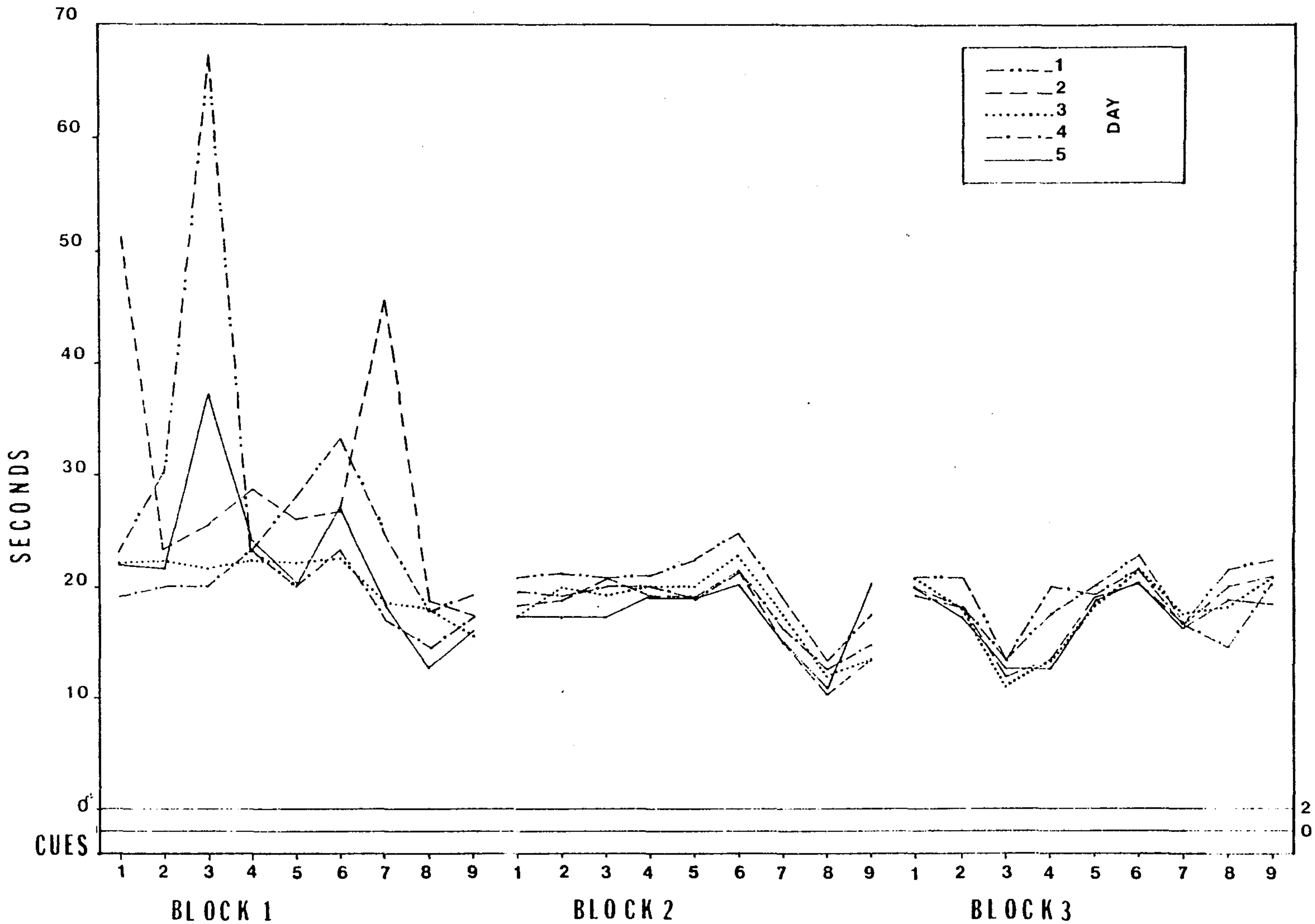

Figure 10. Performance Times - LV4 - Subject One.

Maps

Table 4 presents the map references made by Subject One. As hypothesized, more map referents were required in the nine-position sequences than in the four-position sequences. A seeming departure from the predicted trend of map usage is noted in the lower number of cue referrals made in Trial 1 compared to Trial 2 and the zero map referral total in the HV9 segment, the first sequence in Trial 1. Although unexpected, the pattern is not unexplainable if one considers that the subject was allowed to spend as much time as she wished in studying maps previous to starting a trial. It is possible that Subject One took advantage of this on the first day and was able to perform the first sequence without map referrals. But, by the time she reached the fourth sequence, the memory was less clear and she needed some assistance. On the second day, the reference to the maps could be made before performance However, the maps were not shown as part of the instructions. The subject may not have taken as much time before beginning and thus needed more map references than she had the previous day.

The only map references after the second trial were made in the LV9 sequence, one after a performance error. No map references were made after Trial 6.

Table 4

Map References - Subject One

Type	Sequence	Trials 1	2	3	4	5	6	Total
Initial	HV9		4					4
	HV4	1						1
	LV9	4	2				1	7
	LV4		2					2
A.E.	HV9							
	HV4							
	LV9	1	1		1			3
	LV4							
Total maps		6	9		1		1	17

Note: No map references were made by Subject One after Trial 6.

Errors

Tables 5 and 6 show the errors grouped by type sequence. Eighty-one percent of the errors were low-visual obstacle errors which were distributed across all elements. When obstacle errors were removed from the element totals, elements four, five and six showed fewer errors than the elements at the beginning and end of the sequences. More performance errors occurred in the HV sequences. All destination errors occurred in the LV sequences and were evenly distributed among the LV9 and LV4 sequences. With the exception of obstacle errors, the number of errors per trial decreased across Block 1. After Trial 6, there were no destination errors which coincided with the last map reference which also occurred in Trial 6. Most key contact errors were made in the HV sequences in Block 1.

Tossing

Figure 11 shows the summary of the tossing scores and times. Through all trials, the long tossing times were slower and the scores lower than the short tossing. The discrepancy in time is not necessarily implied by the task; the number of tosses is the same in both sequences. The subject may have taken more time in an effort to raise the consistently lower scores in the long tossing. A second possible explanation is the relative positions of

Table 5

Errors by position - Subject One

Error Type	Sequence	Position 1	2	3	4	5	6	7	8	9
Obstacle	HV9									
	HV4	1								
	LV9	7	5	7	2	3	4	3	1	5
	LV4	4	3	3	2	1	3	4	3	2
Performance	HV9	1						1	1	1
	HV4	1								2
	LV9									2
	LV4				1					
Destination	HV9									
	HV4									
	LV9	1	2				1	1		
	LV4	1		2				1	1	
Other	HV9	2		1			1		1	1
	HV4	3								1
	LV9			1						
	LV4		1			1				
Position Totals		21	11	14	5	5	9	10	7	14
Non-obstacle Totals		9	3	4	1	1	2	3	3	6

Table 6

Errors by Trial - Subject One

Error Type	Sequence	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Obstacle	HV9															
	HV4							1								
	LV9	3	7	3	4	4	4	5				2				5
	LV4	8	1			2		7				4	1			2
Performance	HV9							1			1	1				
	HV4	1							1							1
	LV9							1			1					
	LV4														1	
Destination	HV9															
	HV4															
	LV9	2	3		2											
	LV4	1	2		1	1										
Other	HV9	3	1	1	1											
	HV4	1	1			2										
	LV9		1													
	LV4	1					1									
Trial Totals		20	17	4	8	9	5	15	1	0	2	7	1	0	1	8
Non-obstacle Totals		9	9	1	4	3	1	2	1	0	2	1	0	0	1	1

the two sequences in the task. The short toss was performed in sequence two when the subject was "fresh". The long toss occurred in sequence five and was done following back-to-back multi-element sequences.

The last trial in each of the first two blocks shows an increase in time in both tossing sequences over the previous times; the last trial in Block 3 shows a decrease. This "Friday effect" does not follow a pattern of low scores from the previous day. The decrease in Trial 15 could be explained by the subject's anxiousness to finish what had been a long process. Her total time on the last day was under fourteen minutes,a time not previously achieved. The increase in time on the two previous Fridays was not paralleled by an increase in total time.

The scores across the first intervention show no more variation than had been previously shown although the short tossing scores peaked at 107 in Trial 8. Following the second intervention, the long tossing scores dropped much lower than previous levels and remained there throughout Block 3.

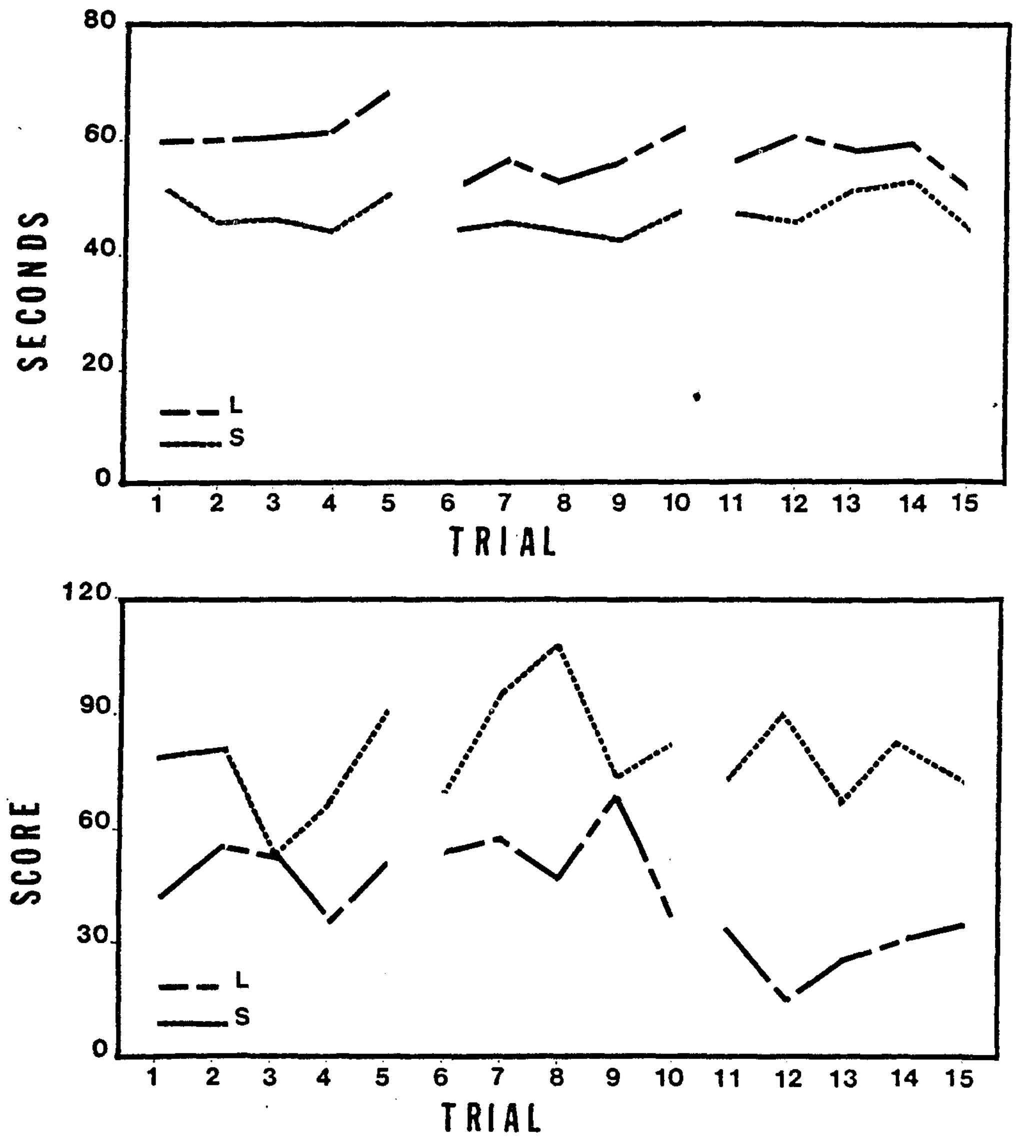

Figure 11. Tossing Summary - Subject One.

Pacing Intervals

Table 7 shows the times for the pacing intervals within the task. There is no significant variation across the fifteen trials. In Trial 1 where some hesitation might be expected while the subject was attempting to remember the order of sequence performances, only one time, the mat-to-mat time at the end of sequence one, shows hesitation. The break in times between Trial 5 and Trial 6 in the mat-to-mat times to and from the tossing sequences reflects the reordering of the subsequences and the change in the distance traversed in the interval.

Subject Two

Subject Two was a twenty-one-year-old student at UNC-G. Her scores for the perceptual tests were .6 degrees average displacement for the RFT and 50 (95th percentile) on the Space Relations scale.

Total Times

Figure 12 depicts total task times for Subject Two. The trend of times is not consistent through the task. Block 1 times show a downward trend. Block 2 times show an increasing trend; Block 3 times are variable within the block but show no trend. Trial 6, which was performed following a change in sequence order, breaks sharply downward in time from the previous trial. A similar break is seen after the second intervention.

Table 7

Pacing Intervals - Subject One

Interval		Trials 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KM	END 1	2.0	1.6	1.7	1.4	1.6	2.4	1.6	1.6	1.6	1.2	1.2	1.6	1.6	1.6	1.2
MM	1-2	6.0	2.4	1.5	1.4	1.6	2.8	4.0	2.8	2.8	3.2	3.2	3.2	3.2	2.4	3.2
MM	2-3	4.1	3.9	3.6	3.2	3.2	1.6	1.6	1.6	1.6	1.6	.8	1.2	1.6	1.2	1.2
KM	END 3	2.0	1.7	1.5	1.6	1.2	1.6	.8	1.2	.8	1.2	1.6	1.2	.8	1.2	1.2
MM	3-4	4.0	4.4	3.2	3.0	3.6	3.2	3.2	3.2	3.2	3.2	4.0	3.2	3.2	3.6	3.2
KM	END 4	1.6	1.6	1.6	1.6	1.6	2.8	1.6	1.6	1.6	1.6	2.0	1.6	2.0	1.6	2.0
MM	4-5	4.8	2.4	3.2	3.2	3.2	1.6	.8	1.2	1.2	1.6	.8	1.6	1.6	.8	1.6
MM	5-6	2.7	2.0	1.1	.8	1.6	3.2	3.2	3.2	2.8	3.2	3.2	2.8	3.2	2.4	3.2
KM	END 6	2.6	2.0	1.6	1.6	.8	1.6	2.0	1.2	2.4	1.6	1.6	1.2	.8	1.2	1.6

KM From contact key at end of element nine to contact mat ending sequence

MM From contact mat ending sequence to contact mat beginning next sequence

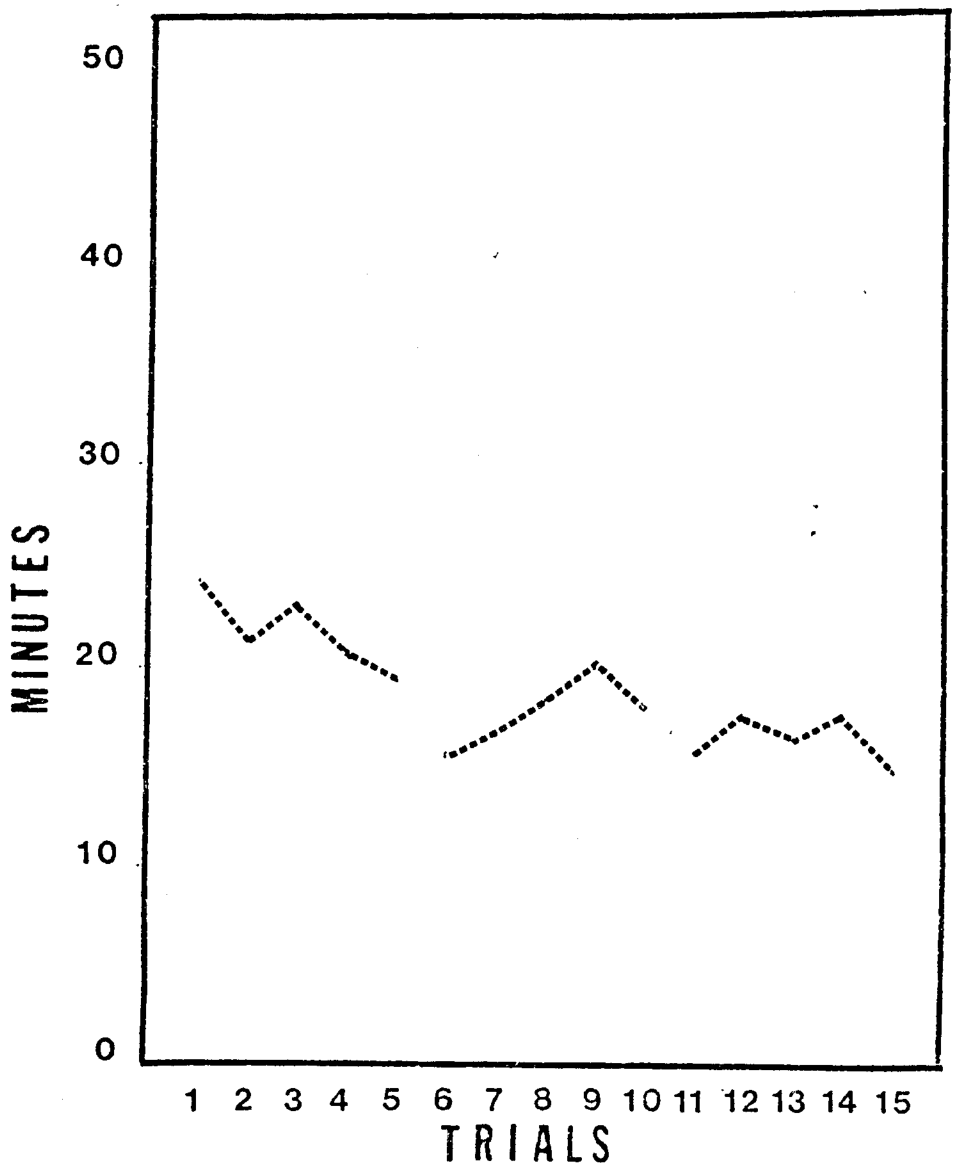

Figure 12. Total Task Times - Subject Two.

Cues

The cue profiles for Subject Two are displayed in Figures 13 through 16. The HV sequence times were faster through all three blocks of trials. The difference decreases sharply after the first block for the four-position sequences. The decrease in cue times shows no pattern related to position but the cue referral baseline information shows a distinct pattern. By Trial 7, no initial cue was used for Element 1. In Trial 8, the first element in the LV4, LV9, and HV4 sequences required no cue reference.The same occurrence was noted for element 5 in LV9. In Trial 9, the first, second, and third elements in the LV9 sequence and the first in the HV4 sequence required no cue. By Trial 10, elements 1, 8, and 9 in HV4, element 9 in LV4, and elements 1,2,3, and 4 in LV9 required no cues. Following the second intervention which changed element order within subsequences, cues were required for all elements again until Trial 14. An exception was element 9 in LV9 which required no cue reference. It is important to note that the lack of cue reference is not necessarily reflected in faster cue times. The subject spent considerable time deciding whether she would attempt to perform the element without referring to the cue or not. In some cases, after considerable debate, she did consult the cue; in other

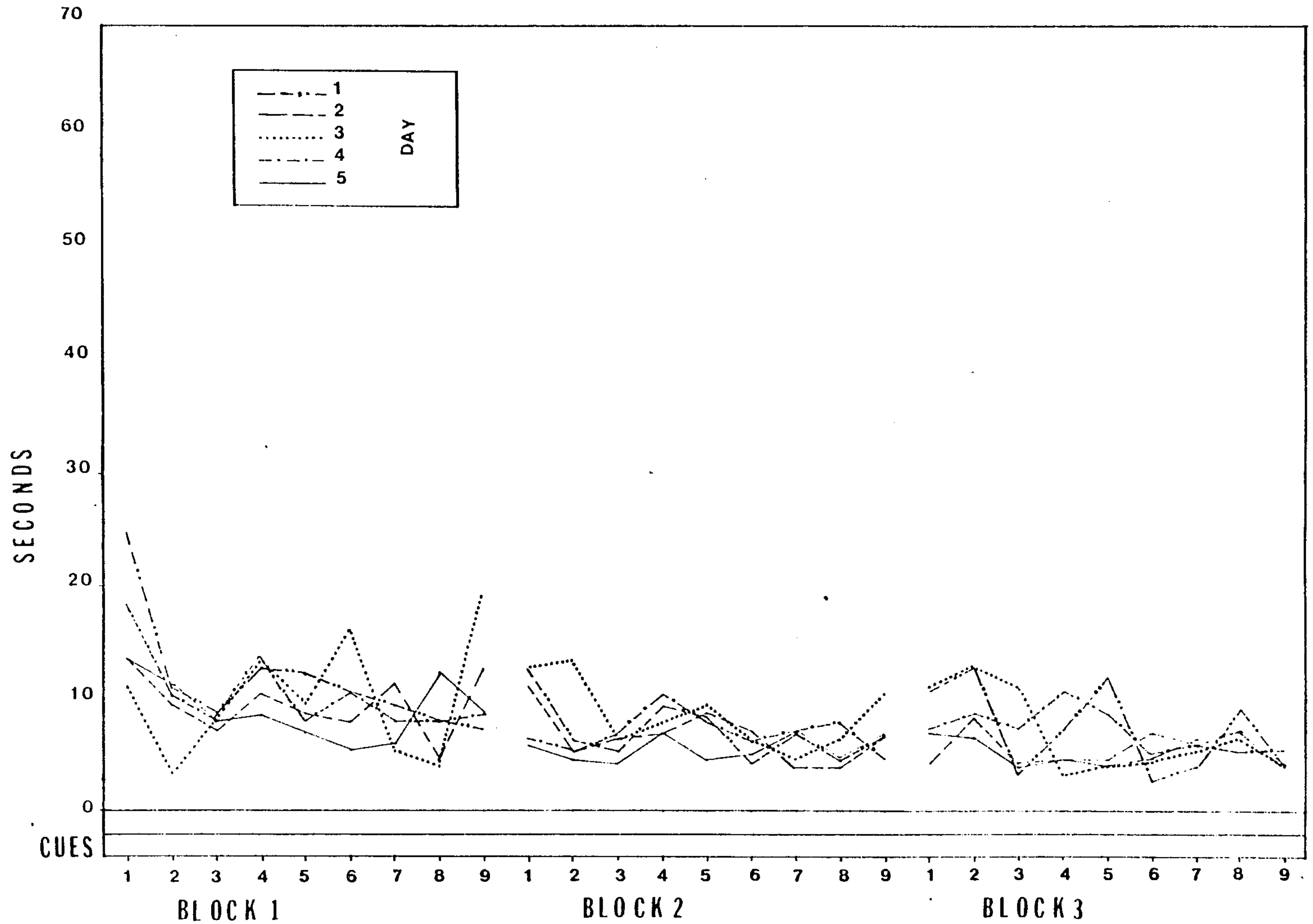

Figure 13. Cue Times - HV9 - Subject Two.

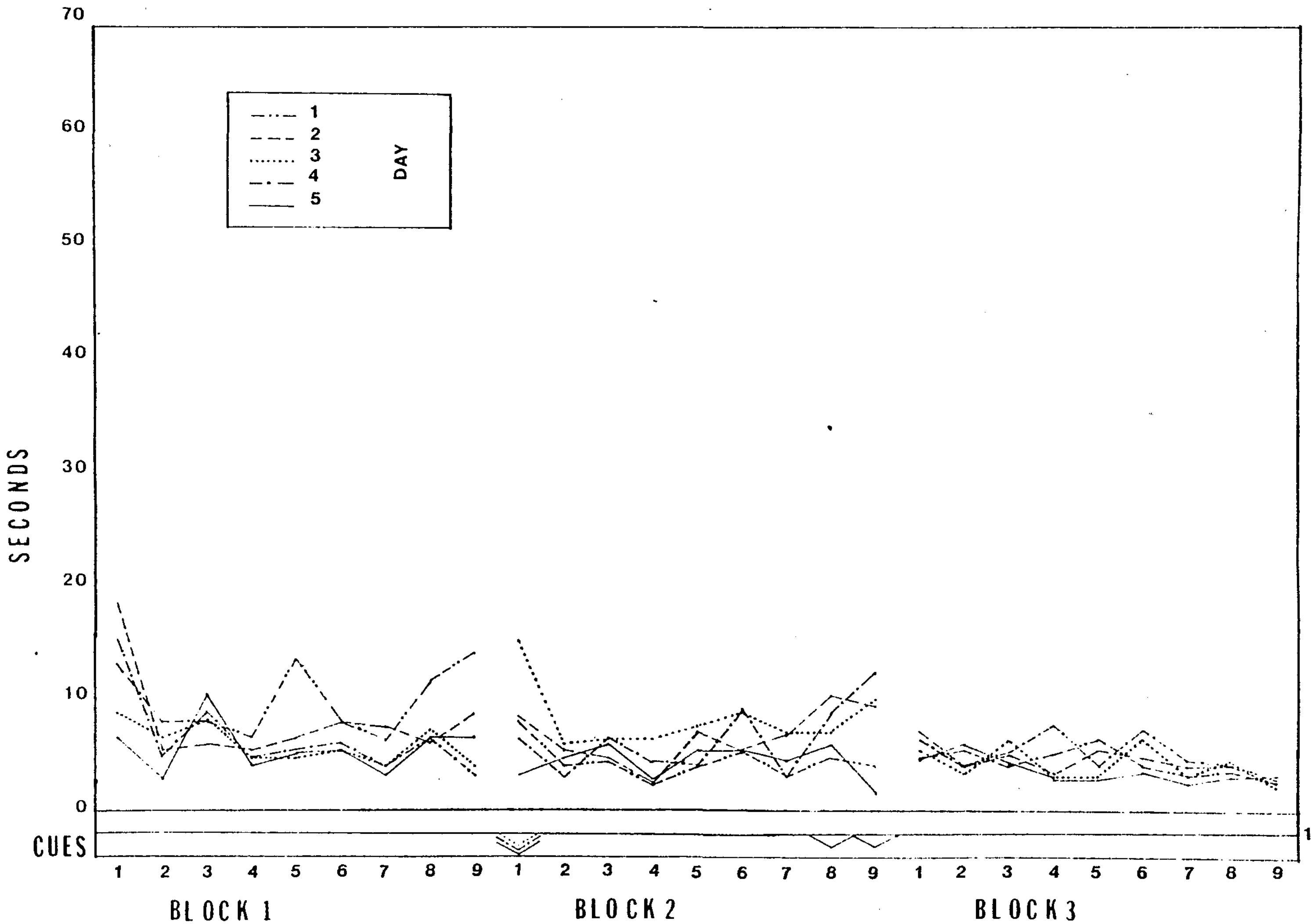

Figure 14. Cue Times - HV4 - Subject Two.

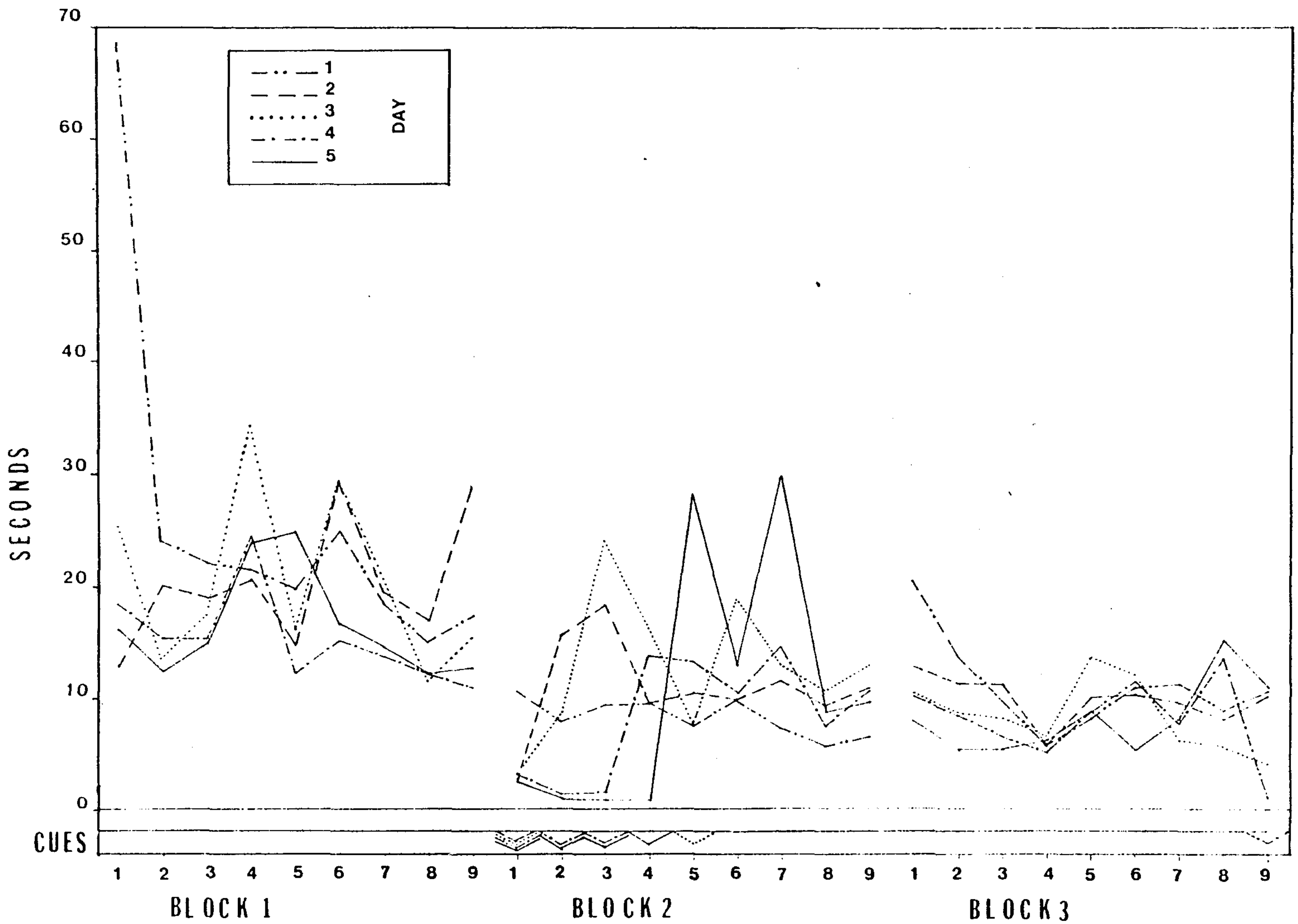

Figure 15. Cue Times - LV9 - Subject Two.

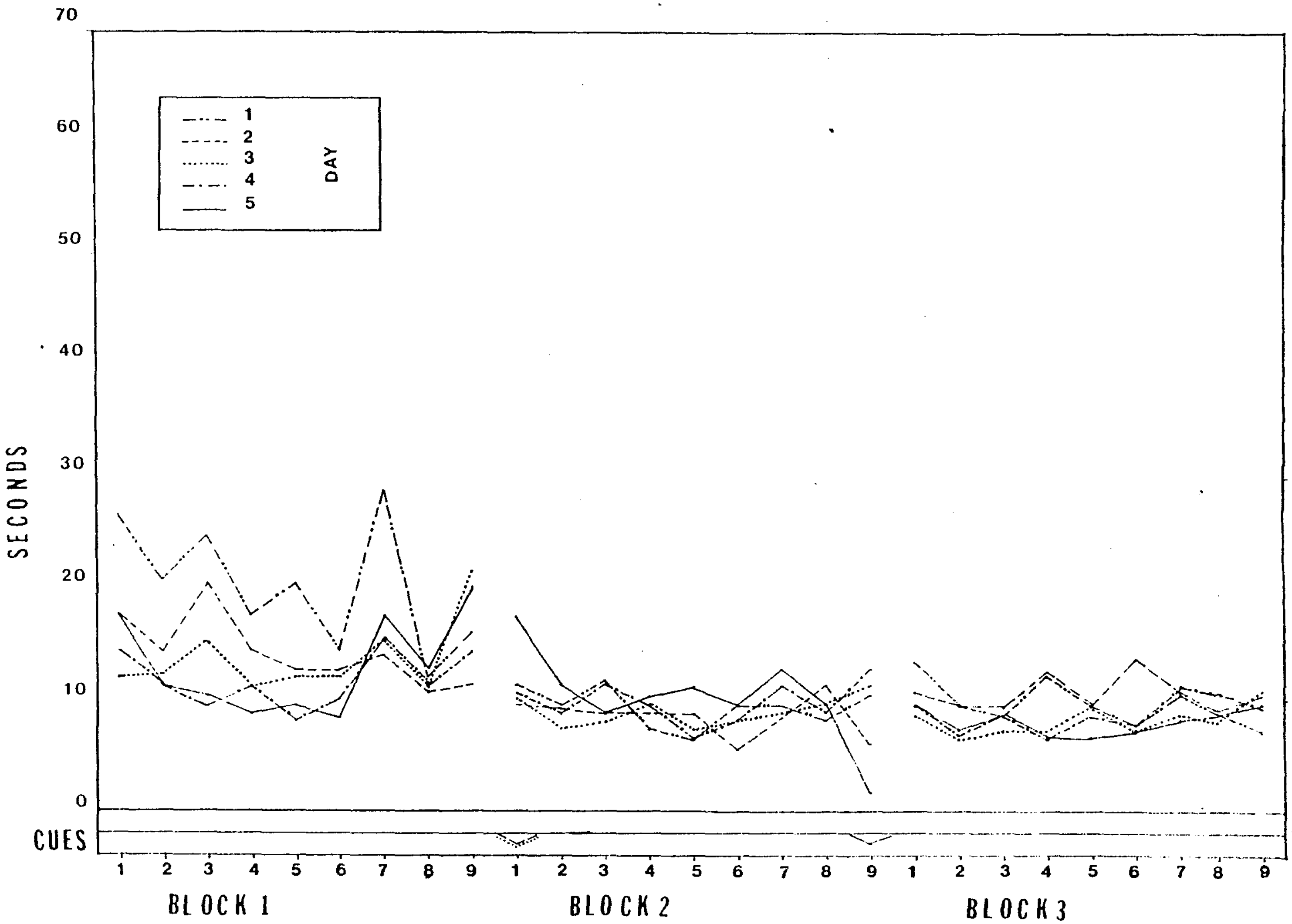

Figure 16. Cue Times - LV4 - Subject Two.

cases, she decided to go ahead without a cue. The fluctuation in LV9 times in Block 2 particularly reflects this process. This is also evident in the rise in total times which can be seen across Block 2.

Performance

Profiles of performance times and baseline secondary cue presented are profiled in Figures 17 through 20. In the HV and LV4 sequences, the profiles show consistent times after the first trial with occasional spikes which are related to the necessity for returning to the cue table to check the cue. The high spike in HV4 shows a return to check the cue subsequent to starting the performance with no initial cue (see Figure 14). To some degree the uneven times through Block 2 may be attributable to the memory process discussed above. In particular, the need for a second cue in Trial 9 in element 3 of the LV9 sequence shows a slow performance time following no initial cue. In this sequence, elements one and two were performed successfully with no initial cue referral but the performance times were slower than the previous trials. The same pattern is seen in Trial 7 in the first element in LV4, in Trial 8 in element 5 in LV9, and in Trial 10 in element 8 in LV4. The extraordinarily slow time for element 6 in Trial 9 of the LV9 sequence is also coupled with an error and a return for a cue reference but the reason for the long delay is not clear. Other elements which necessitated a return for a cue reference following an error were performed 20 to 30 seconds more slowly than when performed without error; the time for LV9 element 6 in Trial 9 was more than a minute slower than the previous trial.

The performance times across Block 3 are consistent. Two anomalies were observed: (a) the lowest performance times occurred in Trial 11 following the second intervention and (b) Trial 14 is elevated across all elements with a spike at element 8 in LV9. These two departures are consistent with the fluctuations in total time shown in Figure 12.

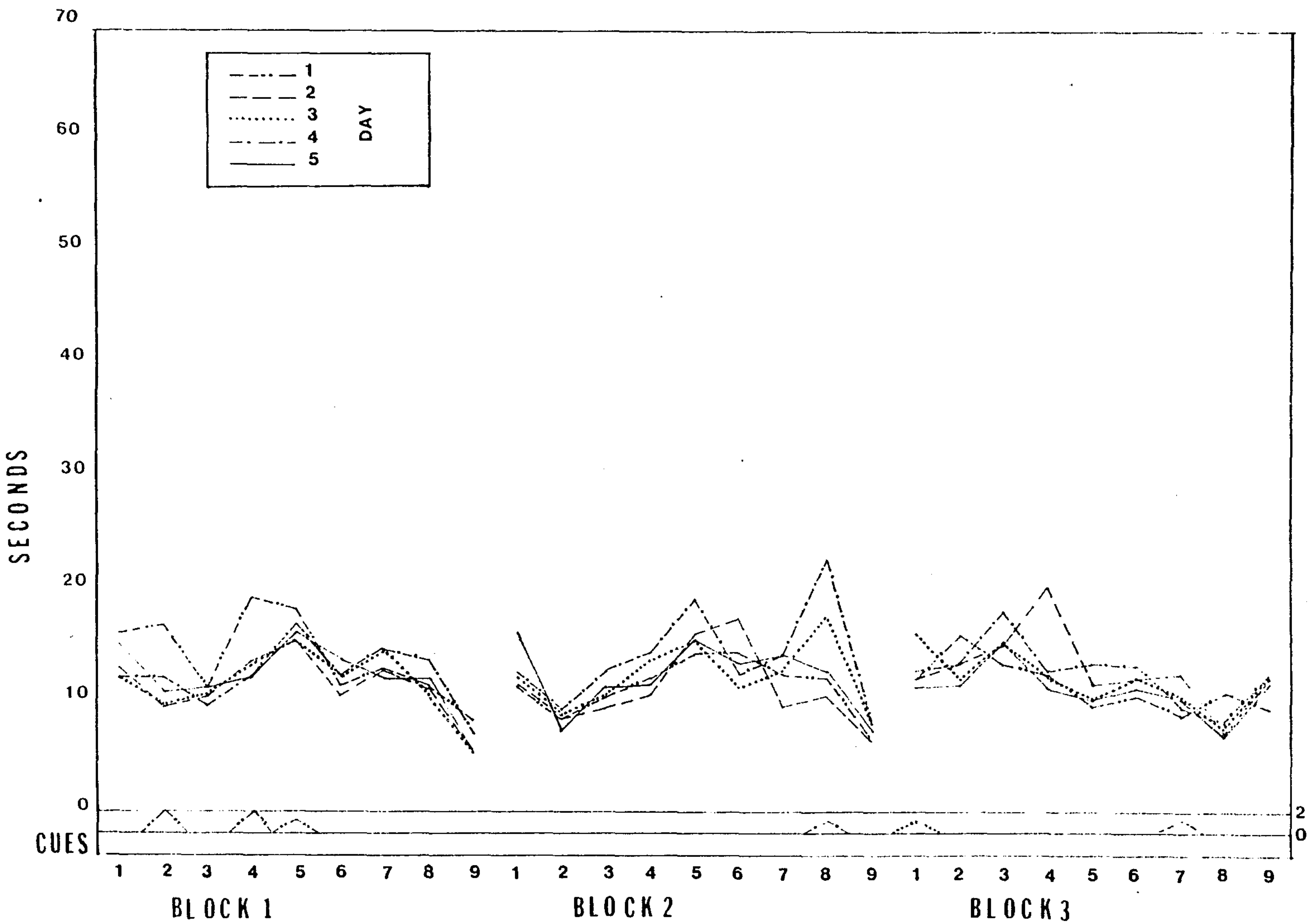

Figure 17. Performance Times - HV9 - Subject Two.

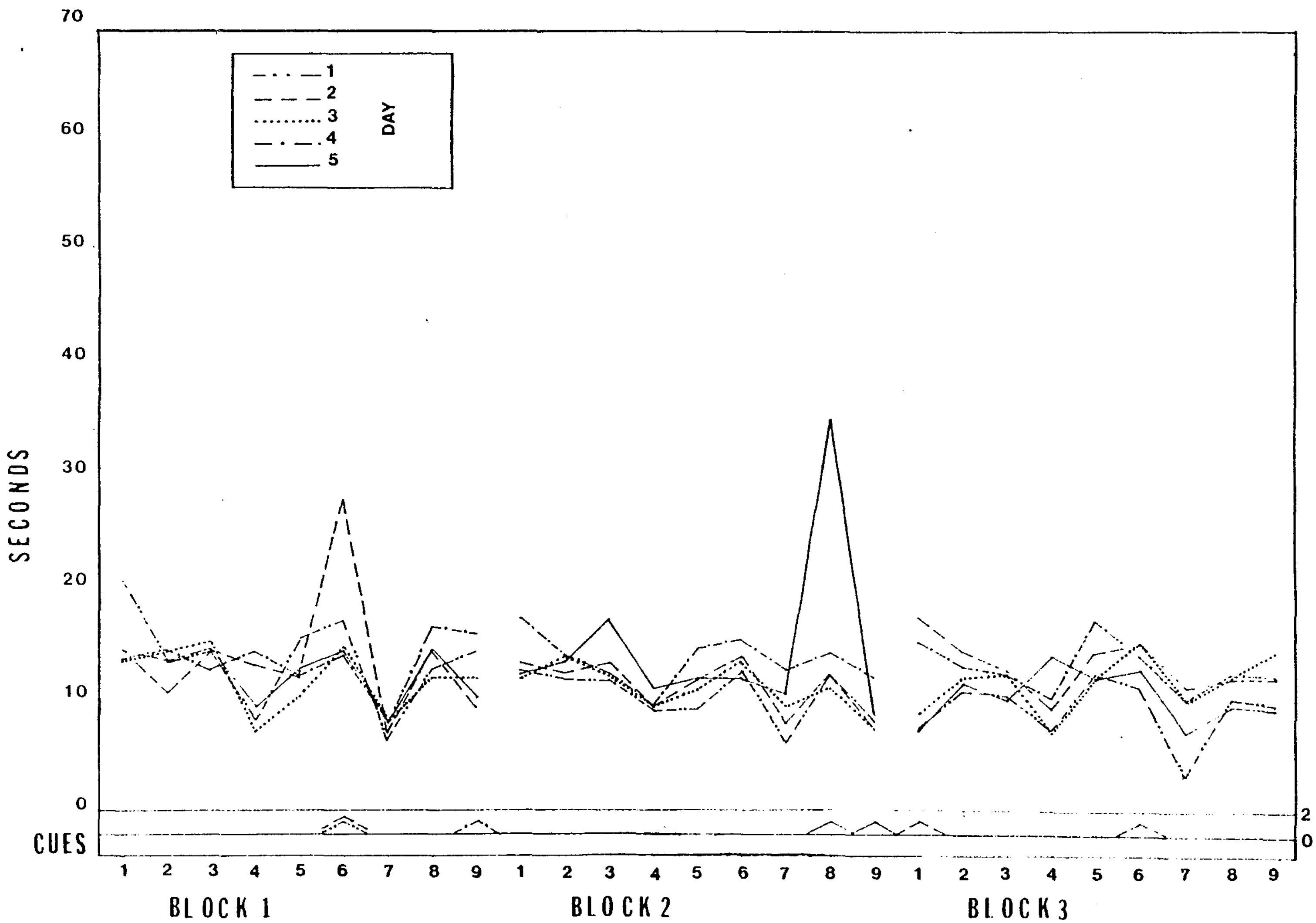

Figure 18. Performance Times - HV4 - Subject Two.

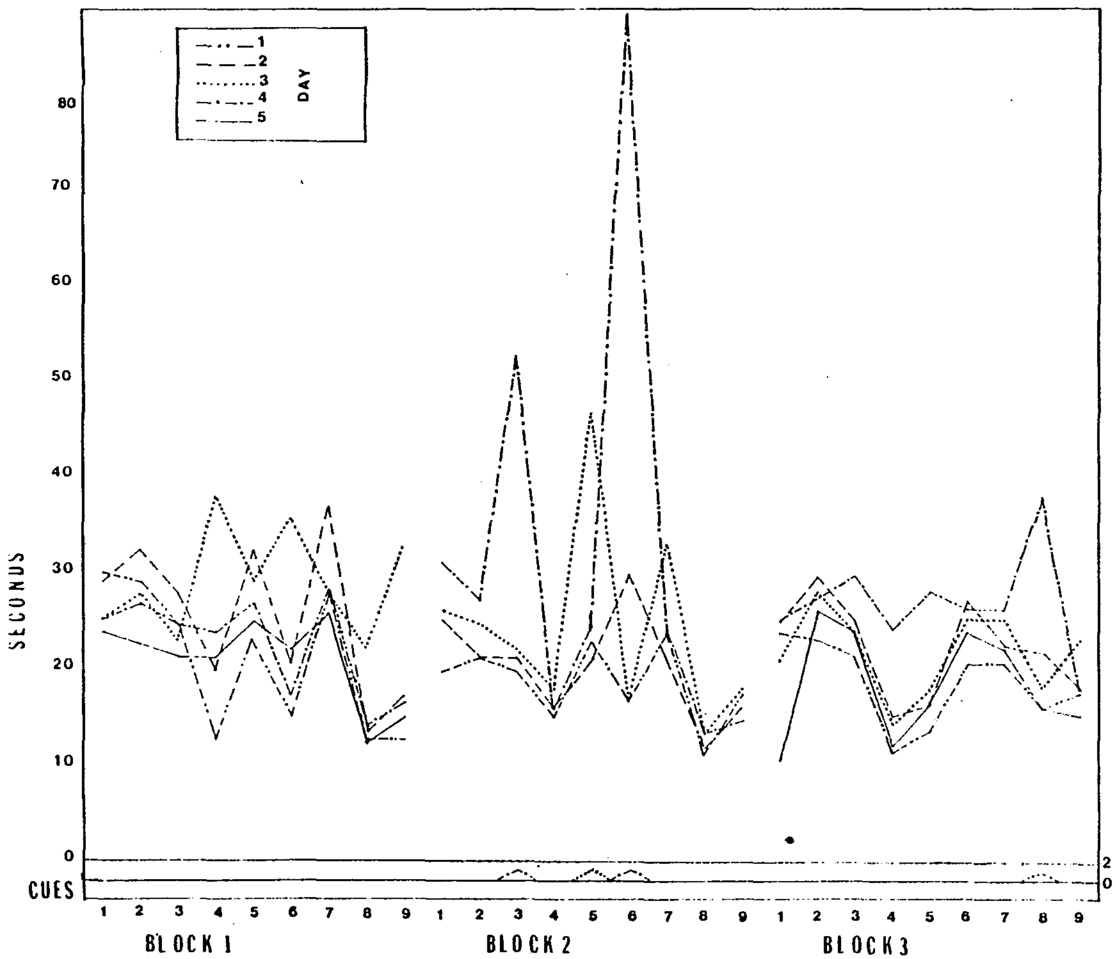

Figure 19. Performance Times - LV9 - Subject Two.

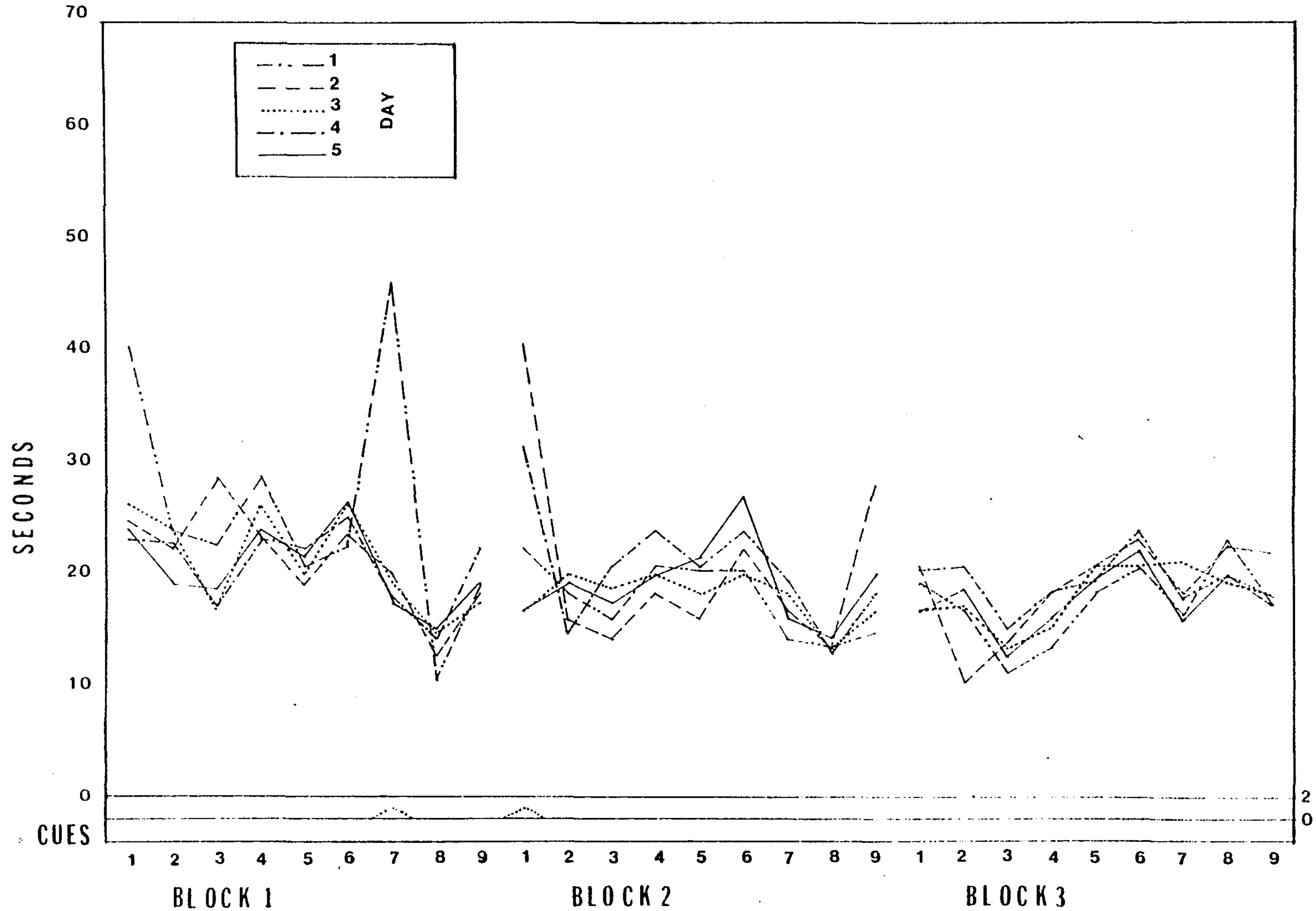

Figure 20. Performance Times - LV4 - Subject Two.

Maps

Table 8 shows the map references made by Subject Two. A high number of map references was made in the four-position sequences in Trial 1. The total number of references was cut by the second trial to only two four-position references. No map references were made within the subsequences after the third trial. However, Table 11 shows very slow pacing interval times before each of the nine-position sequences in Trial 3 and Trial 4. During

Table 8

Map References - Subject Two

		Trials 1	2	3	....Total
Initial	HV9	7	4	3	14
	HV4	8	1		9
	LV9	9	6		15
	LV4	5	1		6
A.E.	HV9				
	HV4				
	LV9			1	1
	LV4				
Total Maps		29	12	4	45

these intervals, the subject studied the map for the coming sequence before contacting the element key to start the cue time for the first element.

Errors

Errors by position are shown in Table 9; errors by trial are presented in Table 10. The obstacle errors were consistent across elements but occurred almost entirely in the LV9 sequence in Trial 1. The non-obstacle errors are spread across the positions with slightly higher totals occurring in the first and last position. The errors by trial profile shows a decrease across Block 1. The first trial following the first intervention reveals only one performance error. The remaining trials in Block 2 show an elevated number of errors, particularly in performance, in sequences which had been error-free during the first block. As previously noted in the discussion of Subject Two's peformance times, Block 2 was characterized by several attempts to perform elements from memory. In several of these attempts, either a performance or destination error was made which necessitated a return to check cue information. Key contact errors were most frequent in the first trial. The key contact errors continued to occur in the HV9 sequence across blocks, most frequently in the last two element positions.

Table 9

Errors by Position - Subject Two

Error Type	Sequence	Position 1	2	3	4	5	6	7	8	9
Obstacle	HV9									
	HV4									
	LV9	2	2	1	2	4	1	5	1	2
	LV4							1		
Performance	HV9	1					2			1
	HV4				1		2		1	4
	LV9					1		1	1	
	LV4	2								1
Destination	HV9				1				1	
	HV4	1			1					
	LV9			1			2			1
	LV4	1		1				2		
Other	HV9	1	1		1		1	1	3	3
	HV4	1	1			1				
	LV9									
	LV4	1		1	1			1		
Total		10	4	4	7	6	8	11	7	12
Non-Obstacle		8	2	3	5	2	7	6	7	8

Table 10

Errors by Trial - Subject Two

Error Type	Sequence	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Obstacle	HV9															
	HV4															
	LV9	18	1					1								
	LV4	1														
Performance	HV9							1	1	1				1		
	HV4		2	1	2						2		1			
	LV9								2						1	
	LV4							2		1						
Destination	HV9									1			1			
	HV4												1			1
	LV9			2						2						
	LV4	2	1					1								
Other	HV9	3	1	1	1				2	1		1			1	
	HV4	2				1										
	LV9															
	LV4	4														
Total		30	5	4	3	1	1	5	5	5	2	1	3	1	2	1
Non-obstacle		12	4	4	3	1	1	4	5	5	2	1	3	1	2	1

Tossing

Figure 21 shows the tossing summary for Subject Two. The time for the long toss remains close to the 60-second level across all three blocks; the short tossing time shows more fluctuation. The long tossing scores indicate an alternating pattern in the first and third blocks. This could occur if the previous low score generated more concentration in the next trial. The consistent series of low long toss scores across Trials 7 through 10 coincides with the increase in error scores and total performance times associated with Subject Two's attempts to perform elements from memory.

Pacing Intervals

The profile of pacing interval times in Table 11 shows slow MM times from sequence one to two in the first three trials and one slow KM time at the end of the first sequence in Trial 1. The slow times in the first trial were not unexpected as some subject hesitation was predictable when moving from sequence to sequence the first time through the task. The reason for the slowness of the MM time through Trial 3 is not clear. The large MM times between sequences two and three and five and six in Trials 3 and 4 are the result of the subject's choice to take time to study the nine-position maps thoroughly before starting those sequences. The results of the

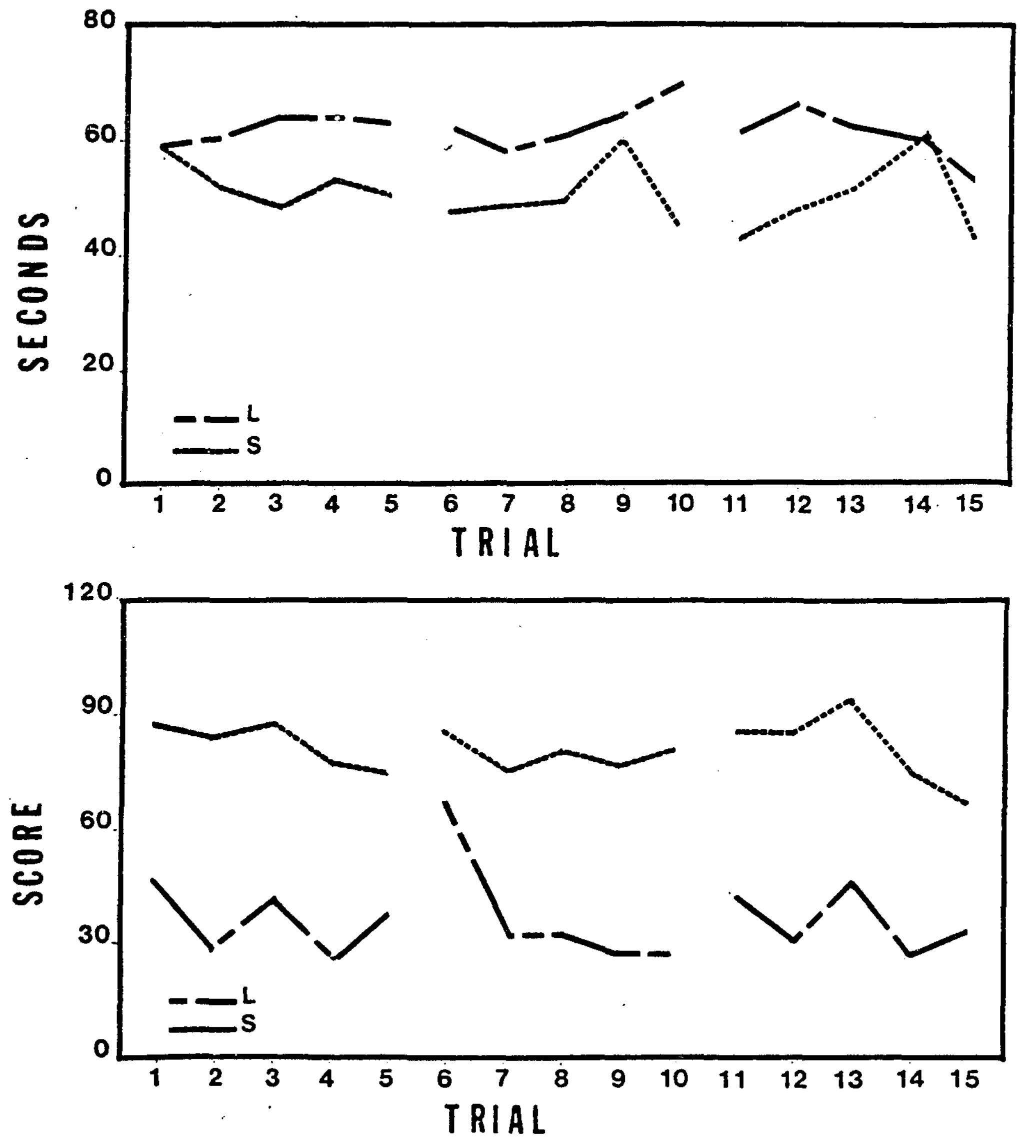

Figure 21. Tossing Summary - Subject Two.

strategy are shown in the drop to zero in map references within those sequences by Trial 4. No map references were made after Trial 3 within the sequences but 26 seconds were spent studying the maps before each nine-position sequence in Trial 4.

Subject Three

Subject Three was a nineteen-year-old student at UNC-G. Her scores for the perceptual tests were 1.4 degrees for the RFT average displacement and 52 (95th percentile) on the Space Relations scale.

Total Times

Figure 22 shows total task times for Subject Three. After the initial decrease from Trial 1 to Trial 2, the times plateau across the remaining trials in Block 1. The time following the first intervention which changed the element order within multi-element subsequences maintains the same level as the previous trial. The times decreased for the first four trials in Block 2, then leveled off. The plateau extended across the second intervention which changed the subsequence order within the task. A decrease of 42 seconds is indicated in the final trial.

Table 11

Pacing Intervals - Subject Two

Interval		Trials														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KM	END 1	9.2	4.4	4.8	3.2	.8	1.6	1.2	2.4	.8	.8	1.6	1.2	.8	1.2	.8
MM	1-2	9.1	6.4	6.4	4.8	4.0	4.0	2.4	1.6	1.6	1.6	1.6	1.2	1.6	1.6	1.6
MM	2-3	3.4	4.0	49.6	25.6	4.8	4.0	4.0	4.4	3.6	5.6	2.8	3.6	3.2	4.4	2.4
KM	END 3	3.2	2.0	1.6	2.4	1.6	.8	3.2	.8	1.6	1.6	.8	1.6	1.2	1.2	1.6
MM	3-4	4.8	5.6	9.6	7.2	4.0	9.6	6.4	4.4	4.0	5.2	6.4	4.0	2.4	3.6	2.8
MM	4-5	2.0	1.6	2.0	1.6	1.6	3.2	4.0	4.4	3.2	3.6	2.8	3.2	2.8	4.4	2.4
MM	5-6	4.2	4.8	52.0	25.6	4.8	2.4	1.6	1.6	1.2	4.4	2.4	1.6	2.4	1.2	1.2
KM	END 6	1.8	1.6	3.2	1.6	.8	1.6	1.6	1.2	1.6	3.2	1.6	2.0	1.6	1.6	1.6

KM From contact key at end of element nine performance to contact mat ending sequence

MM From mat to end sequence to mat to begin next sequence

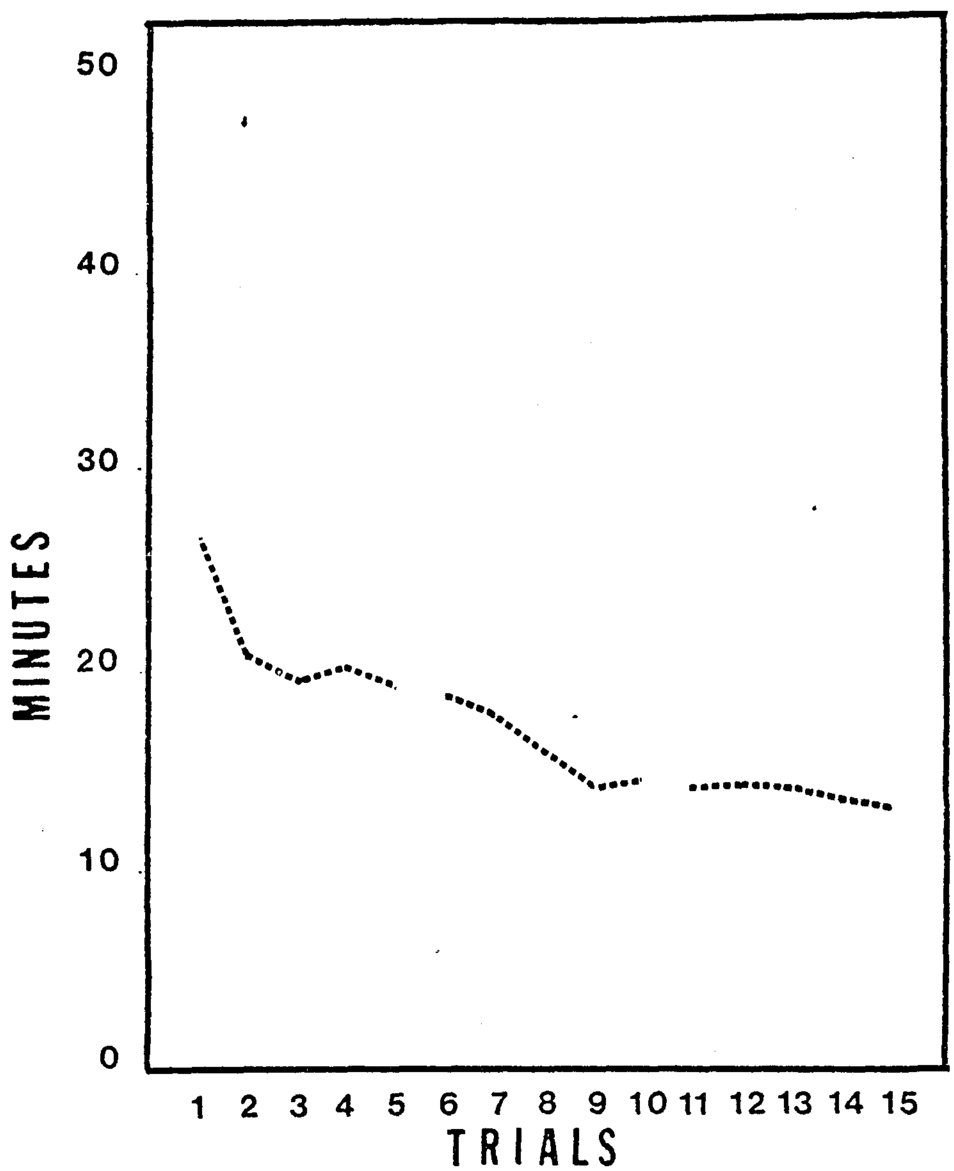

Figure 22. Total Task Times - Subject Three.

Cues

Figures 23 through 26 show the profiles of cue times for Subject Three. The HV times are much faster than the LV times initially; they show little change across the first intervention which changed element order. There was more variability in the LV time through Block 1. In LV9, times were erratic through the first two trials in Block 2 following the change of element order. Then, they dropped sharply for the first 6 elements in Trial 8. By Trial 9, the LV9 cue times were consistent at the 3- to 4-second level and held across the second intervention and through Block 3. By Trial 8, the LV4 times dropped at the beginning and end points of the sequence , but the middle elements, i.e., 3 through 6, did not fall as low until Trial 10. Cue times then remained at the 3- to 4-second level across the second intervention and through Block 3.

The pattern of initial cue references parallels the strong time pattern in the LV sequences, but not in the HV sequences. The HV times decreased very quickly across all elements by Trial 2 in HV4 and Trial 3 in HV9. Following the first intervention, there was a rise in times across all elements in HV9. Beginning with Trial 7, the first element in HV9, which was also the first element in the total task was performed without cue reference. In Trial 9, the first and second elements in HV4 were performed without cue reference. Following the second intervention which changed subsequence order, the first element in HV4 continued to be performed without cue but the second element required a cue in Trial 11. Thereafter, there were no cue references. Element 6 in HV4 required no cue through Block 3. This seeming departure from the pattern is clear when the content of elements 5 and 6 in the HV4 sequence is compared. The two performances are identical with respect to destination, hand movement, and block colors. They differ only in the number of blocks. If this relationship were recognized by Subject Three, the performance of element 5 would invoke the performance of element 6 by associative chaining from one element to the next. The perceived similarity could allow the two elements to be performed as a single chunk which was initiated by the cue at the beginning of element 5.

By Trial 14, only elements 6 and 8 in the HV9 sequence and 4,5,7, and 8 in the HV4 sequence required cue references. In the last trial, the only elements in the entire task which required cue references were elements 4, 6, and 8 in the HV9 sequence and elements 7 and 8 in the HV4 sequence.

The memory pattern was different in the two LV sequences. In the LV9 sequence, the first six elements were performed without cues in Trial 8. By the next

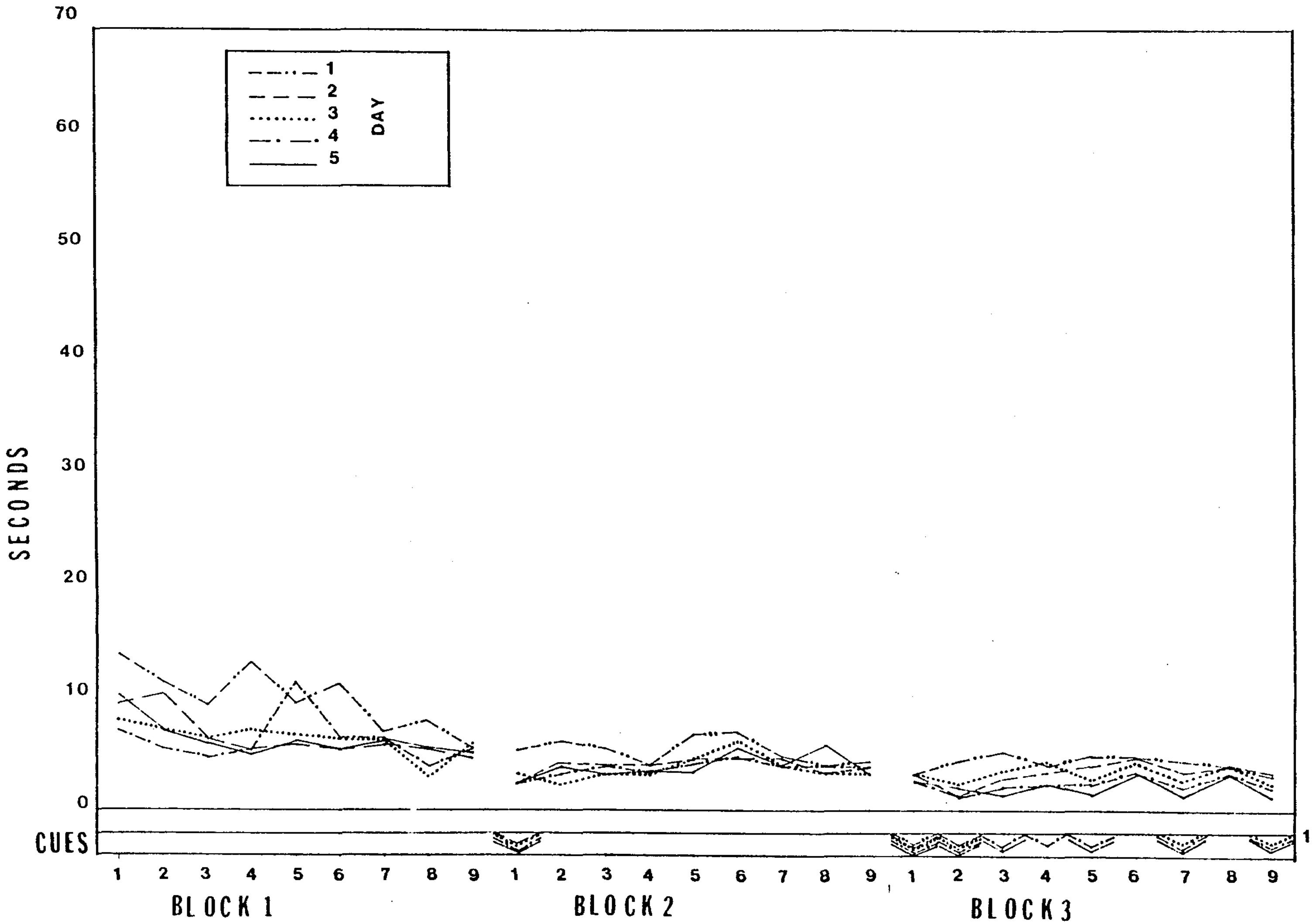

Figure 23. Cue Times - HV9 - Subject Three.

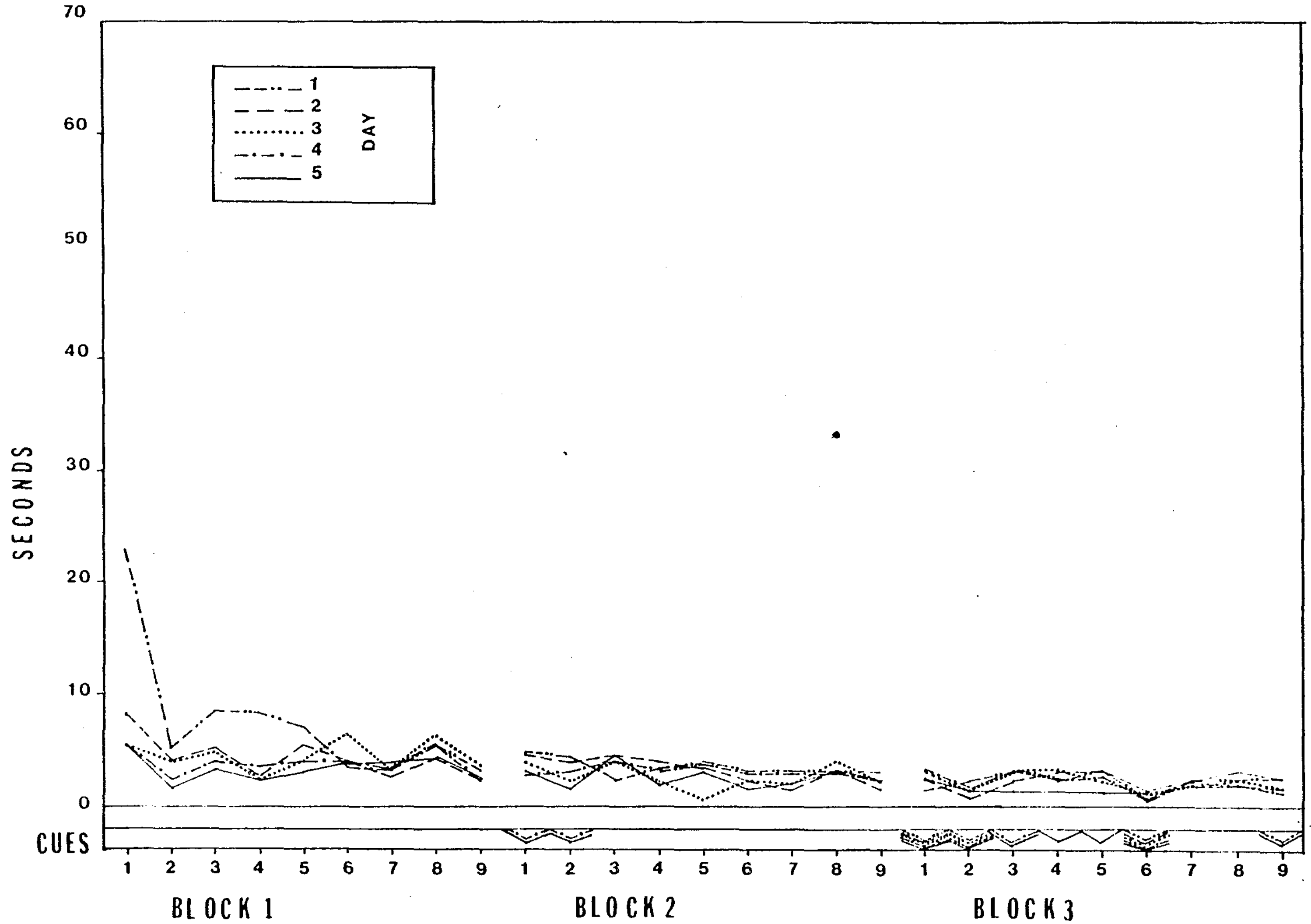

Figure 24. Cue Times - HV4 - Subject Three.

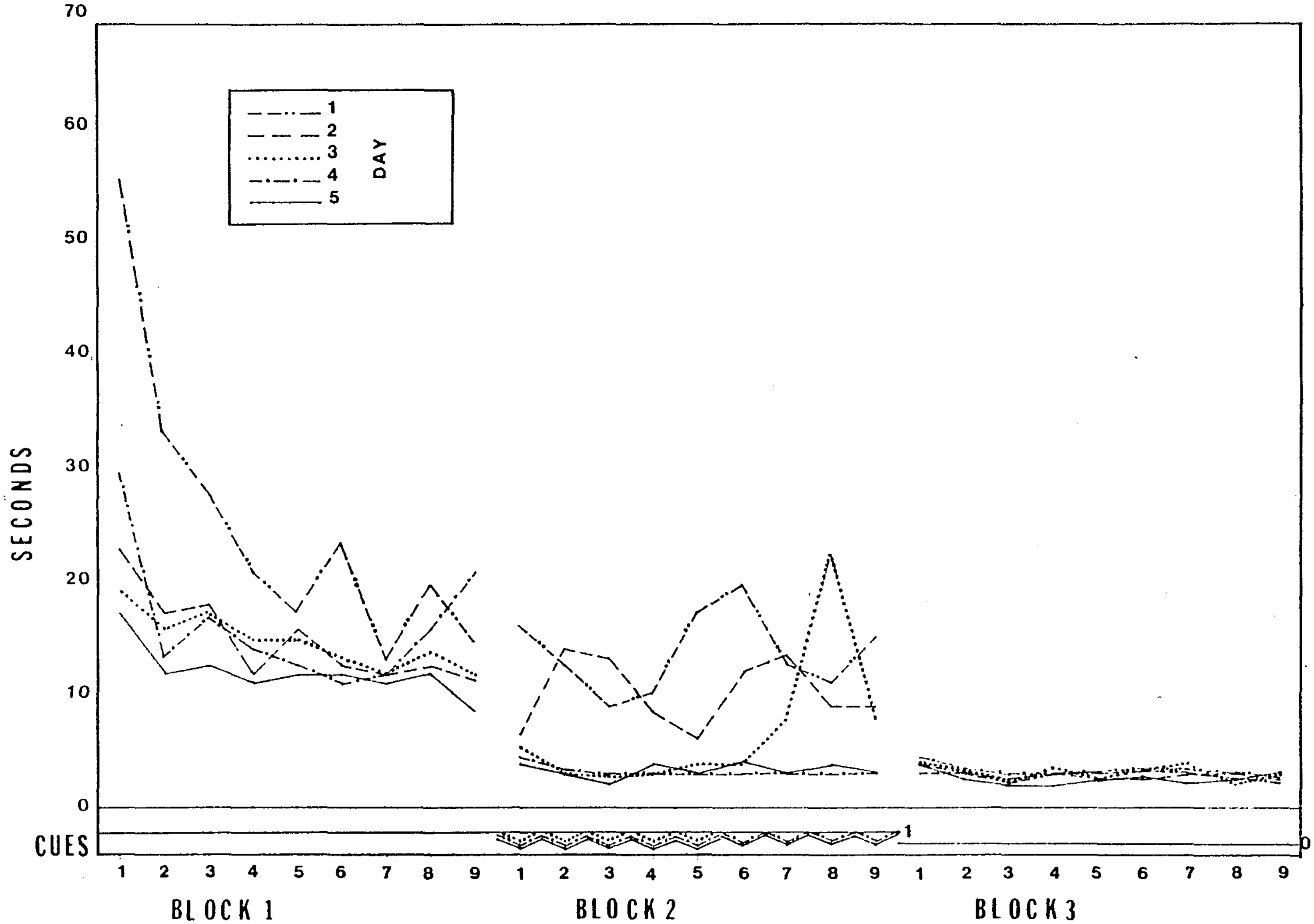

Figure 25. Cue Times - LV9 - Subject Three.

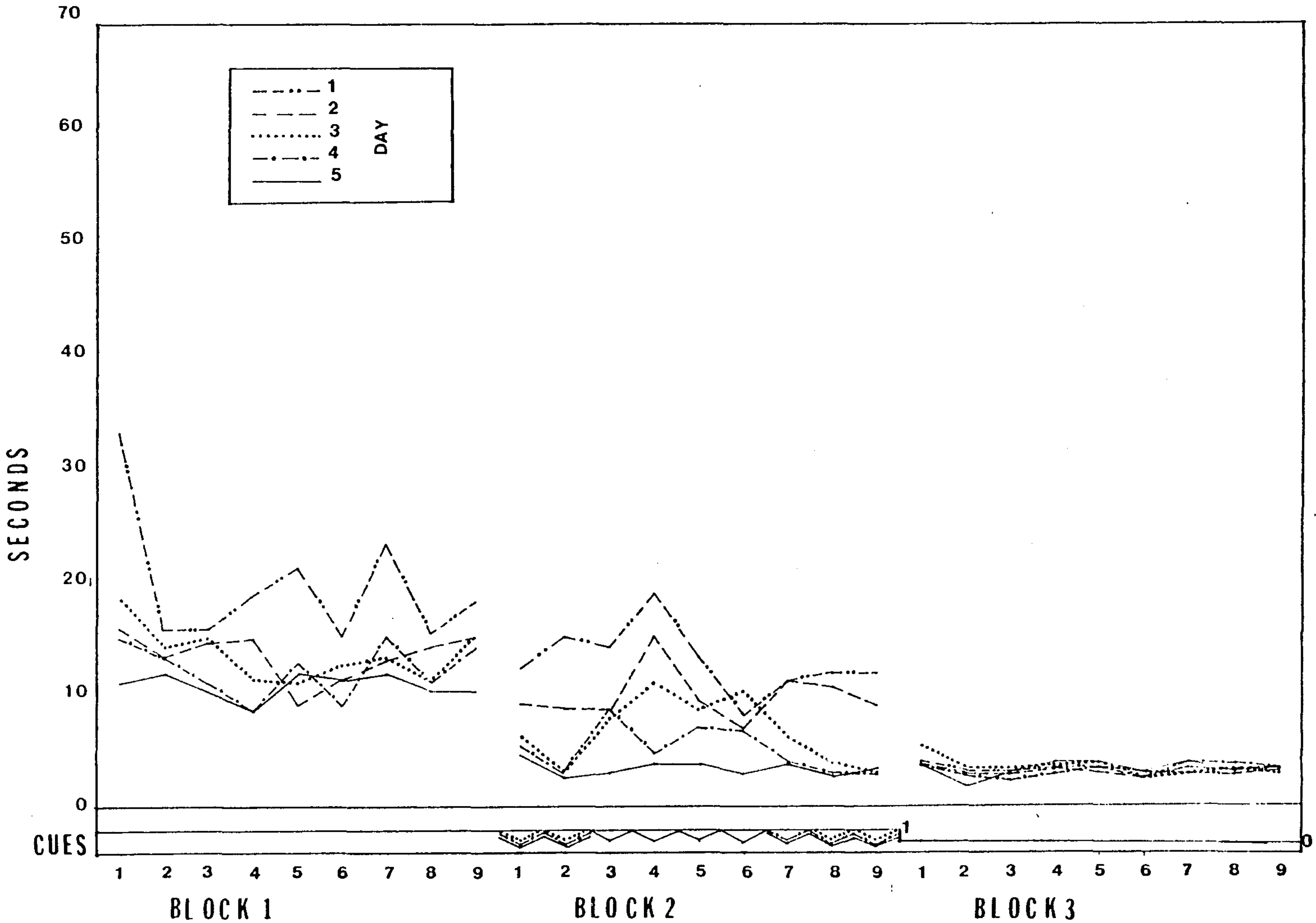

Figure 26. Cue Times - LV4 - Subject Three.

trial, the whole sequence was performed without cues. In the LV4 sequence, elements 1,2,8, and 9 were performed without cues in Trial 8. In Trial 9, element 7 was also performed without cues. In Trial 10, the whole sequence required no cue references.

Performance

Figures 27-30 show the performance times for Subject Three. The times, with the exception of the LV sequences in Trial 1, are clearly consistent. The two large spikes seen in the LV sequences and the one spike in the HV9 sequence correspond to a return for a cue referral following a performance error. In all cases, no initial cue referent had been made. The slower performance times in HV4 were related to performance errors which necessitated rechecking the cue.

The consistency of Subject Three's performance times illustrates the baseline differences in performance times which are built into the task by the differing destination and performance requirements.

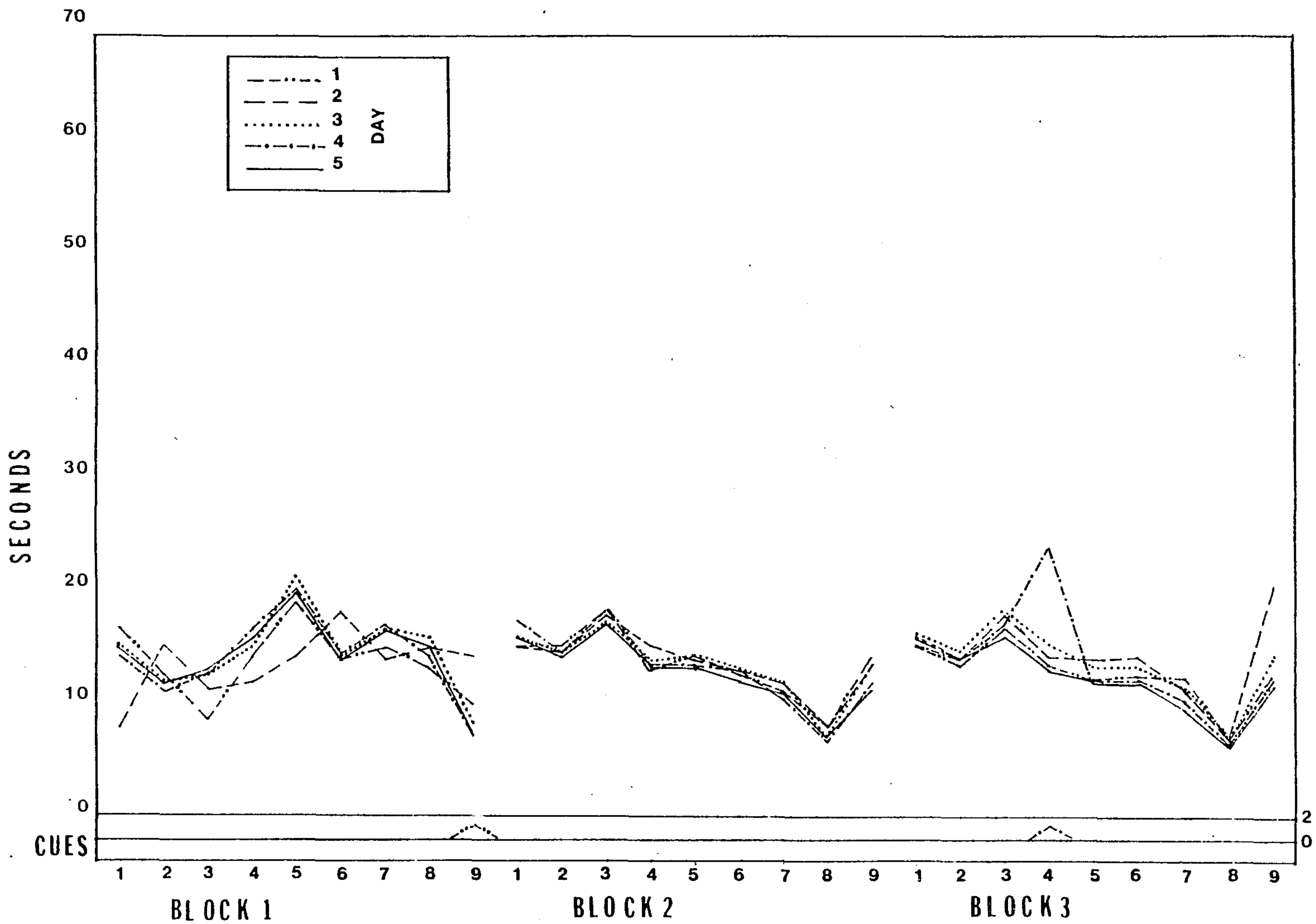

Figure 27. Performance Times - HV9 - Subject Three.

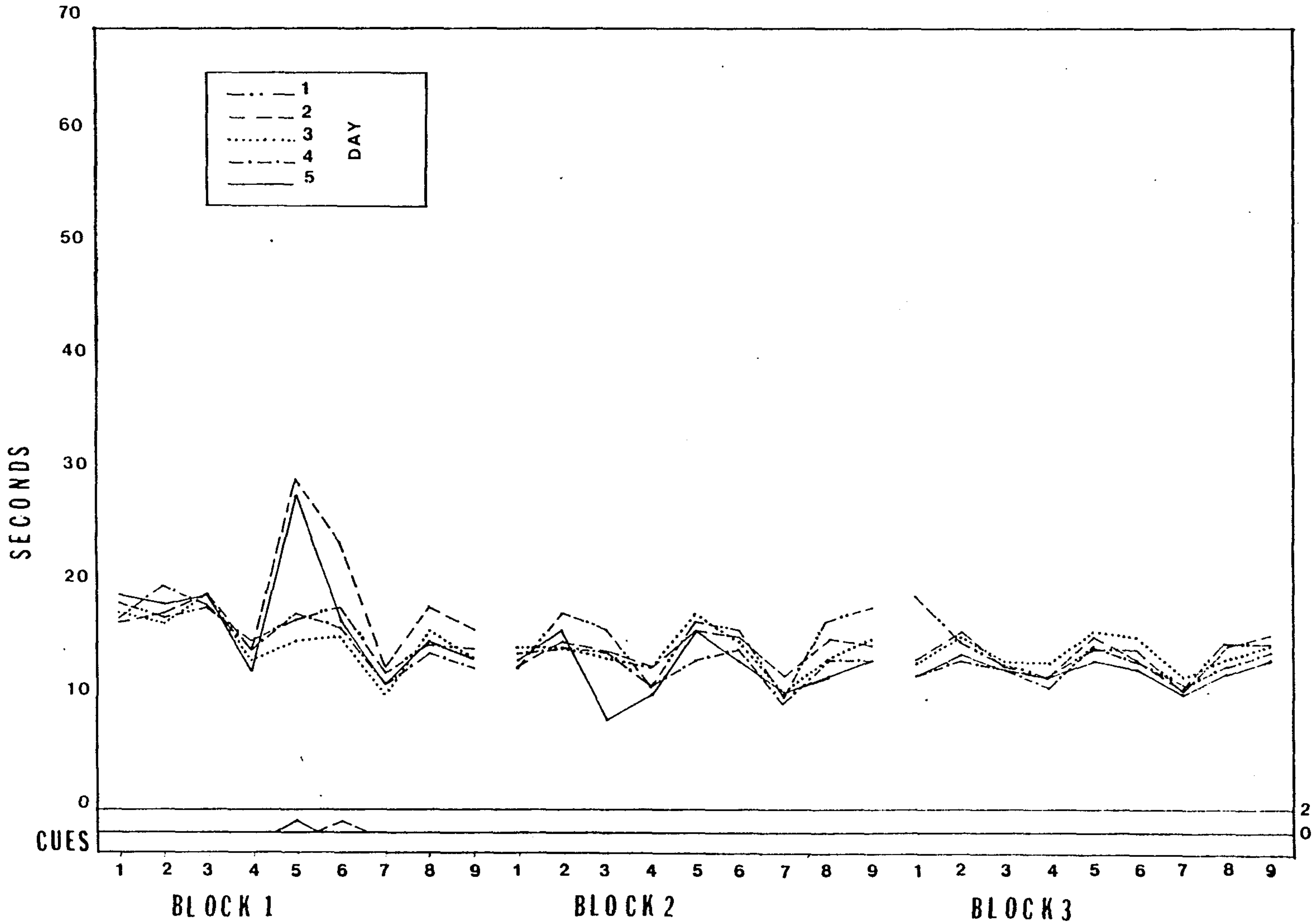

Figure 28. Performance Times - HV4 - Subject Three.

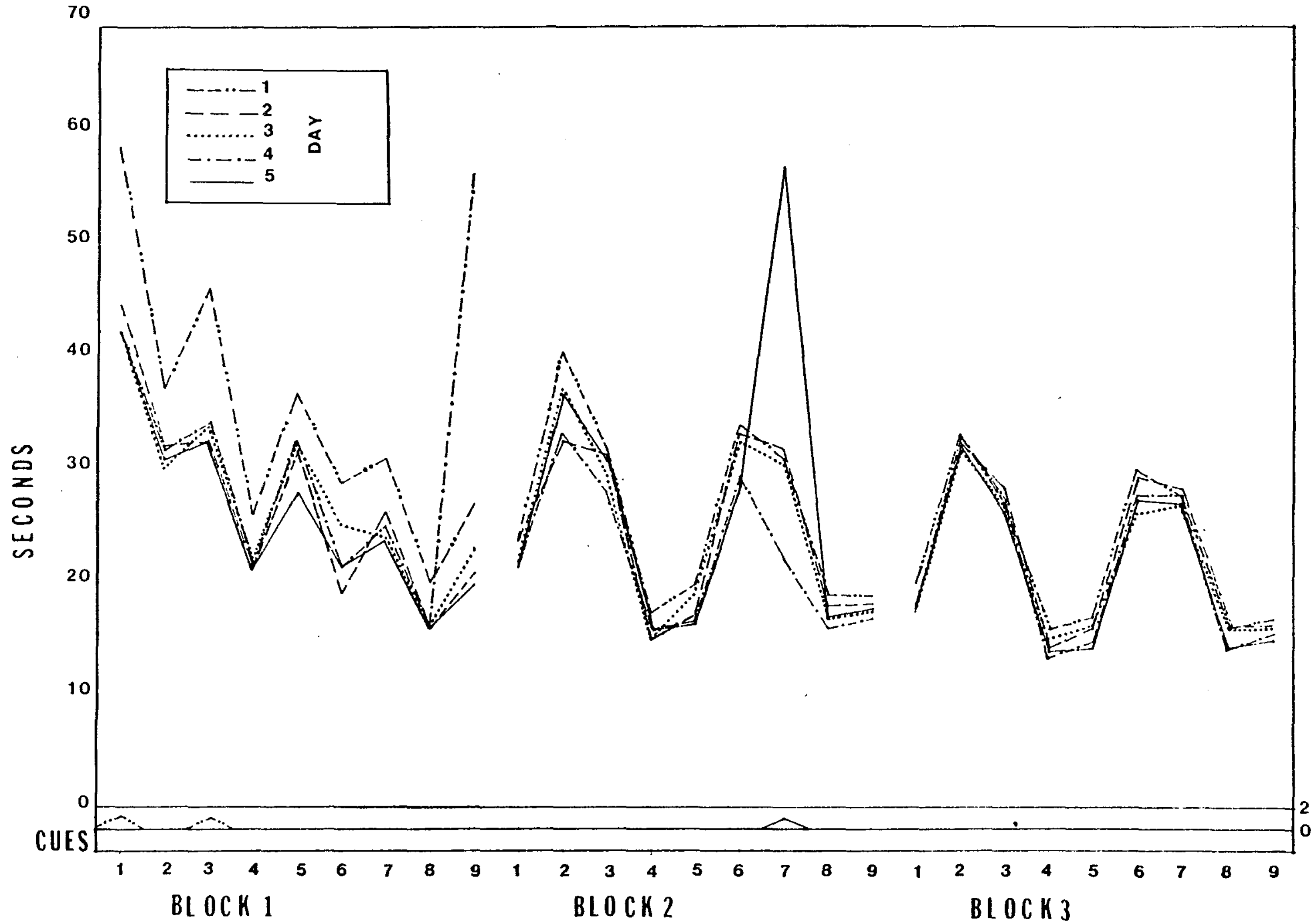

Figure 29. Performance Times - LV9 - Subject Three.

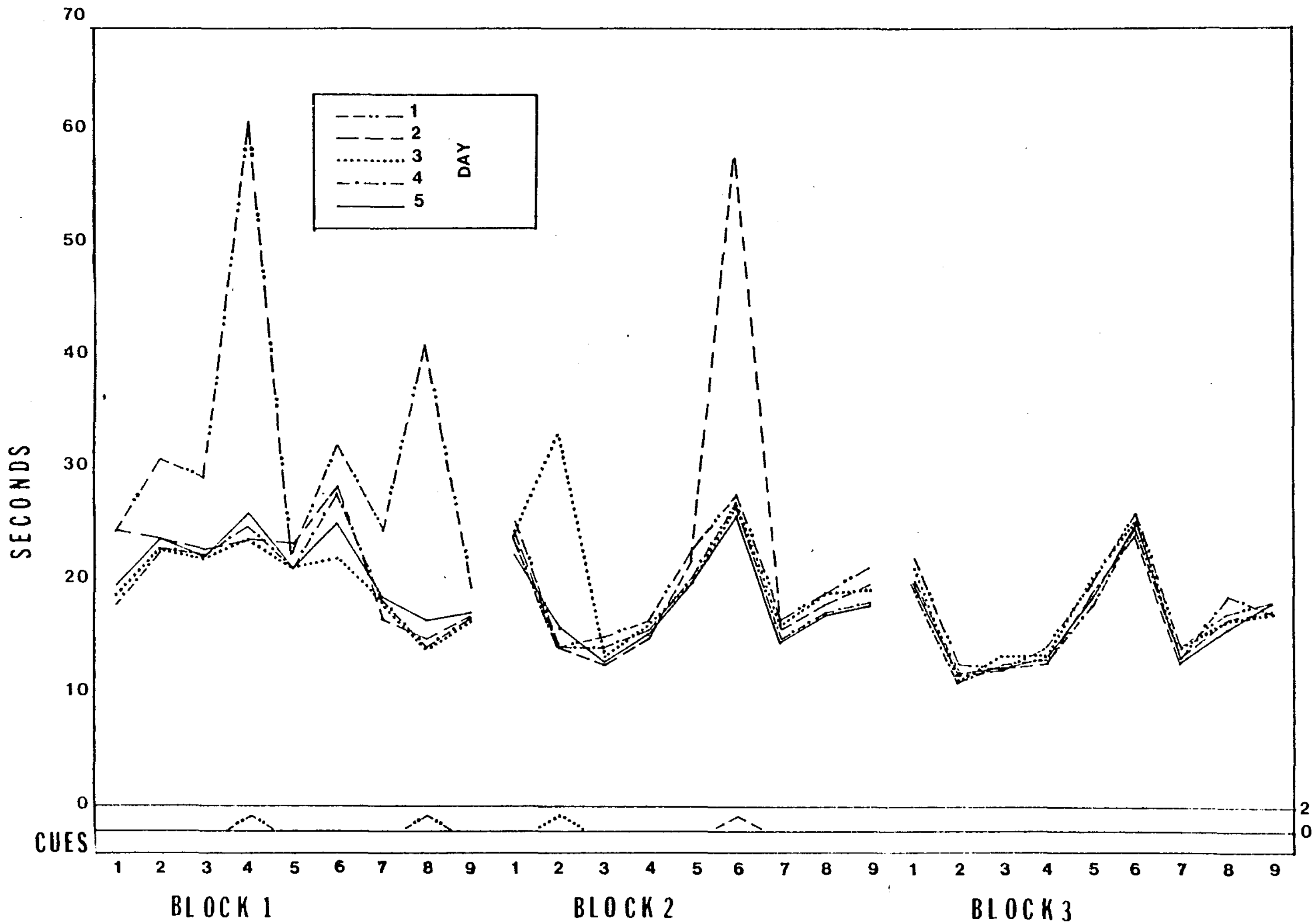

Figure 30. Performance Times - LV4 - Subject Three.

Maps

Subject Three required no map references during the task in any of the trials. She spent time previous to starting the trials studying the maps but there is no coded data to indicate to what extent this was done.

Errors

Table 12 shows errors by position; Table 13 shows errors by trial for Subject Three. Seventy-eight percent of all errors were obstacle errors which occurred mainly in the LV sequences in the first two trials. With the obstacle errors removed from the totals,the other types of errors occurred more frequently through the middle elements in the sequences. The performance and destination errors were made, in many cases, when the sequence was first attempted without an initial cue reference.

Tossing

The tossing summary for Subject Three is presented in Figure 31. The time profiles across the first two blocks are comparable to the total time profile shown in Figure 22. Block 3 times show slight increases although the total time remained the same. The long tossing scores are represented by almost identical profiles across the second and third blocks. The increase in the first trial followed the second intervention which changed the order of the subsequences. This was steeper than the trial

Table 12

Errors by Position - Subject Three

Error Type	Sequence	Position 1	2	3	4	5	6	7	8	9
Obstacle	HV9									
	HV4									
	LV9	3	3	6	2	2	4	3	1	3
	LV4	1		1	2	3	2	4	2	1
Performance	HV9				1					1
	HV4					1				
	LV9						1	1		
	LV4		1							
Destination	HV9									
	HV4					2				
	LV9									
	LV4				1		1	1	1	
Other	HV9		1		1					
	HV4									
	LV9									
	LV4					1				
Total		4	5	7	7	9	8	9	4	5
Non-obstacle		0	2	0	3	4	2	2	1	1

Table 13

Errors by Trial - Subject Three

Error Type	Sequence	Trial 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Obstacle	HV9															
	HV4															
	LV9	1	8	2	4	8		1		3						
	LV4	10	2	1	1									1	1	
Performance	HV9												1		1	
	HV4		1													
	LV9	1									1					
	LV4								1							
Destination	HV9															
	HV4		1			1										
	LV9															
	LV4	2						1								
Other	HV9	2														
	HV4															
	LV9														1	
	LV4	1														
Total		17	12	3	5	9	0	2	1	3	1	0	1	1	3	0
Non-obstacle		6	2	0	0	1	0	1	1	0	1	0	1	0	2	0

following the first intervention which changed the element orders within sequences. The short tossing scores were highest at the beginning of Block 3 after the sequence order change.

Pacing Intervals

The pacing interval times for Subject Three are shown in Table 14. There was some hesitation between sequences shown in the first trial. The times after the first trial are very consistent with an expected break in MM times occurring in Trial 11 when the new sequence order changed the distances travelled in that part of the performance.

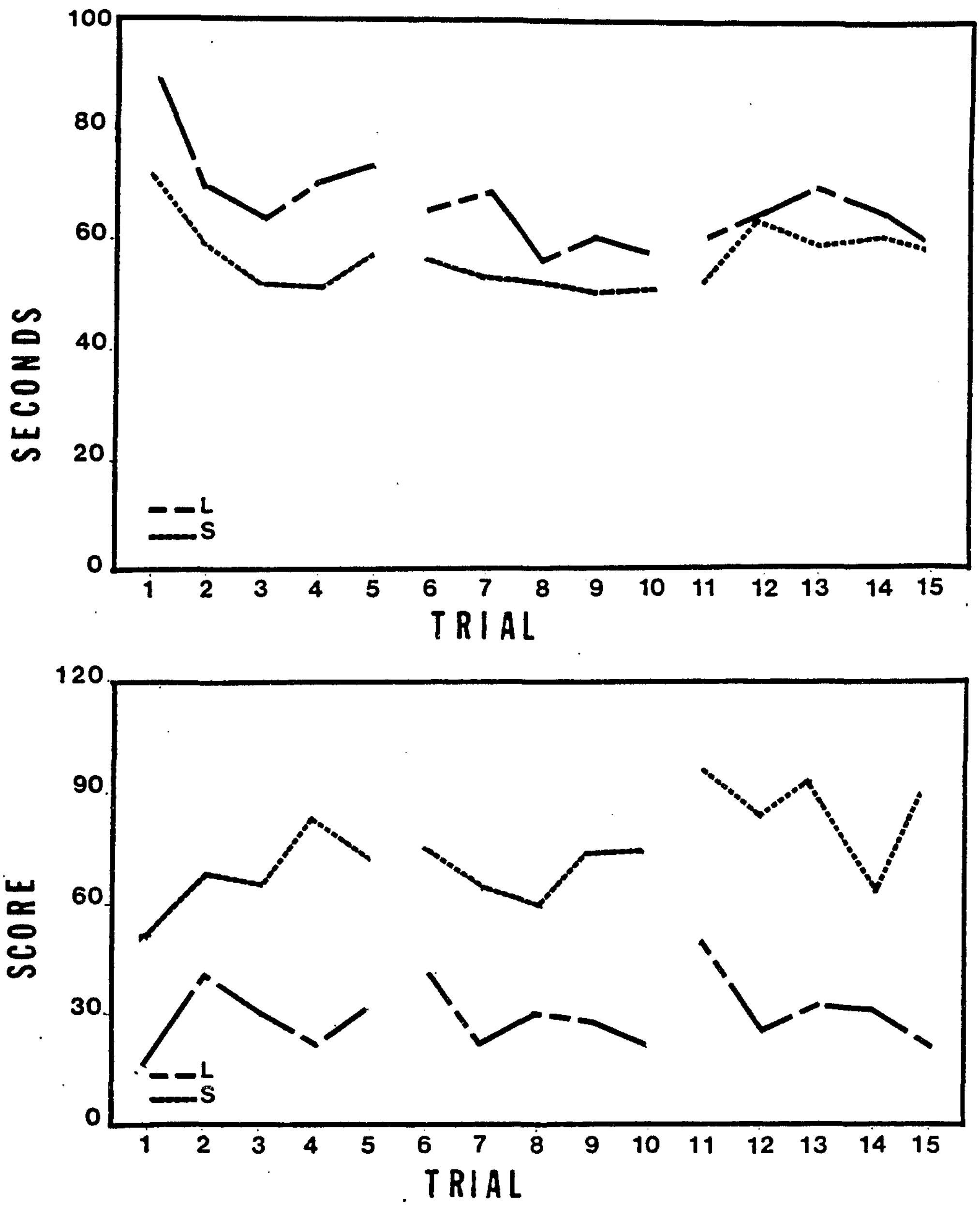

Figure 31. Tossing Summary - Subject Three.

Table 14

Pacing Intervals - Subject Three

Interval	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KM END 1	3.7	1.6	2.2	2.0	1.6	2.4	2.4	1.2	1.6	1.2	.8	1.2	2.8	2.4	.8
MM 1-2	4.4	1.6	1.2	1.6	1.2	1.2	.8	.8	.8	.8	2.4	2.4	.8	.8	2.8
MM 2-3	6.4	2.8	2.4	3.2	3.2	.8	1.6	1.6	.8	.8	1.6	1.6	1.2	1.2	1.2
KM END 3	2.0	2.8	2.0	1.6	1.6	1.2	1.2	.8	.8	.8	1.6	1.6	.8	.8	.8
MM 3-4	4.8	4.0	4.0	3.6	4.0	.8	.8	.8	2.8	3.2	3.6	3.2	4.0	3.2	3.2
KM END 4	1.7	2.4	1.6	2.0	1.6	2.8	2.0	2.0	1.2	1.6	1.6	1.6	1.6	1.6	1.6
MM 5-6	2.5	1.6	1.6	1.6	.8	1.6	1.2	1.6	1.6	.8	3.2	3.2	1.2	3.2	1.2
KM END 6	2.2	2.4	2.0	1.6	1.6	2.0	1.6	2.0	.8	1.2	1.2	1.6	1.2	1.6	1.6

KM From contact key at end of element nine performance to contact mat ending sequence

MM From mat to end sequence to mat to begin next sequence

Subject Four

Subject Four was an eighteen-year-old senior at Page High School in Greensboro. Her scores were 1.1 degrees average displacement for the RFT and 35 (65th percentile) for the Space Relations test.

Total Times

The profile of total task times is shown in Figure 32. The first block indicates a steep decline after an initial slow time of over 40 minutes on Trial 1. Following the first intervention which changed the element order within sequences, the total time rose slightly in Trial 6. The decreasing trend began again in Trial 7. It ended with a sharp upward break at Trial 10. Following the second intervention which changed the order of the subsequences, the times returned to the previous low point (Trial 9) and remained at that level through the remaining trials in the block.

Cues

Figures 33 through 36 depict the initial cue profiles for Subject Four. The HV cue times show a rapid decrease from the first trial times across all elements. The HV4 times indicate little difference from Trial 3 levels on the remaining trials. The HV9 times were slower than the LV4 times in the first two trials. There was an increase across most elements in Trial 6 following the

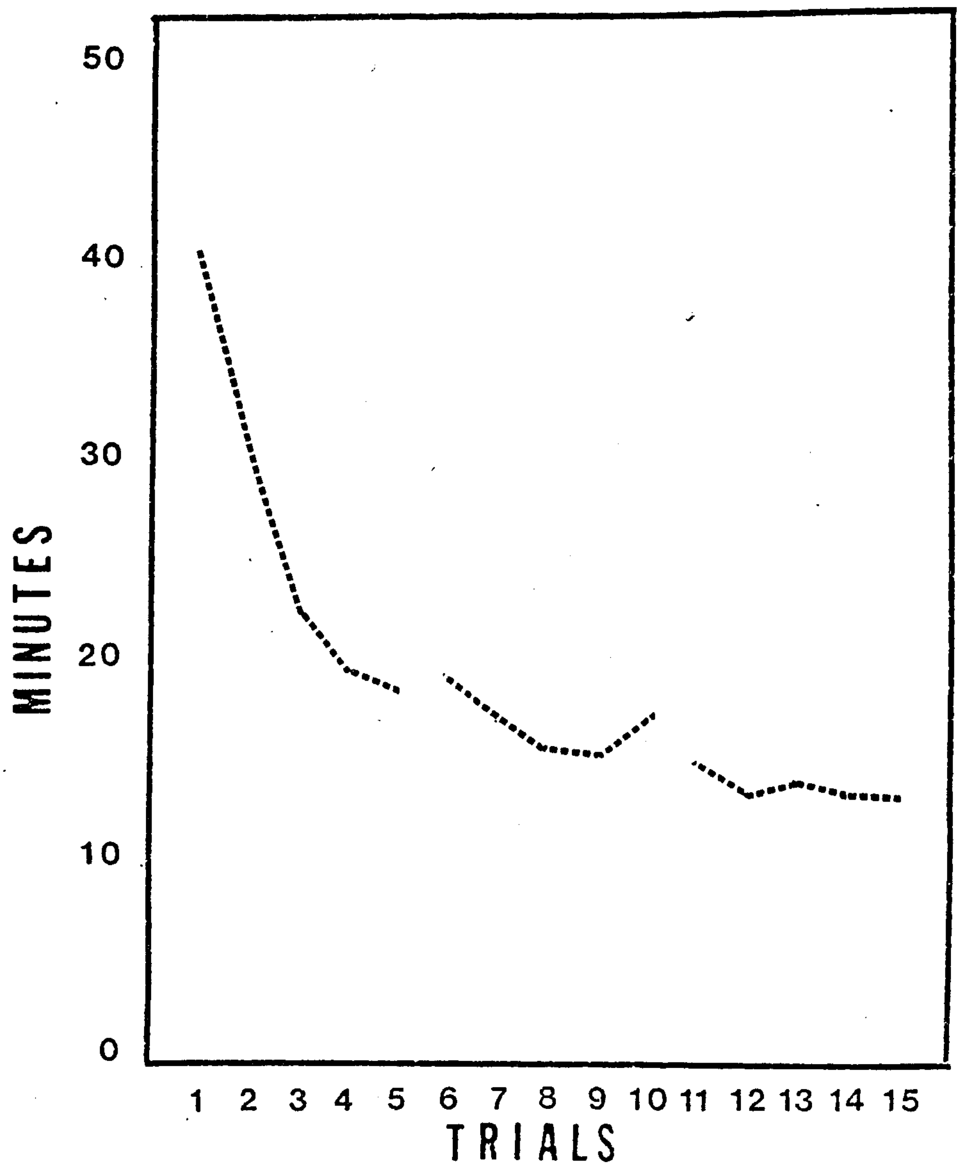

Figure 32. Total Task Times - Subject Four.

first intervention which changed the element order within sequences. The HV9 times showed little variation after Trial 9.

The LV times were slower and showed more variability through Block 1 than the HV times. The LV4 times steadied after the first intervention and remained relatively stable thereafter. The LV9 sequences indicated slow cue times through Trial 7. Trial 8 times dropped in all but the fifth element time. Following the second intervention, elements 5 and 7 continued to show a wide variation until Trial 9 when levels similar to other elements were reached.

Despite the low cue times across the HV sequences, the baseline cue information showed no variation in the cue reference pattern. Subject Four referred to an initial cue in every element of every trial although the reference was a brief one late in the task.

Performance

The wide variation in performance times for Subject Four is discernible by the differing profile scales. In Figures 39 and 40, the dotted lines indicated the slowest time depicted in Figures 37 and 38. The LV sequences show initial times of from one to three minutes for the first six elements in LV4 and a time of almost three minutes in LV9, Block 1. The order of sequence performance placed

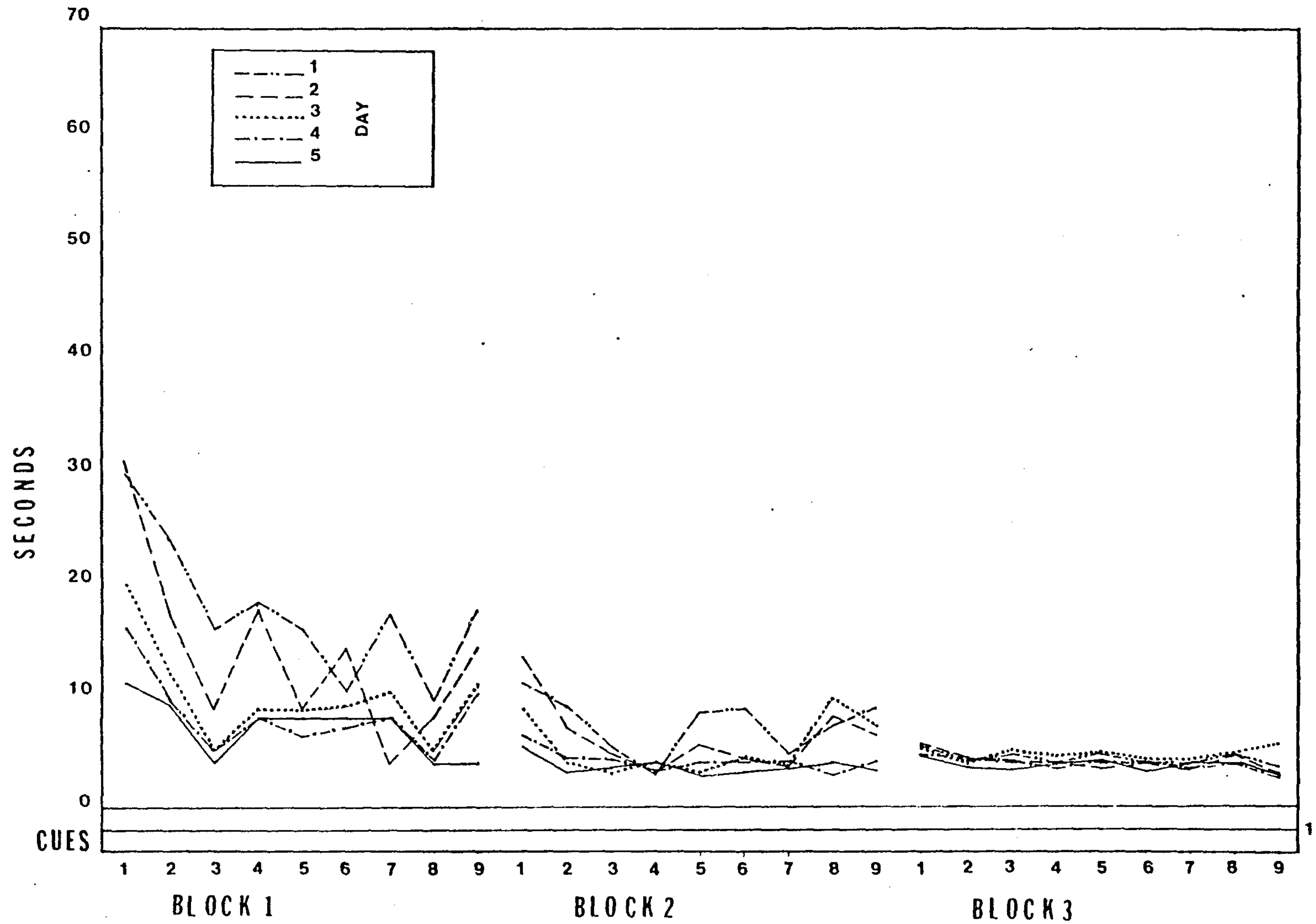

Figure 33. Cue Times - HV9 - Subject Four.

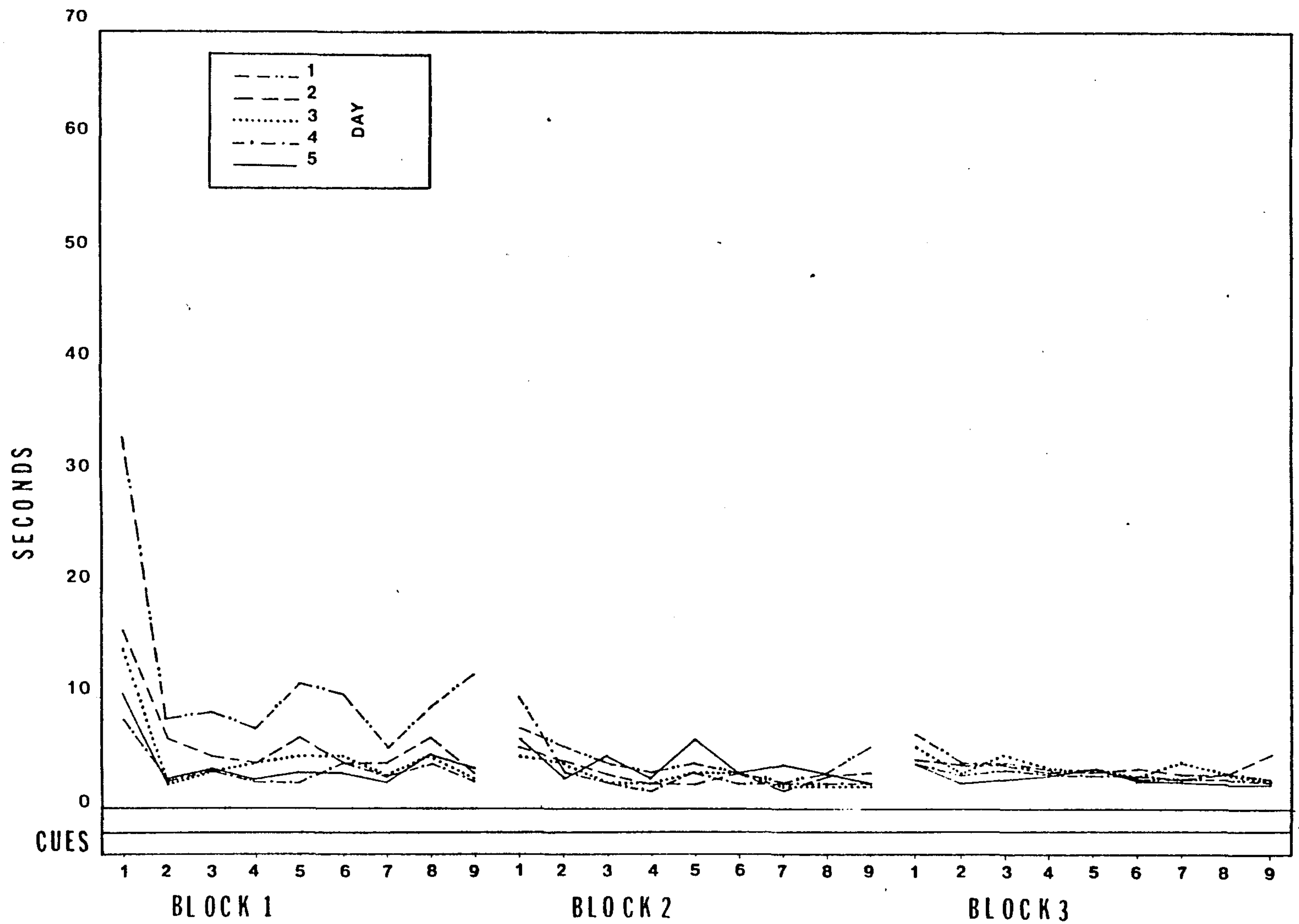

Figure 34. Cue Times - HV4 - Subject Four.

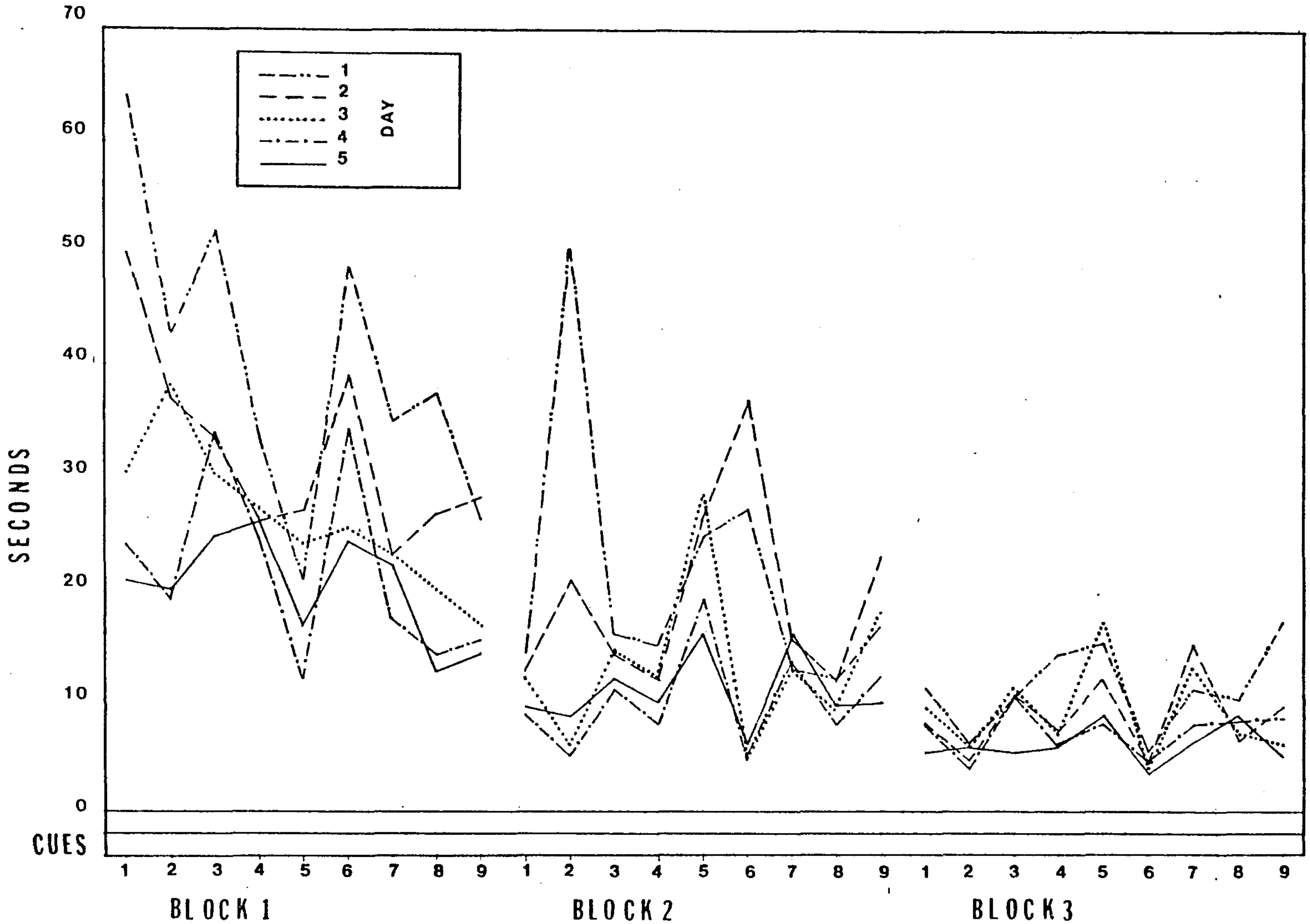

Figure 35. Cue Times - LV9 - Subject Four.

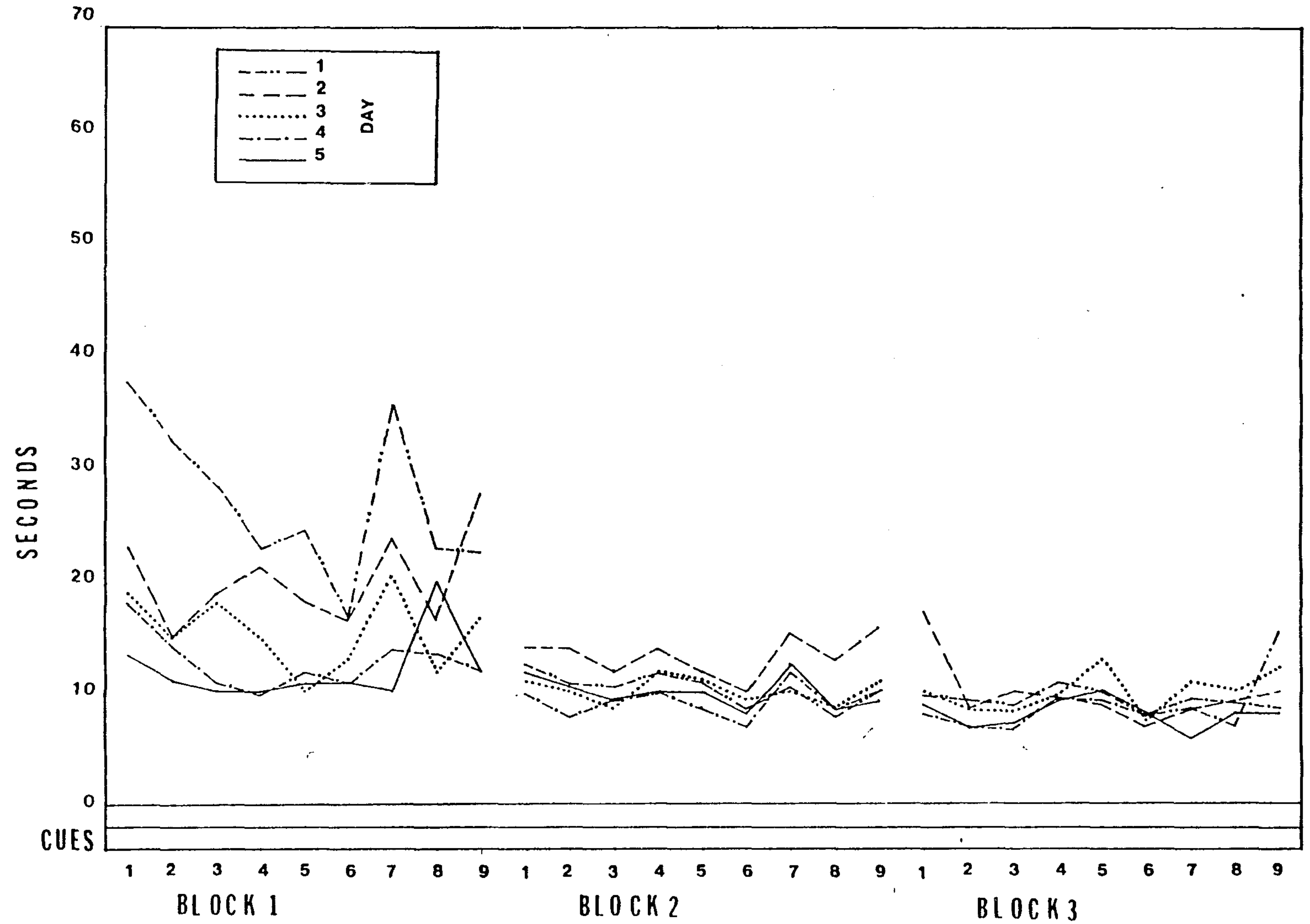

Figure 36. Cue Times - LV4 - Subject Four.

the LV sequences first and last in the task for Block 1 for Subject Three. The slowest performance times included a return for one or two secondary cue reference. In the sixth element in LV9 in Trial 1, the first element in LV4 in Trial 11, and the second element in HV9 in Trial 1, two returns for cue referral were required.

Following the first intervention, performance stabilized in all sequences with occasional slow times related to errors which necessitated returns for cue and/or map references (see Table 15).

Maps

Table 15 indicates the map reference information for Subject Four. Through the first block, a map reference was required for almost all elements in the nine-position sequences. The LV9 sequence also required three additional map references after errors in the first two trials. After the first intervention which changed the element order within sequences, the map reference level was the same as the previous trial. Trial 7 showed a sharp decrease in map references from previous levels. The last map reference required was in the first trial of the third block in the LV9 sequence. The continued use of map references through the second block of trials was not expected. Although the emphasis was made in the instructions that memory was an important aspect of task perfor-

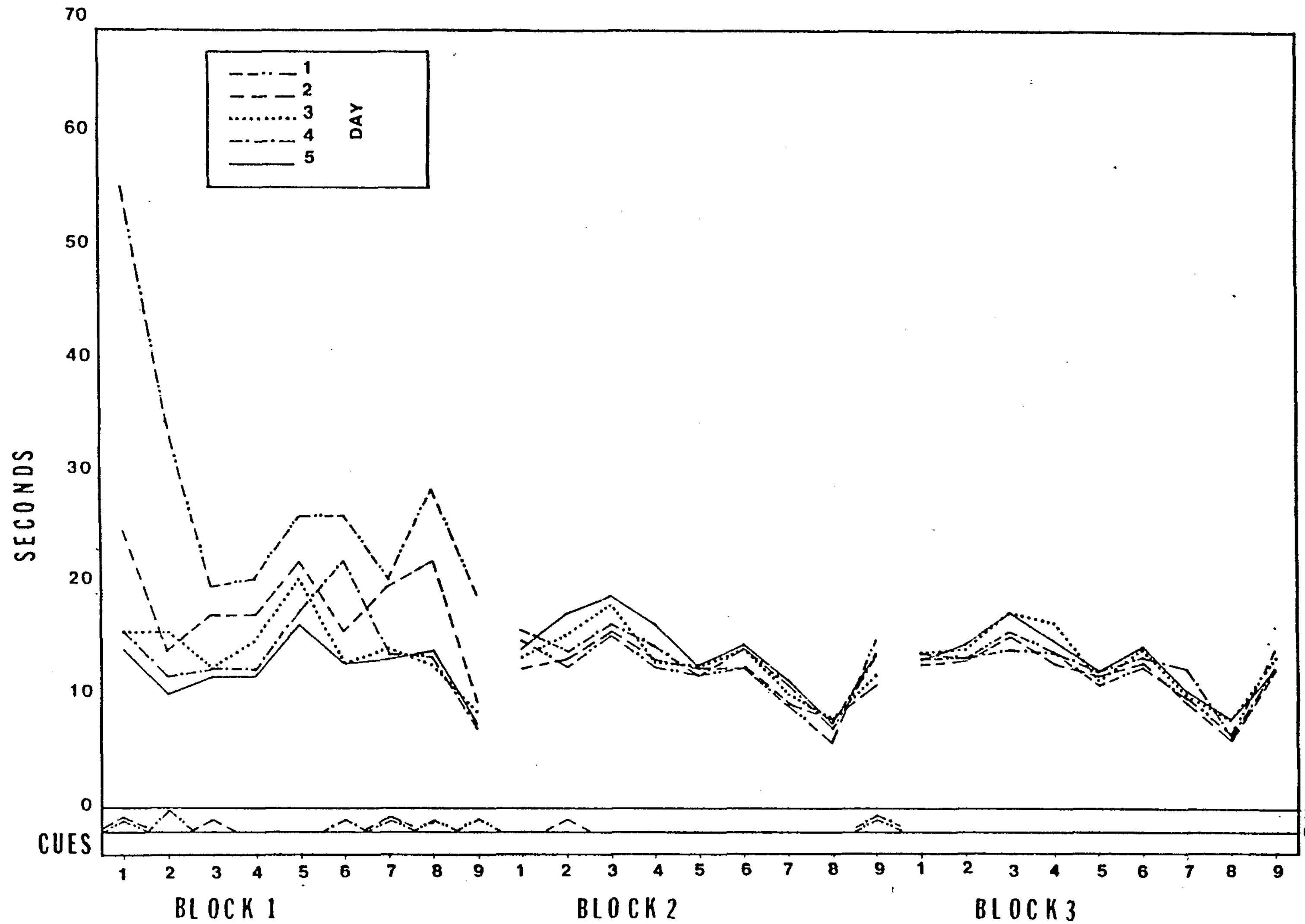

Figure 37. Performance Times - HV9 - Subject Four.

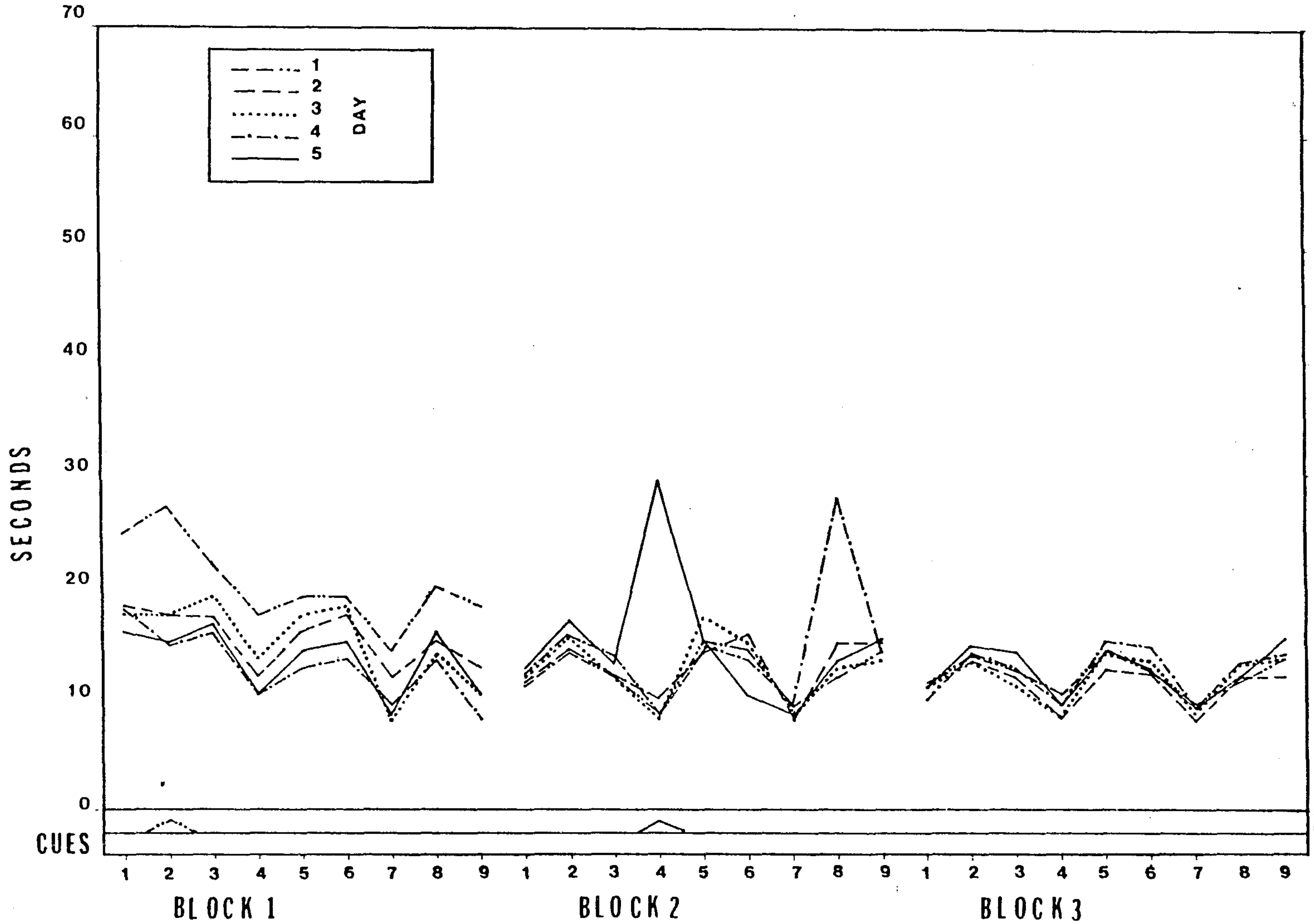

Figure 38. Performance Times - HV4 - Subject Four.

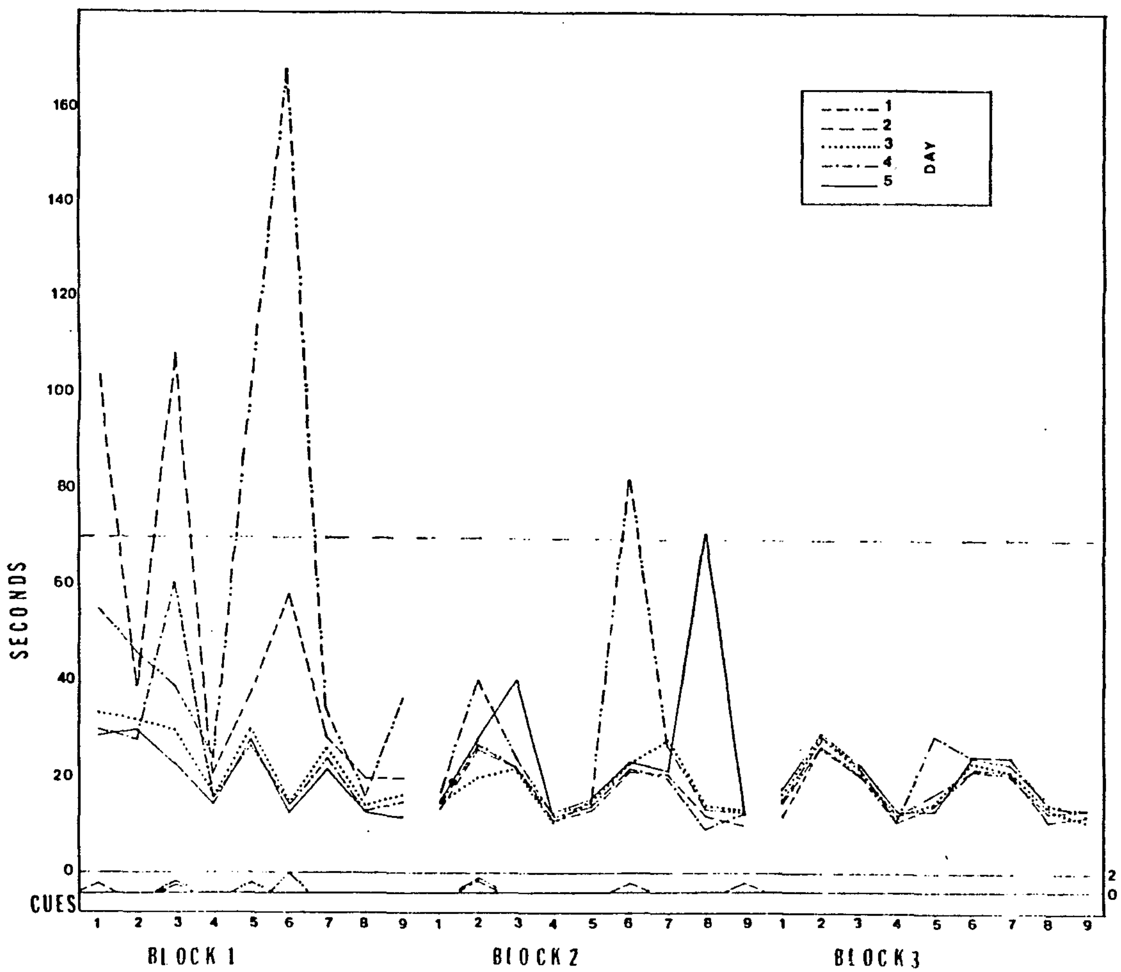

Figure 39. Performance Times - LV9 - Subject Four.

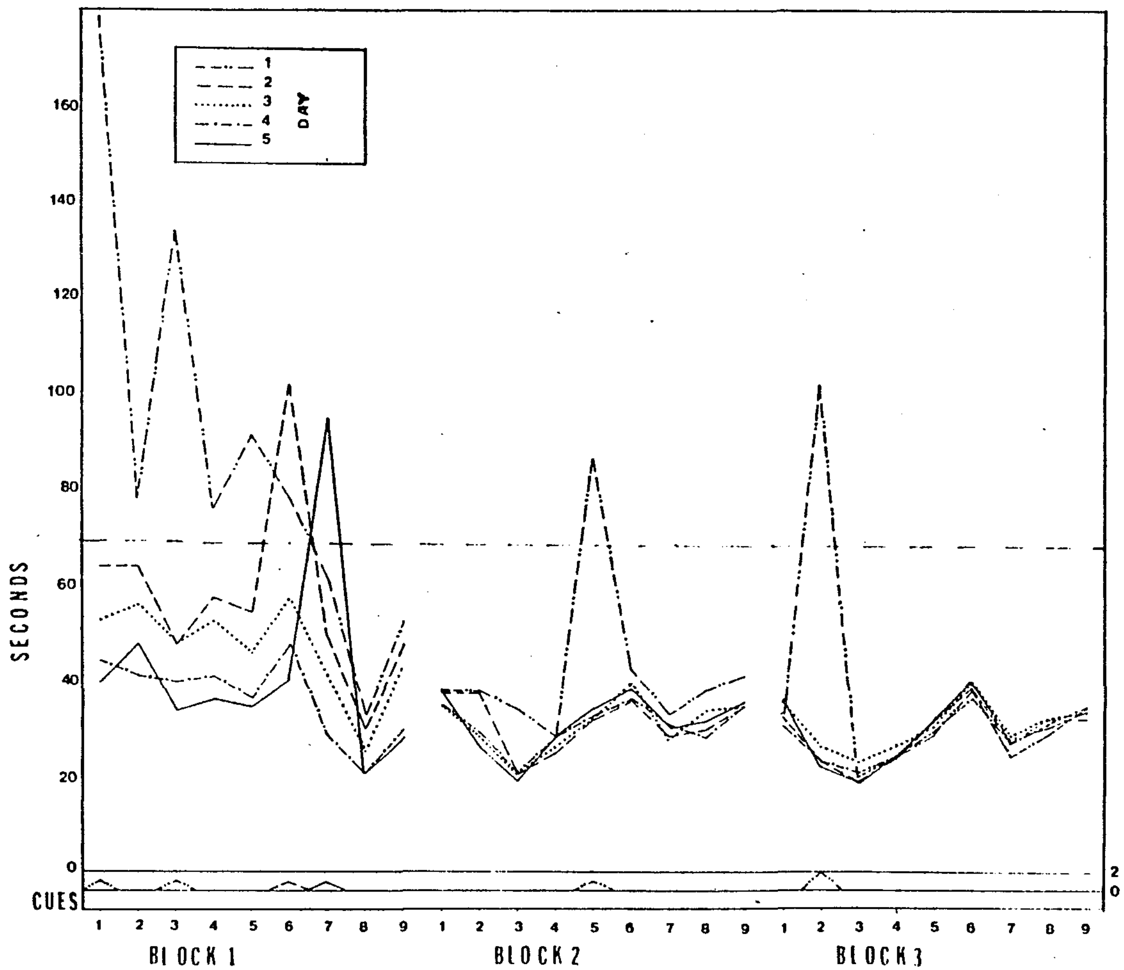

Figure 40. Performance Times - LV4 - Subject Four.

mance, Subject Four tended to be more concerned with the total time and number of errors than with reducing the number of cue and map references. See cue information in Figures 33-36.

Table 15

Map References - Subject Four

Reference Type		Trials										
		1	2	3	4	5	6	7	8	9	10	11
Initial	HV9	8	5	7	7	6	6	3	2			
	HV4	1										
	LV9	9	8	7	6	7	6	2	2			1
	LV4											
A.E.	HV9											
	HV4											
	LV9	3	3		1		1				2	
	LV4											
Total		22	16	14	14	13	13	5	4	0	2	1

Errors

Table 16 shows errors by position; Table 17 indicates errors by trial for Subject Four. The obstacle errors in the LV sequences show no pattern related to position. They occur most frequently in the first six trials. The non-obstacle errors include a high frequency of destination errors which is consistent with the map reference information shown in Table 15. The performance errors occur less frequently in the middle elements of the series, i.e., elements 4-6. A high number of destination errors occurred in the LV4 sequence. The map information, Table 15, shows no map references in this sequence. This would imply that the errors were the result of misreading the cue information rather than mistakes about the location of a particular destination number.

The key contact errors occurred mainly in the first two trials in the HV9 sequence. Several performance errors were made in this sequence of trials. The errors could have contributed to confusion over the key contact pattern. By the third block, the obstacle errors decreased substantially and there were few performance and destination errors. One trial, Trial 8, was performed without errors of any type.

Table 16

Errors by Position - Subject Four

Error Type	Sequence	Position 1	2	3	4	5	6	7	8	9
Obstacle	HV9									
	HV4									
	LV9	4	11	11	1	13	11	14	4	1
	LV4	4	5	8	5	3	6	7	3	4
Performance	HV9	2	1				1	1		1
	HV4		1							
	LV9			1						
	LV4		2		1			1		
Destination	HV9									
	HV4				1					
	LV9	1		2		2	4		2	
	LV4	1	1	1		1	2	1		
Other	HV9	2	1		1	1	1			2
	HV4		1				1	1		2
	LV9									
	LV4									
Total		14	23	23	9	20	26	25	9	10
Non-obstacle		6	7	4	3	4	9	4	2	5

Table 17

Errors by Trial - Subject Four

Error Type	Sequence	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Trials														
Obstacle	HV9															
	HV4															
	LV9	3	12	9	4	8	16	7		2					4	5
	LV4	21	2	2				4		3	1		4	1	3	4
Performance	HV9	2	2		1											
	HV4						1									
	LV9										1					
	LV4					1						2	1			
Destination	HV9															
	HV4										1					
	LV9	3	3		1		1				2				1	
	LV4	2	1			1	1			1		1				
Other	HV9	5	3								1					
	HV4			2			1	2								
	LV9															
	LV4															
Total		36	23	13	6	10	20	13	0	6	6	3	5	1	8	9
Non-obstacle		12	9	2	2	2	4	2	0	1	5	3	1	0	1	0

Tossing

The summary of the tossing scores and times for Subject Four is presented in Figure 37. The profile of tossing times in Block 1 parallels the total time profile. The time profiles of Blocks 2 and 3 are also similar to the total time profile with the exception of the slower time in Trial 8 for the short tossing. There is little difference between long and short tossing times except for the first two trials of Block 2.

The data indicate high middle-of-the-week scores for Block 1 and 2 and a low mid-week score in Block 3 for the short tossing. The short tossing scores increased slightly after the first intervention and decreased sharply after the second intervention which changed sequence order. The long tossing scores are represented by relatively flat profiles in Block 1 and 3. But they increase in the second block when the corresponding total task times were decreasing.

Pacing intervals

Table 18 shows the pacing interval times for Subject Four. The expected hesitation between sequences is seen in Trial 1. There continued to be hesitation in these intervals for all Block 1 trials, particularly from the end of sequence 1 to the short tossing and from the end of sequence 3 (HV9) to the beginning of sequence 4

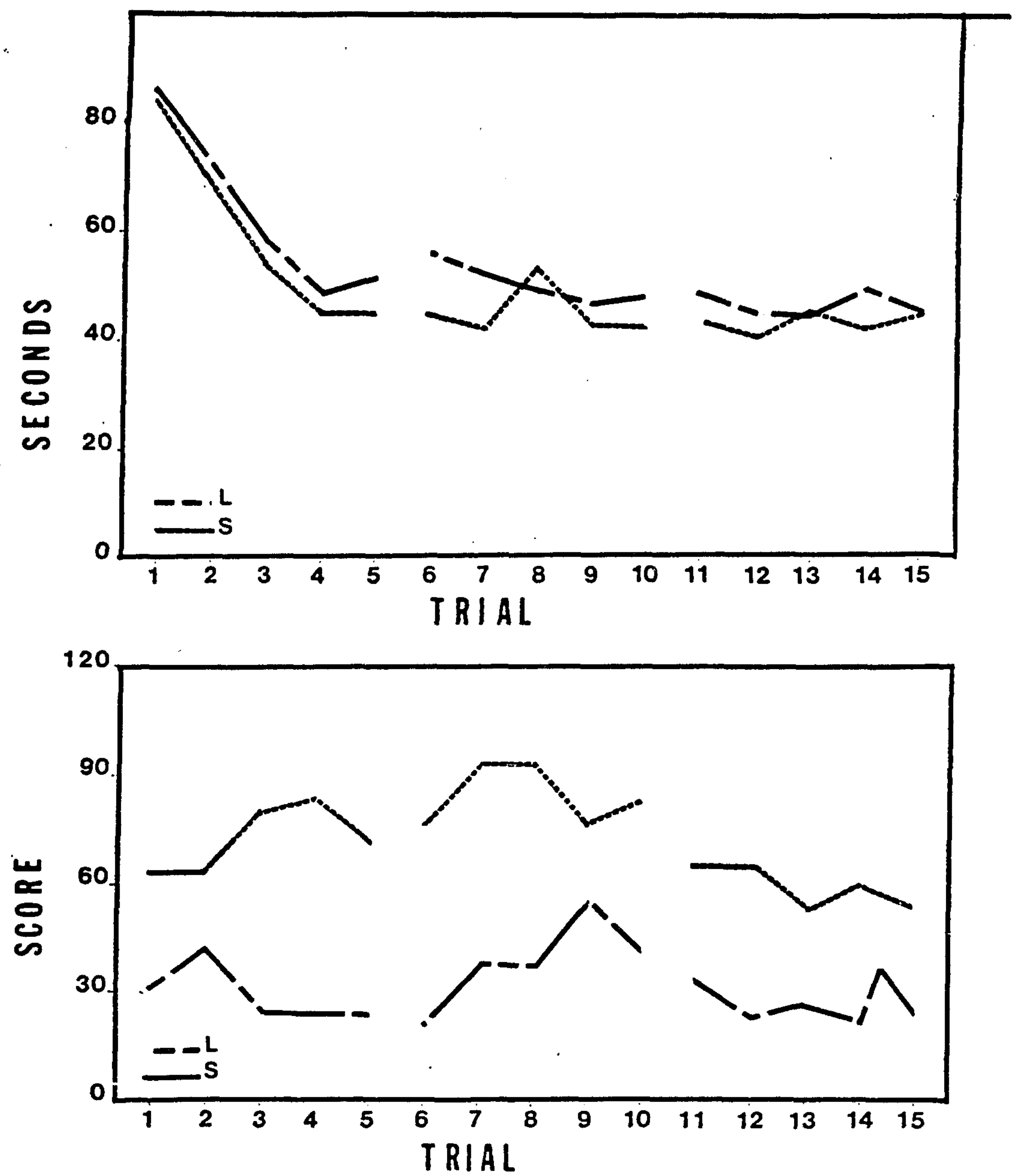

Figure 41. Tossing Summary - Subject Four.

Table 18

Pacing Intervals - Subject Four

Interval	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KM END 1	5.6	3.2	3.2	1.6	3.2	4.8	1.6	1.2	1.2	1.6	1.6	1.6	1.6	1.6	1.6
MM 1-2	11.2	12.0	5.6	5.6	6.4	4.0	5.6	1.6	4.4	8.4	2.4	1.6	1.2	.8	.8
MM 2-3	7.6	5.6	3.2	4.0	1.6	2.8	5.6	4.0	1.6	4.8	6.8	1.2	3.2	4.8	4.0
KM END 3	8.0	3.2	1.6	2.0	2.4	3.2	1.6	1.6	4.0	1.6	2.0	2.8	1.6	1.6	5.6
MM 4-5	8.0	8.0	3.2	1.6	1.6	1.6	1.6	1.2	1.6	4.0	4.0	3.2	5.2	4.4	5.6
MM 5-6	8.8	4.0	5.6	5.2	4.0	3.6	3.2	2.8	3.2	3.2	1.6	2.0	2.0	1.2	1.2
KM END 6	4.8	4.0	4.0	3.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.4	1.6

KM From key at end of last element to mat ending sequence

MM From mat at end of one sequence to mat at beginning of next sequence

(HV4). The Block 3 times were the most consistent. This coincides with the overall task profile.

Summary

The above presentation of the data provides support for the selection of the case-study experimental design with multiple measures for studying motor performance of a complex task. The construction of a criterion task with the experimental design structured into the task provided the opportunity to examine the hypothesized relationships with only four subjects. Although the findings are not generalizable, the case study data provides a description of the performances from which hypotheses for further testing can be derived.

The profiles clearly show the total time measure was insufficient evidence to describe task performance. The total time data do not reveal the relationships of the experimental variables to the differing sequences within the task. Interestingly, an examination of the total time profiles for all subjects shows strong similarities despite the differing experimental conditions under which each subject completed the task. In general, the profiles indicate a more or less typical acquisition of task skills, i.e., steep decline in execution times in the first three trials, followed by a gradual decline through the remaining trials. The gradual decline included some plateaus and slower times, but the overall performance was one of faster times. The exception to this general pattern was Subject Two's total times in the second block of trials. As discussed previously, this period represented one in which the subject was trying to perform sequences from memory and spent time attempting to recall the coming sequence and deciding whether to proceed without use of the cue reference.

The profiles also show that neither the observational data which revealed cue references, map usage, and performance errors nor the timed data for each interval within the task was sufficient information to describe the changes in performance and task memory which occurred during the study. In several instances, the cue times were the same whether the subject referred to the cue or not. In the HV sequences where the cue times were fast, the above was clearly discernible, particularly in the last block of trials. For Subject Two, there were several instances in which the cue times were slow; the observational data showed no cue reference made. In this case of Subject Two, the knowledge of the two data sets, profile time and observational information, was needed to describe that the performance time was comprised of time spent deciding whether to use the cue, not necessarily time spent obtaining cue information.

The four case studies analyzed in this report reveal that one subject acquired the spatial elements of the task quickly, showed very fast cue time, and performed very few elements without cue references. A second subject took time within the task to study maps, spent time deciding whether to attempt a performance from memory, and performed several elements from memory. A third subject acquired the spatial information before beginning the first trial, performed the LV motor patterns with consistency throughout the task, and performed all but five task elements from memory in Trial 15. The fourth subject showed slow cue times, slow acquisition of the spatial information, consistent performance times in the third block of trials, and no performances executed without a cue reference. The analysis of individual data provides a medium through which each subject's strategy and attributes can be studied in relation to a criterion task. What is given up by the inability to generalize to other samples is offset by the thorough examination of the individual's data.

CHAPTER V

DISCUSSION

The following discussion of the research findings elaborates the notable commonalities and idiosyncracies in the data. An important consideration in the selection of points for discussion was the releveance of the findings to skill learning and performance. The predominant theme of the text that follows is perceptual organization and how it relates to the motor task under investigation. Perceptual-motor organization is a cognitive operation that processes memory representations into a structure permitting more efficient functioning by the limited capacity of the human performer (Stelmach, 1978). In anticipation that the organization of the visual field might be a performance factor, the Rod-and-Frame Test was administered to all subjects. However, subject scores were similar so the variable was not introduced into the analysis of the data.

In the discussion, the investigator drew upon the observations made in her role as a trained ovserver to add to the numerical data presented above. The purpose of the discussion is to suggest meanings which further describe the subjects' performance. Liberty is taken in the discussion to draw upon responses made to the investigator by the subjects in the debriefing sessions which followed the performance of the final trial.

Individual Performance Style

The performance data reveal the different decisions made by each subject concerning the selection of the task element upon which to focus her performance. The same instructions were given to the four subjects by the same observer; these instructions called attention to three task elements -- speed, accuracy, and memory. After the first trial, the focus in the instructions was weighted toward a memory set; i.e., the subjects were reminded that the object of the task was to perform with as few cue references as possible. They were instructed on the pattern of key contacts and cue movement which was to be used when a cue was not referenced. Following each trial, the subject was given time, errors, score, and cue reference feedback. Despite the experimental emphasis on memory, the subjects established their own priorities within the experimenter-defined organization.

Subject One was concerned with time and errors and did not appear to prioritize or focus on the memory aspects of the task. She did, however, perform three LV9 elements from memory, the first and ninth in trials 9 and 10 and the ninth in trial 15. Subject Two focused on the memory component and was willing to spend time to gain memory. She spent time within the pacing intervals to study the 9-position maps and hesitated before examining a cue while searching her recall to see if she felt secure enough to proceed without referring to the cue. She was successful in performing many elements following such hesitation, but, in several cases, made errors which necessitated a return to check the cue information causing a slow performance time. Subject Three prioritized the memory component as important from the first trial. She verbally rehearsed patterns following trials and reflected consistently on her priorities for performance of the entire task from memory. When examining the cues, she considered not only performance of the element in that trial but performance of the element from memory in the subsequent trial. She was successful in reaching her performance goal with the exception of two HV4 and three HV9 elements when, in trial 15, she performed the task almost entirely without cue reference. Subject Four appeared to be concerned with decreasing her overall task time. Her first trial took over 40 minutes to complete and she had long cue and performance times in the LV9 sequence. In some trials, she appeared to toss the beanbags with little regard for score just to hurry to the next segment. It could be hypothesized that this selection of goals was an appropriate one in light of her early difficulties. These were remembering the spatial locations of the destinations and the number of errors. The need for Subject Four to return for cue information is evident in the performance profiles.

To design a complex memory task which the subject must complete each day, it was necessary to build in a technique for obtaining information if the subject did not know what to do next. By doing this, two distinct approaches were created, the safe approach and the risk approach. The subject could perform the task quickly and error-free using a cue for each performance element or she could attempt to perform elements without the "crutch" and thereby risk making an error which would be costly in time. There is not sufficient information concerning the subjects and their preferred cognitive styles or patterns of risk-taking behavior to explain the different decisions observed above. However, it is important to note that the structure of a gross motor task introduces the element of decision-making into the performance. Obviously, decision-making is itself a complex phenomenon in which cognitive style and willingness to take risk are reconciled so as to achieve the desired goal.

Intervention Effects

The experimental design included two interventions, one after the fifth trial and another after the tenth trial. The interventions were designed to test (a) the extent to which an associative framework between elements had been developed and (b) the relationship of position of a subsequence to performance.

To examine the associative framework, the order of the elements within the multi-element subsequences was changed after either the fifth or the tenth trial. It was hypothesized that if serial memory were well developed, the change of order would be followed by an increase in errors and a slowing of cue and performance times. This change would be more evident when the intervention was made after ten trials. Little support for this hypothesis is found in the data. The two subjects whose element order was changed after trial 10 did show some slowing in cue times in trial 11, but not to any greater extent than when the intervention came after five trials. With the change of order, the subject needed to check the cue more thoroughly and reorganize the sequence order she had known to that point. In the HV4 sequences, there was little visible slowing. Subject Four showed slower times in HV9. The cue times were generally slower in the LV sequences. This was particularly evident in the LV9 elements which had been performed without cue reference in the previous trial. In trial 11, Subject Two showed little difference in performance time. Subject One had generally slower performance times. The total trial times showed a slower time by two minutes for Subject One and a faster time by two minutes for Subject Two. Because she knew the cues were in a new order, Subject Two gained by not hesitating before each consulting each cue as she had done in previous trials. Subject One referred to a cue in almost every case previously, but very quickly. The new order slowed her time because she had to check all cues for more information than she had sought in previous trials. Subjects Three and Four were within 30 seconds of previous trials when the order change was made after five trials. The greater time changes seen for the first two subjects with the later order interventions suggests the necessity for their reorganization of the pattern of their performance, but the disruption was temporary and they returned to previous levels quickly. This raises considerable question as to the strength of associative chains in the experimental task if they were reorganized with such relative ease.

The second intervention, the change of sequence order, was followed by little difference which could be attribited to the changed order. The subjects who experienced this change as the first intervention showed faster times in the next trial. This would not be expected if the change were disruptive of previously formed memory association and performance patterns. The lack of effect provides additional evidence for the contention that the subjects broke the task into separate lists to perform and recall. The sequence order was a short list and was easily restructured when the order was changed.

Serial Recall

The analysis of the pattern of recall must consider that the task consists of four series within a longer series of items. Explanations which have been extended for the phenomena known as the primacy and recency effects in serial recall posit that the early items in a series of similar items are more easily recalled because they are rehearsed to the detriment of the middle items in the series. The later items in the series, recency effect, are recalled more easily due to their presence remaining in short-term memory. The short-term memory store is more quickly accessible than the long-term memory store. The aforementioned explanations have relevance for single lists which are followed by an attempt to recall the list after some predetermined interval and to the task under investigation if considered as a single list. A primacy effect, then, could be expected. Although there is no way to know with certainty what to expect in such a long list, the first items performed could have a long rehearsal extending into the items in the middle of the task. The perceptual demand characteristics of items may be irrelevant to the consideration of the total task performance.

The primacy effect was not evident when the task as a whole was examined.

The recency effect would favor recall of the last items performed and could be expected to be heightened by coming to the end of such a long list of performance items. This also was not seen in the data, a finding which appears to contradict the explanations of the primacy/recency effects. One plausible reason for the failure of the task to be performed as a single series could be the fact that the list was not, in actuality, a list of similar items but one in which there were sets of similar items. The subjects decomposed the task into sections using the transition from one activity to another as a pause to aid in the grouping and memory for the items just performed. This would parallel findings in verbal studies which indicated that modifications in the serial position curve could be brought about by changes in the boundaries of the chunks of letter units (Harcum, 1975). These studies also showed an increase in recall following a pause which indicated the boundaries of a series.

The examination of the series within the larger series shows evidence for the presence of a primacy and a recency effect to the extent that, when an element was performed from memory, it was located at the beginning or end of the series. If a subject were to remember only one or two items, the probability was high that these were either the first or last items in one of the four within-task series. Once the initial item in a series was re-called, the pattern was to string the second, third, and subsequent items, in order, to the performance series in subsequent trials. Memory for the last items chained toward the middle of the series but not to the extent seen in the initial items.

The explanation for the observed primacy/recency pattern of recall for the series-within-a-series is not clearly related to the rehearsal of early items and the vividness of the recently performed items at the time of recall. Performance of the recalled items in these series was followed by either the tossing sequence, the other multi-element sequence with the same demand characteristics, or the end of the trial. Only in the last situation would the conditions associated with previous explanations apply. Yet, the findings show that at the time of initial recall, the preponderence of recalled items were not in the sixth subsequence. Despite the serial temporal organization of the four lists within the total task, the subjects imposed an organization upon the task which established four parallel and distinct lists to be recalled. They were then able to isolated their attention and process the learning of each list as a separate task. The primacy and recency effects were exhibited because of an associative perceptual organization which started with the first item and organized or chunked the items into a single structure. The initial cue to the performance of such a pattern was the physical entry of the subject into that area of the task from the central timer area. The last item was heavily loaded for recall with the sense of being the "last" or exit requirement before moving on to the next sequence. A backwards chain was built from that item but not as strongly or for as many items as the primacy chain.

Task Demand Characteristics - HV vs LV

With respect to the high and low visual demand characteristics, there appears to be an interplay between the high- versus low-visual as a memory task and the high- versus low-visual as a performance task. Consider first the task as a memory task in relation to the visual/kinesthetic attributes. Then, consider the task in relation to the visual/kinesthetic characteristics and early versus later trial performance.

HV vs LV -- A Memory Task

The profiles clearly demonstrate a time difference between high-visual and low-visual sequences. After the first trial with few expections, HV cue times for all subjects were below ten seconds, with most falling in the 4- to 6-second time range. Recognizing that this time involved turning a card over, reading the information, and then turning the card back over again, a 4- to 6-second time interval implies a quick scanning rather than a thorough reading of the information on each card. It would follow, logically, that if one need only a quick reference each time, one would soon be able to perform without the quick review. This did not occur. The HV sequences showed the fewest elements performed from memory and contained the only elements which Subject Three could not perform without cue reference in the final trial. One possible explanation is that the items were so similar in performance demands, i.e., walking, stacking, walking, hand motion, walking, that the formation of an organizational structure was difficult. The HV sequences could be considered to be similar to a list of verbal nonsense syllables, an abstraction upon which the individual had to impose some meaningful structure. Some support for the difficulty in developing a structure comes from the observation that the errors were in number of blocks and number of hand motions. The destination, block colors, and the type of movement were associated into a structure, but the number was more difficult to integrate.

The LV segments were initially disturbing and frustrating to the subjects as they necessitated the acquisition of information without primary visual reference. Early trial cue times in the LV9 sequence ranged from as low as 14 seconds to as high as 68 seconds. The LV4 cue times were generally faster than the LV9 times but still slower that the HV cue times. Despite the initial slow times, it was the LV elements that were the first and most frequent to be performed without cue reference. Of the two LV sequences, the LV9 sequence, which showed the slowest initial times, was the one in which the elements were most frequently performed from memory. An explanation for this finding may be associated with two characteristics of the cue information, the relationship between the cue and the target performance and the amount of information contained in each cue. First, the LV cues were spatial in their organization and were directly connected to the pattern of movement. The structure of the cue and the performance were reinforced by the gross body movement of the subject walking the pattern. In the HV sequences, the act of picking up the blocks and stacking them at a destination is not tied, in the performance sense, to the color and number of blocks being carried. The formation of an image of a triangle followed by a circle is far more likely to be recalled than the formation of an image of two orange blocks and two white blocks followed by two blue blocks and two white blocks.

The second important consideration is the number or amount of information to be retained in short-term memory in each element. In constructing the task, it was desired that each element in all sequences contain the same amount of information, i.e., three pieces of information. In the LV sequences, shape, destination, and number of repetitions comprised the three pieces of information. In the HV sequences, the three items were destination, block combination, and hand motion. The findings indicated that the LV sequences contained more easily remembered information which could conceivably be a function of the number of items to be integrated. The difficulty in memory for the HV sequences, despite the very fast cue times, implies that there may be more than the intended three items to remember. The HV list might consist of destination, color one, color two, number of color one, number of color two, and hand motion, or six items of information rather than three.

The performance of the LV sequences was consistent with the HV sequences in that the abstract number of repetitions was a common error and was observed to be the one item of information that the subjects sought when checking the LV cues in later trials.

<u>HV vs LV -- A Performance Task</u>

The structure of the experimental task established the high- versus low-visual contrast. Its purpose was to examine the role of visual and kinesthetic perceptual abilities in relationship to performance of a complex serial motor task. One environment was highly visual: the cones were orange; the blocks were orange, blue, and white, the cues were written, and the obstacles were clearly visible. In contrast, the LV/kinesthetic environment had fishing line marking the destinations, the cue information was gained tactually, and the obstacles were not clearly visible. It could be expected that, if vision is a primary sense for information processing in early serial motor learning, the HV sequences would be performed more quickly and with fewer errors in the early trials. The LV sequences, which minimized the use of vision as an information-gathering modality, would be performed more slowly at first. These assumptions about the early trial performance are supported by the data. It was interesting to note that despite the attempt to minimize the visual attributes of the LV sequences, the subjects used two adaptive mechanisms which introduced vision into their performance, i.e., visually locating the motion detectors and visually locating the destinations. To lower the frequency of LV obstacle errors, the subjects would move to the vicinity of the obstacle and then visually locate the detector and watch it while carefully stepping over or ducking under the beam. The adaptation to the height o the obstacles seen across a 20 foot area was a kinesthetic and spatial task, but the subjects did not change this pattern and attempt to proceed through the area without visually targeting the detectors. A second adaptation involved the pattern of moving to the destination in the LV areas. The subject would move in the general direction of the destination and then, once in the area, would do the "fine" adjustment of visually locating the line which marked the destination point and moving to it. This pattern was seen to change in later trials; the subject moved to the destination point without the use of the more general search and position strategy.

The second expectation concerning the role of visual and kinesthetic perceptual abilities in performance would be that in later performance, the kinesthetic perceptual abilities would be more highly related to performance than the visual abilities. If one considers the total picture of a skilled subject performance in this task, it would consist of fast performance time, no errors, and no cue references. Using this criterion in judging later performance, the task sequences containing the kinesthetic cues and repeated gross motor patterns showed more evidence of successful performance. It could be hypothesized, as discussed previously, that the high-visual elements were kinesthetically similar and, thus, difficult to discriminate, one from the other. After the initial trials, the LV elements were kinesthetically distinct and more easily discriminated. The HV performances plateaued at a point at which the visual modality could not provide any more meaningful information to advance performance. The kinesthetic perceptual abilities could not add additional discriminatory capability to the HV information. The one subject who was able to perform the task from memory found the HV elements more difficult to remember and did not remember many of them until the last two trials. In contrast, she had performed the LV elements from memory beginning with the seventh trial for the first few.

Task Spatial Organization

Contrast between the spatial perceptual demands of the four-destination and the nine-destination environments was also structured into the task. In the four-destination sequences, the destinations were located as the major points of the compass, i.e., north, east, south, and west. This configuration was chosen because it appeared to be easy to remember and was well within the limits of the capacity of short-term memory. The nine-destination environment was arranged to appear as random locations. The choice of nine positions was made to place the number of items to be retained at or beyond the capacity of the short-term memory. It was considered that the spatial organization of this area would be more difficult requiring more map references in the early trials. The data support the hypothesis to the extent that, for the subjects who required map references, most references were made in the nine-position sequences. It should be noted that, after studying the maps prior to the performance of the first trial, one subject required no map references in that trial or subsequent trials. Some confirmation for the spatial aspects of the memory for destination locations is found in the relationship between the Space Relations perceptual scores and the use of map references. Three of the subjects scored at the 95th percentile on the Space Relations subtest. The three subjects showed a varying number of map references, but all references were made in the first three trials. Subject Four scored at the 65th percentile on the subtest. In number of map references and number of destination errors, Subject Four clearly differed from the pattern of the other subjects. The fact that such a difference occurred in the hypothesized direction would confirm the spatial nature of the task, particularly in the memory for destination locations.

Implications for Teaching Motor Skills

Literature concerned with the teaching of motor skills emphasizes the necessity of creating a learning environment which accomodates individual differences in the processes of achieving higher levels of skill. When the research pertinent to the processes of skill acquisition is examined for explanations about individual differences, one becomes aware of one limitation in structuring the environment. Little is known about the nature and role of individual differences. To a large extent, research designs use group strategies which focus on measurable outcomes rather than the ongoing process of skill development. Such designs can not adequately describe the relationship of individual style to the learning process or account for differential acquisition rates of the various parts of a complex task. The time-series case study strategy provides the mechanism for developing systematic and meaningful explanations about acquiring skill. Once descriptions of the complex process are known and understood, methodologies can be adjusted to facilitate learning by the introduction of appropriate instructional strategies which are properly sequenced and focused on critical task elements.

The preceding discussion emphasized the necessity for the instructor to understand the complex demand characteristics of a task and the nature of performer decisions which are possible within the task as they relate to ongoing performance. The selection of an appropriate attention set and the balancing of priorities in relation to task outcomes was important in the performance and memory outcomes of the current investigation. The differential adjustment of performer goals could not occur in this study, but would be crucial in a learning situation, in order to establish an appropriate performance set and to minimize the concentration on such typical performance measures as time and errors. Thus, minimizing the role of time and errors in a serial task would free the subject to risk the temporary decrement in performance to achieve crucial long range objectives.

Serial performance structures are found in many physical activities, particularly in those containing learned performance routines, i.e., dance, gymnastics, and figure skating. An understanding of the processes underlying the learning of serial lists of performance items would aid the instructor in structuring the presentation of the task to facilitate recall. Length of list, grouping or clustering of items, pauses in presentation rate, and discussion of strategies for coding list elements are considerations which the instructor must make when presenting serial material. An understanding of the existence of the recency/primacy phenomena would assist in the recognition of the performance difficulties associated with the less clearly recalled middle items in a list and in suggesting strategies to aid in the more efficient organization of such items.

The impetus for the development of the research strategy used in the current investigation was the desire of a teacher and student of the learning process to know more about the process of skill development within the individual. The interest in obtaining a thorough description of one person's struggle with the learning of a complex gross motor task evolved into the design utilized in the current study. The findings indicate that the use of intraindividual case study designs can provide such a description without losing the information most crucial to the teacher, the unique responses of the individual performer.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RESEARCH RECOMMENDATIONS

Summary

This descriptive research investigated intra-individual performance of a complex gross motor task as a function of time. Four case studies of time-series motor performances were designed to examine the relationships among serial recall, visual and kinesthetic perceptual attributes, and spatial complexity. The task included four nine-element serial sequences and two tossing sequences. In the multi-element sequences, subjects were required to perform a series of movement patterns that included walking, simple hand motions, ducking under or stepping over obstacles, stacking blocks of differing colors, and walking in geometrically shaped floor patterns. The selected perceptual demand characteristics were structured into the four serial sequences, i.e., high- versus low-visual attributes and a four- versus nine-destination spatial environment. Prior to the first trial, subjects completed two perceptual tests, the Rod-and-Frame Test of field independence/dependence and the Space Relations subtest of the Differential Aptitude Test (Bennett et al., 1973). Each subject then completed 15 trials over a three week testing period. Performance in each trial was timed and performance variables were coded by trained observers. The timed data included total time for each trial and partial times for the execution of each element within the trial. Two interventions, change of sequence order within the task and change of element order within subsequences, were designed to test the nature of the perceptual organization for serial recall. The first occurred after the fifth trial and the second after the tenth trial. The starting order of sequence performance in combination with the order of the interventions differed for each subject.

The data were analyzed as individual case studies by the inspection of the time-series profiles for each task element. Findings indicated differing subject strategies and patterns in organizing the task for performance and prioritizing task performance outcomes. Two subjects focused on the memory for performance as a task outcome; the other two subjects were concerned with decreasing time and performance errors.

Those sequences with HV attributes had much faster cue times overall, but showed fewer instances of performance memory. LV sequences showed slower cue times and more frequent errors in the early trials but were performed more frequently from memory than the HV sequences.

Evidence of serial recall patterns, the recency and primacy effects, were clearly seen in the data. First and last elements in the multi-element subsequences were more frequently performed without cue reference than those elements in the middle of a series. No evidence was found to support a recency/primacy effect in the task as a single series.

Tentative support was found for the role of vision as the primary modality in early performance and the primary role of kinesthetic abilities in later trial performance.

Conclusions

The following conclusions are consistent with the findings of this study. It should be noted that the nature of the inquiry is such that the conclusions should not be generalized in the classical research tradition. At best, the findings verify some of the theoretical arguments in motor learning literature. Focused hypotheses can be derived from the results of this study.

Answers to the major questions set forth in Chapter I are herewith delineated:

1. With respect to the relationship between performance of a subsequence and the position of that subsequence within the total task, no difference was found to indicate that the position of either the LV vs HV or the 9-destination vs the 4-destination sequences was related to early or to late task performance. This finding was consistent regardless of the beginning order of serial

subsequences or the time at which intervention changed sequence orders within the task.

2. With respect to the relationship between performance of a subsequence and the demand characteristics of the subsequence, the data showed clear differences between performance of the high- and the low-visual sequences. Differences were also found between the performance of the nine- and four-destination sequences. For all subjects, the HV sequences showed faster early cue and performance times and fewer errors than the LV sequences. Later trial performance showed more frequent recall of the LV sequences, as measured by performance without cue reference. No intervention effects were observed in relation to the varying demand characteristics of the sequences.

Evidence was found to indicate a spatial perceptual difference between the four- and nine-destination sequences. Fewer map references were required in the four-destination sequences. The number of trials required for a subject to organize the spatial information appears to be consistent with subject score on the Space Relations subtest of the Differential Aptitude Test (Bennett et al., 1973).

3. The pattern of recall of performance information within each subsequence showed a clear primacy and a recency effect, particularly in the LV sequences, as measured by the position of task elements performed without

reference to available cues. The first instances of serial recall occurred at the first and/or last element in the LV sequences. Later instances showed a forward chaining of additional memory elements and a less pronounced backward chain from the last memory element. For the two subjects whose second intervention involved a change of element order, a difference in performance was noted. This was associated with the necessity of checking each cue to establish the new sequence order. Performance in subsequent trials returned to previous levels. No such change was seen for the two subjects with the early intervention.

4. The self-pacing intervals showed no changes attributed to task variables or to task interventions. Individual strategies were shown in the use of the pacing intervals to study destination maps.

Research Recommendations

The following suggestions are proposed for future investigations using a similar gross motor criterion task and intraindividual design strategy:

1. The structure of the task as a criterion for testing the hypotheses in this design was validated to the extent that, for the subjects in the current study, the data showed (a) contrast between the high- and low-visual sequences related to memory and performance attributes,

(b) evidence for both a primacy and recency effect, and (c) differences in spatial demands between the four- and nine-destination sequences.

2. The structure of the information content of each element should be adjusted to make HV and LV performances equivalent. Interventions which change element order should be designed, rather than randomized. The organization of items within serial lists warrants study and consideration in the task.

3. The design of the cueing materials and the coding of cue utilization should be adjusted to more clearly detect partial cue references, i.e., the observers must be able to detect if the subject only checks the number of repetitions.

4. The coding of errors should be expanded to include a more complete description of the error, i.e., destination errors should be coded to indicate the wrong destination number. This would aid examination of errors following the change of element orders in relation to the previous order.

5. Generalizable findings should be developed by a series of replications with subjects selected with a range of perceptual abilities and cognitive styles. The complete descriptive framework that the intraindividual design offers would provide powerful evidence if the findings were consistent upon replication.

6. Key contact patterns for the entry into each serial sequence should be adjusted so that the cue time of the initial element does not contain the movement time from the pressure mat to the cue table.

7. The criterion task developed and partially validated in the current investigation may be used for the study of differing personality variables in relation to performance. As mentioned previously, risk-taking behavior could be a relevant construct in the explanation of subject performance. Motivation, persistence, body image, and other variables which have been studied in relation to other types of motor performance could conceivably be examined using a similar serial criterion task and the intraindividual time-series design.

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APPENDIX A

TASK SPECIFICATIONS

Tossing Task
Low-visual Sequences
High-visual Sequences
Four-position Sequences
Nine-position Sequences
Low-visual Cue Box and Forms
Low-visual Cue Hole Pattern
Sample High-visual Cue Card

SPECIFICATIONS

Tossing task

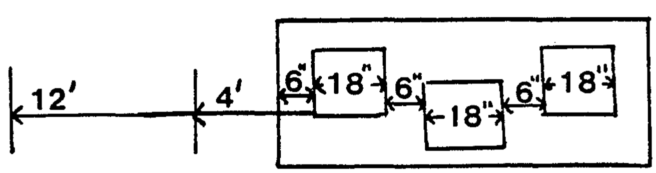
Target Size: 18" squares marked on dark green background with 1 $\frac{1}{2}$" masking tape

Number of tosses: 20

Tossing materials: Beanbags - two sized divided evenly between long and short tossing sequences

Distances:

Short tossing 4', 6', 8'
Long tossing 12', 14', 16'



SPECIFICATIONS

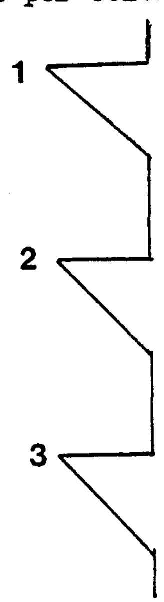
Low-visual Sequences

Area Dimensions: 20' x 20' for each area

Destinations: The destinations were marked by 12 lb. fishing line hanging from an overhead grid constructed of fishing line and suspended from standards placed outside each corner of the area. The overhead cross grid in the four-position sequence connected the mid-points of each side. In the nine-position, the grid consisted of the two diagonals across the area.

Obstacles: The obstacles were marked by photoelectric motion detectors. The beams were aimed across the area parallel to the end lines at the specified height and location.

Cue Forms: The geometric cue forms were cut from 1"x 8" yellow pine. The cue holes were cut in the specified pattern, 5/8" in diameter. The notches were cut in the right side of each form as per below:



SPECIFICATIONS

High-visual Sequences

Area Dimensions: 20' x 20' for each area

Destinations: The destinations were marked by 12" orange plastic cones centered over each destination point.

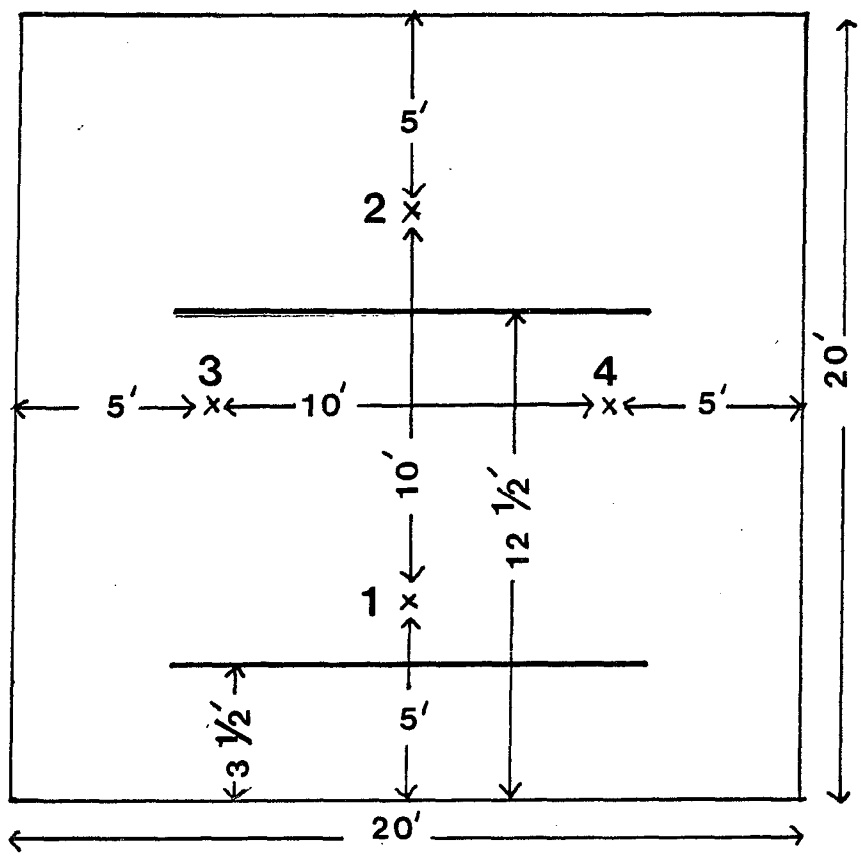
Obstacles: The obstacles were marked by 12' x 1 7/8" wood rods supported by wooden standards. The rods were placed 4 feet in from the sides of the area parallel to the end line at the specified height and location.

Cues: Cue information was placed on 5" x 8" index cards.

Blocks: The blocks were cut from 2" x 6" pine. The blocks were spray painted in blue, orange, and white paint.

SPECIFICATIONS

Four-position Sequences



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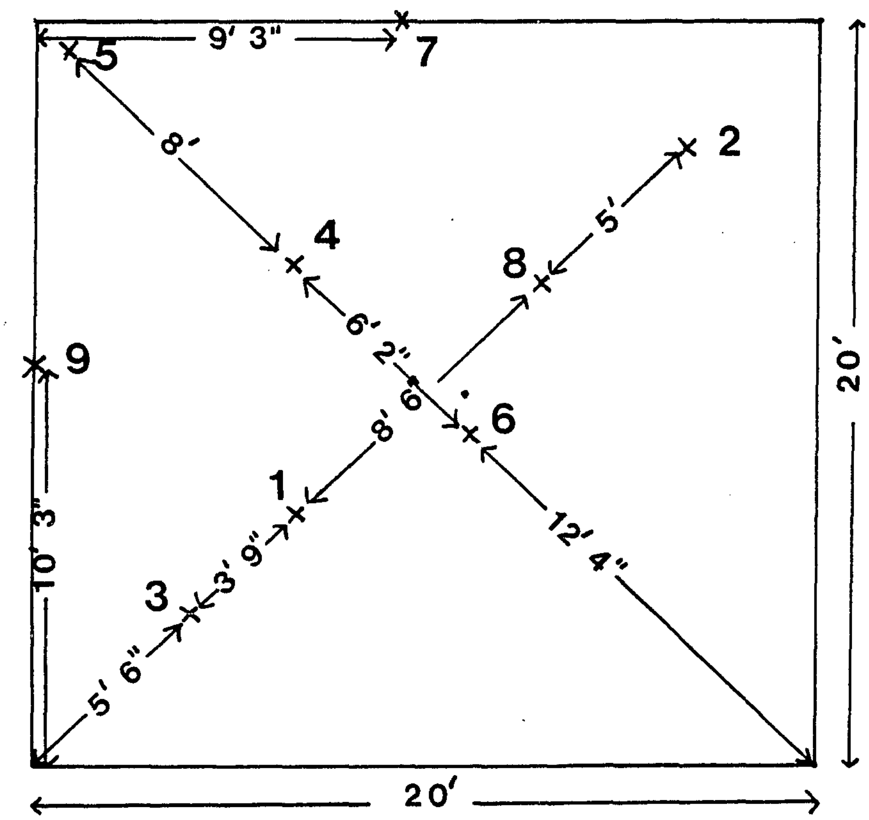
SPECIFICATIONS

Nine-position Sequences



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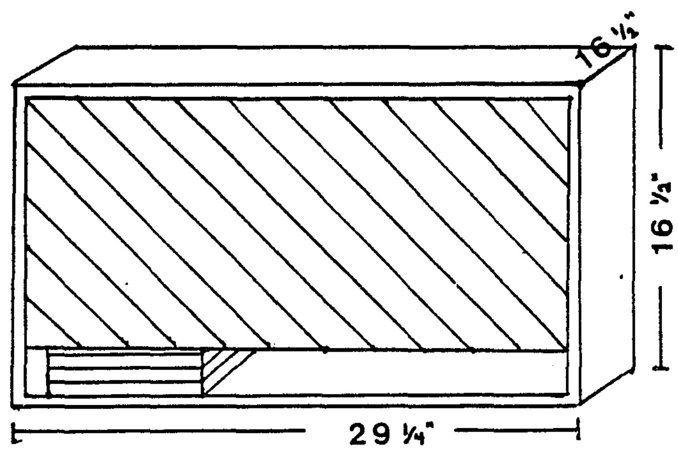
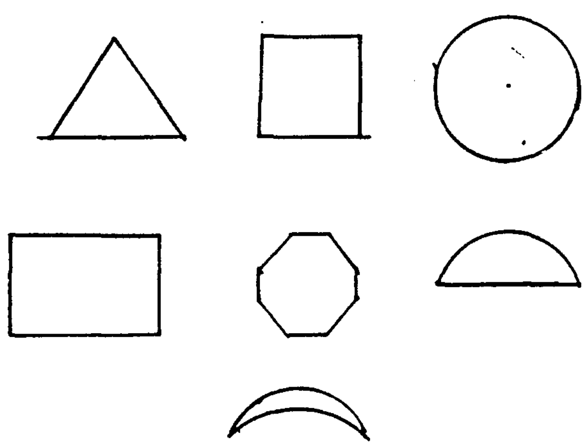
SPECIFICATIONS

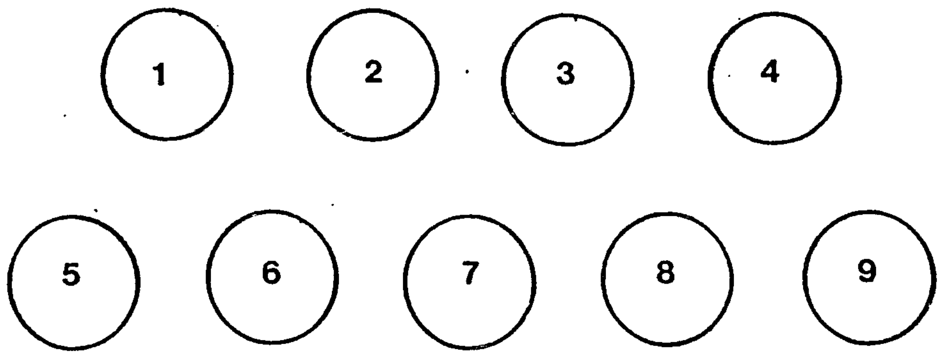
Low-visual Cue Box and Forms



CUE BOX



FORMS



Low Visual Cue Hole Pattern

SPECIFICATIONS

Sample High-visual Cue Card

2

STACK 1 ORANGE

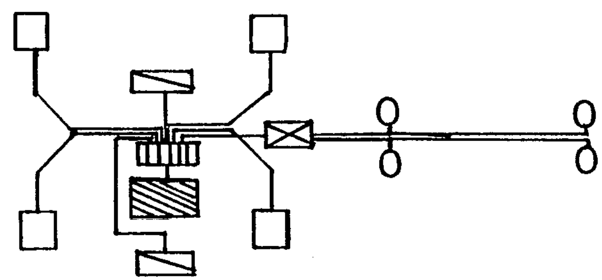
STACK 3 BLUE

Note: Letters and numbers are actual size. Cues were mounted on a 5" x 8" index card.

APPENDIX B

WIRING SCHEMATICS

Wiring Harness
Interconnections of Interfaces with Recorder
Interface Box
Plug Connection
Optic Couple
Photo Motion Detector



O Photoelectric cells

Contact key

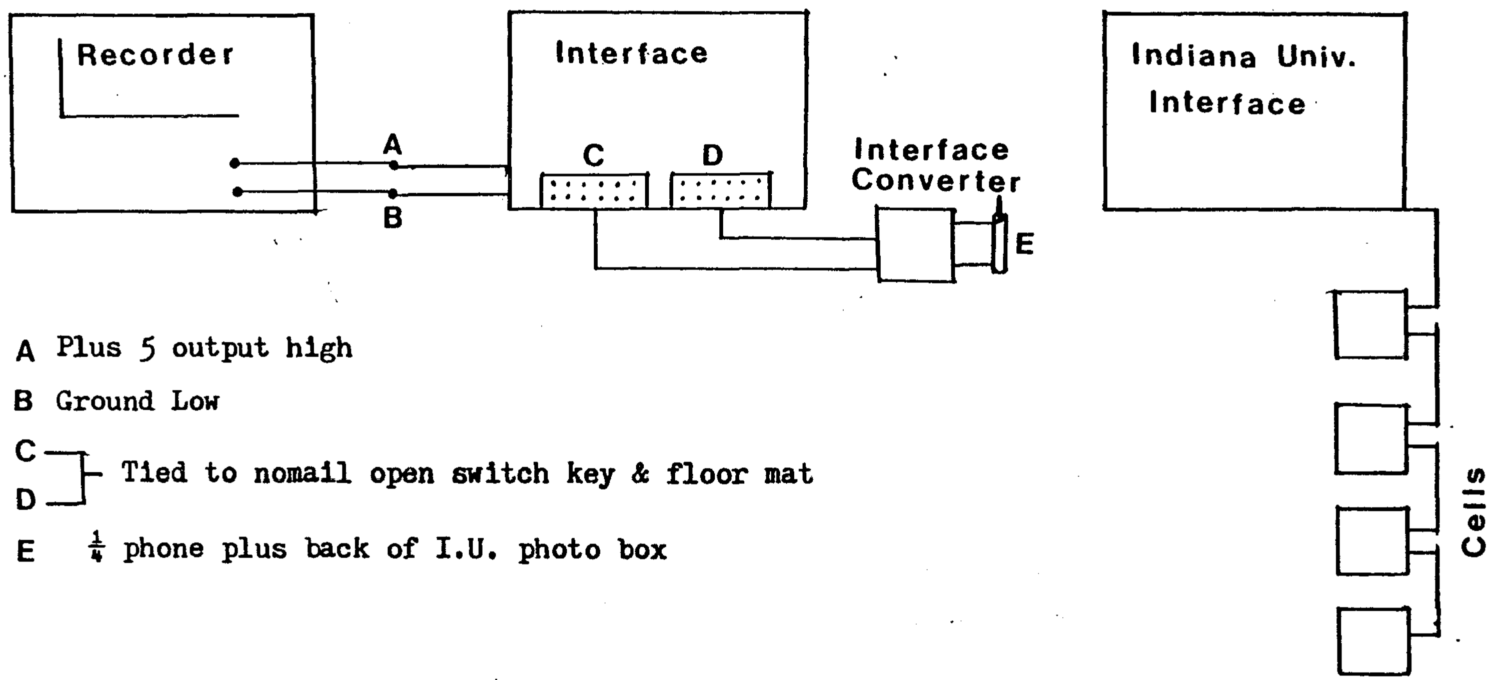
Pressure mat

I.U. Interface for cells

Interface box

Recorder

SCHEMATIC - WIRING HARNESS



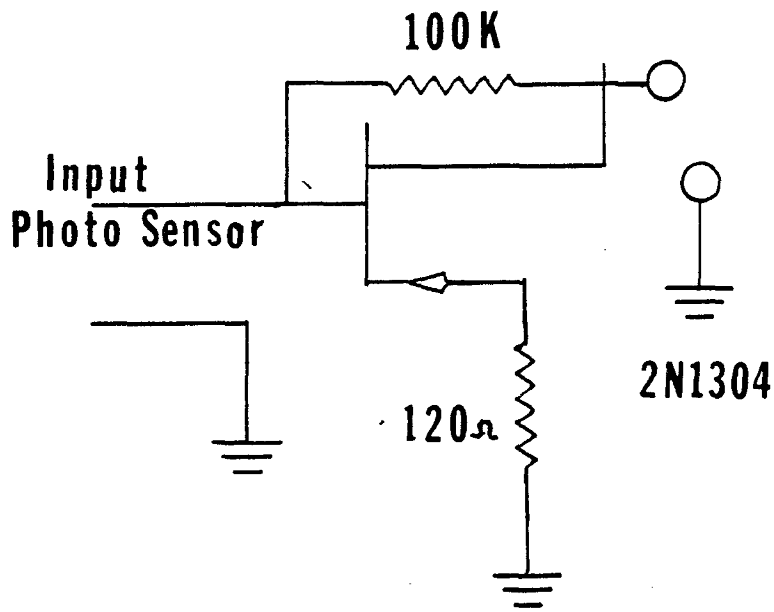
A Plus 5 output high

B Ground Low

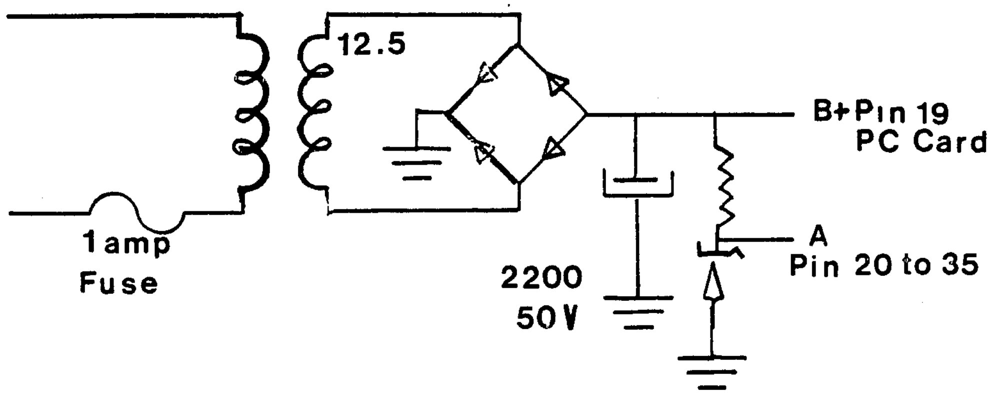
C, D — Tied to nomail open switch key & floor mat

E $\frac{1}{4}$ phone plus back of I.U. photo box

SCHEMATIC - INTERCONNECTIONS OF INTERFACES WITH RECORDER

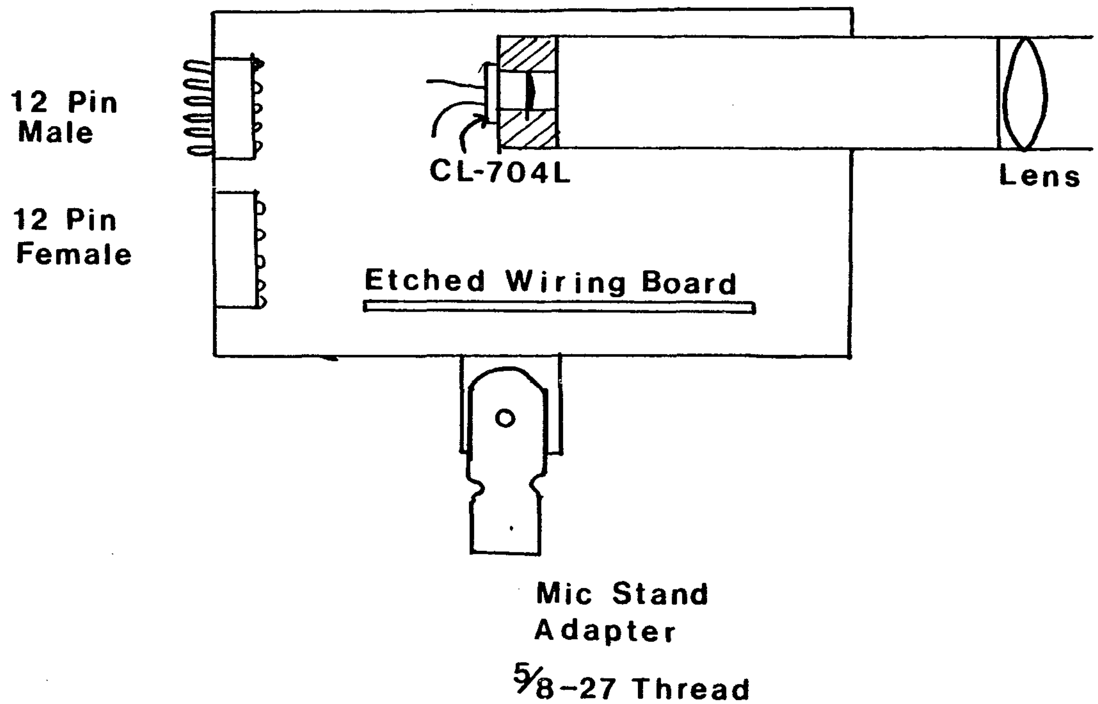


Interface Box

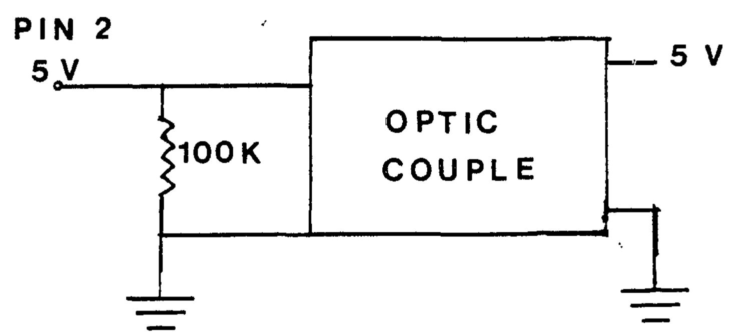


Note: Grounds on card connector. Pin 1+17+18+34+35

SCHEMATIC - PLUG CONNECTION



SCHEMATIC - PHOTO MOTION DETECTOR (INDIANA UNIV., 6-1-72)



Note: The PC card has 15 inputs - Pins 2 to 16. Grounds are Pin 1+17+18+35+36. All couples are fed through card connectors. Each of the first 10 are 100K loaded. The last five will work the same but will handle 200MA. The first 10 work at 10MA and wire length to switch should not exceed 80 feet. For longer runs use 11 to 15.

SCHEMATIC - OPTIC COUPLE

APPENDIX C

Instructions

DIRECTIONS FOR THE NOVEL SERIAL GROSS MOTOR TASK

1. 9-Position High Visual

In this segment you will duck under or step over obstacles, stack blocks and/or make different hand movements. You want to complete this segment with as few errors and as quickly as you can. Since you will also be doing this segment for the rest of this week, you want to remember as much information as you can.

You begin here by stepping firmly on this mat. This contact starts the clock. You then move to that table and read the first card in the stack. These cards look like this (SHOW SAMPLE) and give you the following information:

STATION NUMBER
STACK (NUMBER AND COLOR)
WAVE - SALUTE - CLAP

In this segment there are 9 stations marked by cones. Walk with me through the area and I will show you which cone indicates each of these 9 stations. There is a map showing these locations which may be found beside the cue box. If you cannot remember where a station is located, you may refer to this map at any time. Whenever you come to an obstacle, you must step completely over the low bars, and duck cleanly under the high bars.

To review: You step on the pressure mat, move to the table, and read the first card. When you can remember what the card indicates, turn it over in a separate stack. Then, push the key and do what the card indicated, moving under or over any obstacles in your path.

When you finish performing the items listed, return to the table and push the key again. When you are ready to start the next card, you repeat the steps. That is: read the card, try to remember the items on it, turn it over on a separate pile, push the key and perform the items listed. Remember to push the key <u>before</u> you begin your performance and after you finish your performance.

You will be told when you make an error. If you go to the wrong station, stack an incorrect number or color of blocks, or make the wrong arm movement, you must return to the table to get the correct information from the card. Then, begin your performance again.

When you push the key after completing the items on the last card, you move to the center and step firmly on a mat.

2. Short tossing

In this segment, you toss 20 beanbags. Try to get the highest score you can. the closest square scores 2, middle square scores 4, and farthest square scores 6 points. If a toss lands on a line, it scores 1/2 the value of the square, i.e., 1,2,3.

Remember: Step on a mat before beginning.
Step on a mat when finished.

3. 4-Position Low Visual

In this segment you must move around various stations in a particular pattern a certain number of times. Also, you must step over or duck under any obstacles which are in your path. You want to complete this segment with as few errors and as quickly as you can. Since you will also be doing this segment for the rest of this week, you want to remenmber as much information as you can.

Wooden forms which have these shapes (SHOW SAMPLE SHEET OF FORM SHAPES) are located in this box. You will reach into this box and feel these forms WITHOUT REMOVING THEM FROM THE BOX. The forms contain this information (SHOW SAMPLE FORM).

SHAPE = Indicates the pattern you make around a station
HOLES = Indicates station's number
NOTCHES = Indicates the number of repetitions

Show sample. Ask, "Now, what would you do for your first performance?"

This segment has 4 stations. Walk with me through the area and I will show you the location of each of these stations. There is a map showing these locations which may be found beside this cue box. If you cannot remember where a station is located, you may refer to this map at any time. Whenever you come to an obstacle, you must step completely over the low one, and duck completely under the high one. If you fail to do so, you will hear a "click" sound from the machine.

When you are ready to begin, move to a mat and step firmly on it. Then go to this table, reach into the box, and feel the top form. As you are feeling it, move it to the other side of the box. As soon as you understand all the information on the form, push the key and do the pattern, stepping over or ducking under any obstacles in your path. When you're ready to do the next form, reach into the box again, feel and move the form, push the key when you understand all the information on the form, and do what the form indicated. Remember to return to the table and push the key again when you finish.

You will be told when you make an error. If you go to the wrong pattern, or the wrong number of patterns you must return to the table to get the correct information form the cues. Then begin again.

After the information contained on the last form has been completed and you have pushed the key, move to a mat and step firmly on it.

4. 9-Position Low Visual

This segment requires you to do the same steps as you did in that one (POINT TO 4-POSITION LOW VISUAL). In this segment, however, there are 9 stations. Walk with me through the area and I will show you the location of each of these 9 stations. There is a map showing these locations which may be found beside the cue box. If you cannot remember where a station is located, you may refer to this map at any time. Again you must duck under or step over any obstacles that are in your path.

The forms in the box are the same types as were used in the other segment like this. the only difference is there may be up to 9 holes in the center of the form (SHOW SAMPLE AND EXPLAIN ARRANGEMENT OF HOLES).

When you are ready to begin this segment, step on the pressure mat. Then move to the table, reach into the box, feel the top form, and move it to a separate pile as you are manipulating it. When you understand the information, push the key and perform the requirements, return to the table and push the key. Continue this order - push key, manipulate form inside the box, perform, push key - until all forms have been completed.

You will be told when you make an error. If you go to the srong station, make the wrong pattern, or the wrong number of patterns you must return to the table to get the correct information from the cue. Then begin again.

When the last form has been completed and you have pushed the key, move to the center and step on a mat. Again, try to do the segment as quickly and as accurately as you can.

5. Long Tossing

This segment is the same as that one (POINT OT SHORT TOSSING). Try to get the highest score you can. Remember, the nearest target scores 2, the middle one 4, and the farthest one 6 points. If a toss lands on a line, it scores 1/2 the value of the square.

Remember: Step on a mat before beginning.
Step on a mat when finished.

6. 4-Position High Visual

This segment requires you to do the same steps as you did in that one (POINT TO 9-POSITION HIGH VISUAL). In this segment, however, there are only 4 stations. Walk with me through the area and I will show you which cone indicates each of these 4 stations. There is a map showing these locations which may be found beside the cue cares. If you cannot remember where a station is located, you may refer to this map at any time. Again, you must duck under or step over any obstacles that are in your path.

When you are ready to begin this sequence, step on the pressure mat. Then move to the table, read the first card, move it to a separate pile, push the key and do what the card indicates. When you have finished performing all the items listed on the card, return to the table, and push the key. Continue this order of events - read card, move card to separate pile, push key, perform, push key - until all the cards have been completed.

You will be told when you make an error. If you go to the wrong station, stack an incorrect number or color of blocks, or make the wrong arm movement, you must return to the table to get the correct information from the card. Then begin your performance again.

When the last card has been completed and you have pushed the key, move to the center and step on a mat. Again, try to do the segment as quickly and as accurately as you can.

APPENDIX D

Forms
Informed Consent Form
Subject Information Sheet
Individual Performance Summary
Coding Form - 4-position Low-visual
Coding Form - 9-position High-visual

THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO
SCHOOL OF HEALTH, PHYSICAL EDUCATION & RECREATION

SCHOOL REVIEW COMMITTEE

INFORMED CONSENT FORM*

I understand that the purpose of this study/project is

____

____

____

I confirm that my participation is entirely voluntary. No coercion of any kind has been used to obtain my cooperation.

I understand that I may withdraw my consent and terminate my participation at any time during the project.

I have been informed of the procedures that will be used in the project and understand what will be required of me as a subject.

I understand that all of my responses, written/oral/task, will remain completely anonymous.

I understand that a summary of the results of the project will be made available to me at the completion of the study if I so request.

I wish to give my voluntary cooperation as a participant.

____
Signature

____
Address

____

____
Date

*Adopted from L.F. Locke and W.W. Spirduso. Proposals that work. New York: Teachers College, Columbia University, 1976, p. 237.

Approved 3/78

SUBJECT INFORMATION SHEET

Please complete the following background information. It will remain confidential and will be used without personal identification within the study.

Name ______________________________ Date of Birth ___________

Address ______________________________________ Phone ________

Do you consider yourself to be naturally right-handed?

Do you wear glasses? ________ Contact Lenses ________
If yes, for what condition (nearsighted, farsighted, etc.)

Would you consider yourself more active than the average woman your age?

Are you a high school graduate?
If yes, indicate class standing _____ out of _____.
If no, highest grade completed _________
Did you attend college? How many years?

To be completed at end of study:

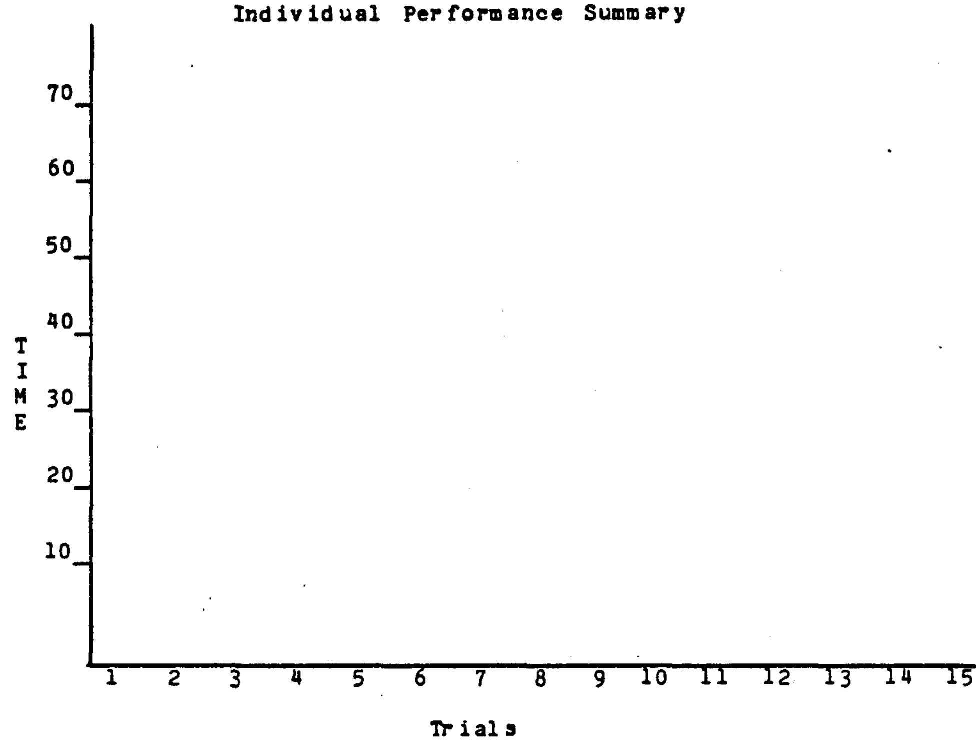
I acknowledge receipt of $__________ for my participation in the ______________ phase of the study.

____
Signed

____
Date

SUBJECT CODE: ___________

Individual Performance Summary



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cues Used															
Errors															
Tossing Scores															

Subject Code _____ Date of First Trial __________

Phase _____

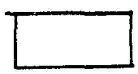
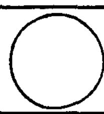
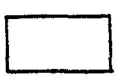
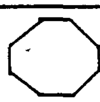
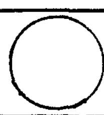
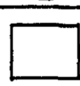
cld 2/81

4-POSITION LOW VISUAL

Position in Task ______

Subject # ________

Trial # ________ **Date** ________

ELEMENT DESCRIPTION	CUE REFERRAL S.P. INT.	CUE REFERRAL PER W/O E	CUE REFERRAL PER A.E.	MAP REFERRAL S.P. INT.	MAP REFERRAL PER W/O E	MAP REFERRAL PER A.E.	ERRORS DES.	ERRORS OBS.	ERRORS PER.	ERRORS OTHER
1. 1  3x										
2. 2  2x										
3. 4  3x										
4. 4  3x										
5. 2  2x										
6. 4  3x										
7. 2  1x										
8. 4  1x										
9. 3  2x										

9-POSITION HIGH VISUAL

Position in Task ________

Subject # _________

Trial # ___________ Date ___________

ELEMENT DESCRIPTION	CUE REFERRAL S.P. INT.	CUE REFERRAL PER W/O E	CUE REFERRAL PER A.E.	MAP REFERRAL S.P. INT.	MAP REFERRAL PER W/O E	MAP REFERRAL PER A.E.	ERRORS DES.	ERRORS OBS.	ERRORS PER.	OTHER
1. 5 Stack 2 Wh.; Stack 2 Bl.; Clap 1x										
2. 9 Stack 2 Wh.; Stack 3 Wh.; Wave 2x										
3. 5 Stack 1 Wh.; Stack 1 Bl.; Clap 1x										
4. 4 Stack 2 Bl.; Stack 3 Bl.; Wave 2x										
5. 7 Stack 3 Bl.; Stack 3 Wh.; Salute 3x										
6. 8 Stack 2 Wh.; Stack 3 Or.										
7. 7 Stack 3 Bl.; Stack 1 Or.; Wave 2x										
8. 7 Stack 1 Bl.; Stack 1 Or.; Clap 1x										
9. 3 Stack 2 Or.; Salute 1x; Wave 1x										

APPENDIX E

Raw Data

RFT SCORES

TRIAL	Frame Position (degrees)	Rod Position (degrees)	SUBJECT 1	2	3	4
1	0	10	+2.0	0	-.5	+1.0
2	10	345	+2.5	+2.0	0	-1.0
3	350	355	0	-2.0	-2.0	-3.0
4	10	350	+1.5	+3.0	-.5	-1.0
5	0	355	+1.0	0	-2.0	0
6	350	350	+.5	-2.0	-2.5	-1.0
7	0	15	+2.0	+1.0	-1.5	0
8	0	20	+1.0	+1.0	-.25	-2.0
9	350	10	0	-1.0	-1.25	-3.0
10	0	350	+.5	0	-1.5	0
11	350	345	0	-1.0	-3.0	-4.0
12	0	5	+1.5	+1.0	-1.25	+1.0
13	10	355	+2.0	+4.0	0	+1.5
14	10	340	+1.5	+4.0	0	+1.5
15	350	15	+1.5	-2.0	-2.5	-2.5
16	10	5	+2.0	+2.0	-.5	-1.0
17	0	345	+1.5	+1.0	-1	-2.0
18	350	20	+1.0	-2.0	-3.0	-3.0
19	10	345	+2.5	+3.0	-.25	0
20	350	10	+1.5	-3.0	-3.0	-2.5
21	10	10	+2.5	+3.0	0	-2.0
		AVE. DISPL.	1.357	.57	-1.369	-1.095
		ABS. DISPL.	1.358	1.8	1.369	1.57

DATA FOR SUBJECT ONE

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	19	1	11.0	10.4	8.0	6.4	3.6
1	1	1	19	1	24.0	16.0	15.2	16.0	14.8
1	2	0	19	1	16.0	7.6	4.4	1.6	4.0
1	2	1	19	1	20.0	13.6	12.0	12.4	11.3
1	3	0	19	1	11.2	9.2	3.2	2.0	4.0
1	3	1	19	1	19.2	13.6	13.8	13.6	12.6
1	4	0	19	1	6.9	8.0	7.3	3.2	4.0
1	4	1	19	1	18.9	13.6	14.4	12.8	14.0
1	5	0	19	1	11.2	8.8	4.9	2.8	4.2
1	5	1	19	1	20.9	18.5	18.3	18.4	18.1
1	6	0	19	1	8.9	4.9	3.9	2.4	4.6
1	6	1	19	1	14.4	12.4	12.8	12.4	13.1
1	7	0	19	1	12.0	4.8	5.2	2.8	4.7
1	7	1	19	1	22.8	16.0	14.2	14.8	15.4
1	8	0	19	1	8.0	10.2	2.6	2.4	3.0
1	8	1	19	1	15.7	13.6	15.3	13.6	14.7
1	9	0	19	1	9.2	13.2	3.2	2.4	4.5
1	9	1	19	1	9.6	8.0	7.6	7.2	7.6
1	0	2	19	1	2.0	1.6	1.7	1.4	1.6
0	0	3	0	1	6.0	2.4	1.5	1.4	1.6
2	0	9	0	1	52.8	47.2	48.0	44.0	50.2
0	0	3	0	1	4.1	3.9	3.6	3.2	3.2
3	1	0	24	1	25.8	23.2	12.8	9.6	11.4
3	1	1	24	1	23.2	51.3	22.1	19.2	22.0
3	2	0	24	1	12.0	14.4	13.0	10.4	8.0
3	2	1	24	1	30.4	23.6	22.4	20.0	21.8
3	3	0	24	1	15.2	13.6	10.8	8.8	13.2
3	3	1	24	1	67.6	25.6	21.6	20.0	37.1
3	4	0	24	1	13.6	8.8	10.8	8.8	9.6
3	4	1	24	1	23.2	28.8	22.4	23.2	24.0
3	5	0	24	1	11.8	16.4	10.5	8.0	8.8
3	5	1	24	1	28.0	26.0	20.6	20.0	20.4
3	6	0	24	1	12.0	12.5	12.6	8.0	11.9
3	6	1	24	1	33.2	26.8	22.6	23.2	27.0
3	7	0	24	1	15.2	11.8	16.8	11.2	8.6
3	7	1	24	1	24.8	45.7	18.7	17.2	18.5
3	8	0	24	1	12.8	9.7	9.0	10.8	10.0
3	8	1	24	1	18.0	18.9	14.6	38.4	12.9
3	9	0	24	1	12.8	15.5	20.7	12.8	12.1
3	9	1	24	1	19.4	17.6	15.7	17.6	16.0
3	0	2	24	1	2.0	1.7	1.5	1.6	1.2
0	0	3	0	1	4.0	4.4	3.2	3.0	3.6
4	1	0	29	1	46.6	41.7	34.8	17.2	14.2
4	1	1	29	1	44.2	67.0	33.6	36.0	31.4
4	2	0	29	1	36.0	17.8	37.8	10.0	18.3

DATA FOR SUBJECT ONE

BLOCK 1

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	29	1	76.0	69.6	27.9	32.8	28.9
4	3	0	29	1	56.8	32.0	17.6	16.0	12.0
4	3	1	29	1	32.0	34.4	26.8	24.8	28.0
4	4	0	29	1	20.0	21.6	17.1	16.0	13.3
4	4	1	29	1	18.8	19.9	17.7	17.6	17.6
4	5	0	29	1	24.4	21.1	17.7	24.8	16.9
4	5	1	29	1	34.0	32.0	29.2	50.8	29.0
4	6	0	29	1	28.0	17.0	17.4	22.4	17.6
4	6	1	29	1	17.6	51.2	16.4	36.0	18.4
4	7	0	29	1	29.6	18.6	14.4	12.0	9.8
4	7	1	29	1	89.2	33.4	28.9	24.8	26.8
4	8	0	29	1	20.4	16.0	12.4	8.8	11.2
4	8	1	29	1	18.8	16.2	14.8	13.2	14.9
4	9	0	29	1	35.2	26.4	13.6	9.6	19.6
4	9	1	29	1	21.6	19.0	16.8	17.6	17.4
4	0	2	29	1	1.6	1.6	1.6	1.6	1.6
0	0	3	0	1	4.8	2.4	3.2	3.2	3.2
5	0	9	0	1	60.0	60.2	60.4	62.8	71.2
0	0	3	0	1	2.7	2.0	1.1	0.8	1.6
6	1	0	14	1	17.2	9.4	5.7	6.0	8.2
6	1	1	14	1	17.3	15.7	12.9	14.4	15.6
6	2	0	14	1	6.8	6.2	2.9	1.6	4.0
6	2	1	14	1	18.2	15.7	12.6	14.4	14.7
6	3	0	14	1	6.4	3.2	3.1	1.6	4.0
6	3	1	14	1	18.4	16.8	14.0	14.4	14.7
6	4	0	14	1	7.2	2.3	1.4	0.8	3.4
6	4	1	14	1	12.3	11.6	10.5	10.4	10.4
6	5	0	14	1	7.2	5.0	6.4	2.4	4.9
6	5	1	14	1	16.0	15.1	13.2	13.2	14.2
6	6	0	14	1	6.4	6.1	4.8	3.6	4.0
6	6	1	14	1	16.4	14.0	13.4	14.4	13.7
6	7	0	14	1	6.8	4.5	4.1	2.0	3.2
6	7	1	14	1	12.0	13.8	8.8	11.2	8.9
6	8	0	14	1	4.8	3.2	3.9	3.2	3.2
6	8	1	14	1	16.0	15.8	12.5	12.8	12.5
6	9	0	14	1	7.6	3.9	4.0	11.2	3.3
6	9	1	14	1	16.8	13.2	12.1	12.0	10.4
6	0	2	14	1	2.6	2.0	1.6	1.6	0.8

DATA FOR SUBJECT ONE

BLOCK 2

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	2	11.6	8.8	8.8	9.6	8.4
1	1	1	24	2	20.8	18.4	17.6	19.6	17.6
1	2	0	24	2	8.0	6.4	6.4	6.4	8.0
1	2	1	24	2	21.2	18.8	20.0	19.2	17.6
1	3	0	24	2	12.0	8.8	7.6	8.0	7.2
1	3	1	24	2	20.8	20.8	19.2	20.0	17.6
1	4	0	24	2	7.2	5.6	4.8	6.4	5.6
1	4	1	24	2	21.2	19.2	20.0	20.0	19.2
1	5	0	24	2	7.2	7.2	6.0	6.4	7.6
1	5	1	24	2	22.4	19.2	20.0	19.2	19.2
1	6	0	24	2	9.2	6.0	5.6	6.4	7.2
1	6	1	24	2	24.8	21.6	22.8	21.6	20.0
1	7	0	24	2	8.4	6.8	6.8	6.4	6.8
1	7	1	24	2	19.2	15.2	17.6	16.4	15.2
1	8	0	24	2	10.4	8.0	8.0	7.2	7.6
1	8	1	24	2	13.6	10.4	12.0	12.8	10.8
1	9	0	24	2	10.4	8.0	8.8	10.4	5.6
1	9	1	24	2	17.6	13.6	13.6	14.8	20.4
1	0	2	24	2	2.4	1.6	1.6	1.6	1.2
0	0	3	0	2	2.8	4.0	2.8	2.8	3.2
2	0	9	0	2	46.0	46.4	45.6	43.2	48.0
0	0	3	0	2	1.6	1.6	1.6	1.6	1.6
3	1	0	19	2	5.6	6.4	4.0	4.0	5.2
3	1	1	19	2	15.2	18.4	14.4	14.8	14.4
3	2	0	19	2	4.0	2.4	2.8	3.6	3.6
3	2	1	19	2	12.0	11.2	11.2	12.0	10.8
3	3	0	19	2	3.6	2.4	2.4	4.0	2.8
3	3	1	19	2	12.0	13.6	12.8	13.6	13.6
3	4	0	19	2	5.6	3.2	3.2	4.0	3.2
3	4	1	19	2	12.8	11.6	12.8	14.4	12.4
3	5	0	19	2	4.0	4.0	3.2	4.8	3.2
3	5	1	19	2	16.0	16.8	16.0	16.0	16.0
3	6	0	19	2	4.0	3.2	2.8	4.0	2.8
3	6	1	19	2	11.2	12.0	11.2	12.0	12.0
3	7	0	19	2	4.8	4.0	2.8	3.2	3.2
3	7	1	19	2	13.6	14.4	12.8	14.0	14.8
3	8	0	19	2	4.0	3.6	3.2	3.2	2.8
3	8	1	19	2	12.8	12.0	12.4	13.6	13.6
3	9	0	19	2	3.2	3.2	2.4	3.2	2.4
3	9	1	19	2	8.8	8.8	8.8	8.8	8.0
3	0	2	19	2	1.6	0.8	1.2	0.8	1.2
0	0	3	0	2	3.2	3.2	3.2	3.2	3.2
4	1	0	14	2	20.0	6.0	4.8	5.6	7.2
4	1	1	14	2	13.6	13.6	13.2	13.6	12.4
4	2	0	14	2	4.0	3.2	2.4	4.8	3.2

DATA FOR SUBJECT ONE

BLOCK 2

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	2	14.4	14.4	12.8	13.6	12.4
4	3	0	14	2	3.2	2.4	3.2	3.2	4.0
4	3	1	14	2	14.4	14.4	13.2	18.4	13.6
4	4	0	14	2	3.2	3.2	1.6	2.4	1.6
4	4	1	14	2	10.0	8.8	9.2	10.0	9.6
4	5	0	14	2	3.2	3.6	2.4	2.0	1.6
4	5	1	14	2	12.8	12.8	13.6	13.2	12.8
4	6	0	14	2	5.6	3.2	3.2	2.8	2.4
4	6	1	14	2	13.6	12.8	12.8	13.6	13.6
4	7	0	14	2	2.0	2.4	1.6	2.0	1.6
4	7	1	14	2	9.6	8.8	8.8	9.2	10.0
4	8	0	14	2	2.8	2.4	2.4	2.8	2.0
4	8	1	14	2	14.4	12.8	13.6	12.8	13.6
4	9	0	14	2	1.6	3.2	1.6	2.4	1.6
4	9	1	14	2	9.6	9.6	10.4	9.6	8.8
4	0	2	14	2	2.8	1.6	1.6	1.6	1.6
0	0	3	0	2	1.6	0.8	1.2	1.2	1.6
5	0	9	0	2	54.4	58.4	54.0	56.8	62.8
0	0	3	0	2	3.2	3.2	3.2	2.8	3.2
6	1	0	29	2	16.8	10.4	4.8	4.0	4.8
6	1	1	29	2	30.4	28.0	28.0	27.2	29.2
6	2	0	29	2	13.6	31.2	4.0	4.0	4.8
6	2	1	29	2	26.4	22.4	25.2	23.2	25.6
6	3	0	29	2	10.0	7.2	4.4	4.8	4.8
6	3	1	29	2	25.6	19.2	24.0	23.6	24.8
6	4	0	29	2	12.8	10.4	12.0	10.4	8.0
6	4	1	29	2	16.8	14.4	17.6	14.4	17.2
6	5	0	29	2	20.0	11.2	11.2	5.6	8.8
6	5	1	29	2	27.2	25.2	24.8	19.2	26.4
6	6	0	29	2	20.0	16.0	12.0	6.8	7.2
6	6	1	29	2	16.8	17.6	16.0	14.8	16.0
6	7	0	29	2	7.2	8.8	15.2	12.8	6.4
6	7	1	29	2	24.8	22.8	24.8	24.8	27.2
6	8	0	29	2	7.2	7.6	5.6	6.4	6.4
6	8	1	29	2	14.8	12.0	14.0	14.0	14.0
6	9	0	29	2	9.6	6.8	10.4	4.0	3.2
6	9	1	29	2	16.8	25.6	16.0	16.0	21.6
6	0	2	29	2	1.6	2.0	1.2	2.4	1.6

DATA FOR SUBJECT ONE

BLOCK 3

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	3	8.0	7.2	8.8	6.4	8.8
1	1	1	24	3	20.8	20.0	20.8	19.6	20.0
1	2	0	24	3	9.2	6.8	6.8	6.8	6.8
1	2	1	24	3	20.8	18.4	18.0	18.0	17.6
1	3	0	24	3	10.4	7.2	6.0	6.4	9.6
1	3	1	24	3	13.6	12.0	11.2	13.6	12.8
1	4	0	24	3	8.0	8.0	8.4	6.4	5.6
1	4	1	24	3	17.6	13.6	13.6	20.0	12.8
1	5	0	24	3	9.6	8.8	7.6	6.4	7.2
1	5	1	24	3	20.0	19.2	18.4	19.2	18.8
1	6	0	24	3	8.0	6.4	8.0	7.6	7.2
1	6	1	24	3	22.8	20.4	21.6	21.6	20.4
1	7	0	24	3	8.8	5.6	4.8	4.8	5.6
1	7	1	24	3	16.8	16.8	17.6	16.8	16.4
1	8	0	24	3	10.4	5.6	8.0	4.8	6.4
1	8	1	24	3	21.6	20.0	18.0	14.6	18.8
1	9	0	24	3	8.8	8.0	8.0	6.0	7.2
1	9	1	24	3	22.4	20.8	20.8	20.0	18.4
1	0	2	24	3	1.2	1.6	1.6	1.6	1.2
0	0	3	0	3	3.2	3.2	3.2	2.4	3.2
2	0	9	0	3	47.2	46.4	51.2	53.6	45.6
0	0	3	0	3	0.8	1.2	1.6	1.2	1.2
3	1	0	19	3	4.0	6.0	5.2	4.0	3.6
3	1	1	19	3	16.0	14.8	12.8	14.4	14.4
3	2	0	19	3	2.4	2.4	2.0	4.0	1.6
3	2	1	19	3	17.6	15.6	14.8	15.2	16.0
3	3	0	19	3	2.4	3.2	2.8	3.2	2.4
3	3	1	19	3	19.2	16.8	16.8	16.4	16.0
3	4	0	19	3	2.8	2.4	3.6	2.4	2.4
3	4	1	19	3	17.6	14.4	14.4	13.6	14.0
3	5	0	19	3	2.8	4.0	4.0	2.4	3.6
3	5	1	19	3	14.0	12.0	12.8	12.0	12.0
3	6	0	19	3	2.8	3.6	4.0	2.4	2.8
3	6	1	19	3	16.0	15.2	15.2	14.4	14.4
3	7	0	19	3	2.4	4.0	3.2	2.8	3.2
3	7	1	19	3	13.2	12.0	12.0	11.2	12.0
3	8	0	19	3	3.2	2.4	3.2	2.4	2.4
3	8	1	19	3	16.8	9.2	10.4	8.8	12.4
3	9	0	19	3	2.4	2.4	2.8	1.6	2.4
3	9	1	19	3	14.0	12.0	12.0	12.0	11.6
3	0	2	19	3	1.6	1.2	0.8	1.2	1.2
0	0	3	0	3	4.0	3.2	3.2	3.6	3.2
4	1	0	14	3	4.0	4.0	4.0	4.8	3.2
4	1	1	14	3	12.0	10.4	9.6	11.6	10.4
4	2	0	14	3	4.0	3.6	2.8	2.4	2.0

DATA FOR SUBJECT ONE

BLOCK 3

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	3	17.6	13.6	13.6	14.0	13.6
4	3	0	14	3	2.0	3.2	3.2	2.4	2.0
4	3	1	14	3	16.0	13.2	12.8	13.6	12.8
4	4	0	14	3	2.4	1.6	4.8	1.6	2.0
4	4	1	14	3	11.2	10.4	12.4	10.4	9.6
4	5	0	14	3	4.0	2.4	2.4	2.0	1.6
4	5	1	14	3	18.4	16.0	15.6	16.0	13.6
4	6	0	14	3	2.4	1.6	2.4	1.6	1.6
4	6	1	14	3	16.8	12.8	12.8	13.2	12.4
4	7	0	14	3	1.6	1.6	1.6	2.4	0.8
4	7	1	14	3	10.4	9.6	11.2	9.6	9.6
4	8	0	14	3	2.0	2.0	2.4	2.0	1.6
4	8	1	14	3	16.8	13.2	14.0	11.6	12.8
4	9	0	14	3	3.2	1.6	1.6	1.2	1.2
4	9	1	14	3	16.4	13.2	14.4	13.6	22.4
4	0	2	14	3	2.0	1.6	2.0	1.6	2.0
0	0	3	0	3	0.8	1.6	1.6	0.8	1.6
5	0	9	0	3	57.2	60.0	58.8	59.2	52.0
0	0	3	0	3	3.2	2.8	3.2	2.4	3.2
6	1	0	29	3	11.2	12.0	7.2	7.2	8.0
6	1	1	29	3	26.4	22.0	24.0	22.0	20.4
6	2	0	29	3	5.2	5.2	5.6	4.8	4.0
6	2	1	29	3	32.8	28.4	28.4	28.8	27.6
6	3	0	29	3	8.8	10.8	7.2	5.6	3.6
6	3	1	29	3	28.0	24.8	24.8	24.0	23.2
6	4	0	29	3	7.2	4.8	5.6	4.4	4.4
6	4	1	29	3	14.8	12.8	12.0	11.2	10.8
6	5	0	29	3	11.6	20.4	6.4	5.6	5.6
6	5	1	29	3	19.2	16.0	16.0	15.6	14.4
6	6	0	29	3	5.2	4.0	4.0	3.6	3.6
6	6	1	29	3	27.6	23.2	25.2	23.6	22.4
6	7	0	29	3	9.6	8.0	6.0	3.2	3.6
6	7	1	29	3	29.2	24.0	25.2	23.2	24.4
6	8	0	29	3	14.8	10.4	10.4	5.6	5.6
6	8	1	29	3	18.4	15.2	15.6	14.4	15.2
6	9	0	29	3	15.2	6.8	7.6	4.0	1.2
6	9	1	29	3	16.4	13.6	14.0	13.6	13.2
6	0	2	29	3	1.6	1.2	0.8	1.2	1.6

DATA FOR SUBJECT TWO

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	1	26.3	17.6	12.0	14.4	17.6
1	1	1	24	1	40.4	24.8	26.4	23.2	24.0
1	2	0	24	1	20.9	14.4	13.2	11.2	11.2
1	2	1	24	1	24.0	22.4	24.0	22.8	19.6
1	3	0	24	1	24.9	20.4	15.2	9.6	10.4
1	3	1	24	1	22.6	28.8	16.8	17.2	18.8
1	4	0	24	1	17.4	14.4	11.2	11.2	8.8
1	4	1	24	1	28.8	23.6	26.4	23.2	24.0
1	5	0	24	1	20.3	12.8	12.0	8.0	9.6
1	5	1	24	1	20.9	19.2	20.0	22.4	21.6
1	6	0	24	1	14.4	12.8	12.0	10.0	8.4
1	6	1	24	1	22.5	23.6	26.4	25.2	26.4
1	7	0	24	1	28.8	14.0	15.2	15.2	17.6
1	7	1	24	1	46.4	20.0	19.2	18.0	17.6
1	8	0	24	1	12.0	10.8	11.2	11.2	12.8
1	8	1	24	1	10.4	12.8	14.8	14.4	15.2
1	9	0	24	1	16.0	11.6	21.6	14.4	20.0
1	9	1	24	1	19.3	18.4	17.6	22.4	19.2
1	0	2	24	1	9.2	4.4	4.8	3.2	0.8
0	0	3	0	1	9.1	6.4	6.4	4.8	4.0
2	0	9	0	1	59.9	52.8	49.6	54.4	51.2
0	0	3	0	1	3.4	4.0	49.6	25.6	4.8
3	1	0	19	1	24.8	13.6	11.2	18.4	13.6
3	1	1	19	1	16.0	12.8	12.0	12.0	15.2
3	2	0	19	1	11.0	9.6	3.2	10.4	11.2
3	2	1	19	1	16.6	9.6	9.6	12.0	10.8
3	3	0	19	1	8.8	7.2	8.0	8.0	8.0
3	3	1	19	1	11.2	10.4	10.4	9.6	11.2
3	4	0	19	1	12.6	10.4	13.6	13.6	8.8
3	4	1	19	1	19.4	13.6	13.2	12.0	12.0
3	5	0	19	1	12.2	8.8	9.6	8.0	7.2
3	5	1	19	1	18.0	15.2	15.2	16.8	16.0
3	6	0	19	1	10.8	8.0	16.0	10.4	5.6
3	6	1	19	1	11.2	10.4	12.0	12.0	13.6
3	7	0	19	1	9.6	11.6	5.6	8.0	6.0
3	7	1	19	1	12.8	12.8	14.4	14.4	12.0
3	8	0	19	1	8.0	4.8	4.0	8.0	12.4
3	8	1	19	1	11.2	11.2	10.4	13.6	12.0
3	9	0	19	1	7.5	12.8	19.2	8.8	8.8
3	9	1	19	1	8.2	7.2	7.2	7.2	8.4
3	0	2	19	1	3.2	2.0	1.6	2.4	1.6
0	0	3	0	1	4.8	5.6	9.6	7.2	4.0
4	1	0	14	1	13.0	18.4	8.8	15.2	6.4
4	1	1	14	1	20.7	14.4	13.6	13.6	14.4
4	2	0	14	1	7.9	5.6	6.4	4.8	2.8

DATA FOR SUBJECT TWO

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	1	13.6	10.8	14.4	14.4	13.6
4	3	0	14	1	8.0	6.0	8.0	8.8	10.4
4	3	1	14	1	14.4	14.4	15.2	12.8	14.4
4	4	0	14	1	6.4	5.6	4.8	4.8	4.0
4	4	1	14	1	8.4	13.2	7.2	14.4	9.6
4	5	0	14	1	13.6	6.4	4.8	5.6	5.2
4	5	1	14	1	15.2	12.0	10.4	12.0	12.8
4	6	0	14	1	7.9	8.0	5.6	6.0	5.6
4	6	1	14	1	17.0	28.0	14.8	14.0	14.4
4	7	0	14	1	6.2	7.6	4.0	4.0	3.2
4	7	1	14	1	6.4	7.2	8.0	8.0	7.2
4	8	0	14	1	11.8	6.0	7.2	6.4	6.4
4	8	1	14	1	12.8	14.4	12.0	16.8	14.4
4	9	0	14	1	14.0	8.8	4.0	3.2	6.4
4	9	1	14	1	14.3	9.6	12.0	16.0	10.4
4	0	2	14	1	2.4	1.6	2.8	2.4	1.6
0	0	3	0	1	2.0	1.6	2.0	1.6	1.6
5	0	9	0	1	59.4	60.0	64.0	64.0	63.2
0	0	3	0	1	4.2	4.8	52.0	25.6	4.8
6	1	0	29	1	68.4	12.8	25.6	18.4	16.0
6	1	1	29	1	30.4	29.6	25.6	25.6	24.0
6	2	0	29	1	24.0	20.0	13.6	15.2	12.4
6	2	1	29	1	29.6	32.8	28.0	27.2	22.8
6	3	0	29	1	22.0	18.8	17.6	15.2	14.8
6	3	1	29	1	24.8	28.0	23.2	24.8	21.6
6	4	0	29	1	21.6	20.8	34.4	24.8	24.0
6	4	1	29	1	12.6	20.0	38.4	24.0	21.6
6	5	0	29	1	19.6	14.4	16.0	12.0	24.8
6	5	1	29	1	23.6	32.8	29.6	27.2	25.2
6	6	0	29	1	24.8	29.6	29.2	15.2	16.8
6	6	1	29	1	15.2	20.8	36.0	17.6	22.4
6	7	0	29	1	18.2	19.2	20.4	13.6	14.4
6	7	1	29	1	28.1	37.6	28.0	28.8	26.4
6	8	0	29	1	14.8	16.8	11.2	12.0	12.0
6	8	1	29	1	13.0	13.6	22.4	14.4	12.4
6	9	0	29	1	17.2	28.8	15.2	10.8	12.8
6	9	1	29	1	13.0	17.6	33.2	16.8	15.2
6	0	2	29	1	1.8	1.6	3.2	1.6	0.8

DATA FOR SUBJECT TWO

BLOCK 2

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	19	2	12.8	11.2	12.8	6.4	6.0
1	1	1	19	2	11.2	11.2	12.0	12.4	16.0
1	2	0	19	2	6.4	5.6	13.6	5.6	4.8
1	2	1	19	2	8.4	8.8	8.8	9.2	7.2
1	3	0	19	2	5.6	6.4	6.4	6.8	4.4
1	3	1	19	2	10.4	9.6	10.4	12.8	11.2
1	4	0	19	2	9.6	7.2	8.0	10.4	7.2
1	4	1	19	2	12.0	10.8	13.6	14.4	11.6
1	5	0	19	2	8.4	8.8	9.6	8.0	4.8
1	5	1	19	2	14.4	16.0	15.2	19.2	15.6
1	6	0	19	2	4.4	7.2	6.4	6.4	5.2
1	6	1	19	2	14.4	17.6	11.2	12.4	13.6
1	7	0	19	2	7.2	4.0	4.8	7.2	7.2
1	7	1	19	2	12.4	9.6	12.8	14.0	14.0
1	8	0	19	2	4.8	4.0	6.4	8.0	4.8
1	8	1	19	2	12.0	10.4	17.6	22.8	12.8
1	9	0	19	2	6.8	6.4	10.8	4.8	6.4
1	9	1	19	2	6.4	6.4	8.0	8.0	7.2
1	0	2	19	2	1.6	1.2	2.4	0.8	0.8
0	0	3	0	2	4.0	2.4	1.6	1.6	1.6
2	0	9	0	2	48.4	49.6	50.8	60.0	46.8
0	0	3	0	2	4.0	4.0	4.4	3.6	5.6
3	1	0	24	2	11.2	9.6	10.0	10.4	17.6
3	1	1	24	2	22.4	40.8	16.8	31.6	16.8
3	2	0	24	2	9.6	9.2	7.6	8.8	11.2
3	2	1	24	2	18.4	16.0	20.0	16.8	19.2
3	3	0	24	2	11.6	8.8	8.0	11.6	8.8
3	3	1	24	2	16.0	14.4	18.8	20.8	17.6
3	4	0	24	2	7.2	8.8	9.6	9.6	10.4
3	4	1	24	2	20.8	18.4	20.0	24.0	20.0
3	5	0	24	2	6.4	8.8	7.2	6.4	11.2
3	5	1	24	2	20.4	16.0	18.4	20.8	21.6
3	6	0	24	2	9.6	5.6	8.0	8.0	9.6
3	6	1	24	2	20.4	22.4	20.0	24.0	27.2
3	7	0	24	2	9.6	8.4	8.8	11.2	12.8
3	7	1	24	2	14.4	16.8	18.4	19.6	16.0
3	8	0	24	2	8.0	11.2	9.6	8.8	9.6
3	8	1	24	2	13.6	13.6	13.6	13.2	14.4
3	9	0	24	2	10.4	6.0	11.2	12.8	1.6
3	9	1	24	2	14.8	28.0	16.8	18.4	20.0
3	0	2	24	2	0.8	3.2	0.8	1.6	1.6
0	0	3	0	2	9.6	6.4	4.4	4.0	5.2
4	1	0	29	2	10.4	2.4	3.2	3.2	2.4
4	1	1	29	2	20.0	25.6	26.4	31.6	29.6
4	2	0	29	2	7.6	15.2	8.8	1.2	0.8

DATA FOR SUBJECT TWO

BLOCK 2

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	29	2	21.6	21.6	24.8	27.6	32.0
4	3	0	29	2	9.2	18.4	24.0	1.6	0.8
4	3	1	29	2	20.0	21.6	22.4	53.2	27.2
4	4	0	29	2	9.6	9.6	16.0	13.6	0.8
4	4	1	29	2	15.2	16.0	18.0	16.0	18.4
4	5	0	29	2	7.2	10.4	7.6	12.8	28.0
4	5	1	29	2	23.2	21.6	47.2	24.8	24.0
4	6	0	29	2	9.6	9.6	18.8	10.4	12.8
4	6	1	29	2	16.8	30.4	16.8	89.6	17.2
4	7	0	29	2	7.2	11.2	12.8	14.4	29.6
4	7	1	29	2	24.0	21.6	33.6	24.4	24.8
4	8	0	29	2	5.6	9.2	10.4	7.2	8.8
4	8	1	29	2	11.2	12.0	13.6	13.6	12.8
4	9	0	29	2	6.4	10.8	12.8	10.4	9.6
4	9	1	29	2	17.6	16.4	18.0	16.8	20.0
4	0	2	29	2	0.8	2.4	1.6	1.6	1.6
0	0	3	0	2	3.2	4.0	4.4	3.2	3.6
5	0	9	0	2	62.4	57.2	60.0	64.0	70.4
0	0	3	0	2	2.4	1.6	1.6	1.2	4.4
6	1	0	14	2	8.0	8.4	15.2	6.4	3.2
6	1	1	14	2	12.8	13.6	12.0	17.6	12.4
6	2	0	14	2	4.0	5.6	6.0	3.2	4.8
6	2	1	14	2	12.0	12.8	14.0	14.0	13.6
6	3	0	14	2	4.4	4.8	6.4	6.4	6.0
6	3	1	14	2	12.0	13.6	12.4	12.8	17.6
6	4	0	14	2	2.4	2.4	6.4	4.4	2.8
6	4	1	14	2	9.2	9.6	9.6	9.6	11.2
6	5	0	14	2	4.0	7.2	7.6	4.0	5.6
6	5	1	14	2	9.6	12.0	11.2	14.8	12.0
6	6	0	14	2	5.6	5.6	8.8	9.2	5.6
6	6	1	14	2	12.8	14.0	13.6	15.6	12.0
6	7	0	14	2	3.2	6.8	7.2	3.2	4.4
6	7	1	14	2	6.4	8.0	9.6	12.8	10.8
6	8	0	14	2	4.8	10.4	7.2	8.8	6.0
6	8	1	14	2	12.4	12.4	11.2	14.4	35.2
6	9	0	14	2	4.0	9.6	10.0	11.2	1.6
6	9	1	14	2	8.0	7.6	7.6	12.0	8.8
6	0	2	14	2	1.6	1.6	1.2	1.6	3.2

DATA FOR SUBJECT TWO

BLOCK 3

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	19	3	10.8	4.4	11.2	7.6	7.2
1	1	1	19	3	12.0	12.0	16.0	12.8	11.2
1	2	0	19	3	12.8	8.4	12.8	8.8	6.8
1	2	1	19	3	16.0	13.6	12.0	13.6	11.6
1	3	0	19	3	3.6	4.4	11.2	7.6	4.0
1	3	1	19	3	13.6	15.2	15.2	18.0	15.2
1	4	0	19	3	7.2	4.8	3.2	10.8	4.8
1	4	1	19	3	12.4	20.4	12.0	12.8	11.2
1	5	0	19	3	12.0	4.8	4.0	8.8	4.0
1	5	1	19	3	9.6	11.6	11.2	13.6	10.0
1	6	0	19	3	2.8	7.2	4.4	5.2	4.8
1	6	1	19	3	10.4	12.0	12.0	13.2	11.2
1	7	0	19	3	4.0	6.0	5.6	6.0	6.4
1	7	1	19	3	8.8	12.4	10.4	9.6	10.4
1	8	0	19	3	9.2	7.2	6.4	5.6	7.2
1	8	1	19	3	10.8	7.2	7.6	8.0	7.2
1	9	0	19	3	4.0	4.0	4.0	5.6	4.0
1	9	1	19	3	9.6	12.0	12.0	12.4	12.0
1	0	2	19	3	1.6	1.2	0.8	1.2	0.8
0	0	3	0	3	1.6	1.2	1.6	1.6	1.6
2	0	9	0	3	45.6	49.6	56.0	62.0	44.8
0	0	3	0	3	2.8	3.6	3.2	4.4	2.4
3	1	0	24	3	13.2	10.8	8.4	9.6	9.2
3	1	1	24	3	19.2	20.8	16.8	20.4	16.8
3	2	0	24	3	9.6	9.6	6.4	6.8	7.2
3	2	1	24	3	16.8	10.4	17.2	20.8	18.8
3	3	0	24	3	8.4	9.6	7.2	8.4	9.2
3	3	1	24	3	11.2	14.0	13.6	15.2	12.8
3	4	0	24	3	12.0	12.4	7.2	6.4	6.4
3	4	1	24	3	13.6	18.4	15.2	18.4	16.0
3	5	0	24	3	9.2	9.6	9.6	8.4	6.4
3	5	1	24	3	18.4	20.8	20.8	19.6	19.6
3	6	0	24	3	7.6	13.6	7.2	7.6	7.2
3	6	1	24	3	20.8	23.2	20.8	24.0	22.0
3	7	0	24	3	10.4	10.8	8.4	11.2	8.0
3	7	1	24	3	16.4	18.4	21.2	18.0	16.0
3	8	0	24	3	8.8	9.2	8.0	10.8	8.8
3	8	1	24	3	23.2	22.8	19.6	20.0	20.0
3	9	0	24	3	7.2	10.4	10.8	9.2	9.6
3	9	1	24	3	17.6	22.0	18.4	18.0	17.6
3	0	2	24	3	0.8	1.6	1.2	1.2	1.6
0	0	3	0	3	6.4	4.0	2.4	3.6	2.8
4	1	0	29	3	20.8	12.8	10.4	10.4	8.0
4	1	1	29	3	24.0	25.2	21.2	25.6	10.8
4	2	0	29	3	13.6	11.2	8.8	8.8	5.6

DATA FOR SUBJECT TWO

BLOCK 3

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	29	3	23.6	30.0	28.4	29.6	26.4
4	3	0	29	3	9.6	11.2	8.0	6.4	5.6
4	3	1	29	3	21.6	25.6	24.0	30.0	24.0
4	4	0	29	3	5.2	5.6	6.4	5.2	6.0
4	4	1	29	3	11.6	15.2	14.4	14.4	12.0
4	5	0	29	3	8.0	10.0	13.6	8.4	8.4
4	5	1	29	3	13.6	16.4	18.0	18.4	16.4
4	6	0	29	3	10.8	10.4	12.0	11.2	5.2
4	6	1	29	3	20.8	27.6	25.6	26.4	24.0
4	7	0	29	3	11.2	9.6	6.0	7.6	8.0
4	7	1	29	3	20.8	22.8	25.6	26.4	22.4
4	8	0	29	3	8.8	8.0	5.6	13.6	15.2
4	8	1	29	3	16.0	22.0	18.4	38.4	16.0
4	9	0	29	3	10.4	10.0	4.0	0.8	10.8
4	9	1	29	3	17.6	18.4	23.2	18.0	15.2
4	0	2	29	3	1.2	1.6	1.6	2.4	2.4
0	0	3	0	3	2.8	3.2	2.8	4.4	2.4
5	0	9	0	3	61.6	69.6	62.8	61.2	52.4
0	0	3	0	3	2.4	1.6	2.4	1.2	1.2
6	1	0	14	3	4.8	7.2	5.6	6.4	4.8
6	1	1	14	3	7.6	17.6	8.8	15.2	7.6
6	2	0	14	3	5.6	4.0	3.6	4.0	6.0
6	2	1	14	3	10.8	14.4	12.0	13.2	11.6
6	3	0	14	3	4.0	5.2	6.4	5.2	4.4
6	3	1	14	3	10.4	12.8	12.4	12.4	10.0
6	4	0	14	3	5.2	3.6	3.2	7.6	3.2
6	4	1	14	3	7.2	9.2	7.2	10.4	14.0
6	5	0	14	3	6.4	5.6	3.2	4.0	3.2
6	5	1	14	3	12.4	14.4	12.0	17.2	12.0
6	6	0	14	3	4.0	4.8	6.4	7.2	3.6
6	6	1	14	3	11.2	15.2	15.2	14.0	12.8
6	7	0	14	3	3.2	4.0	3.2	4.4	2.4
6	7	1	14	3	3.6	11.2	10.0	10.0	7.2
6	8	0	14	3	3.6	4.0	4.4	4.0	3.2
6	8	1	14	3	10.0	12.0	12.0	12.4	11.6
6	9	0	14	3	2.4	2.4	2.0	2.4	3.2
6	9	1	14	3	9.6	12.0	14.4	12.0	11.2
6	0	2	14	3	1.6	2.0	1.6	1.6	1.6

DATA FOR SUBJECT THREE

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	19	1	14.0	9.6	8.0	7.2	10.4
1	1	1	19	1	16.9	8.0	15.2	14.4	15.2
1	2	0	19	1	11.6	10.4	7.2	5.6	7.2
1	2	1	19	1	12.6	15.2	12.0	11.2	12.0
1	3	0	19	1	9.6	6.4	6.4	4.8	6.0
1	3	1	19	1	8.9	11.6	12.8	12.8	13.2
1	4	0	19	1	13.1	5.6	7.2	5.6	5.2
1	4	1	19	1	14.4	12.0	15.2	16.8	16.0
1	5	0	19	1	9.6	6.0	6.8	11.6	6.4
1	5	1	19	1	19.4	14.4	21.6	20.4	20.0
1	6	0	19	1	11.2	5.6	6.4	6.4	5.6
1	6	1	19	1	14.0	18.4	14.4	14.4	14.0
1	7	0	19	1	7.2	6.0	6.4	6.4	6.4
1	7	1	19	1	15.2	14.0	16.8	16.8	16.8
1	8	0	19	1	8.0	5.6	3.2	4.0	5.6
1	8	1	19	1	13.6	15.2	16.0	14.4	15.2
1	9	0	19	1	5.8	4.8	6.0	5.6	5.2
1	9	1	19	1	10.0	14.4	8.0	7.2	7.2
1	0	2	19	1	3.7	1.6	2.2	2.0	1.6
0	0	3	0	1	4.4	1.6	1.2	1.6	1.2
2	0	9	0	1	72.8	59.6	51.2	50.4	56.8
0	0	3	0	1	6.4	2.8	2.4	3.2	3.2
3	1	0	24	1	33.7	16.0	18.8	15.2	11.2
3	1	1	24	1	24.9	24.8	19.2	18.4	20.0
3	2	0	24	1	16.0	13.6	14.4	13.6	12.0
3	2	1	24	1	31.2	24.0	23.2	23.2	24.0
3	3	0	24	1	16.0	14.8	15.2	11.2	10.4
3	3	1	24	1	29.6	23.2	22.4	22.4	22.4
3	4	0	24	1	19.0	15.2	11.6	8.8	8.8
3	4	1	24	1	61.8	24.0	24.0	25.2	26.4
3	5	0	24	1	21.5	9.2	11.2	12.8	12.0
3	5	1	24	1	22.8	23.6	21.6	21.6	21.6
3	6	0	24	1	15.2	11.6	12.8	9.2	11.2
3	6	1	24	1	32.2	28.8	22.4	28.4	25.6
3	7	0	24	1	23.5	13.2	13.2	15.2	12.0
3	7	1	24	1	24.8	16.8	18.4	18.4	18.8
3	8	0	24	1	15.5	14.4	11.2	11.2	10.4
3	8	1	24	1	41.7	15.2	14.4	14.4	16.8
3	9	0	24	1	18.4	15.2	15.2	14.4	10.4
3	9	1	24	1	20.0	17.2	16.8	16.8	17.6
3	0	2	24	1	2.0	2.8	2.0	1.6	1.6
0	0	3	0	1	4.8	4.0	4.0	3.6	4.0
4	1	0	29	1	56.1	23.2	19.6	30.0	17.6
4	1	1	29	1	59.2	44.8	42.4	43.2	42.4
4	2	0	29	1	33.7	17.6	16.0	13.6	12.0

DATA FOR SUBJECT THREE

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	29	1	38.0	32.4	30.4	32.0	31.2
4	3	0	29	1	28.1	18.4	17.6	17.2	12.8
4	3	1	29	1	46.6	32.8	34.0	34.4	32.8
4	4	0	29	1	21.4	12.0	15.2	14.4	11.2
4	4	1	29	1	26.2	21.6	22.4	21.6	21.6
4	5	0	29	1	17.8	16.0	15.2	12.8	12.0
4	5	1	29	1	37.2	32.0	31.2	32.8	28.0
4	6	0	29	1	23.7	12.8	13.6	11.2	12.0
4	6	1	29	1	29.3	19.2	25.2	21.6	21.6
4	7	0	29	1	13.4	12.0	12.0	12.0	11.2
4	7	1	29	1	31.4	26.4	24.0	25.2	24.0
4	8	0	29	1	20.0	12.8	14.0	16.0	12.0
4	8	1	29	1	20.1	16.0	16.0	16.0	16.0
4	9	0	29	1	14.8	11.6	12.0	21.2	8.8
4	9	1	29	1	27.2	21.2	23.2	56.8	20.0
4	0	2	29	1	1.7	2.4	1.6	2.0	1.6
0	0	3	0	1	5.0	3.2	3.6	3.6	3.2
5	0	9	0	1	88.4	68.0	64.0	69.2	72.0
0	0	3	0	1	2.5	1.6	1.6	1.6	0.8
6	1	0	14	1	22.8	8.0	5.6	5.6	8.0
6	1	1	14	1	18.5	16.8	17.6	17.2	19.2
6	2	0	14	1	5.4	4.0	4.0	2.4	1.6
6	2	1	14	1	17.3	17.6	16.8	20.0	18.4
6	3	0	14	1	6.4	5.2	4.8	4.0	3.2
6	3	1	14	1	18.0	19.2	19.2	18.4	19.2
6	4	0	14	1	6.3	2.8	2.4	3.6	2.4
6	4	1	14	1	15.1	14.4	13.6	14.4	12.4
6	5	0	14	1	5.2	5.6	4.0	4.0	3.2
6	5	1	14	1	17.0	29.6	15.2	17.6	28.0
6	6	0	14	1	3.6	4.0	6.4	4.0	4.0
6	6	1	14	1	18.0	24.0	15.6	16.4	16.8
6	7	0	14	1	3.3	2.8	3.2	3.2	4.0
6	7	1	14	1	12.1	12.8	10.4	11.2	11.2
6	8	0	14	1	5.5	4.4	6.4	5.6	4.4
6	8	1	14	1	14.8	18.0	16.0	14.0	15.2
6	9	0	14	1	3.3	2.4	3.6	2.4	2.4
6	9	1	14	1	14.4	16.0	13.6	12.8	13.6
6	0	2	14	1	2.2	2.4	2.0	1.6	1.6

DATA FOR SUBJECT THREE

BLOCK 2

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	2	5.6	2.4	3.2	2.4	2.4
1	1	1	24	2	15.2	15.2	16.0	17.6	16.0
1	2	0	24	2	6.4	4.4	2.4	3.2	4.0
1	2	1	24	2	15.2	14.8	14.8	14.8	14.4
1	3	0	24	2	5.6	4.0	3.2	4.0	3.2
1	3	1	24	2	18.4	18.0	17.6	18.4	17.2
1	4	0	24	2	4.0	4.0	3.2	3.6	3.6
1	4	1	24	2	13.2	15.2	14.0	13.6	13.6
1	5	0	24	2	6.8	4.8	4.8	4.4	3.6
1	5	1	24	2	14.4	14.0	14.4	13.6	13.6
1	6	0	24	2	7.2	4.8	6.4	4.8	5.6
1	6	1	24	2	12.8	13.2	13.2	13.2	12.0
1	7	0	24	2	4.8	4.8	4.0	4.0	4.0
1	7	1	24	2	11.2	12.0	12.0	10.4	11.2
1	8	0	24	2	4.0	3.6	3.6	4.0	6.0
1	8	1	24	2	8.0	8.0	7.2	6.8	7.2
1	9	0	24	2	4.4	4.0	3.6	4.0	3.2
1	9	1	24	2	14.4	13.6	13.6	12.0	11.6
1	0	2	24	2	2.4	2.4	1.2	1.6	1.2
0	0	3	0	2	1.2	0.8	0.8	0.8	0.8
2	0	9	0	2	56.0	52.0	51.2	49.2	49.6
0	0	3	0	2	0.8	1.6	1.6	0.8	0.8
3	1	0	19	2	12.4	9.2	6.4	5.6	4.8
3	1	1	19	2	25.6	24.8	24.4	24.0	22.8
3	2	0	19	2	15.2	8.8	3.2	3.2	2.8
3	2	1	19	2	14.4	14.4	33.6	14.4	16.0
3	3	0	19	2	14.4	8.8	8.0	8.8	3.2
3	3	1	19	2	15.2	12.8	13.6	14.4	13.2
3	4	0	19	2	19.2	15.2	11.2	4.8	4.0
3	4	1	19	2	16.8	15.2	16.4	16.0	15.6
3	5	0	19	2	13.6	9.6	8.8	7.2	4.0
3	5	1	19	2	23.2	22.4	20.0	20.8	20.4
3	6	0	19	2	8.4	7.2	10.4	6.8	3.2
3	6	1	19	2	28.0	58.4	27.2	27.2	26.4
3	7	0	19	2	11.2	11.2	6.4	4.0	4.0
3	7	1	19	2	16.8	16.0	16.4	15.2	15.2
3	8	0	19	2	12.0	10.8	4.0	3.2	3.2
3	8	1	19	2	19.2	18.4	19.2	17.6	17.6
3	9	0	19	2	12.0	9.2	3.2	3.2	3.6
3	9	1	19	2	21.6	20.0	19.6	18.4	18.4
3	0	2	19	2	1.2	1.2	0.8	0.8	0.8
0	0	3	0	2	0.8	0.8	0.8	2.8	3.2
4	1	0	14	2	16.4	6.8	5.6	4.8	4.0
4	1	1	14	2	24.0	24.0	22.0	21.6	22.0
4	2	0	14	2	12.8	14.4	3.2	3.6	3.2

DATA FOR SUBJECT THREE

BLOCK 2

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	2	40.8	32.8	37.6	33.6	37.2
4	3	0	14	2	9.2	13.6	2.8	3.2	2.4
4	3	1	14	2	32.0	31.6	29.6	28.0	31.2
4	4	0	14	2	10.4	8.8	3.2	3.2	4.0
4	4	1	14	2	17.6	15.2	15.2	16.0	16.0
4	5	0	14	2	17.6	6.4	4.0	3.2	3.2
4	5	1	14	2	20.0	17.6	19.2	16.8	16.8
4	6	0	14	2	20.0	12.0	4.0	3.2	4.4
4	6	1	14	2	34.4	33.6	32.8	29.6	31.2
4	7	0	14	2	12.8	13.6	22.8	3.2	3.2
4	7	1	14	2	31.2	32.0	30.8	22.4	57.2
4	8	0	14	2	11.2	9.2	8.0	3.2	4.0
4	8	1	14	2	19.2	18.0	17.2	16.0	16.8
4	9	0	14	2	15.2	9.2	7.6	3.2	3.2
4	9	1	14	2	19.2	18.4	17.6	16.8	17.6
4	0	2	14	2	2.8	2.0	2.0	1.2	1.6
0	0	3	0	2	1.2	3.2	0.8	3.2	3.2
5	0	9	0	2	65.6	67.2	54.4	59.2	56.8
0	0	3	0	2	1.6	1.2	1.6	1.6	0.8
6	1	0	29	2	4.8	4.8	4.0	2.8	3.2
6	1	1	29	2	12.8	12.8	14.4	14.0	13.6
6	2	0	29	2	4.4	4.0	2.4	3.2	1.6
6	2	1	29	2	17.6	15.2	14.4	14.4	16.0
6	3	0	29	2	2.4	4.8	4.0	4.0	4.4
6	3	1	29	2	16.0	14.4	13.6	14.0	8.0
6	4	0	29	2	3.6	4.0	2.4	3.2	2.0
6	4	1	29	2	11.2	12.8	12.8	11.2	10.4
6	5	0	29	2	4.0	3.6	0.8	4.0	3.2
6	5	1	29	2	16.8	16.0	17.6	13.6	16.0
6	6	0	29	2	3.2	2.4	2.4	3.2	1.6
6	6	1	29	2	16.0	15.6	15.2	14.4	13.6
6	7	0	29	2	3.2	1.6	2.0	3.2	2.0
6	7	1	29	2	10.0	12.0	10.4	9.6	10.4
6	8	0	29	2	3.2	3.2	4.0	3.2	3.2
6	8	1	29	2	16.8	15.2	13.6	13.6	12.0
6	9	0	29	2	3.2	1.6	2.4	2.4	2.4
6	9	1	29	2	18.0	14.8	15.2	13.6	13.6
6	0	2	29	2	2.0	1.6	2.0	0.8	1.2

DATA FOR SUBJECT THREE

BLOCK 3

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	3	4.0	4.0	5.6	4.0	4.0
1	1	1	24	3	22.4	20.0	21.6	20.0	20.0
1	2	0	24	3	3.2	3.2	3.6	3.2	2.0
1	2	1	24	3	12.8	12.0	11.6	11.6	12.0
1	3	0	24	3	3.2	3.2	3.2	2.8	3.2
1	3	1	24	3	12.4	12.4	13.6	12.8	12.4
1	4	0	24	3	3.6	3.6	3.6	3.2	4.0
1	4	1	24	3	14.4	13.2	13.6	13.2	13.6
1	5	0	24	3	3.6	3.2	4.0	3.6	4.0
1	5	1	24	3	20.0	19.2	20.4	18.4	18.8
1	6	0	24	3	3.2	2.8	2.8	3.2	3.2
1	6	1	24	3	26.4	24.8	26.0	25.2	25.6
1	7	0	24	3	3.2	3.6	3.2	4.0	4.0
1	7	1	24	3	14.8	13.6	14.4	13.6	13.2
1	8	0	24	3	3.2	3.2	3.6	4.0	3.2
1	8	1	24	3	17.6	16.8	16.8	19.2	16.0
1	9	0	24	3	3.6	3.6	3.2	3.6	3.6
1	9	1	24	3	18.4	17.6	17.6	17.6	18.4
1	0	2	24	3	0.8	1.2	2.8	2.4	0.8
0	0	3	0	3	2.4	2.4	0.8	0.8	2.8
2	0	9	0	3	52.8	61.2	58.4	59.6	57.2
0	0	3	0	3	1.6	1.6	1.2	1.2	1.2
3	1	0	19	3	3.2	3.2	3.2	2.8	2.4
3	1	1	19	3	15.2	16.0	16.4	15.2	16.0
3	2	0	19	3	4.4	1.6	2.4	1.6	2.0
3	2	1	19	3	13.6	14.0	14.8	14.0	14.4
3	3	0	19	3	5.2	2.8	3.6	2.4	1.6
3	3	1	19	3	16.8	18.0	18.4	17.2	16.0
3	4	0	19	3	4.0	3.6	4.4	2.4	2.4
3	4	1	19	3	13.6	14.4	15.2	24.0	13.2
3	5	0	19	3	4.8	4.0	2.8	2.4	1.6
3	5	1	19	3	12.4	14.0	13.6	12.4	12.4
3	6	0	19	3	4.8	4.8	4.4	3.6	3.2
3	6	1	19	3	12.8	14.4	13.6	12.4	12.4
3	7	0	19	3	4.4	3.6	2.8	2.0	1.6
3	7	1	19	3	10.4	11.6	11.6	10.4	9.6
3	8	0	19	3	4.0	4.0	4.0	3.6	3.2
3	8	1	19	3	6.8	7.2	6.8	6.4	6.4
3	9	0	19	3	3.2	3.2	2.4	2.0	1.6
3	9	1	19	3	12.8	20.8	14.4	12.4	12.0
3	0	2	19	3	1.6	1.6	0.8	0.8	0.8
0	0	3	0	3	3.6	3.2	4.0	3.2	3.2
4	1	0	14	3	1.6	2.4	3.2	3.2	2.4
4	1	1	14	3	19.2	13.6	13.2	12.0	12.0
4	2	0	14	3	2.4	0.8	1.6	1.6	1.6

DATA FOR SUBJECT THREE

BLOCK 3

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	3	15.2	16.0	15.6	13.6	14.0
4	3	0	14	3	3.2	2.4	3.2	3.2	1.6
4	3	1	14	3	13.2	12.8	13.2	12.8	12.8
4	4	0	14	3	2.4	3.2	3.2	2.4	1.6
4	4	1	14	3	12.0	12.0	13.2	11.2	12.0
4	5	0	14	3	3.2	3.2	2.4	2.8	1.6
4	5	1	14	3	14.4	15.6	16.0	14.8	13.6
4	6	0	14	3	0.8	1.6	1.2	0.8	1.6
4	6	1	14	3	14.4	13.6	15.6	13.6	12.8
4	7	0	14	3	2.4	2.4	2.0	2.4	2.0
4	7	1	14	3	10.8	11.2	12.0	11.2	10.4
4	8	0	14	3	2.4	3.2	2.4	2.0	2.0
4	8	1	14	3	14.8	14.4	13.6	12.8	12.4
4	9	0	14	3	2.4	2.4	1.6	1.2	1.6
4	9	1	14	3	14.8	15.6	14.8	14.0	13.6
4	0	2	14	3	1.6	1.6	1.6	1.6	1.6
0	0	3	0	3	0.8	0.8	0.8	0.8	0.8
5	0	9	0	3	59.2	61.6	68.4	63.2	58.8
0	0	3	0	3	3.2	3.2	1.2	3.2	1.2
6	1	0	29	3	3.2	4.0	4.0	4.4	4.4
6	1	1	29	3	20.0	18.4	18.4	18.0	17.6
6	2	0	29	3	3.2	3.2	3.2	3.2	2.8
6	2	1	29	3	33.6	32.8	32.0	33.2	32.4
6	3	0	29	3	2.4	2.8	2.4	3.2	2.4
6	3	1	29	3	27.2	28.8	27.2	27.6	26.4
6	4	0	29	3	3.2	3.2	3.6	3.2	2.4
6	4	1	29	3	16.0	14.4	15.2	13.6	14.0
6	5	0	29	3	3.2	2.8	2.8	3.2	2.8
6	5	1	29	3	17.2	16.0	16.4	14.8	14.4
6	6	0	29	3	3.6	2.8	3.6	3.6	3.2
6	6	1	29	3	30.4	29.6	26.4	28.0	27.6
6	7	0	29	3	3.2	3.2	4.0	3.6	2.4
6	7	1	29	3	28.0	28.8	27.2	28.0	27.2
6	8	0	29	3	2.8	3.2	2.4	3.2	2.8
6	8	1	29	3	16.0	16.0	16.0	14.4	14.4
6	9	0	29	3	2.4	2.8	3.2	2.8	3.6
6	9	1	29	3	16.8	16.4	16.0	15.6	15.2
6	0	2	29	3	1.2	1.6	1.2	1.6	1.6

DATA FOR SUBJECT FOUR

BLOCK 1

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	1	38.0	23.2	19.2	18.4	13.6
1	1	1	24	1	89.2	32.0	26.4	22.4	20.0
1	2	0	24	1	32.8	15.2	15.2	14.4	11.2
1	2	1	24	1	39.2	32.0	28.0	20.8	24.0
1	3	0	24	1	28.8	19.2	18.4	11.2	10.4
1	3	1	24	1	66.8	24.0	24.0	20.0	17.2
1	4	0	24	1	23.2	21.6	15.2	10.0	10.4
1	4	1	24	1	38.0	28.8	26.4	20.8	18.4
1	5	0	24	1	24.8	18.4	10.4	12.0	11.2
1	5	1	24	1	45.6	27.2	23.2	18.4	17.6
1	6	0	24	1	16.8	16.8	13.2	11.2	11.2
1	6	1	24	1	39.2	50.8	28.8	24.0	22.4
1	7	0	24	1	36.0	24.0	20.8	14.0	10.4
1	7	1	24	1	30.8	24.8	20.8	16.8	47.2
1	8	0	24	1	23.2	16.8	12.0	13.6	24.0
1	8	1	24	1	16.8	15.2	12.8	10.4	10.4
1	9	1	24	1	22.8	28.0	16.8	12.0	12.0
1	9	1	24	1	26.4	24.0	21.6	15.2	14.4
1	0	2	24	1	5.6	3.2	3.2	1.6	3.2
0	0	3	0	1	11.2	12.0	5.6	5.6	6.4
2	0	9	0	1	84.8	72.8	53.6	45.6	45.6
0	0	3	0	1	7.6	5.6	3.2	4.0	1.6
3	1	0	19	1	30.4	31.2	20.0	16.0	11.2
3	1	1	19	1	56.0	25.2	16.0	16.0	14.4
3	2	0	19	1	24.0	17.6	12.0	9.6	9.2
3	2	1	19	1	35.2	14.4	16.0	12.0	10.4
3	3	0	19	1	16.0	8.8	5.2	5.6	4.0
3	3	1	19	1	20.0	17.6	12.8	12.8	12.0
3	4	0	19	1	18.4	17.6	8.8	8.0	8.0
3	4	1	19	1	20.8	17.6	15.2	12.8	12.0
3	5	0	19	1	16.0	8.8	8.8	6.4	8.0
3	5	1	19	1	26.4	22.4	20.8	17.6	16.8
3	6	0	19	1	10.4	14.4	9.2	7.2	8.0
3	6	1	19	1	26.4	16.0	13.2	22.4	13.2
3	7	0	19	1	17.6	4.0	10.4	8.0	8.0
3	7	1	19	1	20.8	20.0	14.4	14.0	13.6
3	8	0	19	1	9.6	8.0	5.2	4.4	4.0
3	8	1	19	1	28.8	22.4	12.8	13.6	14.4
3	9	0	19	1	17.6	14.4	10.8	10.4	4.0
3	9	1	19	1	19.2	9.6	8.8	7.2	7.2
3	0	2	19	1	8.0	3.2	1.6	2.0	2.4
0	0	3	0	1	10.8	6.0	9.6	8.8	4.8
4	1	0	14	1	33.6	16.0	14.4	8.0	10.4
4	1	1	14	1	24.8	18.4	17.6	18.0	16.0
4	2	0	14	1	8.0	6.4	2.0	2.4	2.4

DATA FOR SUBJECT FOUR

BLOCK 1

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	1	27.2	17.6	17.6	14.8	15.2
4	3	0	14	1	8.8	4.8	3.2	3.2	3.2
4	3	1	14	1	22.0	17.6	19.2	16.0	16.8
4	4	0	14	1	7.2	4.0	4.0	2.4	2.4
4	4	1	14	1	17.6	12.0	13.6	10.4	10.4
4	5	0	14	1	11.2	6.4	4.8	2.4	3.2
4	5	1	14	1	19.2	16.0	17.6	12.8	14.4
4	6	0	14	1	10.4	4.0	4.8	4.0	3.2
4	6	1	14	1	19.2	17.6	18.4	13.6	15.2
4	7	0	14	1	5.6	4.0	3.2	3.2	2.4
4	7	1	14	1	14.4	12.0	8.0	9.6	8.8
4	8	0	14	1	9.2	6.4	4.8	4.0	4.8
4	8	1	14	1	20.0	15.2	12.0	13.6	16.0
4	9	0	14	1	12.0	3.2	2.8	2.4	3.6
4	9	1	14	1	18.4	12.8	10.4	8.4	10.4
4	0	2	14	1	3.2	3.2	2.4	2.4	2.4
0	0	3	0	1	8.0	8.0	3.2	1.6	1.6
5	0	9	0	1	86.0	70.4	58.8	50.4	53.6
0	0	3	0	1	8.8	4.0	5.6	5.2	4.0
6	1	0	29	1	64.0	50.0	30.4	24.0	20.8
6	1	1	29	1	55.2	104.0	33.6	30.4	28.8
6	2	0	29	1	43.2	37.2	38.4	19.2	20.0
6	2	0	29	1	46.0	39.2	32.0	28.0	30.0
6	3	0	29	1	52.0	33.6	30.4	34.0	24.8
6	3	1	29	1	39.2	108.8	28.4	60.4	23.2
6	4	0	29	1	33.6	26.4	27.2	24.8	26.4
6	4	1	29	1	24.0	21.2	16.4	16.0	15.2
6	5	0	29	1	20.8	27.2	24.0	12.0	16.8
6	5	1	29	1	108.8	37.6	30.4	27.2	28.0
6	6	0	29	1	48.8	39.2	25.6	34.4	24.4
6	6	1	29	1	168.0	58.4	15.2	15.2	13.2
6	7	0	29	1	35.2	23.2	23.2	17.6	22.4
6	7	1	29	1	34.4	28.8	26.4	24.4	22.4
6	8	0	29	1	37.6	26.8	20.0	14.4	12.8
6	8	1	29	1	16.8	20.0	14.4	13.2	12.8
6	9	0	29	1	26.4	28.4	16.8	15.6	14.4
6	9	1	29	1	36.8	20.0	16.8	15.2	12.0
6	0	2	29	1	4.8	4.0	4.0	3.2	1.6

DATA FOR SUBJECT FOUR

BLOCK 2

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	24	2	12.8	14.4	11.2	10.0	12.0
1	1	1	24	2	19.2	19.2	17.6	17.6	19.2
1	2	0	24	2	11.2	14.4	10.4	8.0	10.8
1	2	1	24	2	19.2	19.2	14.4	14.8	13.2
1	3	0	24	2	10.8	12.0	8.8	9.6	9.6
1	3	1	24	2	17.2	10.4	10.4	10.4	9.6
1	4	0	24	2	12.0	14.4	12.0	10.4	10.4
1	4	1	24	2	14.4	12.8	13.2	14.0	14.4
1	5	0	24	2	11.2	12.0	11.2	8.8	10.4
1	5	1	24	2	43.2	16.0	16.0	16.4	17.2
1	6	0	24	2	8.8	10.4	9.6	7.2	8.4
1	6	1	24	2	21.6	20.0	20.0	18.4	19.6
1	7	0	24	2	10.8	15.6	10.4	12.0	12.8
1	7	1	24	2	16.8	14.4	14.0	15.6	15.2
1	8	0	24	2	8.0	13.2	8.8	8.8	8.8
1	8	1	24	2	19.2	15.2	17.2	14.4	16.0
1	9	0	24	2	10.4	16.0	11.2	10.4	9.6
1	9	1	24	2	20.8	17.6	17.6	17.6	18.0
1	0	2	24	2	4.8	1.6	1.2	1.2	1.6
0	0	3	0	2	4.0	5.6	1.6	4.4	8.4
2	0	9	0	2	45.6	41.2	54.4	43.2	41.6
0	0	3	0	2	2.8	5.6	4.0	1.6	4.8
3	1	0	19	2	11.2	13.6	8.8	6.4	5.6
3	1	1	19	2	15.2	12.8	13.6	16.0	14.4
3	2	0	19	2	9.2	7.2	4.0	4.4	3.2
3	2	1	19	2	12.8	13.6	15.6	14.4	17.6
3	3	0	19	2	5.6	4.8	3.2	4.4	3.6
3	3	1	19	2	15.6	16.0	18.4	16.8	19.2
3	4	0	19	2	2.8	3.2	4.0	3.2	4.0
3	4	1	19	2	12.8	13.6	13.2	14.8	16.8
3	5	0	19	2	8.4	5.6	3.2	4.0	2.8
3	5	1	19	2	12.0	12.8	12.8	12.0	12.8
3	6	0	19	2	8.8	4.4	4.4	4.0	3.2
3	6	1	19	2	12.8	12.8	14.4	14.4	14.4
3	7	0	19	2	4.8	3.6	3.6	4.0	3.6
3	7	1	19	2	9.6	9.6	10.4	11.2	11.2
3	8	0	19	2	7.2	8.0	9.6	2.8	4.0
3	8	1	19	2	6.0	8.0	8.0	7.2	7.6
3	9	0	19	2	8.8	6.4	7.2	4.0	3.2
3	9	1	19	2	15.2	11.2	12.0	14.0	15.2
3	0	2	19	2	3.2	1.6	1.6	4.0	1.6
0	0	3	0	2	6.4	4.8	4.0	5.2	4.8
4	1	0	14	2	7.2	5.6	4.8	10.0	6.4
4	1	1	14	2	11.2	11.2	12.0	12.0	12.8
4	2	0	14	2	5.6	4.4	4.0	3.2	2.8

DATA FOR SUBJECT FOUR

BLOCK 2

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	14	2	14.4	14.4	15.6	15.2	17.2
4	3	0	14	2	4.0	3.2	2.4	2.4	4.8
4	3	1	14	2	12.0	12.0	12.0	14.0	13.2
4	4	0	14	2	3.2	2.4	2.4	1.6	2.8
4	4	1	14	2	8.8	10.4	8.4	8.4	29.6
4	5	0	14	2	4.0	2.4	3.2	3.2	6.4
4	5	1	14	2	15.2	14.4	17.6	14.8	15.6
4	6	0	14	2	3.2	3.2	3.2	2.4	3.2
4	6	1	14	2	14.4	16.0	15.2	13.6	10.4
4	7	0	14	2	2.4	1.6	2.0	2.4	4.0
4	7	1	14	2	9.6	8.0	8.4	9.6	8.8
4	8	0	14	2	3.2	2.8	2.0	2.4	3.2
4	8	1	14	2	12.0	15.2	12.8	28.0	13.6
4	9	0	14	2	5.6	3.2	2.0	2.4	2.4
4	9	1	14	2	14.4	15.2	13.6	14.4	15.6
4	0	2	14	2	2.0	2.4	2.4	2.4	2.4
0	0	3	0	2	1.6	1.6	1.2	1.6	4.0
5	0	9	0	2	56.0	52.8	48.0	46.4	47.6
0	0	3	0	2	3.6	3.2	2.8	3.2	3.2
6	1	0	29	2	14.4	12.8	12.0	8.8	9.6
6	1	1	29	2	16.8	13.6	14.8	14.4	14.4
6	2	0	29	2	50.4	20.8	6.0	5.2	8.8
6	2	1	29	2	40.0	26.4	20.0	27.2	27.2
6	3	0	29	2	16.0	14.4	14.4	11.2	12.0
6	3	1	29	2	24.0	22.4	22.4	21.6	40.0
6	4	0	29	2	15.2	12.0	12.0	8.0	10.0
6	4	1	29	2	12.4	11.2	11.2	12.0	12.0
6	5	0	29	2	24.8	26.4	28.0	19.2	16.0
6	5	1	29	2	15.2	13.6	15.6	14.4	15.2
6	6	0	29	2	27.2	36.8	5.2	4.8	6.4
6	6	1	29	2	82.4	21.6	23.2	22.0	23.6
6	7	0	29	2	12.8	15.6	12.8	13.6	16.0
6	7	1	29	2	22.8	20.8	28.0	20.0	21.6
6	8	0	29	2	12.0	12.0	9.2	8.0	9.6
6	8	1	29	2	13.6	12.0	13.6	9.6	71.2
6	9	0	29	2	16.8	23.2	18.0	12.4	10.0
6	9	1	29	2	12.8	10.4	12.8	12.8	12.8
6	0	2	29	2	1.6	1.6	1.6	1.6	1.6

DATA FOR SUBJECT FOUR

BLOCK 3

SEG- MENT	ELE- MENT	CUE/ PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1	1	0	19	3	5.2	5.6	5.2	4.8	4.8
1	1	1	19	3	13.6	13.2	14.0	14.0	13.6
1	2	0	19	3	4.0	4.4	4.0	4.4	3.6
1	2	1	19	3	13.6	13.6	14.4	13.6	14.8
1	3	0	19	3	4.8	4.0	4.8	4.0	3.6
1	3	1	19	3	16.0	15.6	17.6	14.4	17.6
1	4	0	19	3	4.0	4.0	4.4	3.6	4.0
1	4	1	19	3	14.0	13.2	16.8	14.0	15.2
1	5	0	19	3	4.8	3.6	4.8	4.0	4.4
1	5	1	19	3	11.2	12.0	11.6	12.4	12.4
1	6	0	19	3	4.0	4.0	4.0	4.0	3.2
1	6	1	19	3	12.8	13.2	14.4	13.6	14.4
1	7	0	19	3	4.0	3.6	4.0	3.6	4.0
1	7	1•	19	3	10.0	9.6	10.4	12.8	10.4
1	8	0	19	3	4.8	4.8	4.8	4.0	4.0
1	8	1	19	3	6.8	6.4	8.0	6.4	8.0
1	9	0	19	3	3.6	3.2	5.6	2.8	3.2
1	9	1	19	3	14.4	12.8	13.2	12.8	12.8
1	0	2	19	3	1.6	1.6	1.6	1.6	1.6
0	0	3	0	3	2.4	1.6	1.2	0.8	0.8
2	0	9	0	3	43.2	40.8	46.8	42.4	46.4
0	0	3	0	3	6.8	1.2	3.2	4.8	4.0
3	1	0	24	3	10.0	17.6	10.4	8.4	9.2
3	1	1	24	3	16.8	16.4	18.0	15.6	18.4
3	2	0	24	3	9.6	8.8	8.8	7.2	7.2
3	2	1	24	3	50.8	11.6	13.2	11.6	11.2
3	3	0	24	3	9.2	10.4	8.8	7.2	7.6
3	3	1	24	3	10.0	9.6	11.6	10.4	9.6
3	4	0	24	3	11.2	9.6	10.0	9.6	9.6
3	4	1	24	3	12.0	12.0	13.2	12.0	12.4
3	5	0	24	3	10.4	9.2	13.2	9.6	10.8
3	5	1	24	3	14.4	16.0	15.2	14.8	16.0
3	6	0	24	3	8.0	7.2	7.6	8.0	8.0
3	6	1	24	3	19.2	19.2	20.0	18.4	20.0
3	7	0	24	3	8.8	8.8	11.2	9.6	6.0
3	7	1	24	3	12.4	13.6	14.4	13.6	14.0
3	8	0	24	3	7.2	9.6	10.4	9.2	8.4
3	8	1	24	3	14.4	16.0	16.0	15.6	15.2
3	9	0	24	3	15.6	10.4	12.4	8.8	8.4
3	9	1	24	3	17.2	16.0	16.8	17.2	16.8
3	0	2	24	3	2.0	2.8	1.6	1.6	5.6
0	0	3	0	3	3.2	3.2	3.6	3.2	4.8
4	1	0	29	3	11.2	8.0	9.6	8.0	5.6
4	1	1	29	3	15.2	16.0	16.4	15.6	17.6
4	2	0	29	3	6.4	4.8	6.0	4.0	6.0

DATA FOR SUBJECT FOUR

BLOCK 3

SEG-MENT	ELE-MENT	CUE/PERF	VISCOND	BLOCK	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
4	2	1	29	3	26.4	27.2	28.4	28.0	28.8
4	3	0	29	3	10.0	10.8	11.2	10.8	5.6
4	3	1	29	3	20.8	20.8	22.0	22.4	23.2
4	4	0	29	3	14.0	7.6	7.2	6.4	6.0
4	4	1	29	3	11.2	12.0	12.0	11.6	12.8
4	5	0	29	3	15.2	12.0	17.2	8.0	8.8
4	5	1	29	3	14.4	16.8	14.8	28.8	13.2
4	6	0	29	3	5.6	4.8	4.0	4.8	3.6
4	6	1	29	3	21.6	21.6	23.2	24.0	24.8
4	7	0	29	3	11.2	15.2	13.2	8.0	6.4
4	7	1	29	3	20.4	20.8	20.8	22.8	24.0
4	8	0	29	3	10.0	6.4	7.2	8.4	8.8
4	8	1	29	3	12.8	11.2	12.8	14.4	14.4
4	9	0	29	3	17.2	9.6	6.0	8.8	5.2
4	9	1	29	3	13.2	12.0	11.2	12.0	13.0
4	0	2	29	3	1.6	1.6	2.0	1.6	2.0
0	0	3	0	3	4.0	3.2	5.2	4.4	5.6
5	0	9	0	3	48.0	44.0	46.0	48.8	46.4
0	0	3	0	3	1.6	2.0	2.0	1.2	1.2
6	1	0	14	3	6.8	4.4	5.6	4.0	4.0
6	1	1	14	3	11.2	11.6	11.2	10.0	11.2
6	2	0	14	3	4.0	4.0	3.2	3.2	2.4
6	2	1	14	3	14.0	13.6	13.6	14.0	14.8
6	3	0	14	3	4.0	4.0	4.8	3.6	2.8
6	3	1	14	3	12.8	12.0	11.2	12.8	14.4
6	4	0	14	3	3.2	3.2	3.6	3.2	3.2
6	4	1	14	3	10.4	8.4	8.4	9.6	9.6
6	5	0	14	3	3.6	3.2	3.2	3.2	3.6
6	5	1	14	3	14.4	12.8	14.4	15.2	14.0
6	6	0	14	3	2.8	3.6	2.8	3.2	2.8
6	6	1	14	3	12.8	12.4	13.6	14.8	12.8
6	7	0	14	3	2.8	3.2	4.0	2.8	2.8
6	7	1	14	3	9.6	8.0	8.8	9.2	9.6
6	8	0	14	3	2.8	3.2	3.2	3.2	2.4
6	8	1	14	3	11.6	12.0	13.2	13.2	12.0
6	9	0	14	3	2.4	4.8	2.4	2.4	2.4
6	9	1	14	3	13.6	12.0	13.6	14.0	15.2
6	0	2	14	3	1.6	1.6	1.6	2.4	1.6