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The Effects of Augmented Attentional Focus on the Performance with Practice of a Closed Perceptual-Motor Task for Individuals Who Differ in Task Mastery

John Allen Richards
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by John Allen Richards entitled "The Effects of Augmented Attentional Focus on the Performance with Practice of a Closed Perceptual-Motor Task for Individuals Who Differ in Task Mastery." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Exercise Science.

Patricia A. Beitel, Major Professor

We have read this dissertation and recommend its acceptance:

Craig A. Wrisberg, Ralph E. Jones, Mark A. Hector

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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and recommend its acceptance:

Marsha C. Keeton

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THE EFFECTS OF AUGMENTED ATTENTIONAL FOCUS ON THE PERFORMANCE WITH PRACTICE OF A CLOSED PERCEPTUAL-MOTOR TASK FOR INDIVIDUALS WHO DIFFER IN TASK MASTERY

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

John Allen Richards

August 1984

DEDICATION

To Laura, the person who has provided the greatest stability in my life, for her special understanding, patience, and love that has supported me through the completion of this task.

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I would like to recognize the effort of several individuals, all of who made important contributions to the completion of this piece of research. First to the director of my committee, Dr. Patricia Beitel, I wish to express my deepest gratitude for her timely words of encouragement, her sincere interest in me as both a person and a researcher, and her total dedication to teh pursuit of scholarly work. I also with to thank the members of my committee. To Dr. Craig Wrisberg in appreciation for his meticulous editing of the manuscript. To Dr. Buck Jones who, through example, taught me about the power of positive thinking. To Dr. Mar Hector, whose willingness to serve on the committee was pivotal to brining this endeavor to closure. I also wish to recognize Mrs. Gail Clay, who generously, arranged the provisions for use of the bowling facilities and videotape equipment utilized in this study.

ABSTRACT

The purpose of this study was to investigate the effects of augmented attentional focus on the performance with practice, of a closed perceptual-motor task for individuals who differ in task mastery. Sixty-four male volunteers were assigned to either the beginning or advanced task mastery group (n = 32) based on bowling averages (≦ 130, ≧ 150 respectively). Each subject in the task mastery groups was randomly assigned to one of four augmented focus of attention conditions, i.e., focus on: (a) environmental results of the movement that was performed (KR); (b) the movement that was performed (KP); (c) self via presence of VTR camera and monitor (VTR); or (d) nothing by experimental manipulation (control). The hypotheses tested the theoretical projections of Gentile (1972) and Fleishman and Rich (1963), i.e., (a) for beginning bowlers the augmented attention to KR group would perform better than the KP, VTR, or control groups, and (b) for advanced bowlers the augmented attention to KP and/or VTR groups would perform better than the KR or control groups. Each subject rolled 30 balls at a full ten-pin set-up. The pinfall and distance from target scores were averaged and grouped into six blocks of five trials each.

For both levels of task mastery, an a priori test of planned comparisons and an analysis of variance for the split plot factorial (4.6) were used to analyze the data. Results indicated that: (a) the bowling accuracy of beginning bowlers who received an augmented attentional focus to KR was significantly better ($p \leq .004$) than that of

the beginning control group with no other group differences; (b) the distance from target scores of the advanced bowlers who received an augmented attentional focus to KP were more accurate ($p = .038$) than those of the KR focus or advanced control group; (c) there were no significant ($p \leq .03$) main effects for pinfall between group factors at either level of task mastery; and (d) there were no significant ($p \leq .05$) main or interaction effects for within group factors at either level of task mastery. In conclusion, the results of the study partially supported the theoretical projections of Gentile (1972) and Fleishman and Rich (1963).

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CHAPTER I

INTRODUCTION

The concept of attention has been received with varying degrees of interest through its history in psychology. It was a favorite topic for thought as early as James (1890, pp. 403-404) who defined attention as "the taking possession of the mind, in a clear and vivid form, of one out of what seem simultaneously possible trains of thought." However, no solid predictions regarding the place of attention in experimental psychology were developed until the latter half of the 20th century when theorists proposed several classical structural models (Broadbent, 1958; Deutsch & Deutsch, 1963; Treisman, 1969). These models suggested that attention operated as a filtering mechanism, rigidly positioned at a single stage of the information processing system, to perform functions on selected sensory input in order to enhance perceptual processing. These structural theories stand in contrast to more recently developed capacity models (Kahneman, 1975; Keele, 1973; Moray, 1970) which view attention as a more dynamic, flexibly allocated, but limited resource pool from which effort is drawn, as needed, to match situational demands.

Despite the lack of consensus supporting a unified theoretical model of attention, one of the contentions commonly held by theorists is that attention is the mechanism through which conscious learning/ performance experiences are mediated (Broadbent, 1958; Deutsch & Deutsch, 1963; James, 1890; Kahneman, 1975; Keele, 1973). Persons

choose to attend to certain stimuli in preference to others. This ability to allocate cognitive power to specific locations or to stages of the information processing system is referred to as selective attention (Broadbent, 1958; Whiting, 1969).

Within the domain of possible salient stimuli, a dichotomous classification exists, which provides useful insights into human behavior. This classification takes into consideration the source of stimulus origin. Stimuli which originate outside of the individual belong to the external environment. Selectively attending to these stimuli is referred to as an environmental focus (Carver & Scheier, 1981b), or a state of subjective self-awareness (Duval & Wicklund, 1972). In contrast, other stimuli originate from within the individual (Lewis & Brooks, 1978; Raye, Johnson, & Taylor, 1978). Selectively attending to stimuli from this internal information source is referred to as a self-focus (Carver & Scheier, 1981b), or objective self-awareness (Duval & Wicklund, 1972).

A basic belief of James (1890) was that the self is an originator of behavior-regulating information. He proposed that the self is a multifaceted construct comprised of: (a) the material self, (b) the social self, and (c) the spiritual self. Additional self-related constructs have since been brought to light and examined in psychological research. Self-concept is a broad construct which encompasses other more specific subconstructs such as self-image, self-esteem, self-presentation, self-perception, self-monitoring, and self-evaluation (Wylie, 1961). Persons who are cognizant of situational or

dispositional self factors and the continuous shifting of attentional focus across the facets of the self are said to be reflective and self-aware (Fenigstein, Scheier, & Buss, 1975; Wicklund, 1979). When this awareness of the self as an entity is exhibited more habitually, the person is described as being dispositionally self-conscious. This objective view of the body has been described as "taking the feeling or attitude of another towards yourself" (Mead, 1934, p. 171).

Self-focused attention, therefore, can encompass a great number of internal states, operations, or processes. However, a common property to all of these dimensions is that they become more significant behavior regulating determinants once the self is viewed as the object rather than the subject of our observation (Wicklund, 1979). With increased awareness of self as an object comes a subsequent state of self-analysis and self-evaluation. This is the central assumption underlying Duval and Wicklund's (1972) theory of objective self-awareness. Research in social psychology (Brockner, 1979; Carver & Scheier, 1979; Ickes, Wicklund, & Ferris, 1973; Wicklund, 1979) has recently demonstrated increased internalization of attentional focus within several contextual frameworks. Studies (Brockner, 1979; Carver & Scheier, 1977; Davis, 1975) have revealed that in the presence of certain self-focusing stimuli (i.e., a mirror or videotape camera), the self as an object of observation receives greater realization, with stimulus saliency gravitating to that aspect of the self which is most relevant at the moment. That is to say, objective self-awareness is an internally-directed state. This is to be contrasted to

the state of subjective self-awareness, in which attention is directed towards external events. In the latter, the only self-awareness is the "feeling of being the source of forces directed outward" (Duval & Wicklund, 1972, p. 3).

During conditions of increased self-focus, subjects have demonstrated: (a) an enhanced awareness and responsiveness to such salient emotional affects as fear (Scheier, Carver, & Gibbons, 1981), depression (Smith, 1981), elation, attraction, and repulsion (Scheier & Carver, 1977); (b) an increased awareness of such internal states as sexual arousal and taste (Scheier, Carver, & Gibbons, 1979); (c) an increased awareness of behavioral responses (Gibbons, 1976); and (d) an increased accuracy of self-report (Pryor, Gibbons, Wicklund, Fazio, & Hood, 1977). Fenigstein, Buss and Scheier (1975) have found that these characteristics particularly pronounced in subjects who rate themselves high in self-consciousness. Despite the conclusions drawn regarding the effect of increased self-focused attention on one's sensitivity to a number of affective experiences, more evidence is needed to support a parallel effect for other internally-generated information (e.g., kinesthetic or proprioceptive orientation).

Additional research in social psychology has demonstrated that an increased self-focus can enhance one's sensitivity to existing discrepancies between actual behavior and the experimentally-established standards for that behavior (Carver & Scheier, 1979). According to Scheier and Carver (1983), once self-focused attention has revealed an

incongruity between current behavior and an expected standard of behavior, an individual attempts to change the actual behavior to better match the standard. This negative, feedback-loop operation is theoretically similar to the test-operate-test-exit (TOTE) mechanism suggested by Miller, Galanter, and Pribram (1960). Research by Wicklund and Duval (1971) has demonstrated that during conditions of increased self-focused attention, subjects were more easily persuaded to alter their personal opinions and attitudes to more closely conform to experimentally-suggested standards which were in opposition to their own. Perhaps of greater significance, however, is the evidence suggesting that during conditions of self-focused attention, subject's overt responses to perceived actual-ideal behavioral discrepancies tended to concur with the behavioral standards established by the experimenter (Carver, Scheier, & Gibbons, 1981). According to Carver and Scheier (1981a), self-focused subjects attempt to reduce behavioral discrepancies through a greater frequency of comparison between their actual behavior and the ideal standard. The same theorists (Carver & Scheier, 1981a) have extended their predictions to explain performance facilitation effects for novel simple tasks with high cognitive components under self-focused conditions. However, further testing of Carver and Scheier's (1981a) model is needed to extend its application to the performance of other types of perceptual-motor tasks.

The nature of the task as a consideration in perceptual-motor performance has been noted by motor behavior theorists (Gentile,

1971; Poulton, 1957). Poulton (1957) dichotomized perceptual-motor tasks as being either open or closed depending on the environmental context within which the task is performed. Gentile (1972) suggested that performers must attend to certain regulatory cues that are specific to the environmental conditions and movement demands inherent in the task. If the performer is confronted with stable environmental demands in closed task situations, the spatial organization (i.e., distance, location) of the movement pattern selected to match those environmental demands is limited in range. However, the temporal organization (i.e., initiation, duration, termination, pace) for the same movement pattern may vary to a greater extent both within and across performance trials. In closed situations, therefore, it is important to locate and identify the changing internal cues that regulate the movement pattern.

The effect of selectively attending to regulatory cues originating from within the external environment (knowledge of results--KR) or within the movement (knowledge of performance--KP) on the acquisition of an open task (Beitel, 1983) has supported Gentile's (1972) model. Beitel (1982) identified focused attention on the environment (KR) and on the relationships on environment and movement (KR/KP) as facilitating factors for the acquisition of open skills. Further support for Gentile's model (1972) was evidenced through a study by Del Rey (1971) in which augmented knowledge of performance (KP) facilitated better accuracy and form of a closed task. However, the direction of subjects' attentional focus concurrent with task performance in this

study could only be speculated. Using a content analysis to investigate the effect of videotape feedback on bowling learning/performance, Rothstein and Arnold (1976) found that videotape viewing of practice produced significant improvement of performance objectives when used in conjunction with teacher feedback. They concluded from their review that improvement in bowling depends on the ability to use feedback concerning both the movement (KP) and the outcome of the movement (KR).

Although it is generally accepted that internally-generated stimuli (i.e., kinesthesis, proprioception) are important sources of information in perceptual-motor skill performance, the extent to which they are utilized remains equivocal. Fleishman and Rich (1963) investigated the role of kinesthetic and spatial sensitivity in a two-handed coordination task. They concluded that psychomotor abilities which are important to task performance early in practice may not necessarily be the same as those which are important late in practice. They further suggested that psychomotor abilities can be thought of as the "capability for using different kinds of information" (p. 10). These authors proposed that during initial practice, subjects utilize visual-spatial cues to guide their movements in general patterns, but as more precise movements are demanded, they switch to a greater dependence on kinesthetic information, transmitted across more direct proprioceptive channels. Fleishman and Hempel (1955) have contended that from the subject's point of view, the nature of the task changes over practice. It appears that at later stages of performance/learning, performers direct

their attentional focus toward kinesthetic and proprioceptive cues, producing a more operationally effective knowledge of performance.

As a result of the existing evidence regarding the role of attentional focus within information processing theory (Kahneman, 1975; Keele, 1973), it appears justifiable to test predictions set forth by objective self-awareness theory (Duval & Wicklund, 1972) concerning the potential facilitative effects of self-focused attention on the performance of perceptual-motor tasks with different attentional demands. Two factors warranting particular notice are: (a) the specific environmental and movement demands of the task (Gentile, 1972), and (b) the ability of performers at different levels of task mastery to utilize different sensory stimuli that originate from different information sources (Fleishman & Rich, 1963).

Statement of the Problem

The purpose of this study was to investigate the effect of various types of attentional focus on the performance of a selected closed perceptual-motor task for individuals who differ in task mastery. The hypotheses listed below were addressed in an attempt to determine the effects of attentional focus on the performance variables of: (a) pinfall and (b) distance from the target.

1. The performance of beginners receiving an augmented knowledge of results focus (KR) would be significantly ($p \leq .03$) better than that of beginners receiving: (a) an augmented knowledge of performance focus (KP), (b) an augmented

self-focus (VTR), and (c) no augmented attentional focus (control).

2. The performance of advanced subjects receiving an augmented knowledge of performance focus (KP) or an augmented self-focus (VTR) would be significantly ($p \leq .03$) better than that of advanced subjects receiving an augmented knowledge of results focus (KR) or no augmented attentional focus (control).
3. The performance of beginners receiving an augmented knowledge of results focus (KR) would show significantly ($p \leq .05$) better performance with practice than that of beginners receiving: (a) an augmented knowledge of performance focus (KP), (b) an augmented self-focus (VTR), and (c) no augmented attentional focus (control).
4. The performance of advanced subjects receiving an augmented knowledge of performance focus (KP) or an augmented self-focus (VTR) would show significantly ($p \leq .05$) better performance than that of advanced subjects receiving an augmented knowledge of results focus (KR) or no augmented attentional focus (control).

Definition of Terms

The following terms have been defined theoretically and, where appropriate, operationally. The terms are used consistently throughout the text of this paper.

Attentional Focus

The source of information to which one's attention is selectively directed (Carver & Scheier, 1981b), categorized in this study as: (a) self-focused attention, or (b) environmental focused attention.

Environmental focused attention. "Selectively attending to information originating in the environment" (Carver & Scheier, 1981b, p. 35), defined in this study as having attention focused on the visual environmental task-goal cues resulting from performance (KR). Environmental-focused attention was mediated in this study through a knowledge of results questionnaire.

Self-focused attention. "Selectively attending to information that originates from within and concerns the self" (Carver & Scheier, 1981b, p. 35), defined in this study as having attention focused on the movement or on the kinesthetic and/or proprioceptive cues available during performance (KP). Self-focused attention was mediated in this study through: (a) a knowledge of performance questionnaire, or (b) the presence of a videotape camera with television monitor.

Kinesthetic Information

Sensory information about active movement provided internally to the central nervous system from stretch receptors (Higgins, 1972).

Knowledge of Performance (KP)

Intrinsic sensory feedback which concerns movement-relevant information (Bilodeau, 1966), defined in this study as the kinesthetic and proprioceptive cues that provide task-relevant information

concerning total body transport and limb transport/manipulation (Gentile, Higgins, Miller, & Rosen, 1975) during performance.

Knowledge of Results (KR)

Intrinsic sensory information which concerns the produced outcomes of movement (Annett & Kay, 1957), defined in this study as the visual environmental cues that provide task-relevant information concerning the bowling ball, the target spot, and the bowling pins.

Performance

"The temporary expression of motor skill behavior" (Stallings, 1982, p. 12), measured in this study by: (a) pin fall and (b) distance from the target.

Distance from the target. The number of boards by which the vertical midline of the ball deviates from the intended target spot on the first ball of each frame. Individual scores were averaged for six blocks of five trials each.

Pinfall. The number of pins knocked down on the first ball of each frame. Individual scores were averaged for six blocks of five trials each.

Proprioceptive Information

Sensory information about limb and body posture, touch and pressure provided internally to the central nervous system from joint and cutaneous receptors (Higgins, 1972).

Selected Perceptual-Motor Task

The perceptual-motor task selected for this study involved the rolling of a bowling ball at a full 10-pin set-up, as in the first ball rolled in each frame in the sport of bowling. The task is characterized by spatial environmental control and intertrial environmental consistency. Movement demands include total body transport and limb transport/manipulation. Attentional demands include visual fixation and postural body/limb monitoring.

Self-Awareness

"The existence of self-directed attention, as a result of either transient situational variables, chronic disposition or both" (Fenigstein, Scheier, & Buss, 1975, p. 522).

Increased objective self-awareness. "A greater proportion of time spent in the objective rather than the subjective state of awareness" (Duval & Wicklund, 1972, p. 3).

Objective self-awareness. "Consciousness focused exclusively upon those aspects of the self which include personal history, the body, or any other personal aspect of the self" (Duval & Wicklund, 1972, p. 3).

Subjective self-awareness.

> Consciousness in which attention is focused on events external to the individual's consciousness. People experience the peripheral feedback from their actions and various other feelings that arise from within the body. The feeling of being the source of forces directed outward, the amount of self-awareness that can be experienced even as attention is directed outward. (Duval & Wicklund, 1972, p. 3).

Task Mastery

The degree of proficiency at bowling, as measured by average scores from ten games, in reference to established norms for college age subjects (Martin, 1964).

Beginning level. For men, an average of less than or equal to 130 pins per game.

Advanced level. For men, an average of greater than or equal to 150 pins per game.

Assumptions Underlying the Study

The following assumptions were made in reference to this study:

1. The videotape camera with television monitor, the knowledge of performance questionnaire, and the knowledge of results questionnaire produced the desired manipulation of subjects' attentional focus.
2. The dependent measures of: (a) pin fall on the first ball rolled, and (b) distance the ball deviated from the target spot, were valid indicators of bowling performance.

Scope of the Study

The time period encompassing collection of the data was February through March 1984. The 64 subjects were male college-age students with varying degrees of bowling skill.

Significance of the Study

In recent years, the role of attentional focus on the performance of perceptual-motor skills has received greater consideration. Moreover, theoreticians (Duval & Wicklund, 1972; Nideffer, 1976) have proposed cognitive constructs that can be manipulated and measured.

In support of Duval and Wicklund's (1972) theory of objective self-awareness, research in the field of social psychology has provided evidence to suggest that increased self-focus can: (a) enhance one's sensitivity to both emotional and physiological states (Scheier, Carver, & Gibbons, 1979; Carver, Scheier, & Gibbons, 1981), and (b) increase the saliency of existing discrepancies between one's actual and intended behavior (Carver & Scheier, 1979; Scheier & Carver, 1983). Literature in motor behavior (Fleishman & Rich, 1963; Gentile, 1972) has suggested that selective attention to internal (kinesthetic) and external (visual) information sources will facilitate perceptual-motor skill performance depending on: (a) the information processing demands of the task, and (b) the skill level of the performer.

Taken together, the tenets of objective self-awareness theory and skill acquisition theory appear to fall within the realm of psychological explanations of sport and motor behavior, e.g., (a) increased objective self-awareness might enhance a performer's sensitivity to kinesthetic information, (b) increased environmental focus might enhance a performer's sensitivity to visual information, (c) increased objective self-awareness may increase the frequency with which a performer compares their actual performance to a reference performance,

(d) inducing an increase in self-focus might provide an effective context through which implications for the internal/external attentional construct of beginning and advanced performers could be investigated, and (e) a more accurate assessment of task demands might be facilitated by examining the effect of shifts in attentional allocation on the performance/learning of different types of perceptual-motor tasks for performers who differ on task mastery.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter was to synthesize the literature relating to the areas of attentional focus and the performance of perceptual-motor skills. The research was presented within the following subtopics: (a) models of attention, (b) self-focused attention, and (c) attention and the nature of the task.

Models of Attention

The role of attention as a mediator of our conscious experience has long been documented in the psychological literature (James, 1890; Titchener, 1908; Mead, 1934). William James (1890, pp. 403-404) defined attention as "the taking possession of the mind, in a clear and vivid form, one of what seem simultaneously possible objects or trains of thought." Despite its recognized importance as an underlying determinant of cognition and experience, attention as an entity initially was not conceptually operationalized, and consequently lost its popularity in experimental psychology. In the 1950s, new perspectives concerning attention were developed which took into consideration the individual's conscious control of information processing.

Early models of attention (Broadbent, 1958; Deutsch & Deutsch, 1963; Welford, 1952) regarded attention as a fixed-capacity resource which was positioned as a single, complete entity, at a particular stage of the information processing system. Although these models differed

as to the specific location of the attentional mechanism, each suggested that the function of attention was that of a filter, responsible for selecting the particular input that required an increased mental focus for further perceptual discrimination. Although similar in principle to these early models, Keele's model (1973) suggested that the selective attention function operated later in the response phase (memory) of the system, facilitating response selection, rather than input selection.

Later models of attention (Kahneman, 1975; Moray, 1970) have suggested that although there is a general, quantitative limit to one's attentional capacity in performing mental work, attention is a dynamically-constructed, and flexibly-allocated resource which can be distributed freely between or among concurrent inputs or operations. According to Gentile, Higgins, Miller, and Rosen (1975), and Kahneman (1975), task difficulty and complexity may vary among different activities. Depending upon the exact attentional demands of the task, a specific number of attentional units are presumably drawn from a differentiated pool of mental effort in an attempt to match the environmental demands, and subsequently facilitate the ensuing perceptual-motor performance. If the attentional capacity or pool is depleted, information processing is impaired. The limiting factor is not in the neurological "hardware," but instead in the processing "software." Research supporting Kahneman's 1975 model implies that the individual holds a much greater responsibility for the control of attention by focusing, dividing, allocating, and distributing it to specific components within the information processing system (Allport,

Antonis, & Reynolds, 1972; Navon & Gopher, 1979). Conscious control is characterized by time-sharing strategies utilized for effective processing.

Despite the lack of theoretical consensus among researchers in defining attention, there are common characteristics of attention that are more largely suggested by all the theories. The ability to allocate attention to either single or multiple locations suggests that attention is characterized by the dimension of size or capacity. This aspect has been referred to as attentional distribution (Carver & Scheier, 1981) and attentional width (Nideffer, 1981). Nideffer (1981) defines width of attention as the amount of information that is received by an individual. Within this dimension, attentional focus is either broadened to accommodate multiple inputs or narrowed in a more concentrated form to operate on a single input. Broadening one's attentional focus has been described by Gallwey (1974) as letting the mind touch a number of stimuli with a certain degree of evenness. In contrast to a broad attentional focus, concentrating solely on one stimulus in a more singular manner requires narrowing of attentional focus to the neglect of those stimuli in the attentional periphery.

Reis and Bird (1982) have successfully tested predictions stemming from Nideffer's (1981) width construct. In their study, subjects were administered Nideffer's (1976) Test of Attentional and Interpersonal Style (TAIS), an instrument designed to measure an individual's ability to manipulate their attentional focus is profiled. Reis and Bird (1982) found that subjects who scored toward the broad

end of the width continuum, labelled broad-attenders, significantly ($p < .05$) outperformed narrow-attenders on a task which involved peripheral vision for signal detection followed by a reaction time response. This study provides some experimental evidence for the validity of the width construct of attentional focus.

A second characteristic of attention that has been identified experientially and experimentally is the dimension of attentional direction (Nideffer, 1981). Within a person's subjective, conscious experience attention appears to be dynamic in nature. That is, there is an apparent move or shift of attentional focus in an order or sequence, from one or more factors to another factor. The information processing system isolates certain stimuli to allow for more detailed processing of selected input. Within the domain of all information available to awareness, a dichotomy exists which takes into consideration the point of the stimulus origin (Carver & Scheier, 1981b). While a great amount of behavior-shaping information originates from the external environment, a substantial portion of information is gathered from those internal stimuli emanating from within the person (Lewis & Brooks, 1978; Raye, Johnson, & Taylor, 1980). As suggested by Nideffer (1981), one's attentional focus can either be internalized or externalized.

Researchers in social psychology (Duval & Wicklund, 1972) have defined the phenomenon of internal/external attentional focus in terms of the objective/subjective state of self-awareness that is generated within an individual. More recently, other social psychologists

(Carver & Scheier, 1981) have referred to the internal focus of attention as self-focused attention.

Self-Focused Attention

James (1980) analyzed in depth the structure of the multifaceted self. He proposed that the self, as a whole entity, could be divided into three general, but distinct subcomponents: (a) material self, (b) social self, and (c) spiritual self. The material self includes such aspects as the body, family, and home. These physical elements are contrasted to the more abstract elements of values, attitudes, or behavioral standards which comprise the second dimension, the social self. The spiritual self completes the triad. This is a more encompassing construct which includes the private and personal thoughts and feelings of the person.

Because the work of James (1890) was at the descriptive level, the concept of the self as an entity was not originally examined extensively through experimental study. However, later discussion (Mead, 1934) regarding the nature of the self within the context of self-awareness and self-consciousness suggested that the self as a construct was unique in the sense that the person has the ability to look at the self as an object of observation. Schutz (1945) similarly suggested that when attention is turned upon the self, the subsequent state of self-awareness is accompanied by the feeling of being broken or splintered into different self elements. Attention is focused on that particular aspect of the self which is most relevant to the immediate

situation and context. Investigation specific to self-image, self-esteem, self-concept, self-evaluation, and self-consciousness has seemed to lend support to the notion that one's self is comprised of different elements (Wylie, 1961).

The systematic manipulation of attentional focus (Duval & Wicklund, 1972; Wicklund & Duval, 1971) was initially based on the assumption that certain environmental stimuli (TV camera, mirror, voice recording) would serve to intuitively remind subjects of themselves. However, documented evidence for the validity of the self-focus construct did not begin to appear until this construct was tested in later studies (David & Brock, 1975; Carver & Scheier, 1978).

In an experiment by Davis and Brock (1975), two groups of subjects (n = 49) from a mixed-gender pool were presented with a series of sentences written in unfamiliar foreign languages and were then asked to guess which English pronoun corresponded to the targeted foreign pronouns. The authors assumed that under conditions of increased self-focus, subjects would be more disposed to choose self-relevant words. The results confirmed the prediction. Under self-focused conditions (TV camera or mirror directly facing the subject), subjects guessed a greater number of first person pronouns than those subjects in the control condition (no mirror, no TV camera).

In a similar study (Carver & Scheier, 1978), two groups of female subjects (N = 79) were asked to complete an egocentricity measure (Exner, 1973) that involved a sentence completion task. Responses

were scored to reflect either an individual's self-focus or external-focus. In accordance with predictions of Duval and Wicklund's (1972) theory of objective self-awareness, those subjects who completed the task in the presence of self-focusing stimuli (mirror) responded with a greater proportion of self-relevant words.

As pointed out by theorists (Carver & Scheier, 1982; Wicklund & Duval, 1971), it is important to recognize attentional focus as being relative and not absolute in nature. To speak of increased internal focus, increased objective self-awareness, or increased self-focus (as opposed to external, environmental focus), is to suggest only that a greater proportion of time is spent in that state than is normally experienced during the behavioral situation in study.

It was not until 1972 that Duval and Wicklund expanded upon the distinction of self-focused attention and proposed their theory of objective self-awareness. The theory states that once one's attention is brought to bear directly on the self as an object of observation, an enhanced self-realization occurs with a subsequent state of self-analysis. This claim is based on four assumptions: (a) attention may be self-focused or environmentally-focused; (b) when attention is brought to bear on the material self (the body), the person is increasingly prone to focus on other self-components which can be aspects of the material, social, or spiritual self; (c) once self focused attention comes into play, attention will then be focused on whatever feature of the self is most salient, and not on the entire self; and (d) once attention comes to bear on a specific dimension of the self,

self-analysis begins. In sum, Duval and Wicklund propose that the self will be engaged as a more significant determinant of behavior when it is viewed as the object rather than the subject of observation.

Since the introduction of self-awareness theory, social psychologists (Duval & Wicklund, 1972; Ickes, Wicklund, & Ferris, 1973; Liebling & Shaver, 1973; Pryor et al., 1977; Scheier, Carver, & Gibbons, 1981) have investigated the experiential and behavioral consequences of self-focused attention. The predicted effect that increased self-focused attention would lead to an enhanced sensitivity to internal states (emotional and physiological) has been examined in several studies. Scheier and Carver (1977) conducted two experiments to investigate the effect of self-focused attention on affective reactions to the emotions of attraction, repulsion, elation, and depression. In the first experiment, two groups of male subjects ($N = 27$) were asked to view and rate slides of nude women in the presence of: (a) a mirror, or (b) no mirror. As predicted, subjects in the mirror condition rated the slides significantly ($p < .025$) higher in attractiveness than subjects in the no mirror condition. In the second experiment, two groups of subjects ($N = 30$) from a mixed gender pool were exposed or not exposed to a mirror and asked to read a series of statements which became either increasingly positive or negative. Following the reading, they rated their response to the induced affect, as measured by a 10-item mood rating scale (Velten, 1968). Consistent with predictions of self-awareness theory, self-focused attention significantly ($p < .05$) heightened sensitivity to mood.

A study was conducted by Scheier, Carver, and Gibbons (1981) to investigate the effect of self-focused attention on subjects' reactions to fear. Male and female subjects (N = 68), classified as either phobics (n = 34) or nonphobics (n = 34), were asked to approach and hold a nonpoisonous snake in the presence of: (a) a mirror or (b) no mirror. Results revealed that for the phobic group, mirror presence lead to an earlier withdrawal from the approach attempt than for the nonphobic group. Scheier et al. (1981) concluded that exposure to the mirror, and the resultant behavior opposite to that requested by the experimenters was a significant finding. This study provided evidence that conditions of self-focused attention might also inhibit behavior.

An experiment by Gibbons, Carver, Scheier, and Hormuth (1979) assessed the role of self-focused attention in reactions to a placebo. The authors tested the hypothesis that the mirror-induced self-focus would minimize a suggested placebo affect. Of the 38 female subjects who ingested the placebo, one half (n = 19) were lead to believe that the drug would produce arousal symptoms. As measured by three questions regarding experience of arousal, mirror subjects reported significantly ($p < .01$) less arousal than did th no mirror subjects. Thus, self-focused attention produced: (a) less suggestibility affect, and (b) a more accurate self-report.

A study by Wegner and Giuliano (1980) was designed to determine whether increasing the general state of arousal would result in increased self-focused attention. Thirty male and female college

students were divided into three groups (n = 10) and then exposed to a treatment designed to vary their arousal level. The hypothesis that was tested stated that increased arousal would be accompanied by a corresponding increase in self-focused attention. Treatment groups were: (a) relaxation (reclining in a lounge chair), (b) normal (sitting in a chair), and (c) arousal (running in place). The duration of each treatment was 2 minutes. The simple heart rate measure chosen to test the arousal manipulations revealed that although running in place produced greater arousal than sitting in a chair, reclining in a lounge chair did not reduce arousal below the level experienced while sitting. Level of self-focused attention, as measured by the number of first person pronouns chosen to complete a series of sentences was: (a) significantly ($p \leq .05$) different in the expected direction between the arousal and normal groups, and (b) significantly ($p \leq .05$) different between the normal and relaxation groups. The authors noted that although the expected difference in arousal effects between the two sedate groups did not occur, the treatment effects on self-focused attention were significant.

Additional research in social psychology has demonstrated that increased self-focused attention enhanced subjects' sensitivity to existing discrepancies between their actual behavior and experimentally-established standards for the same behavior (Carver & Scheier, 1979). Research by Wicklund and Duval (1971) demonstrated that during conditions of increased self-focused attention, subjects (N = 20) were more easily persuaded to alter their personal opinions

and attitudes to more closely conform to experimentally-suggested standards which were in opposition to their own. Perhaps of more importance, however, was evidence to suggest that during conditions of increased self-focused attention (N = 125), with positive outcome expectancies, subjects' overt responses to perceived actual to ideal behavioral discrepancies tend to concur with the experimentally suggested standard (Carver, Scheier, & Gibbons, 1981). Carver and Scheier (1981) suggested that increased self-focused subjects attempt to reduce behavioral discrepancies through a greater frequency of comparison between actual and ideal performance. Research by the same theorists (Carver & Scheier, 1983) has demonstrated that self-focused attention increased subjects' tendencies to seek out information about reference performance norms.

Other research has examined the effect of self-focused attention on task performance (Wicklund & Duval, 1971; Liebling & Shaver, 1973). Wicklund and Duval (1971) asked two groups of female undergraduates who were either in the presence (n = 16) or not in the presence (n = 16) of a mirror, to copy German prose for 5 minutes. Performance was measured as the number of letters copied by each subject. The study tested the hypothesis that increased self-focus would cause the subject to focus on herself as an object, evaluate her task performance, and increase efforts to perform well. As was expected, there was a significant ($p \leq .05$) increase in the amount copies in the mirror condition as compared to the no mirror condition.

In a similar study, Liebling and Shaver (1973) investigated self-focused attention, task performance, and level of evaluation.

Using four groups of female subjects ($\underline{n}$ = 10), and a task of copying Swedish prose, the investigators found that while low-evaluation subjects performed better during conditions of increased self-focus, the high evaluation subjects' performance was impaired during increased self-focus conditions. In a subsequent paper, Carver and Scheier (1981a) attributed the results of Liebling and Shaver (1973) to the possibility that self-focused attention causes subjects to temporarily interrupt their behavior to assess their outcome expectancy. This interruption, which they conjectured would most likely occur in highly evaluative situations, can differentially affect task performance depending upon whether the subject perceives the outcome expectancy as being either: (a) negative, leading to a subsequent behavioral withdrawal, or (b) positive, causing an increased persistence on the task (Carver, 1979).

Although a review of the literature seems to suggest some general effects of self-focused attention on task performance, no literature specific to self-focus effects on the performance of perceptual-motor tasks with different attentional demands appears to be available. The importance of appropriate attentional allocation during the performance/learning of perceptual-motor tasks has been suggested by several researchers (Gentile, 1972; Poulton, 1957; Whiting, 1972), with special consideration for the nature of the performer, the task/movement demands, and the environmental characteristics of the task situation.

Attention and the Nature of the Task

Poulton (1957) has suggested that tasks might be classified according to the characteristics of the context or environment within which they are performed. He described dynamic environments as being "open" in nature, as contrasted to static environments that are "closed." Open situations are characterized as having components of spatial/temporal variability that can generate uncertain environmental conditions with which a performer must contend. Closed environments have more stable conditions that present the performer with spatial variability only.

Gentile, Higgins, Miller, and Rosen (1975) extended Poulton's (1957) thinking and proposed a perceptual-motor taxonomy based on the nature of both the environmental and movement demands possible in a task. In relating task differences, levels of skill, and information processing theory, Gentile (1972) suggested that, for open situations, performers must diversify their response to match the varying demands presented by the changing environment. In closed situations, however, movements must be consistently uniform in pattern to match a single set of more stable environmental demands. Gentile (1972, p. 6) proposed that within the total body of stimuli that impinge upon an individual at any moment, those which provide information relevant to the achievement of a desired goal are "regulatory cues." Attention to these regulatory cues enables a performer to formulate an effective movement plan to match the environmental conditions present in the task. Gentile further contended that the changing regulatory cues for

open tasks lie primarily in the external environment (KR) as contrasted to the changing regulatory cues in closed tasks which fall primarily in the internal sensory cues emanating from the movement (KP).

The use of internally generated information during the performance of a perceptual-motor task was investigated by Fleishman and Rich (1963). They assessed the kinesthetic sensitivity (weight discrimination task) and spatial ability (United States Air Force Aerial Orientation Test) of 40 male subjects and then used the measures of these abilities to assign subjects to one of four groups: (a) high kinesthetic, (b) low kinesthetic, (c) high spatial, or (d) low spatial. All subjects were tested over 40 trials on a two-handed coordination task. The task required the subjects to keep a target follower on a small target disc as the target moved randomly around a circular plate. Movement of the target follower was controlled by two lathe-type handles the combined actions of which resulted in target follower movement in different directions. Performance was measured in terms of time on target for a trial. The results indicated that early in practice the high spatial group performed significantly ($\underline{p} < .01$) better than the low spatial group. After 40 trials, however, the performance of the same two groups was virtually equivalent. This suggested that the use of visual information may be most important early in practice. The results also revealed that, early in practice, the performance of the high and low kinesthetic groups was not significantly ($\underline{p} < .01$) different. However, after 40 practice trials, the performance of the

same two groups differed significantly ($p < .01$) with the high kinesthetic group having higher time on target scores than the low kinesthetic group. These results suggest that with practice, the ability to use kinesthetic information becomes more important to successful task performance. The data further suggested that performers utilize spatial (external) and kinesthetic (internal) information to a different extent after they have gained some task mastery through practice. According to Fleishman and Rich (1963, p. 10), psychomotor abilities can be thought of as the "capabilities for using different kinds of information." This claim supports the earlier notion of Fleishman and Hempel (1955, p. 312), that with practice at a task, "from the point of view of the subject, the nature of the task changes."

One implication of Gentile's model (1972) for the learning/performance of open and closed tasks is that depending on the type of task to be performed, focus of attention must be directed to the important regulatory cues that provide critical information about: (a) the spatial/temporal variability of the external environment, or (b) the temporal variability of the movement itself. Experimental support for Gentile's predictions has been provided for both open tasks (Beitel, 1980; Beitel, 1983; Del Rey, 1971), and closed tasks (Beitel, 1980; Del Rey, 1971; Del Rey, 1972; Rothstein & Arnold, 1976).

Extending the work of Fleishman and Hempel (1955) and Gentile et al. (1975), Beitel (1980) investigated the contribution of visual-perceptual abilities to the performance of perceptual-motor tasks

with: (a) spatial or spatial/temporal environmental demands, and (b) total body transport movement demands. Data estimating five visual-perceptual abilities were collected on 80 female subjects and interrelated to early and late practice stages of both the open and closed task. Consistent with Fleishman's earlier findings (1955), the results indicated that the contribution of independent visual-perceptual abilities to successful task performance diminished with practice on both types of tasks.

In a later study, Beitel (1983) examined the effect of different types of augmented feedback on the learning/performance of an open task with practice. The self-paced, complex soccer task required subjects to dribble, pass, and receive a ball as quickly as possible through a fixed environment. Between practice trials, subjects received augmented feedback from one of eight treatment conditions. Feedback factors consisted of: (a) focusing attention in one of four ways (KP, KR, KP/KR, or no focus), and (b) viewing videotape replay of their performance (yes or no). Performance measures were recorded over 18 trials for: (a) length of time to complete the task, and (b) the subject's accuracy in assessing the degree to which they achieved the desired movement (KP), and the goal (KR). The results indicated that, over four blocks of practice trials, focus of attention was the most critical feedback factor. At blocks three and four, all three focused-attention groups were significantly ($p \leq .01$) more accurate in assessing the degree to which the desired movement was achieved (KP). At block four, the KR and KP/KR feedback groups

assessed their goal attainment (KR) with greater accuracy ($p \leq .01$) than did either the KP or control feedback groups. Videotape viewing proved to be most effective feedback when combined with attention focused on KR. Beitel (1983) suggested that these findings provide further support for Gentile's (1972) projections concerning selective attention and environmental demands of tasks.

Del Rey (1970) provided augmented knowledge of performance through videotape replay to subjects who performed a modified fencing lunge during either open or closed conditions. These experimental feedback conditions were replicated in a later study (Del Rey, 1971) and supplemented with teacher cueing for the purpose of focusing the performer's attention more directly toward the critical regulatory cues within the lunge movement. Data collected on the dependent performance variables of form, accuracy, and response latency revealed that augmented knowledge of performance (KP) yielded better form and accuracy scores during closed conditions than during open conditions. Therefore, Del Rey (1970) suggested that augmented KP is the most effective type of information feedback in closed task situations.

Using a content analysis to investigate the effect of videotape feedback in teaching motor skills, Rothstein and Arnold (1976) found that the effectiveness of videotape viewing appeared to be related to: (a) the performer's level of skill, and (b) teacher cueing. According to the authors, intermediate and advanced performers appear to benefit more from videotape replay than do beginning performers during normal viewing conditions. However, beginners gain more from

viewing the replay when verbal cues are added to direct their attention to the regulatory cues of the performance. A more focused synthesis (Rothstein & Arnold, 1976) which investigated the effect of videotape replay on bowling performance/learning revealed that learners who had their attention focused on relevant cues in the environment (target spot) were more effective than those who did not. It is important to note that subjects in these studies (Church, 1963; Cox, 1963) bowled at the beginning skill level. Polvino (1970) and Hoff (1969) investigated the effectiveness of videotape replay in providing feedback regarding characteristics of the movement response. They found no difference between the performances of those subjects who did or did not watch videotape replay. No teacher cueing was utilized to direct attention in either study. However, when teacher cueing was combined with videotape replay (Kraft, 1972), bowling performance improved. Rothstein and Arnold (1976) summarize these findings to suggest that bowling performance/learning depends upon the performer's ability to selectively attend to information feedback about the movement (KP) and the outcome of the movement (KR).

Taken together, research on attention reviewed in this chapter suggested that the utilization of empirically validated attentional manipulation techniques in motor behavior research is possible. Such methodology may provide a new perspective to assessment of the nature of the task attentional demands of selected perceptual-motor tasks. Establishing defined attentional contexts within which open or

closed tasks are performed/learned, in addition to taking into consideration individual differences in the amount of time spent practicing a task may reveal new information regarding the dynamics of the attentional construct.

CHAPTER III

PROCEDURES

The following methodological procedures were utilized during this study: (a) selection of subjects, (b) selection of task and measures, (c) task administration, and (d) data analysis. A detailed description of each of the above procedural aspects is discussed separately in this chapter.

Selection of Subjects

Subjects were 64 male college-age students enrolled at the University of Tennessee, Knoxville. Each subject was assigned to one of two bowling skill groups. The groups were classified according to performance norms established for college men enrolled in university elective bowling programs (Martin, 1963). Subjects assigned to the beginning group held a current (i.e., at the time of data collection) average of 130 pins or less. Advanced bowlers had an established bowling average of 150 pins or greater. Bowling averages utilized for subject classification were determined by the following criteria: (a) subject self-evaluation of previous performance, and (b) demonstrated ability as exemplified by either in-class averages established not more than 6 weeks prior to the beginning of the study or team tryout, and league averages established not more than 6 weeks prior to the beginning of the study. For each subject, bowling averages for ten games were utilized to determine demonstrated ability.

Beginning bowlers were randomly selected from students enrolled in elective elementary and intermediate bowling classes at the University of Tennessee, Knoxville. Advanced bowlers were randomly selected from the pool of candidates trying out for positions on the University of Tennessee men's bowling team in addition to bowlers who were registered and regularly participating in campus bowling leagues.

A letter of explanation and a consent form (Appendix A) were given to each subject prior to participation in the study. Signed consent forms were collected and kept by the investigator.

Selection of Task and Measures

It was the intent of this study to investigate the effect of various types of attentional focus on the performance of a selected closed motor task. The perceptual-motor task chosen for this study was bowling. The primary task analyzed was the rolling of a ball toward a full, 10-pin set-up. Such a task is analogous to the first ball rolled in each frame in the sport of bowling. The primary goal outcome in bowling is to maximize pin fall for each and every ball rolled. To meet this objective, a bowler must visually fixate on the target spot over which the ball must be rolled. Although this exteroceptive processing may be viewed as a viable attentional focus (Higgins, 1972), it is equally necessary for the bowler to concurrently monitor postural alignment and limb manipulation throughout the approach, delivery, and release. Awareness of proprioceptive and kinesthetic information for bowling is especially important because of: (a) the atypically

heavy weight of the bowling ball (relative to other tasks involving ball skills); and (b) the high degree of precision and consistency with which the bowler must roll the ball. Consequently, competition for attentional time or capacity is strong, demanding the most careful and appropriate distribution of attention to both internal and external information sources to facilitate both body balance and target accuracy. Bowling provides the type of task (i.e., closed task with an external target to be hit by a projected object) which might be predicted to be most sensitive to an imposed shift in attentional focus; with observable performance effects being most pronounced due to the delicate balance of the attentional demands of the task. Distinguishing two groups of task mastery (high and low) within each treatment condition (focus of attention) allowed for an assessment of Fleishman and Rich's (1963) assertion that differences in levels of task mastery would be reflected by the degree to which sensitivity to kinesthetic (internal; KP) and spatial (external; KR) information affects task performance.

The four specific treatment conditions were: (a) augmented self-focused attention, as mediated by taping the subject's task performance with a videotape camera and television monitor (VTR), (b) augmented knowledge of performance as mediated through the subject's monitoring and written assessment of their task performance (KP), (c) augmented environmental-focused attention, as mediated by the subject's observation and written assessment of the results of their task performance (KR), and (d) no attentional focus control group, in

which no taping or written assessment was administered. The first two conditions were designed to elicit an increased internal focus and a greater sensitivity to sensory information (temporal organization) originating from inside the subject. The augmented environmental-focused attention condition was designed to elicit an increased external focus, and a greater sensitivity to sensory information (spatial organization) originating from outside the subject. The control group was included to provide baseline data during conditions where no augmented focus of attention was provided.

Two performance scores for each subject were recorded for each trial. Pinfall was measured as the number of pins knocked down on the first roll for each of 30 frames. Distance from the intended target was measured as the distance, to the nearest board, from which the middle of the ball deviated from the target arrow or target board over which the subject was aiming. Collecting data on only the first ball was used as a control for task difficulty and uniformity across all trials. Individual performance scores were averaged over six blocks of five trials each. Each subject executed all trials on the same bowling lane to control for lane conditions. The board error scores were measured by the researcher with reliability greater than 90%.

Task Administration

Prior to the testing session, the investigator collected background information on each subject regarding level of task mastery. Each of the 64 subjects was first categorized as either a beginning or advanced

bowler as determined by prior self-evaluation and established bowling averages collected by the investigator. The two task mastery groups were equal in size (n = 32). Within each level of task mastery, subjects were randomly assigned to each of the four groups. The three experimental conditions were: (a) augmented self-focused attention, as mediated by the presence of a videotape camera and television monitor, (b) augmented knowledge of performance, as mediated by the completion of a questionnaire monitoring knowledge of performance (Appendix D), and (c) augmented environmental-focused attention, as mediated by the completion of a questionnaire monitoring knowledge of results (Appendix E).

The testing sessions were conducted at the University of Tennessee, Knoxville, bowling lanes. Each subject was tested individually in one 30 to 45 minute session as scheduled by the investigator. Upon entering the bowling area, the subject was given bowling shoes and asked to select a ball of their choice. They were directed to the appropriate bowling lane and given directions from the investigator regarding the components of their task (Appendix B). Each subject warmed up by rolling five balls without score. They then rolled 30 balls following the procedures designated by the particular treatment as follows.

Self-Focused Attention (VTR)

A videotape camera was located immediately behind the scoring table (Appendix C). The camera was pointed in a direction such that the camera field of view included: (a) the bowler as he was positioned

on the deck addressing the pins, (b) the bowler's line of approach, (c) the length of the bowling lane including the ten pins, and (d) the scoring table. The television monitor was located immediately adjacent to the scoring table, situated at eye level to each subject as he scored his performance. The television screen was positioned such that the picture was in full view of the subject as he scored his roll and prepared for the next ball. When the subject was ready to roll the ball, and upon a signal from the investigator, the videotape unit was engaged. The subject then proceeded to roll 30 balls, each at a full 10-pin set-up. Between rolls, the subject moved to the scoring table and recorded his pinfall score for the ball just completed. During this time, the investigator recorded performance scores and then, if necessary, activated the reset cycle in preparation for the next roll. Following the completion of 30 rolls the session was concluded.

Augmented Knowledge of Performance (KP)

Each subject rolled 30 balls, each at a full 10-pin set-up (Appendix C). Between each roll, they returned to the scoring table, recorded the pinfall for that roll, and responded to four questions assessing knowledge of performance for that particular trial (Appendix D). During that time, the investigator recorded performance scores and then, if it was necessary, activated the reset cycle in preparation for the next roll. Upon the subject's completion of 30 rolls, and the completion of the knowledge of performance questions for all trials, the session was concluded.

Augmented Environmental Focused Attention (KR)

Each subject rolled 30 balls, each at a full 10-pin set-up (Appendix C). Between each roll, he returned to the scoring table, recorded the pinfall for that roll, and responded to four questions assessing knowledge of results for that particular trial (Appendix D). During that time, the investigator recorded performance scores and then, if it was necessary, activated the reset cycle in preparation for the next roll. Upon the subject's completion of 30 rolls, and the completion of knowledge of results questions for all trials, the session was concluded.

Control (C)

Each subject rolled 30 balls, each at a full 10-pin set-up (Appendix C). Between each roll, he returned to the scoring table, and recorded the pinfall for that roll. During that time, the investigator recorded performance scores and then, if necessary, activated the reset cycle in preparation for the next roll. Upon the subject's completion of 30 rolls the session was concluded.

CHAPTER IV

ANALYSIS OF THE DATA

The primary purpose of this study was to examine how augmented focus of attention affects perceptual-motor skill performance with practice for individuals who differ in task mastery. Within both levels of task mastery, the data analyses included: (a) a one way (focus of attention) analysis of variance (ANOVA) on bowling averages to determine whether there were significant ($p \leq .05$) pre-experimental performance differences among treatment groups; (b) an a priori Bonferroni test (Hays, 1981) of planned comparisons to identify whether significant ($p \leq .03$) differences in pinfall and/or distance from target existed between the knowledge of results attentional focus group and each of the three other treatment groups; (c) application of the Geisser-Greenhouse conservative F test (Kirk, 1968) to the within group factors of the split plot factorial (4.6) analysis of variance (ANOVA); (d) a post-hoc simple main effects procedure for further analyzing any significant ($p \leq .05$) within group main or interaction effects; and where appropriate, (e) calculation of the percent of variability accounted for by the significant effects. The results were organized in relation to: (a) the level of task mastery which included beginning and advanced levels, and (b) the between group and within group main and interaction effects for the two dependent performance variables which included distance from the target and pinfall. The overall alpha level (.03) for the a priori test was predetermined by the

decision to examine three individual contrasts with the Bonferroni method of analysis. The level of significance selected for the analysis of variance was .05.

For both levels of task mastery, the one-way ANOVA on pretest scores revealed no significant ($p \leq .05$) differences in bowling performance among focus of attention groups. The ANOVA source of variance model and means for pretest bowling averages for beginners is presented in Tables 1 and 2 respectively. The ANOVA model and table of means for the advanced group are presented in Tables 3 and 4 respectively.

Table 1

Pretest Scores ANOVA Table for Beginning Bowlers

Source	df	Sum of Squares	F	PR > F
Focus of Attention	3	19.63	0.09	0.96
Error	28	2004.25		

Table 2

Pretest Means of Focus of Attention for Beginning Bowlers

Focus of Attention	Mean Average
Knowledge of Performance (KP)	122.38
Knowledge of Results (KR)	121.25
Self-focus (VTR)	123.00
Control (C)	121.13

Table 3

Pretest Scores ANOVA Table for Advanced Bowlers

Source	df	Sum of Squares	F	PR > F
Focus of Attention	3	5.38	0.02	0.99
Error	28	3177.50		

Table 4

Pretest Means of Focus of Attention for Advanced Bowlers

Focus of Attention	Mean Average
Knowledge of Performance (KP)	161.50
Knowledge of Results (KR)	162.25
Self-focus (VTR)	162.25
Control (C)	162.50

Beginning Level of Task Mastery

Between Group Factors

The Bonferroni planned comparisons were performed on the dependent measures of distance from target (Table 5) and pinfall (Table 6) to identify performance differences between the group who received augmented attentional focus to knowledge of results (KR) and the groups who received augmented attentional focus to knowledge of performance (KP), to the objective self (VTR), or to no directed source of information (control). The results revealed that the KR treatment group had significantly ($F_{1,28} = 10.13$, $p = .004$) better accuracy than the control group and accounted for 57% of the variability in the attentional focus treatment condition. There were no significant differences in accuracy scores between the KR attentional focus group and the KP or VTR groups (Figure 1). The results also indicated that there were no significant differences in pinfall scores among the four attentional focus groups (Figure 2). These findings lend only partial support to the hypothesis that beginners who received the augmented KR attentional focus would have significantly better performance than beginning bowlers who received the augmented KP, VTR, or control attentional focus. Utility indices (Dodd & Schultz, 1973; Gaeblein & Soderquist, 1974) indicated that for distance from target, the percentage of variability accounted for by focus of attention was 7%. The means and standard deviations for pinfall and distance from target measures for the beginning group are presented in Appendix G.

Table 5

Distance from Target Bonferroni Table for Beginning Bowlers

Focus of Attention	Mean Boards from Target		F^a	PR > F	% of var
Knowledge of Results (KR)	1.07	(0.51)			57.5
Knowledge of Performance (KP)	1.46	(0.62)	3.50	.065	.5
Self-focused (VTR)	1.44	(0.56)	3.20	.071	.1
Control (C)	1.23	(0.89)	10.13	.004	41.9

[a] F reflects the contrast of that group to the KR group

Table 6

Pinfall Bonferroni Table for Beginning Bowlers

Focus of Attention	Mean Pinfall		F^a	PR > F	% of var
Knowledge of Results (KR)	7.88	(0.72)			14.0
Knowledge of Performance (KP)	7.83	(0.97)	0.05	.994	27.2
Self-focus (VTR)	7.38	(1.01)	3.07	.074	56.8
Control (C)	7.62	(0.93)	0.83	.401	2.0

[a] F reflects the contrast of that group to the KR group

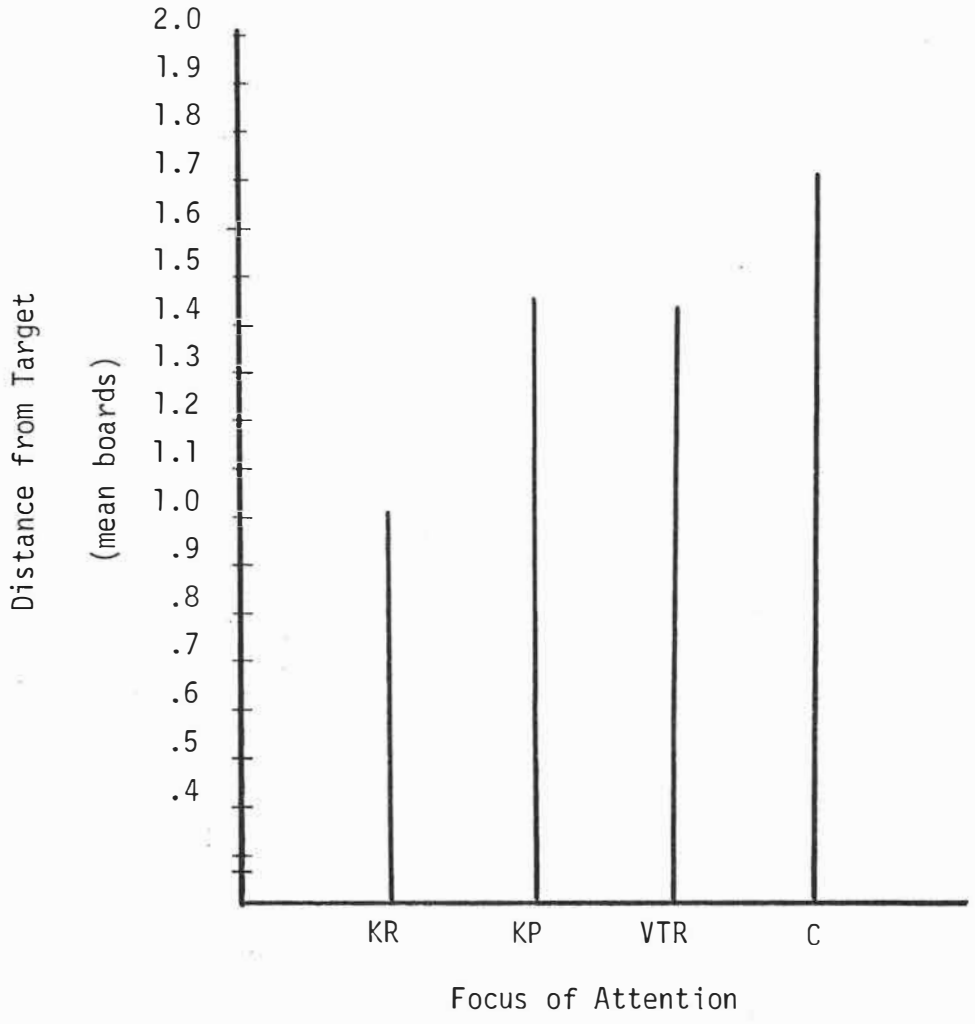

Figure 1. Beginning bowlers focus of attention main effect for distance from target.

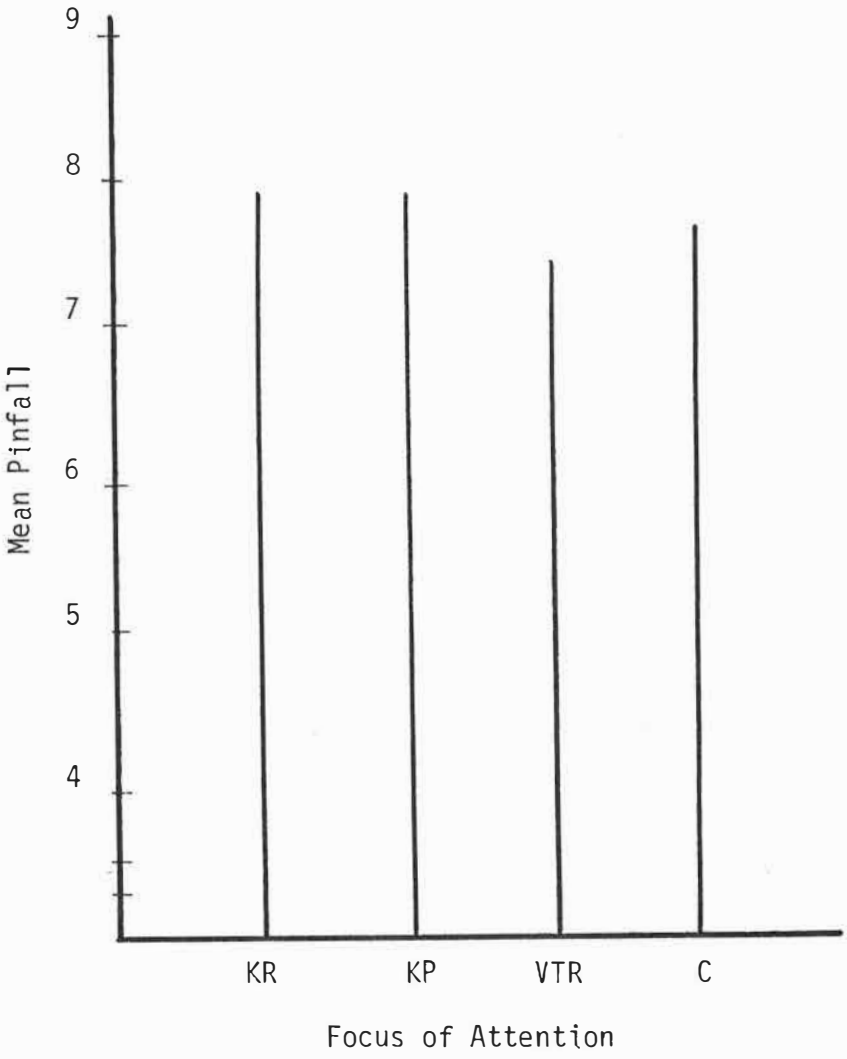

Figure 2. Beginning bowlers focus of attention main effect for pinfall.

Within Group Effects

The application of the Geisser-Greenhouse conservative F test to the within group portion of the split plot factorial (4.6) analysis of variance revealed that there were no significant ($p \leq .05$) main (blocks) or interaction (blocks x attentional focus) effects for distance from target (Table 7) or pinfall (Table 8). Therefore, no simple main effects analyses were performed. Because there were no significant main or interaction effects obtained, the alternative hypothesis which predicted better performance with practice for beginning bowlers who received augmented KR attentional focus as compared to the three other focus groups was not supported. The means and standard deviations for pinfall and distance from target measures for the beginning group are presented in Appendix G.

Advanced Level of Task Mastery

Between Group Effects

The Bonferroni test of planned comparisons (Hays, 1981) was performed on the measures of distance from target (Table 9) and pinfall (Table 10). The results revealed no significant ($p \leq .03$) differences between the mean performance scores of the KR attentional focus group and the KP, VTR, and control groups for distance from target (Figure 3) or for pinfall (Figure 4). However, the difference between the distance from target scores of the KR attentional focus group and the KP focus group approached significance ($F_{1,28} = 5.22$, $p = .038$) with the scores of the KP group ranking highest and accounting for 39% of the variability in the attentional focus treatment condition.

Table 7

Distance from Target ANOVA Table for Beginning Bowlers

Source	df	Sum of Squares	F	PR > F
Between				
Focus	3	10.67	3.40	.0001
S (Focus)	28	29.29		
Within				
Blocks	5	1.72	1.01[a]	>.05
Focus x Blocks	15	3.87	0.76[a]	>.05
S (Focus) x Blocks	140	47.45		

[a]Geisser-Greenhouse conservative F test (Kirk, 1968)

Table 8

Pinfall ANOVA Table for Beginning Bowlers

Source	df	Sum of Squares	F	PR > F
Between				
Focus	3	7.50	1.27	.304
S (Focus)	28	55.12		
Within				
Blocks	5	6.53	2.09[a]	>.05
Focus x Blocks	15	8.27	0.88[a]	>.05
S (Focus) x Blocks	140			

[a]Geisser-Greenhouse conservative F test (Kirk, 1968)

Table 9

Distance from Target Bonferroni Table for Advanced Bowlers

Focus of Attention	Mean from	Boards Target	F[a]	PR > F	% of var
Knowledge of Results (KR)	1.15	(0.63)			39.9
Knowledge of Performance (KP)	0.69	(0.39)	5.22	.038	24.5
Self-focus (VTR)	0.80	(0.42)	2.93	.100	12.1
Control (C)	1.15	(0.00)	0.00	1.00	23.5

[a] F reflects the contrast of that group to the KR group

Table 10

Pinfall Bonferroni Table for Advanced Bowlers

Focus of Attention	Mean Pinfall		F[a]	PR > F	% of var
Knowledge of Results (KR)	8.05	(1.04)			13.7
Knowledge of Performance (KP)	8.35	(0.74)	1.40	.250	64.3
Self-focus (VTR)	8.38	(0.57)	1.65	.276	21.9
Control (C)	8.24	(0.80)	0.60	.464	0.1

[a] F reflects the contrast of that group to the KR group

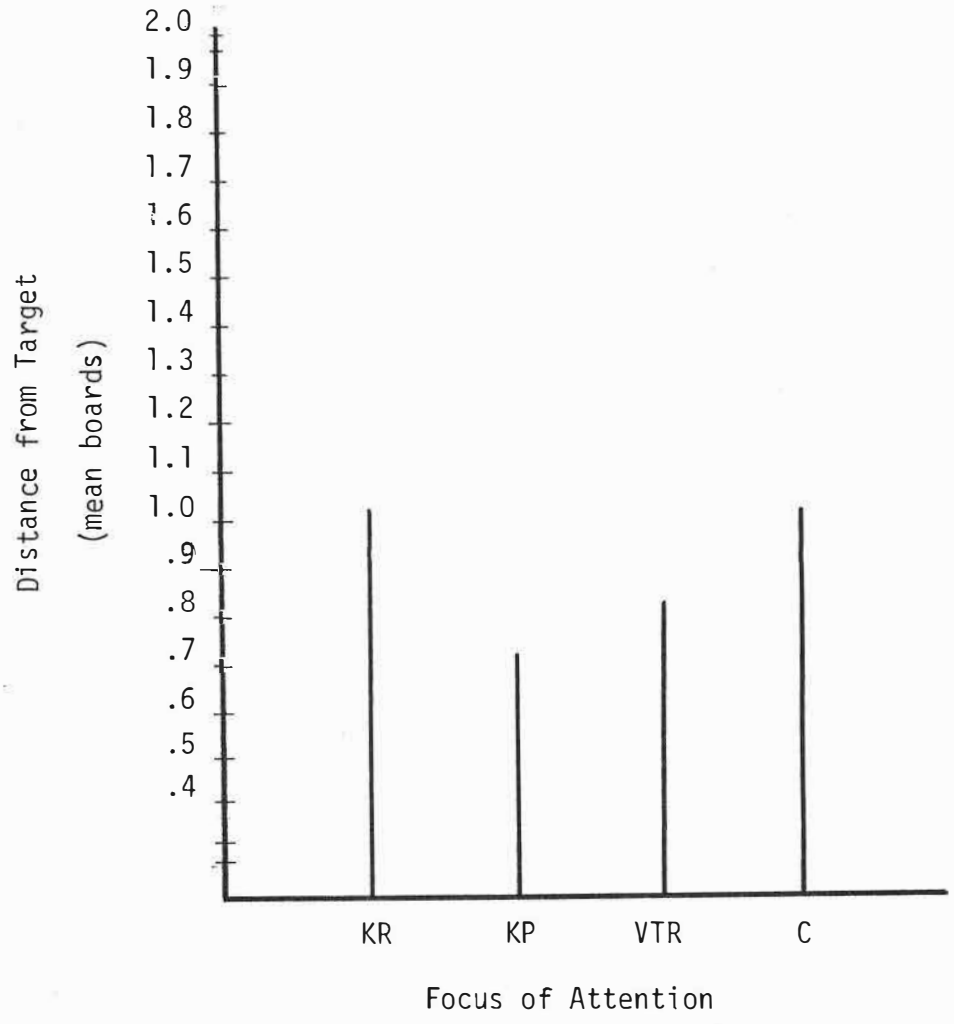

Figure 3. Advanced bowlers focus of attention main effect for distance from target.

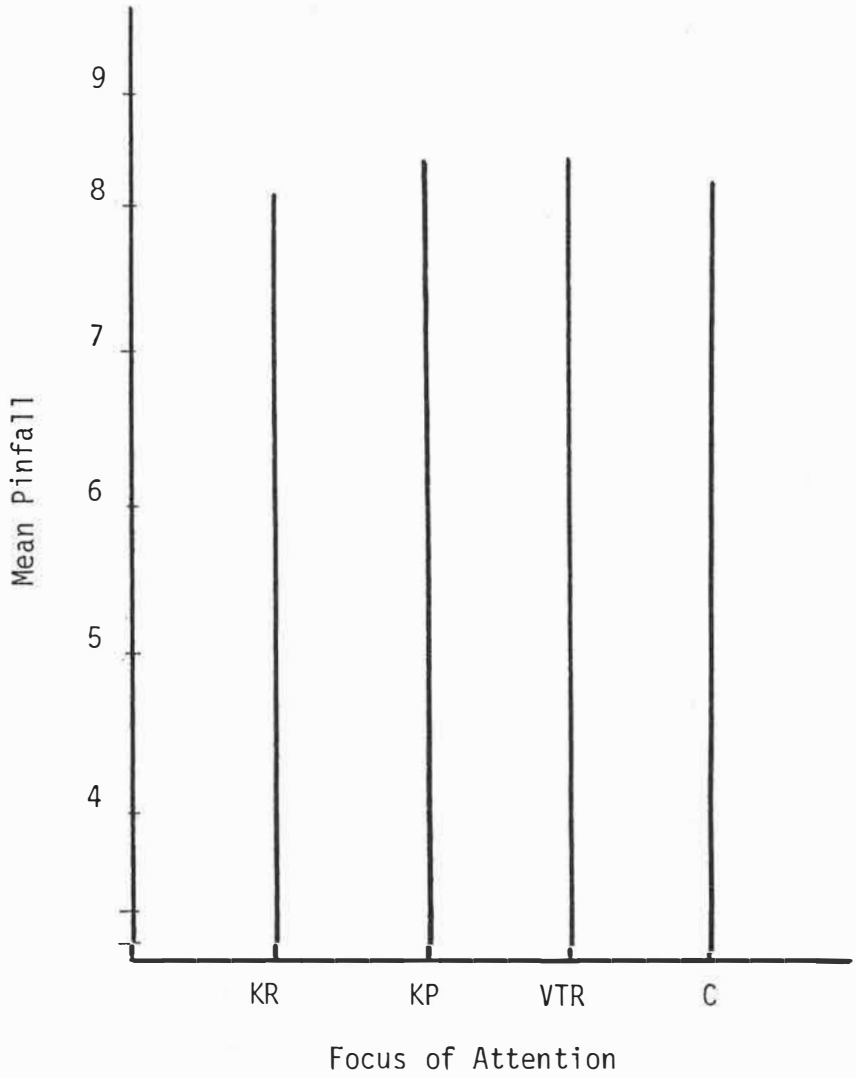

Figure 4. Advanced bowlers focus of attention main effect for pinfall.

Within Group Effects

The application of the Geisser-Greenhouse conservative F test to the within-group portion of the split plot factorial (4.6) analysis of variance indicated that there were no significant main (blocks) or interaction (blocks x attentional focus) effects for either distance from target (Table 11) or pinfall (Table 12). Therefore, no simple main effects analyses were performed. The alternative hypothesis which predicted that the performance with practice of the advanced bowlers who received the augmented KP or VTR attentional focus would be better than the performance with practice of advanced bowlers who received the augmented KR or control attentional focus was not supported. The means and standard deviations for pinfall and distance from target measures for the advanced group are presented in Appendix G.

Table 11

Distance from Target ANOVA Table for Advanced Bowlers

Source	df	Sum of Squares	F	PR > F
Between				
Focus	3	8.09	2.77	.060
S(Focus)	28	27.25		
Within				
Blocks	5	0.96	1.11[a]	>.05
Focus x Blocks	15	2.40	0.92[a]	>.05
S(Focus) Blocks	140	24.32		

[a]Geisser-Greenhouse conservative F test (Kirk, 1968)

Table 12

Pinfall ANOVA Table for Advanced Bowlers

Source	df	Sum of Squares	F	PR > F
Between				
Focus	3	3.15	0.69	.568
S(Focus)	28	42.82		
Within				
Blocks	5	3.07	1.20[a]	>.05
Focus x Blocks	15	4.77	0.62[a]	>.05
S(Focus) Blocks	140	71.57		

[a]Geisser-Greenhouse conservative F test (Kirk, 1968)

CHAPTER V

DISCUSSION

Researchers in psychology (Broadbent, 1958; James, 1890; Kahneman, 1975; Keele, 1973; Mead, 1934) have projected the importance of attention as a critical mediator of conscious performance/learning experiences. Theorists (Kahneman, 1975; Keele, 1973; Moray, 1970) view attention as a dynamic construct which can be selectively allocated to specific internal or external information sources. The importance of the self as a source of behavior-regulating information has been strongly suggested from objective self-awareness theory in social psychology (Carver & Scheier, 1982; Duval & Wicklund, 1972). Studies testing objective self-awareness theory have indicated that increased self-focus produces enhanced self-awareness to such internal perceptual events as: (a) emotional affect, (b) physiological arousal, and (c) behavioral/performance states as referenced against relevant standards of comparison (Carver, 1979; Scheier, Carver, & Gibbons, 1981; Wicklund & Duval, 1971). Additional research (Carver, 1981; Scheier & Carver, 1983) has suggested that increased self-focused subjects, who perceive a discrepancy between their actual behavior and a reference behavior, appear to operate to reduce these differences through: (a) an analysis of self-information, and (b) continued attempts at matching their actual behavior to the standard of behavior. Extensions of objective self-awareness theory have been used to explain task performance facilitation effects for simple novel tasks with

high cognitive components during increased self-focused conditions. Motor behavior researchers and theorists (Del Rey, 1971; Fleishman & Rich, 1963; Gentile, 1972) have called attention to the utilization of internally generated kinesthetic information during the performance of selected perceptual-motor tasks. Based on Poulton's (1951) dichotomy of perceptual-motor tasks, Gentile (1972) proposed a model of skill acquisition that included the prediction that the performance/learning of a closed perceptual-motor task would be facilitated by selectively attending to task-relevant information from regulatory cues. She suggested that for beginners, the critical cues are located in the stable, environmental conditions. In contrast, the critical regulatory cues for the more skilled performer lie within the kinesthetic/proprioceptive information which accompanies the movement. Empirical support for Gentile's (1972) predictions have been provided by studies with closed tasks (Del Rey, 1971; Rothstein & Arnold, 1976) in which the performer's attention was directed to terminal augmented knowledge of performance cues through videotape replay.

Additional research by Fleishman and Rich (1963) indicated that with an open perceptual-motor task that demanded sensitivity to both visual and kinesthetic information, the utilization of kinesthetic information contributed more to successful performance after a period of practice on the task. The results suggested that sensitivity to the movement cues became a more influential determinant of performance after the subjects had gained some level of task mastery.

The review of literature from social psychology on self-focused attention, and from motor behavior on the attentional demands of perceptual-motor tasks suggested the potential of a facilitative effect of augmented attentional focus on the performance/learning of selected sport skills for individuals who differ in their level of task mastery. This study was designed to test the predictions of objective self-awareness theory (Duval & Wicklund, 1972) and skill acquisition theory (Gentile, 1972) for the performance/learning of a closed perceptual-motor task with strong attentional demands from both internal and external information sources.

There were four hypotheses set forth in this study concerning the effects of augmented attentional focus on bowling performance for subjects at the beginning level and advanced level of task mastery. Based upon the literature from motor behavior (Fleishman & Rich, 1963; Gentile, 1972; Rothstein & Arnold, 1976) and social psychology (Carver & Scheier, 1981b; Duval & Wicklund, 1971) it was predicted that for bowlers at the beginning level of task mastery, an augmented attentional focus to knowledge of results would produce: (a) significantly better task performance and (b) significantly better task performance with practice, than would an augmented attentional focus to knowledge of performance, self-focused information, or information utilized in the absence of experimentally augmented attention. In contrast, for bowlers at the advanced level of task mastery, it was predicted that an augmented attentional focus to knowledge of performance or to the self would produce: (a) significantly better task

performance, and (b) significantly better task performance with practice than would an augmented attentional focus to knowledge of results or information utilized in the absence of the experimentally augmented attentional focus.

Performance

Beginning Level of Task Mastery

Although the results of this study did not entirely support the first hypothesis concerning performance of beginners the data analysis revealed a pattern of performance that suggested the potential for future research. The distance from target of beginners whose attention was focused on knowledge of results (KR) was the best of the four focus groups, and significantly better ($p = .004$) than the distance from target of beginners with no experimentally augmented attentional focus (Figure 1, p. 47). There were differences between the distance from target scores of the KR focus group and both the KP focus group ($p = .065$) and the VTR focus ($p = .071$) group (Figure 1, p. 47). Also, by logical deduction from the Bonferroni tests on distance from the target (Table 5, p. 46): if the KR group is not significantly different ($p \leq .03$) from the VTR group (difference = .56); then the VTR and KP groups are not significantly different from the control group (differences = .29 and .27 respectively, Figure 1, p. 47). Therefore the results suggest that an augmented attentional focus that directs the beginner's attention to the environment has more potential to influence performance than one that directs attention to internal cues.

The results seem to concur with research by Fleishman and Rich (1963) which suggested that during the early stages of task mastery, performers depend on visual spatial information to facilitate task performance. The data also provide partial support for Gentile's (1972) predictions which suggest that during a beginning level student's initial attempts at closed performance, the teacher's role should be to facilitate the enhancement of stable regulatory cues. Attention to constant regulatory cues in closed skills warrants an external environmental focus of attention (KR).

The results also indicated that beginners given an environmentally-focused attentional set had somewhat better accuracy scores than beginners given a self-focused attention (Figure 1, p. 47). Because the performance of the VTR group was not significantly different from the performance of the other treatment groups, the findings appear to be contrary to the prediction of Carver and Scheier (1981b) that self-focused attention will lead to task facilitation through a greater frequency of comparison between actual performance and the intended or reference performance. However, if the projections of Fleishman and Rich (1963) and Gentile (1972) are correct, the reference behavior for beginning bowlers may not be based upon internal, kinesthetic information, but rather on external environmental cues that regulate the movement. Therefore, to the extent that beginners are objectively self-aware, they may be unable to appropriately focus attention to regulatory cues in the environment.

Advanced Level of Task Mastery

The results for the advanced group of subjects indicated no significant ($p \leq .03$) support for the hypotheses that of the four augmented attention focus groups, the KP and VTR focus groups would produce the greater performance/learning facilitation effects. However, the distance from target data revealed that the performance scores of the advanced bowlers who had their attention focused on knowledge of performance (KP) were the most accurate of the three groups with attentional manipulation of focus. The KP focus group performed with the best distance from target (Figure 3, p. 52). The mean distance from target scores of the KR focus group and control focus group were virtually identical (Table 9, p. 51). The distance from target scores of the KP focus group were better ($p = .038$) than the distance from target scores of both the KR focus and control focus groups. By logical deduction from the Bonferroni contrasts (Table 9, p. 51): if the KR group is different from the KP group ($p = .038$), and the means of the KR and control groups are equal ($M = 1.15$); then the control group is also different from the KP group ($p = .038$). The pattern of results suggested that the rolling accuracy of advanced bowlers may be facilitated through selective attention to the internal information sources of kinesthetic and proprioceptive cues of the movement (KP). Although not statistically significant, the results for advanced mastery subjects suggested that predictions stemming from skill acquisition theory (Fleishman & Rich, 1963; Gentile, 1972) warrant further investigation. The data indicated that at the advanced stages

of task mastery, attention directed internally to kinesthetic and proprioceptive information may hold more potential for facilitating greater bowling accuracy than attention focused on external, visual information. This conjecture supports the work of Fleishman and Rich (1963) which suggested that at the later stages of task mastery performers' dependence on kinesthetic information increases. The results suggest the need for further investigation of Gentile's (1972) contentions that at the later fixation stage of closed skill acquisition: (a) the learner's attention must be directed to the changing regulatory cues in the movement, and (b) the most appropriate type of feedback for the learner is intrinsic and augmented knowledge of performance.

Performance with Practice

Within each level of task mastery, the data revealed that there were no significant differences in performance improvement over six blocks of trials among the four focus of attention groups. Therefore, the hypotheses concerning differences between groups in the amount of improvement in performance with practice were not supported. It would appear that for the particular task selected for this study, 30 rolls may not have provided enough time on task to reveal treatment effects for practice. For this reason, it seems justifiable to investigate further the effects of augmented attentional focus on perceptual-motor task performance with practice, over a greater number of practice trials.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

The purpose of this study was to investigate the effects of augmented attentional focus on the performance with practice, of a closed perceptual-motor task for individuals who differ in level of task mastery. The hypotheses tested the theoretical projections of Gentile (1972) and Fleishman and Rich (1963), that: (a) the performance of beginning bowlers who received augmented attentional focus to knowledge of results (KR) would be significantly ($p \leq .03$) better than that of beginners who received augmented attentional focus to knowledge of performance (KP), self-focused information (VTR), or information utilized in the absence of experimentally augmented attentional focus (control); and (b) the performance of advanced bowlers who received augmented attentional focus to knowledge of performance (KP) or self-focused information (VTR), would be significantly better ($p \leq .03$) than that of advanced bowlers who received augmented attentional focus to knowledge of results (KR) or information utilized in the absence of experimentally augmented attentional focus (control). Each subject performed 30 trials of rolling a ball at a full ten-pin set-up. The pinfall and distance from target scores were averaged and grouped into six blocks of five trials each.

Within each level of task mastery, the *a priori* Bonferroni test of planned comparisons ($p \leq .03$) was utilized to identify mean score

differences between the KR focus group and the three other focus groups. The Geisser-Greenhouse conservative F test was applied to the split plot factorial (4.6) with repeated measures on the last factor (blocks) to investigate main and interaction effects of within group factors. Utility indices were calculated to further investigate the significant between group factors.

The results of the study indicated that: (a) the bowling accuracy of beginning bowlers who received the KR focus was significantly better ($p = .004$) than that of beginning bowlers who received no experimentally augmented attentional focus; (b) the rolling accuracy scores of advanced bowlers who received the KP focus were better ($p = .038$) than those of advanced bowlers who received the KR focus or no experimentally augmented attentional focus; (c) there were no significant ($p \leq .03$) between main effects for pinfall at either level of task mastery; and (d) there were no significant ($p \leq .05$) main or interaction effects for within group factors at either level of task mastery.

The results partially supported research by Fleishman and Rich (1963), and Gentile (1972), which suggested that during the early stage of closed perceptual-motor skill acquisition, i.e., the beginners, performance was enhanced by selectively attending to visual spatial information in the external environment. The results also suggested some potential support for the notion that during the later stage of closed perceptual-motor skill acquisition, i.e., the advanced, performance might be facilitated by selectively attending to internal, kinesthetic information which accompanies the movement.

The findings did not support a projection of objective self-awareness theory (Carver & Scheier, 1981b; Duval & Wicklund, 1972) which contended that during conditions of increased self-focused attention, performance would be facilitated. However, the pattern of results suggested a research potential for clarifying the projection with respect to the task mastery level of the performer.

Conclusions

The purpose of this study was to investigate the effects of four types of augmented attentional focus: (a) focus on knowledge of results (KR); (b) focus on knowledge of performance (KP); (c) focus on the self (VTR); and (d) no focus directed by experimental manipulation (control) on bowling performance with practice, for beginning and advanced level performers. The results suggested that:

1. For beginning bowlers, attentional focus on visual knowledge of results produced the better rolling accuracy among the four focus groups.

2. For advanced bowlers, attentional focus on knowledge of performance may produce better rolling accuracy than focused attention on knowledge of results.

Implications for Future Research

The present study has provided partial support for the premise that for beginning and advanced skill performance, augmented attentional focus to internal and/or external information sources is a

contributing factor to closed perceptual-motor task performance. The utilization of empirically validated attentional manipulation techniques in motor behavior research may provide a new perspective to the experimental and experiential assessment of the following performance factors:

1. The nature of attentional demands for open and closed perceptual-motor tasks with respect to: (a) sources of behavior-regulating information, and (b) skill level of the performer.

2. The subjective experience of physiological and psychological performance states with respect to cue utilization during performance.

3. Optimal levels of imposed shifts in attentional direction for the performance of perceptual-motor tasks as mediated through various combinations of attentional manipulation techniques.

4. The effects of augmented attentional focus on the learning and retention of perceptual-motor tasks with practice, with respect to the amount of time spent in practice with the task and the attentional techniques under study.

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APPENDICES

APPENDIX A

LETTER AND INFORMED CONSENT

January, 1984

Dear

You have been specially selected to participate in a study concerned with the effects of attentional focus on bowling performance. This study is directed by John Richards and is part of his doctoral dissertation. The purpose of the study is to determine the relative effects of different levels of skill.

The task will involve rolling thirty balls, each at a full ten pin set up, and scoring the pin fall for each roll. Different groups of subjects will have their attention focused on different components of their performance. There will be a videotape recorder used for some groups. If you are in one of those groups, you will be informed and will see the videotapes; you will be tested individually; and all tapes will be erased at the conclusion of the study. No names will be recorded on the score sheets; and all of your scores will be considered confidential information. Only group data will be used in reporting the results and conclusions.

If you are willing to participate in the study, you are asked to attend a one hour session at the Stokely bowling lanes in the university center.

This study can only be accomplished with your help. Your contribution is very important and your are doing a real favor if you agree to participate. If you so choose, you may withdraw from this study at any time. There will be no effect on your academic and/or competitive status if you decide not to participate or to withdraw from the study.

Please complete the attached form and indicate your preferred times of the scheduled times attached.

Thank you very much for your assistance.

John Richards
523-6949 (home phone)
Office 362 HPER
974-5111 (office phone)

Stokely Bowling Lanes

Dates: _____ M T W TR F S S

Time: _____ p.m.

INFORMED CONSENT

I have read the letter explaining the expectations and I understand that the purpose of the study is to learn about the effect of attentional focus and bowling performance.

I confirm that my participation as a subject is entirely voluntary. No coercion of any kind has been used to obtain my cooperation. I confirm that no portion of my grade or university status is dependent upon participation in this experiment.

I understand that I may withdraw my consent and terminate my participation at any time during the investigation. I also understand that withdrawing from the study would have no effect on my academic and/or competitive status.

I have read the procedures that will be used in the study and understand what will be required of me as a subject. I know that I may ask any questions for clarification at any time.

I understand that all of my responses and scores will remain completely confidential.

I wish to give my cooperation as a subject.

Signed _____

Witness _____

Date _____

Campus address _____

_____

Local phone number _____

John Richards
Phone 974-5111
Office HPER 362

APPENDIX B

PROTOCOL

PROTOCOL

The purpose of this study is to examine the effects of different methods of focusing attention on bowling performance. Your task is to roll a total of 35 balls. For each ball that you roll, all 10 pins will be standing. The first five rolls will be used to get warmed up and adjusted to lane conditions. The warm-up rolls will not count for score. When you finish your warm-up rolls, you will roll 30 more balls, each for score.

Control

Following each ball rolled, return to the scoring table and record the pinfall score for that roll. Then, get ready to roll the next ball. While you are scoring your roll, I will also be recording your scores on my score sheet, and resetting the pins for your next roll. The session will be completed when you have rolled and scored 30 balls.

VTR

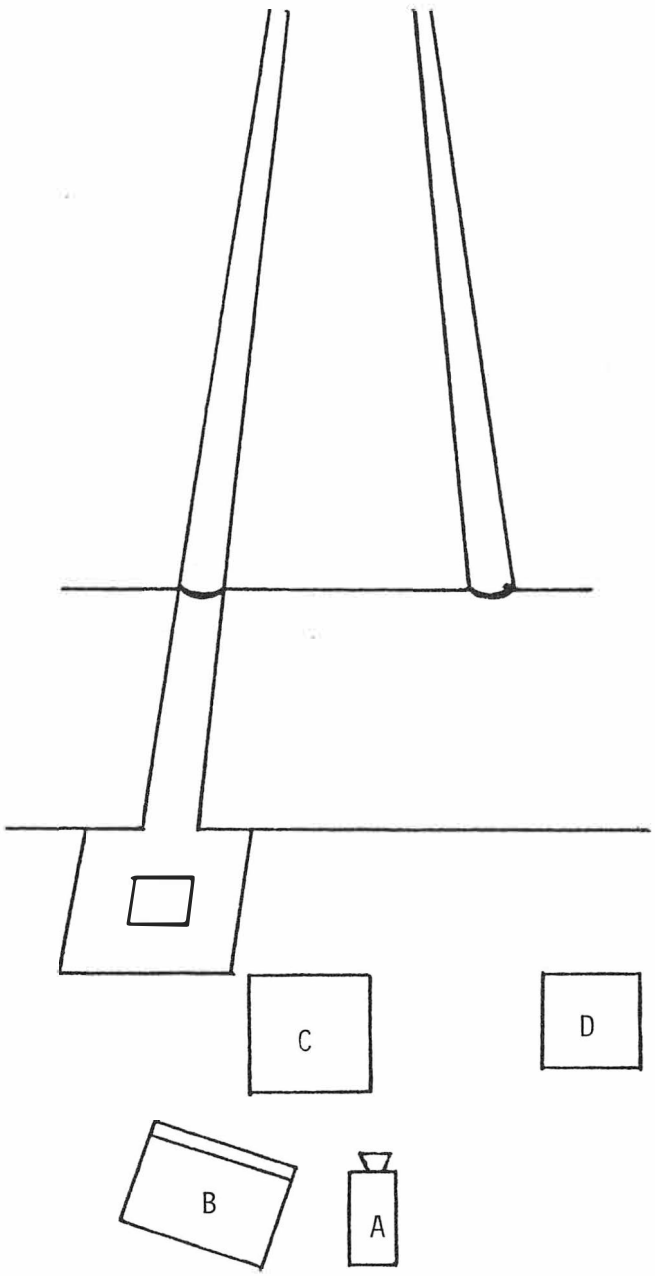
You are one of several individuals in this study who will have their performance videotaped. I want you to know that your part of the tape will be erased at the end of the study. No one will see your tape but you and me. As soon as I have turned on the videotape machine, you may begin your 30 rolls. Following each ball rolled, return to the scoring table, and record the pinfall for that roll. Then get ready to roll your next ball. While you are scoring your roll, I will also be recording your scores on my score sheet, and resetting the pins for your next roll. The session will be completed when you have rolled and scored 30 balls.

KP/KR

You are one of several individuals in this study who must answer questions about their performance. Following each ball rolled, return to the scoring table, record the pinfall for that roll, and answer the four items on your questionnaire concerning your performance for the ball just rolled. The session will be completed when you have rolled 30 balls for score and answered the items on your questionnaire for each roll.

APPENDIX C

LAYOUT OF TEST SITE



Key

A - Videotape Camera
B - Television Monitor
C - Score Table
D - Experimenter's Position

Figure 5. Layout of test site.

APPENDIX D

KNOWLEDGE OF PERFORMANCE QUESTIONNAIRE

KNOWLEDGE OF PERFORMANCE QUESTIONNAIRE

INSTRUCTIONS: Respond to the following questions after every ball rolled. Indicate your responses using either: (Y) for YES, (N) for NO, or (?) for I DON'T KNOW. Please choose the answer that best represents your truest recollection of the events as they occurred.

QUESTIONS	TRIALS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
APPROACH: Did you walk in a straight line?	
SWING: Did your arm swing in a straight, pendular motion?	
RELEASE: Did your hand follow through toward the target?	
FINISHED POSITION: Did your shoulders face straight, down the lane?	

APPENDIX E

KNOWLEDGE OF RESULTS QUESTIONNAIRE

KNOWLEDGE OF RESULTS QUESTIONNAIRE

INSTRUCTIONS: Respond to the following questions after every ball rolled. Indicate your responses using either: (Y) for YES, (N) for NO, or (?) for I DON'T KNOW. Please choose the answer that best represents your truest recollection of the events as they occurred.

QUESTIONS	TRIALS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
TARGET SPOT: Did the ball hit the target spot?	
SPOT ACCURACY: By how many boards did the ball miss the target spot?	
ANGLE OF ROLL: Did the ball follow the correct line?	
TARGET POCKET: Did the ball hit the intended strike pocket?	

APPENDIX F

SCORE SHEET

SUBJECT: _____ DATE: _____

TREATMENT: _____ TARGET BOARD: _____

TRIALS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BOARDS															
PINFALL															

TRIALS	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BOARDS															
PINFALL															

APPENDIX G

DESCRIPTIVE STATISTICS FOR DEPENDENT VARIABLES

Table 13

Descriptive Statistics for Dependent Variables: Beginners

Variables	N	μBoards		μPinfall	
Focus					
Knowledge of Performance (KP)	48	1.46	(0.62)	7.83	(0.97)
Knowledge of Results (KR)	48	1.07	(0.51)	7.89	(0.72)
Videotape Camera/Recorder (VTR)	48	1.45	(0.56)	7.38	(1.01)
Control (c)	48	1.73	(0.89)	7.62	(0.93)
Blocks					
One	32	1.37	(0.61)	7.72	(0.83)
Two	32	1.59	(0.81)	7.59	(0.93)
Three	32	1.45	(0.64)	7.66	(0.82)
Four	32	1.31	(0.68)	8.00	(0.86)
Five	32	1.34	(0.65)	7.56	(1.18)
Six	32	1.50	(0.79)	7.73	(0.86)
Focus x Blocks					
KP, 1	8	1.35	(0.55)	1.06	(0.57)
KP, 2	8	1.43	(0.64)	1.01	(1.17)
KP, 3	8	1.73	(0.67)	1.16	(0.94)
KP, 4	8	1.15	(0.17)	1.06	(0.69)
KP, 5	8	1.53	(0.96)	1.17	(1.32)
KP, 6	8	1.60	(0.52)	1.34	(0.80)
KR, 1	8	1.08	(0.55)	0.96	(0.78)
KR, 2	8	1.18	(0.63)	1.07	(0.83)
KR, 3	8	1.03	(0.33)	7.98	(0.77)
KR, 4	8	1.10	(0.72)	8.15	(0.58)
KR, 5	8	0.95	(0.35)	7.68	(0.89)
KR, 6	8	1.10	(0.52)	8.15	(0.37)
VTR, 1	8	1.33	(0.55)	7.55	(0.92)
VTR, 2	8	1.80	(0.69)	7.15	(1.01)
VTR, 3	8	1.43	(0.39)	7.53	(0.76)
VTR, 4	8	1.23	(0.71)	7.7	(1.09)
VTR, 5	8	1.55	(0.50)	6.95	(1.33)
VTR, 6	8	1.35	(0.40)	7.40	(1.10)
C, 1	8	1.73	(0.68)	7.65	(1.07)
C, 2	8	1.95	(1.10)	7.13	(0.82)
C, 3	8	1.62	(0.88)	7.65	(0.87)
C, 4	8	1.80	(0.80)	7.60	(0.77)
C, 5	8	1.35	(0.58)	7.96	(1.11)
C, 6	8	1.95	(1.26)	7.73	(0.97)

Note: Standard deviations in parenthesis.

Table 14

Descriptive Statistics for Dependent Variables: Advanced

Variables	N	μBoards		μPinfall	
Focus					
Knowledge of Performance (KP)	48	0.69	(0.39)	8.35	(0.74)
Knowledge of Results (KR)	48	1.15	(0.63)	8.05	(1.04)
Videotape Camera/Recorder (VTR)	48	0.80	(0.42)	8.38	(0.57)
Control (c)	48	1.15	(0.66)	8.24	(0.80)
Blocks					
One	32	0.98	(0.63)	8.28	(0.86)
Two	32	0.96	(0.67)	8.07	(0.87)
Three	32	0.81	(0.54)	8.41	(0.72)
Four	32	0.94	(0.51)	8.15	(0.78)
Five	32	0.99	(0.59)	8.41	(0.74)
Six	32	1.03	(0.52)	8.21	(0.88)
Focus x Blocks					
KP, 1	8	0.85	(0.44)	8.35	(0.89)
KP, 2	8	0.48	(0.18)	8.40	(0.73)
KP, 3	8	0.73	(0.41)	8.53	(0.87)
KP, 4	8	0.70	(0.48)	8.40	(0.44)
KP, 5	8	0.70	(0.24)	8.32	(0.64)
KP, 6	8	0.70	(0.50)	8.10	(0.96)
KR, 1	8	1.20	(0.76)	8.03	(1.03)
KR, 2	8	1.35	(0.86)	7.90	(1.38)
KR, 3	8	0.88	(0.43)	8.35	(0.73)
KR, 4	8	0.98	(0.42)	7.88	(0.88)
KR, 5	8	1.28	(0.74)	8.30	(1.06)
KR, 6	8	1.25	(0.52)	7.85	(1.25)
VTR, 1	8	0.73	(0.49)	8.60	(0.55)
VTR, 2	8	0.97	(0.49)	8.03	(0.55)
VTR, 3	8	0.63	(0.29)	8.65	(0.49)
VTR, 4	8	0.85	(0.23)	8.05	(0.56)
VTR, 5	8	0.70	(0.51)	8.55	(0.59)
VTR, 6	8	0.98	(0.39)	8.38	(0.46)
C, 1	8	1.13	(0.74)	8.15	(0.97)
C, 2	8	1.05	(0.70)	7.95	(0.67)
C, 3	8	1.00	(0.86)	8.10	(0.73)
C, 4	8	1.23	(0.74)	8.28	(1.11)
C, 5	8	1.30	(0.52)	8.48	(0.68)
C, 6	8	1.20	(0.55)	8.53	(0.67)

Note: Standard deviations in parenthesis.

VITA

John Allen Richards was born in Bryn Mawr, Pennsylvania, on November 21, 1952. His youth and early high school years were spent in Leviltown, Pennsylvania, until his senior year when he moved to Pittsburgh and graduated from Upper St. Clair High School in 1970. He attended Slippery Rock State College in Pennsylvania, where he played varsity baseball for 3 years, was elected to the Phi Epsilon Kappa honorary fraternity, and graduated in 1974. In the fall of 1975, he accepted a position as a graduate teaching assistant at Slippery Rock State College, and graduated with a Master of Education degree in Physical Education in August, 1975. Following graduation, he accepted an instructors position at the University of Tennessee, Knoxville, where for eight years he taught a variety of activity, teaching methods and coaching classes in addition to coaching women's soccer for 4 seasons. In his ninth year at Tennessee, he received a graduate teaching assistantship and completed his Doctor of Education degree with an emphasis in Motor Behavior and Sport Psychology in August, 1984.