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THE EFFECT OF IMAGERY REHEARSAL ON FREE THROW SHOOTING PERFORMANCE UNDER CONDITIONS OF HOSTILE CROWD NOISE

by

Mark David Tadeson

An Abstract

of a thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in the Division of
Health, Physical Education, and
Recreation at Ithaca College

September 1991

Thesis Advisor: Dr. William F. Straub

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ABSTRACT

The purpose of this study was to demonstrate the effects of RAIR (relaxation and imagery rehearsal) on basketball free throw shooting performance under the conditions of intermittent hostile crowd noise and no noise. The subjects were college-aged students (N = 35) enrolled in undergraduate courses at a private institution in upstate New York. Following a pretest that consisted of 15 free throws, subjects were randomly assigned to experimental (n =18) and control (n = 17) groups. The experimental group practiced RAIR once daily for 21 days. Following the 3-week treatment period, all subjects took two posttests of 15 free throws each. One posttest was performed under a no-noise condition identical to the pretest. The other posttest was performed under conditions of loud intermittent hostile crowd noise. The administration of the posttests was randomly assigned to neutralize order effects. Descriptive and inferential statistical procedures were used to analyze the data. Group means and standard deviations were calculated for free throw shooting performance.
A 2 (RAIR/control) x 3 (trials) repeated measures ANOVA was used to test for main and interaction effects on free throw shooting performance. The first null hypothesis stated that there will be no significant differences in mean free throw shooting performance among subjects who participated in the RAIR program and a control group. The second null hypothesis stated that there will be no significant differences in mean free throw shooting performance under conditions of noise and no noise. The third null hypothesis stated that there will be no significant interaction effects between RAIR and noise variables on mean free throw shooting performance. Main and interaction effects did not reach statistical significance at the determined level (.05 level). Therefore, the three null hypotheses were accepted. It was concluded that RAIR and noise did not affect basketball free throw shooting performance.

THE EFFECT OF IMAGERY REHEARSAL ON FREE THROW SHOOTING PERFORMANCE UNDER CONDITIONS OF HOSTILE CROWD NOISE

A Thesis Presented to the Faculty of the Division of
Health, Physical Education, and Recreation at
Ithaca College

In Partial Fulfillment of the Requirements for the Degree
Master of Science

---

by
Mark David Tadeson
September 1991

Ithaca College

Division of Health, Physical Education, and Recreation

Ithaca, New York

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

This is to certify that the Master of Science Thesis of

Mark David Tadeson

submitted in partial fulfillment of the requirements for the degree of Master of Science in the Division of Health, Physical Education, and Recreation at Ithaca College has been approved.

Thesis Advisor:

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Dean of Graduate Studies:

Date: July 24, 1991

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Chapter 1

INTRODUCTION

Sport psychology has been said to be theory poor (Wollman, 1986), and the mental practice literature is no exception (Hecker & Kaczor, 1988). Despite the large number of studies already conducted, there still is a need for more methodologically sound and theoretically based research to effectively assess the specific conditions under which mental practice is most effective (Wollman, 1986).

In sport psychology, imagery rehearsal is the application of visualization to the repetition of a specific task, usually with the intent of improving the skill (Suinn, 1982). Most studies in this area have examined imagery rehearsal as a training aid for skill acquisition and performance enhancement. Few studies were found that investigated imagery rehearsal for the retention of a skill. Retention studies concern the effects of imagery rehearsal in maintaining motor skill proficiency in the absence of physical practice.

There have been a number of major literature reviews concerning the effects of mental rehearsal on motor performance (Corbin, 1972; Feltz & Landers, 1983; Richardson, 1967a, 1967b; Suinn, 1982). The majority of imagery research has concentrated on performance enhancement. Some researchers have concluded that mental imagery rehearsal has a favorable effect on motor skill performance, however the empirical support is less than overwhelming (Feltz & Landers, 1983).

It is generally accepted that systematic mental imagery coordinated with a physical practice program is superior to either training practiced alone (Corbin, 1972; Suinn, 1985). The validity of imagery rehearsal in the absence of physical practice requires further empirical development, although it is suggested that imagery practice is better than no practice at all (Wollman, 1986).

The legitimacy of mental imagery rehearsal independent of physical practice could be further supported under a research premise other than performance enhancement. Such validation could occur if imagery practice was to demonstrate a capacity to maintain athletic skill levels under performance inhibiting conditions. There is an abundance of research on mental imagery and its effects on athletic performance (Kolonay, 1977; Noel, 1980; Suinn, 1982; Ziegler, 1987), but the premise of imagery rehearsal for performance maintenance under adverse conditions has not been studied.

Significance of the Study

The premise of imagery practice as a means to simply maintain motor performance levels under adverse conditions may prove to be a viable direction for future research. This investigation attempted to provide support for a model linking attentional focus as one key mechanism through which imagery practice can affect motor performance.

Proper attention is an important factor in performance (Nideffer, 1976). Imagery practice may direct the athlete's attention to task relevant thoughts and away from task irrelevant thoughts. Thus, mental imagery training may develop an athlete's ability to focus attention on task relevant cues (Feltz & Landers, 1983). If such is the case, subjects who are trained in imagery should outperform control subjects under conditions intentionally designed to distract attention (e.g., loud intermittent hostile crowd noise). Consequently, subjects untrained in imagery should demonstrate significantly lower performance levels than imagery trained subjects while performing under conditions of distraction.

The potential for imagery practice to be an effective device to aid athletes in attaining optimal attentional focus during performance requires empirical substantiation. This study will address this important issue.

Definition of Terms

Attention: An essential component of the human information processing system that gates information to a limited processor and allows for concentration and selective perception.

Closed Motor Skill: A motor skill task conducted in an environment that is consistent and predictable and requires one repetitive response.

Imagery Rehearsal: Mental imagery of a task that is repeatedly practiced and subject to conscious control in terms of what images are produced and what actions occur.

Mental Imagery: A covert activity whereby a person experiences sensory-motor sensations that reintegrate reality experiences (Suinn, 1982).

Performance Inhibiting Condition: A condition that is purposely created to hamper performance (e.g., loud intermittent hostile crowd noise).

Relaxation: A process of exercises whereby breathing is altered and imagery is utilized to achieve a calm and relaxed state. The exercises are characterized by slow deep breathing and imaging of peaceful and tranquil scenes.

Relaxation and Imagery Rehearsal (RAIR): An imagery rehearsal technique that utilizes relaxation prior to imagery.

Scope of the Problem

The purpose of this investigation demonstrated if imagery rehearsal (without physical practice) was a viable practice technique for maintaining basketball free throw performance levels under conditions of distracting hostile crowd noise. The study was conducted during the 1990 fall semester. Participants were college-aged students ($\underline{N}$ = 35) enrolled in undergraduate courses. A selection criterion test required all volunteer subjects to physically demonstrate a minimal skill level of 50% in basketball free throw performance. Most subjects had no prior experience with imagery rehearsal.

The study was conducted over a 5-week period. Following a pretest that consisted of 15 free throws, subjects were randomly assigned to an experimental group or a control group. The experimental group practiced relaxation followed by imagery rehearsal (RAIR) once daily for 21 days. Following the 3-week treatment period, all subjects took two posttests. Each posttest consisted of 15 free throws. One posttest was performed under identical conditions to the pretest. The other posttest was performed under conditions of potentially distracting auditory stimuli. The administration of the posttests was randomly assigned to neutralize order effects.

Statistical analyses demonstrated the effects of RAIR on free throw shooting performance under conditions of noise and no noise. The data recorded from each subject yielded three separate performance scores. One pretreatment performance score (15 basketball free throws) and two posttreatment scores (15 basketball free throws) were collected for each subject. The performance scores for experimental and control groups across the tests were analyzed to assess the effects of RAIR under conditions of noise and no noise.

Statement of the Problem

The purpose of this study was threefold. First, it demonstrated the effect of RAIR on free throw shooting performance in the absence of physical practice. Second, the effect of hostile crowd noise on free throw shooting performance was considered. Finally, the effect of RAIR on free throw performance under conditions of hostile crowd noise was assessed.

Null Hypotheses

The null hypotheses for this experiment are as follows:

1. There will be no significant differences in mean free throw shooting performance among RAIR subjects and control subjects.

2. There will be no significant differences in mean free throw shooting performance under the noise and no-noise conditions.

3. There will be no significant interaction effects between the RAIR and noise variables on free throw shooting performance.

Assumptions

The following assumptions were made for this study:

1. The subjects performed each task to the utmost of their ability during the pretest and posttest sessions.

2. The experimental group subjects diligently practiced the imagery treatment to the best of their ability.

3. The control group subjects did not utilize their own personal imagery techniques.

Delimitations

The following delimitations were established for this study:

1. Only college students (N = 35) from a private institution in upstate New York served as subjects.

2. Motor performance was measured by basketball free throws.

Limitations

The following limitations were established for this study:

1. The results only apply to college students who are similar to those in this study.

2. Imagery effects apply only to the closed motor skill of basketball free throw shooting.

3. Some subjects may have engaged in free throw shooting during the study.

Chapter 2

REVIEW OF LITERATURE

There is an abundance of research on imagery in the sport science literature. An area in sport psychology, however, that has not generated much research concerns the attentional focusing properties of mental imagery. A common factor in most major sporting events is the presence of a large crowd. All too often audience effects on performance have been studied without consideration of the possible influence of noise generated by crowds in actual sport environments. These two areas are brought under empirical scrutiny in this exploratory study considering the effects of imagery rehearsal on sport performance under adverse conditions of hostile crowd noise.

An examination of related literature will consider the following sections: (a) mental practice or imagery rehearsal, (b) imagery effects, (c) modifying variables of the imagery process, (d) theoretical explanations for imagery effects, (e) performance under conditions of noise, (f) attention and performance, and (g) the role of imagery.

Mental Practice or Imagery Rehearsal

Investigators have not always been careful about drawing a distinction between mental practice and imagery rehearsal. Mental practice and imagery rehearsal are not the same. Corbin (1972, p. 94) defined mental practice "as the repetition of a task without observable movement for the specific purpose of learning." This definition includes any form of covert practice or symbolic learning, including simply thinking about an action.

Conversely, imagery rehearsal means covert practice where imagery is the dominant experience used to achieve the rehearsal (Suinn, 1985). This process involves remembering and reflecting upon pieces of information stored in memory from all types of experiences and cognitively reformulating them into a meaningful mental conception. Through imagery athletes are able to recreate as well as create future experiences in their mind. Imagery is based on memory, and athletes experience it internally by reconstructing memory stimuli in their mind (Suinn, 1982).

Although imagery is essentially a product of memory, athletes are able to put the information of past experiences together in different ways. As programmers of their own imagery programs, athletes are able to build images from cognitive memory structures. Thus, imagery experiences may be recalled through any or all of the sense organs. Depending upon the sensations that are recreated, athletes are able to see, hear, taste, smell, emote, and kinesthetically sense movement. Imagery can and should involve all the senses to recreate or create an experience in the mind (Harris & Harris, 1984).

Although imagery may be regarded as symbolic experience that can occur in any sensory mode, those modalities thought to be most important to motor skill performance are kinesthetic (athletes should feel the sensations of their bodies as they move in different positions and include sensations such as speed, coordination, and pressure), visual, and auditory (Harris & Harris, 1984).

Imagery Effects

Extensive research has tested the effects of mental practice on a variety of motor skills. There have been a number of major literature reviews concerning the effects of mental practice on motor performance (Corbin, 1972; Feltz & Landers, 1983; Martens, 1982; Richardson, 1967a, 1967b; Suinn, 1985). Richardson reviewed 25 studies and concluded that mental practice was associated with improved motor performance. He suggested that imagery may be an important aspect of mental practice. Corbin reviewed 50 studies and stated that the effects of mental practice on acquisition and retention of skilled motor behavior were inconclusive. Martens reviewed 34 studies on imagery and performance. He concluded that imagery rehearsal was beneficial for motor performance. Feltz and Landers noted that the conclusions of earlier reviewers may be inaccurate because they were based on too few studies. In a meta-analysis on 60 studies, Feltz and Landers concluded that mental practice enhances motor performance more effectively than no practice at all. Suinn suggested that a particular style of imagery, visual motor behavior rehearsal (VMBR), favorably affects motor performance. Despite the vast amount of literature, however, the results are too inconsistent to reasonably guarantee success in particular motor skill performance situations.

Specific research on imagery rehearsal and the motor skill of free throw shooting is also equivocal. Clark (1960), Kolonay (1977), and Wrisberg and Anshel (1989) concluded that imagery rehearsal enhanced mean free throw shooting performance. However, Hall and Erffmeyer (1983), Lane (cited in Suinn, 1982), and Ziegler (1987) demonstrated that imagery rehearsal did not significantly enhance free throw shooting performance. Furthermore, there is little empirical evidence, other than case studies (Meyers & Schlesser,1980; Silva,1982), that reliably suggests that mental imagery was the causal factor relating to any particular real-life anecdotal sports success (Wollman, 1986).

Although the results of many studies (Epstein, 1980; Kolonay, 1977; Wrisberg & Anshel, 1989) suggest that imagery practice enhances motor performance, uncertainty about the exact relationship exists within the scientific community (Feltz & Landers, 1983). There are many factors that affect the outcome of mental practice experiments. Richardson (1967a), for example, stipulated that skill level, imagery ability, intelligence, kinesthetic ability, gender, and motor ability influence the effectiveness of mental practice. Singer and Milne (1975) stated that other mediating factors to consider include the instructions given to subjects, determining whether subjects actually mentally practiced, motivation, outside uncontrolled practice (physical or mental), and the amount of practice engaged in during the specified practice time.

Most of the early research on imagery rehearsal effects focused upon simple empirical demonstrations (Feltz & Landers, 1983). Recently, however, scientists have attempted to delineate variables within the imagery process itself to identify those factors that mediate or modify imagery's effects on motor skill performance. Such research (Burhans, Richman, & Bergey, 1988; Epstein, 1980; Kolonay, 1977; Powell, 1973; Wrisberg & Anshel, 1989) has been conducted in an attempt to outline the specific conditions that facilitate sport imagery training.

Modifying Variables of the Imagery Process

An essential concept within the imagery process is controllability. In an early study, Gordon (1949) suggested the importance of controllability in imagery for performance enhancement. Not all athletes are able to control their imagery. Clark (1960) found that, as subjects reported gains in their ability to visualize and control their mental imagery, they experienced improvements in self-confidence and in their ability to identify errors in their performance.

Vividness is another variable within the imagery process that has been empirically related to enhanced performance. Vividness in imagery rehearsal incorporates colorful and realistic images from all sensory modes along with the emotions that are associated in the actual physical performance (Smith, 1987). The premise that necessitates the need for vivid imagery suggests that imagery rehearsal similar in quality to real life experiences may facilitate future bridging of the synapses for the time when those tasks are actually performed (Eccles, 1958; Hebb, 1968; MacKay, 1981).

Questionnaire studies administered to skiers of differing skill levels demonstrated that the imagery of highly skilled skiers was more vivid and clear then less skilled skiers (Suinn, 1982). More effective racquetball players also reported that they experienced more vivid imagery than less successful players (Meyers, Cooke, Cullen, & Liles, 1979). However, a problem with the above research is that cause and effect cannot be inferred from correlational data. It is difficult to determine whether vivid images make athletes more effective or whether elite athletes are simply able to create more vivid images (Smith, 1987).

Researchers have questioned whether controllability or vividness is more important for imagery effects on performance. Start and Richardson (1964) investigated the singular and combination effects of vividness of imagery (as measured by the Betts QMI Vividness of Imagery Scale) and controllability of imagery (using the Gordon Test of Visual Imagery Control). They found that subjects who possessed vivid and controlled imagery demonstrated more effective performance in discrete gymnastic skills than subjects whose imagery was vivid but uncontrolled. However, Corbin (1972) recognized that both variables are conceptually important for competent imagery. He suggested that imagery seems most effective when the images are both vivid and under control. Perhaps when athletes are assured they can create and control vivid mental images, this information may lead to increased confidence in their ability to actually perform those skills (Smith, 1987). A major weakness of most imagery research is a failure to train the subjects in vividness and controllability. These skills may be developed through systematic practice (Richardson, 1967a).

Another characteristic of the imagery process that was investigated is the imagery perspective used by the athlete. Investigators have differentiated between internal and external perspectives of imagery. Internal imagery is essentially kinesthetic and is distinguished by a first person perspective (Epstein, 1980). In this case athletes imagine themselves watching the surrounding environment during performance and focusing on how they feel from within their bodies.

External imagery or spectating, in contrast, is predominantly visual imagery and is characterized by a third person perspective (Epstein, 1980; Suinn, 1985). When athletes image from this perspective, they imagine that they are observing themselves performing the skill much like a spectator might observe the actual performance.

In studies that have analyzed the two perspectives, internal imagery has been associated with more effective, more skilled performance than external visualization. Epstein (1980), for example, studied male college students ($\underline{N}$ = 75). Those subjects who tended to use internal imagery were more skilled at throwing darts than subjects who predominantly used external imagery. Results from another exploratory study suggested that elite gymnasts reported a higher frequency of internal imagery as opposed to external imagery (Mahoney & Avener, 1977).

A theoretical explanation for these findings was offered by Hale (1982), who demonstrated that there is a physiological distinction between internal and external imagery with greater muscle activity occurring during internal imagining. In a later study, however, Harris and Robinson (1986) demonstrated that innervation was not specific to the muscle groups necessary to execute the task.

The above focus on internal imagery may be somewhat misleading. Hale (1982) did not manipulate internal vs. external imagery. He only found that highly skilled performers used internal imagery more than athletes of lesser skill. The only empirical data comparing the effects of internal vs. external imagery on performance of a motor skill revealed that there was no significant difference between the two perspectives (Epstein, 1980). Therefore, there is no behavioral evidence that internal is superior to external imagery in facilitating athletic performance even though there are significant differences in below threshold electrical activity levels (Burhans et al., 1988). This conclusion supported other researchers' suggestions that it is doubtful that mental practice effects on motor skill performance are solely produced by low gain innervations of the specific muscles used during actual performance (Hecker & Kaczor, 1988).

The relationship between imaginal perspective style and motor performance requires an additional comment. Epstein (1980) found it was virtually impossible to characterize subjects as strictly internal or external imagers because individuals' perspectives tended to vary considerably both within and between images. Apparently, the notion of stable and extreme imaginal perspective styles may be far too simplistic and uniform to warrant empirical validation. Although it seems logical to assume that an internal perspective may be more beneficial, the scientific evidence indicates it is certainly not a prerequisite for effective imagery practice (Smith, 1987).

Task outcome is another variable within the imagery process that has been tested as a potential modifying agent in the relationship between imagery rehearsal and motor skill performance. This variable has been subjected to empirical query on two distinct, yet related, levels. The major thrust of research has been upon the effects of positive vs. negative imagery. The other thrust of research has questioned the necessity for a successful task outcome as opposed to focusing solely upon the movements required.

Woolfolk, Murphy, Gottesfeld, and Aitken (1985) studied the effect of imagery on the closed motor skill of golf putting of male college students ($\underline{N}$ = 50). They used an experimental design that regulated the imagery rehearsal of a task and assessed the systematic variation of either positive or negative outcome imagery. The researchers found that the use of positive imagery enhanced putting accuracy over time. Control subjects ($\underline{n}$ = 16) who practiced negative outcome imagery decreased in their performance. These results substantiated earlier research that found negative mental imagery caused a decrement in motor skill acquisition on a dart throwing task (Powell, 1973).

In another study, Woolfolk, Parish, and Murphy (1985) investigated the relative influence of performance vs. outcome components of imagery on the accuracy of putting a golf ball. In their investigation, the presence or absence of mental rehearsal of the task was accompanied by imaginal depiction of task outcome (positive, negative, or no outcome). The findings showed that negative imagery led to performance decrements. Positive imagery did not lead to an improvement in performance. This finding suggested that picturing a poor result may be more powerful in its ability to damage skilled athletic performance than the use of positive imagery to improve performance. Thus, positive imagery may help athletes to avoid "choking" by focusing only on task relevant thoughts.

In a related study by Burhans et al. (1988), positive mental imagery was used with skill-oriented imagery to assess the subsequent effects on cross-country running speeds over a 12-week training period. The 36 male and 29 female subjects were volunteers enrolled in a physical conditioning course. Skill-oriented imagery produced a significantly larger increase in running performance over a 4-week period of training than in the control group. However, after 12 weeks of training, all the groups reached the same level of performance.

These results are inconsistent with other investigators (Woolfolk et al., 1985) who studied imagery depiction of the outcome. Possibly the type of task may be another confounding variable in the relationship between imagery depiction and performance enhancement.

Because of inconsistent findings, the effects of various styles of imaginal outcome need further investigation. Woolfolk et al. (1985) concluded that the efficacy of positive imagery, though evident, requires further validation. Nevertheless, it was recommended that positive imagery be incorporated into imagery training. Future studies should establish the specific skills and conditions under which success-oriented imagery produces the most effective results. Investigators should also scrutinize the mechanisms underlying the impact of negative imagery on subsequent motor performance (Murphy, Woolfolk, & Budney, 1988).

Another variable thought to affect the imagery/performance relationship is the rate at which the imagery is rehearsed. Nideffer (1985) stated that the ability to rehearse in "real-time" is a critical part of top level performance. Real-time equates the length of time it takes to mentally rehearse the activity to the time it actually takes to physically perform the activity. Supposedly, using imagery rehearsal in real-time is a key factor because imagery utilizes pictures in one's imagination as opposed to verbal descriptions. Athletes do not have time to verbally describe a sequence of events at the tempo they occur in actual competition. It is important that athletes learn to see, feel, and experience through images rather than through word descriptions (Harris & Harris, 1984).

The logic behind real-time imagery is that athletes who are capable of visualizing at the same rate as it takes them to physically perform the skill are less likely to experience performance anxiety. Therefore, these athletes will have a greater tolerance for pressure (Nideffer, 1985). This perspective is in conjunction with the attention-arousal set formulation and does seem worthy of consideration and further research.

Conversely, in a theoretical position paper, Means (cited in Andre & Means, 1986) emphasized that slow-motion imagery may aid in performance enhancement through a retarded feeding of information to the athlete. Hypothetically, details that are unseen or go unnoticed might become very clear and lead to more vivid experiencing of the imagined motor task, eventually resulting in improved performance. If the imagery is slowed down, performance-inhibiting mistakes will become more salient. Therefore, the appropriate corrections can more easily be determined.

Andre and Means (1986) studied the effects of a slow-motion rate of mental imagery on putting performance in frisbee golf. Sixty-six male subjects were randomly assigned to a standard mental imagery group, a slow-motion imagery group, or a control group. They speculated that the use of slow-motion imagery in a 5-day mental practice program might enhance the effectiveness of such practice by enriching an athlete's imaginal experience. However, no significant differences in performance (.05 level) between the experimental and control groups were found.

Research on the speed of imagery may be of interest to sport psychologists, in light of the fact that Nideffer's position on real-time imagery still awaits direct empirical validation. Furthermore, Andre and Means (1986) failed to find significant support for slow-motion imagery rehearsal effects on performance. Future researchers in this area should focus upon developing an effective methodology for determining performance effects between distinct imagery rate differences. As can be deduced from the two hypothetical positions presented on the rate of imagery rehearsal, it is left to researchers to define the dimensions of practice under which one could best utilize imagery rates for enhancing athletic performance (Andre & Means, 1986).

It is obvious that employing any mental imagery program would undoubtedly require a consideration of many variables, both internal and external. Thus, it appears that the relationship between imagery and performance is complex and requires a theoretical basis to guide and direct future research.

Theoretical Explanations for Imagery Effects

Although there may be many speculations about why imagery rehearsal affects motor skill performances, only four theoretical formulations have found their way into the sport science literature. These theories are (a) symbolic learning, (b) psychoneuromuscular, (c) bioinformational, and (d) attention-arousal set (Hecker & Kaczor, 1988).

The symbolic learning theory, first postulated by Sackett (1935), suggests that imagery may function as a coding system to help athletes acquire or understand their movement patterns. All coordinated movements that one makes must first be encoded in the central nervous system, providing a blueprint or plan. The symbolic learning theory suggests that imagery rehearsal helps individuals to blueprint or code their movements into symbolic components, making movements more familiar and automatic. The acquisition and subsequent rehearsal of symbols that represent patterns of overt movement will facilitate the learning of skills in which cognitive factors are predominant. According to Sackett, tasks that are primarily characterized by muscle movements would not be as strongly influenced by symbolic rehearsal as would cognitive tasks.

Hecker and Kaczor (1988) stated that symbolic learning theory is inconsistent with studies on enhancing athletic performance. Although this theory can account for the research findings that imagery rehearsal facilitates new skill development and early skill acquisition, it does not sufficiently explain performance enhancements of well learned athletic skills following the use of imagery rehearsal.

The psychoneuromuscular theory attempts to explain the functions that mental imagery rehearsal serve in enhancing athletic performance. When athletes engage in various sport movements, the brain is constantly transmitting efferent electrical impulses to the muscles for the execution of the movement. The psychoneuromuscular theory suggests that similar impulses occur between the brain and the muscles when athletes imagine movements without actually performing them (Suinn, 1982). This theory has also been referred to as muscle memory (Vealey, 1987), feedback (Corbin, 1972), muscle potential (MacKay, 1981), neuromuscular feedback (Harris & Robinson, 1986), and mirror hypothesis (Feltz & Landers, 1983). All these terms essentially refer to the same physiological phenomenon (Hecker & Kaczor, 1988).

Some researchers have stated that imagery rehearsal of overt motor acts involves minute innervations of the muscles. The innervations that occur during imagery were said to be identical in pattern but weaker in magnitude to those that occur during actual movement (Jacobson, 1930; Schramm, 1967; Suinn, 1982). It was thought that these innervations aided in athletic performance because the learner obtained visual and kinesthetic feedback that was used to make adjustments in motor performance. There is considerable support for the proposition that imagery rehearsal is accompanied by small but measurable activations of visual and motor responses.

However, other researchers have concluded that these increases in muscular action potentials occur throughout the body and are not specific to the muscles used in the overt movement (Harris & Robinson, 1986; Shaw, 1938). There is no evidence of localization (Feltz & Landers, 1983). Therefore, the theory is weak in explaining how feedback results in improved athletic performance (Anderson, 1981). Hecker and Kaczor (1988) concluded that neuromuscular electrical innervations should be considered a description of an important aspect of effective imagery rehearsal rather than an explanation of the processes involved in improved performance.

Another theory that attempts to explain the relationship between performance enhancement and mental imagery is the bioinformational theory proposed by Lang (1979). This theory assumes that mental images can be understood as products of the brain's information-processing capacity. Lang hypothesized that an image is a finite structure that can be reduced to specific propositional units. Accordingly, imagery involves activation of a network of propositionally coded information stored in long term memory. It follows that these propositions can be organized into at least two categories of information. The first category refers to stimulus information characteristics. The second refers to response information characteristics concerning the physiological and overt behavioral responses. This information network is considered to be a prototype for overt behavior. The prototype can be processed by internally generating prototype matching information through mental imagery rehearsal. Thus, processing is initiated when a critical number of propositions are accessed by the athlete.

Imagining oneself throwing a football would involve activating stimulus propositions that would include the leather-like texture and feel of the ball in one's hands and also associated visual stimuli such as the receiver and pass defender. Response propositions would therefore include muscular changes in the arm and shoulder as well as changes in the cardiovascular system.

Bioinformational theory specifies that response propositions, which provide a prototype for the overt motor act, must be activated so they can be altered in some beneficial way so that imagery rehearsal may enhance athletic performance. Hecker and Kaczor (1988) postulated that extraneous response information may become detached from the network so that important response characteristics for proper execution of the skill may be strengthened.

The attention-arousal set formulation is another theoretical explanation for imagery rehearsal's effectiveness in aiding athletic performance. This theory incorporates both cognitive and physiological aspects of imagery rehearsal as being responsible for athletic performance improvements (Vealey, 1987). According to Feltz and Landers (1983), imagery rehearsal assists athletes in setting their physiological arousal at an optimal level. In the cognitive domain, imagery rehearsal may help to focus attention on task relevant thoughts and away from interfering task irrelevant ones that may inhibit top athletic performances.

This theory postulates that mental imagery rehearsal is of primary functional use in activities having few symbolic elements and also as a secondary facilitator of performance when tasks are high in symbolic elements. Imagery rehearsal could conceivably be used by novice or experienced performers. The only requirement is that performers have perfected psychological skills that enable them to maintain their attention directed toward task relevant cues to aid in setting appropriate pre-tension levels (Feltz & Landers, 1983).

The attention-arousal theory may explain many of the trends in the imagery research literature. The widespread use of imagery by elite athletes may be indicative of the necessity of setting tension levels and focusing attention to the beginning of an upcoming task where attention demands are known to be the greatest (Feltz & Landers, 1983).

The attention-arousal theory can accommodate both physiological and psychological variables concerning the "inward experience" of the performer. Considering the strengthened re-emergence of cognitive psychology, no other theory addresses the mind/body relationship as directly and completely.

Performance Under Conditions of Noise

It is logical to assume that an optimal mental focus is intrinsically developed by the practice of any well-developed imagery rehearsal program. And, if an optimal mental focus facilitates sport performance in any way, the performance benefits of an imagery rehearsal program, in part, may be attributed to its attentional focusing qualities. In order to describe the potential effects of attentional processes in the imagery/performance relationship, literature concerning performance under adverse conditions of noise was reviewed.

The true effects of noise on performance represents an ongoing debate among members of the scientific community. Popular belief suggests that noise degrades performance. However, investigators have found evidence to support a number of opposing positions (Loeb, 1981). Some researchers have concluded that noise does not affect performance (Arnoult, Gillfillan, & Voorhees, 1986; Kryter, 1970; Lewandowski & Fink, 1988; Moller, 1980), whereas others have suggested that noise enhances performance (Poulton, 1980). In light of these contradictory findings, other investigators claim that the effect of noise on performance and its nature depend on the kind of noise, the type of activity, and certain psychological attributes of the performer (Loeb, 1981).

It seems logical to presume that the latter conclusion would best explain the inability of researchers to conclusively determine universal effects of noise on performance. Furthermore, insufficient attention has been paid to subject variables such as personality and state characteristics of the performer. These include the previous experience of individuals to the noise, their attitudes toward it, and the meaning they assign to it (Loeb,1981).

Nevertheless, the effects of noise on performance have been studied across a wide range of tasks including intellectual functioning such as general intelligence (Kryter, 1970), multiple tracking tasks (Arnoult et al., 1986; Broadbent, 1954), memory tasks (Broadbent, 1978; Loeb, 1981), computation (Moller, 1980), and reaction time (Lewandowski & Fink, 1988).

Kryter (1970) concluded that intellectual functioning appears not to be influenced by exposure to noise. In multiple tracking tasks, intense noise was shown to produce an impairment on the secondary task while having no effect or even an improvement on the primary task. However, it was noted that the noise effects will vary as a function of noise quality and level; task complexity, incentives, and priorities; and other subject variables (Loeb, 1981).

Noise seems to have an effect on memory. Noise seems to alter memory, perhaps by altering priorities and strategies. Broadbent (1978) has suggested that noise effects on memory may be caused by interference with articulation and rehearsal. Computation tasks seem to be altered in the same way, however the importance of other factors was evident in the literature.

Mech (1953), for example, found that when subjects were given "data" indicating that noise either impaired or facilitated performance, profound changes in performance toward the suggested direction occurred. Such findings suggest that the meaning attributed to the noise may in fact be the main determinant of one's actual performance. That is, if one is told that noise detrimentally affects one's performance, and the performer views the source of information as credible, then it is likely that one's performance will be negatively affected. Of course, speculations about the specific variables involved would undoubtedly require a very complex formula even in its simplest form.

Although the exact relationship between noise and performance is unknown, certain characteristics of noise have been identified as having potentially deterring effects on performance (Loeb, 1981). In such cases the mechanism underlying this relationship between noise and performance can and has been attributed to distraction. The notion of distraction implicates some sort of attentional system dysfunction.

Attention and Performance

Broadbent's (1954) concept of filter theory suggests that biological information processing systems tend to shift away from the sources they are monitoring to other sources, especially when they are novel and intense. According to Broadbent, noises are more distracting when they are loud, intermittent, unpredictable, and novel. However, even a faint, continuous stimulus might distract if it carried information that is meaningful and important to the individual (Loeb, 1981).

The exact functioning of the attentional system is disputed, but the importance of attention for understanding and predicting behavior has long been emphasized in sport psychology (Nideffer, 1976). It is logical to assume that the ability to direct our senses and thought processes to particular objects, thoughts, or feelings is an important characteristic of those who are able to perform effectively. In fact some researchers claim that "it is hard to imagine a variable more central to performance than the ability to direct and control one's attention" (Nideffer, 1976, p. 395).

According to Nideffer (1976), attention can be conceptualized on the two dimensions of width and direction. The dimension of width suggests an individual's attentional focus can be found somewhere along a continuum between a broad and narrow focus. While an individual's attention is focused in this manner, it is also directed toward internal or external environmental stimuli. Each environmental situation will demand a certain type of attention for successful performance. The degree of behavioral proficiency an individual exhibits when performing a task is supposedly dependent upon the degree to which that individual's preferred attentional style matches the demands of the task and situation (Dewey, Brawley, & Allard, 1989).

Realizing the importance of attentional focus in effective performance but downplaying the trait-like descriptions of "preferred attentional style," Wine (1971) claimed that personality characteristics such as test anxiety mediate the effects between attention and performance. Accordingly, persons high in test anxiety experience more difficulty in paying attention to a task at hand.

Wine (1971) specifically stated the importance of proper focus for direction and width. He argued that low test-anxious subjects are focused on task-relevant variables while performing tasks. Conversely, highly test-anxious subjects are more internally focused on self-evaluative, self-deprecating thinking and the perception of autonomic responses. The highly test-anxious individual responds to evaluative testing conditions with ruminative, self-evaluative worry and thus, cannot direct adequate attention to task relevant variables (Wine, 1971).

Eysenck (1988) also recognized the importance of anxiety on attentional functioning. He argued that those high in trait anxiety exhibit greater attentional selectivity, smaller available attentional capacity, and greater distractibility than those low in trait anxiety. Furthermore, Eysenck proposed that the extent to which individuals high in trait anxiety will be distracted by task irrelevant stimuli depends on the nature of those stimuli, with distraction being maximal when the task irrelevant stimuli are threat related. It has been demonstrated that high anxiety subjects allocate a greater degree of their processing resources to threat-related stimuli at the expense of neutral stimuli, whereas those low in trait anxiety demonstrate the opposite tendency (Eysenck, 1988).

Somewhat related research (Carpenter & Mahoney, 1980) on attentional strategies found that subjects who were exposed to the demand characteristics of improvement, regardless of directional focus, tended to perform worse. It was suggested that such subjects may have experienced more performance anxiety than subjects who were told that their particular attentional focus detracted from performance.

The issue of choking in sport performance is related to attention and anxiety. Leith (1988) concluded that the mere mention of the word "choke" led to a decreased performance in a basketball shooting task for college athletes. Choking is a metaphorical expression used to describe the occurrence of inferior performance despite individual striving and situational demands for superior performance (Baumeister, 1984). Therefore, choking can be equated to performance decrements. Much of the literature explains and accounts for this phenomenon through a mechanism of inappropriate attentional shifts. Baumeister's research was based on a model that suggested that pressure increases self-consciousness and self-consciousness disrupts performance of some tasks via inappropriate attention.

Perhaps Wine (1971) would explain this problem as reflecting worry and that the highly test anxious individual responds to evaluative testing conditions with ruminative, self-evaluative thoughts. Thus, they cannot direct adequate attention to task relevant variables. However, Baumeister (1984) has suggested that pressure leads to a conscious attempt to ensure correctness of execution by monitoring the process of performance. Conscious attempts by athletes to monitor automatic skills ironically interferes with performance because their consciousness does not contain the knowledge of these skills.

It would seem apparent that both explanations are viable and that perhaps a synthesis of both positions might better explain the construct of choking as it relates to attention. Regardless, this literature is construed as being relevant because the internal attentional conditions characteristic to choking are hypothesized as attentional dysfunctions. Accordingly, performance decrements may occur under adverse conditions of hostile crowd noise, especially if meaningful reference is made to choking.

The Role of Imagery

Wine (1971) stated that it has been empirically established that persons can be instructed to be selectively more attentive to specific stimulus attributes or dimensions and to be less attentive to others. Moreover, with repeated training under attention-directing instructions, subjects become more and more skilled in attending to relevant stimuli and ignoring irrelevant stimuli.

Although the role of mental practice in developing the proper attentional set has been ignored in the research literature, Feltz and Landers (1983) have stated that extended mental practice of the relevant aspects of a physical task can develop a capacity for narrowed or focused attention. Imagery practice may enable the performer to concentrate proper attention on the task while blocking disrupting thoughts and irrelevant environmental stimuli.

Imagery practice may help athletes overcome natural psychological and biological functions that act to impede performance under distracting conditions, such as hostile crowd noise. If this is the case as proposed, then subjects who engage in a mental imagery program should demonstrate higher performance levels than untrained subjects under conditions designed to distract attention.

Summary

Mental practice is an umbrella concept that includes all forms of covert practice, such as conceptualizing, visual modelling, and overt verbalization. Imagery rehearsal, on the other hand, refers to a specific type of mental practice in which imagery is the dominant experience. Imagery rehearsal utilizes information from all senses stored in memory. Athletes use imagery rehearsal to create internal experiences that simulate their responses to actual experiences.

Sport research on imagery rehearsal has mainly focused on performance enhancement. Various researchers have concluded that imagery rehearsal is beneficial to motor skill performance. The evidence to support this conclusion, however, is less than overwhelming. Furthermore, the moderating effects of a number of variables associated with imagery rehearsal confound the issue.

Imagery rehearsal programs should consider the influence of variables such as controllability, vividness, perspective, task outcome, and speed. Therefore, these variables were reviewed.

Imagery rehearsal research should also be theoretically based. The literature review focused on four theoretical explanations for imagery effects on motor performance. These theories were (a) symbolic learning, (b) psychoneuromuscular, (c) bioinformational, and (d) attention-arousal set.

The attentional aspects of imagery rehearsal were expounded upon under the context of noise and performance. Few studies were found that focused on the effects of noise on motor performance. Fewer studies were found that sought the effects of noise on sport performance. Researchers have concluded that the effects of noise on performance, if any, depend upon the nature of the noise, the type of activity, and the psychological attributes of the performer.

It has been suggested that noise that is loud, intermittent, unpredictable, novel, and meaningful may detrimentally affect performance through distraction. Distractions may lead an athlete to have an inappropriate attentional focus for the task at hand. Choking, a condition that is equated to inferior performance, has been attributed to attentional dysfunctions. Imagery rehearsal was proposed as a technique that may facilitate proper attentional focus. Through this review of literature, it was suggested that the beneficial effects of imagery rehearsal on motor skill performance may become apparent under conditions designed to distract attention.

Chapter 3

METHODOLOGY

This chapter will delineate the methods used to investigate the effects of RAIR on the performance of a basketball free throw task under conditions of hostile crowd noise. The methodology is sectioned into the following divisions: (a) subjects and criteria, (b) procedures, and (c) research design and statistical analyses. A summary of this chapter's contents is provided.

Subjects and Criteria

The subjects ($\underline{N}$ = 35) were male ($\underline{n}$ = 23) and female ($\underline{n}$ = 12) students who ranged in age between 18-22 years. They were attending a private college in upstate New York. All subjects were volunteers recruited from undergraduate courses offered in exercise and sport sciences. All subjects were treated in accordance with the "Ethical Principles of Psychologists" (American Psychological Association, 1981). The procedures followed the ethical guidelines specified by the Human Subjects Committee of the college. All subjects signed an informed consent form (Appendix A) before participation.

Potential subjects answered the following five questions during an initial interview. Subjects had to respond affirmatively to all questions to be considered for the study.

1. Do you consider yourself to be reasonably proficient in the skill of shooting basketball free throws?

2. Do you believe that you could successfully make 5 out of 10 basketball free throws?

3. Do you believe that mental preparation can enhance motor skill performance?

4. Would you be willing to practice a mental imagery program for free throw shooting 10 min each day for 21 days?

5. Would you like to participate in my research project involving mental imagery for free throw shooting?

Seventy-two students met the above criteria, however, subjects were also required to pass a performance level criterion test. Only 42 subjects demonstrated that they could successfully complete a minimum of 5 out of 10 free throws. Thirty-five of the 42 subjects successfully completed the requirements of the study.

Procedures

This section includes the procedures that were followed for the pretest, assignment to groups, imagery treatment, control group, and posttest. The methods used during this 5-week investigation are fully explained in the subsections that follow.

Pretest

The pretest was administered over a 6-day period. Subjects appeared at designated times at an off-campus gymnasium for a test of their basketball free throw shooting proficiency. All basketballs were junior-sized and appropriately checked for correct pressure (6-8 psi). Following five practice free throws, each subject listened to the following instructions before taking the pretest.

> Please listen carefully to the following instructions. This is a test of your free throw shooting proficiency. Now, stand slightly behind the foul line. You will notice the cart of basketballs to your immediate right. When you are told, pick up a basketball from this cart and shoot, trying your best to score. Do not attempt to retrieve this ball. If it rebounds directly back to you, you may shoot that ball again. If the ball bounces away,

stay in your position at the foul line, select another ball from the cart, and shoot your next shot. Continue shooting until you have made 15 attempts. The experimenter will keep count of your shots and inform you of your score every five shots. Remember to try your best to sink as many baskets as you can. You may begin with your first shot now.

Assignment to Groups

Following the pretest, subjects were randomly assigned to an experimental group (n = 18) or a control group (n = 17). The experimental group engaged in a RAIR program, whereas the control group was told that their imagery program would be initiated in 3 weeks time. All subjects were asked not to physically practice free throws during the course of the experiment.

Imagery Treatment

A modification of Suinn's (1986) VMBR procedure was used by the experimental group to mentally practice free throws. The treatment program, which consisted of relaxation followed by visualization, was introduced to experimental group subjects during an initial meeting prior to the start of the first imagery treatment. During this meeting the merits of effective imagery rehearsal were carefully explained (Appendix B). The RAIR program (Appendix C) was practiced daily by each experimental group subject for 10-12 min each day for 21 days. The program stressed a positive outcome and allowed for both directed and non-directed imagery practice.

Experimental group subjects were personally led through the RAIR by the investigator twice weekly for 3 weeks. These subjects also received a cassette tape that included a recorded version of the RAIR for home practice on the other 15 days of the program.

Weekly journals were kept by experimental subjects so that they could record their daily RAIR experience. The journals enabled subjects to personally assess their imagery experience relating to relaxation, concentration, quantity, vividness, kinesthetic sensations, and controllability using Likert-type scales (Appendix D). This procedure was followed to assess the subjects' qualitative experiences of RAIR and to promote adherence to the program.

Control Group

The control group subjects were not exposed to RAIR. These subjects were intentionally misled by the investigator. These subjects believed that their imagery treatment would begin later in the semester. The control group subjects were told that the actual posttest was a second pretest necessary to establish valid pretreatment performance levels. These procedures were followed to discourage self-employed imagery or physical practice by the control group subjects. At the conclusion of this investigation control group subjects were informed of the purpose of the study and given opportunities to practice imagery.

Posttest

Upon completion of the imagery treatment, the posttest was administered to subjects in both groups. The procedures for the posttest were similar to the pretest. However, two posttests of 15 free throws were performed by each subject. Five practice shots were taken by all subjects before each posttest. One posttest followed the same procedures as the pretest. During the other posttest of 15 free throws, subjects were exposed to loud and potentially distracting crowd noise recorded on a cassette tape and played on a portable stereo that was positioned 2 m behind each subject. The contents of this cassette are described in Appendix E. The noise or no-noise conditions were randomly assigned for each subject to neutralize order effects.

Research Design and Statistical Analyses

The present study is a variation of the classical pretest/posttest design. A pretest (15 free throws) and two posttests (15 free throws without noise and 15 free throws with noise) provided the data for this experiment. Following the posttests, means and standard deviations of free throw shooting scores for RAIR and control group subjects were calculated.

A 2 (RAIR/control) x 3 (trials) repeated measures ANOVA was used to test the major null hypotheses as stated in chapter 1. It was hypothesized that the main and interaction effects on free throw shooting performance would not be statistically significant at the .05 level.

Summary

The subjects (N = 35) were male (n = 23) and female (n = 12) students who ranged in age from 18-22 years. They were attending a private college in upstate New York. All subjects were volunteers recruited from undergraduate courses offered in the exercise and sport sciences. All subjects participated in a pretest consisting of 15 basketball free throws. Subjects were then randomly assigned to either a control group (n = 17) or an experimental group (n = 18). The experimental group subjects participated in a 21-day RAIR program for basketball free throw shooting. Both groups were told to abstain from physically practicing free throws throughout the experiment.

Following the 3-week program, both groups participated in a posttest consisting of shooting basketball free throws under conditions of hostile crowd noise and no noise. Descriptive and inferential statistical procedures were used to analyze the data. The effects of RAIR and adverse crowd noise on free throw performance were assessed by a repeated measures ANOVA.

Chapter 4

RESULTS

Chapter 4 contains the results of this basketball free throw shooting experiment. Descriptive and inferential statistics will be presented for experimental (n = 18) and control (n = 17) group subjects under noise and no-noise conditions. The hypotheses that were formulated in chapter 1 will be accepted or rejected. Graphical and tabular analyses will be utilized in the presentation of data.

The sections of this chapter concern (a) treatment adherence, (b) subjects' RAIR experiences, (c) descriptive statistics, (d) order effects, (e) effect of RAIR on free throw shooting performance, (f) effect of noise on free throw shooting performance, and (g) interaction effects. A summary of chapter 4 is provided.

Treatment Adherence

To promote adherence, each experimental subject kept a log of his/her daily participation in the RAIR program. Subjects practiced relaxation and imagery exercises for 21 consecutive days. All experimental subjects attended six RAIR sessions led by the experimenter.

Of the 18 RAIR subjects, 12 (67%) reported that they did mental training each day for 21 consecutive days. Three (16.5%) subjects stated that they missed only 1 day of home practice. Two (11%) subjects indicated that they missed 2 days of home practice. One (5.5%) subject stated that she missed 3 days of home practice. As a group, the compliance rate was 97% (only 10 sessions out of a possible 378 sessions were missed).

Subjects' RAIR Experiences

Experimental subjects (n = 18) were asked at the conclusion of each imagery training session to complete a 5-item questionnaire that assessed the quality of their RAIR. A 5-point Likert-type scale was used.

Question 1 assessed the subjects' ability to relax and concentrate. On a Likert scale of 1 (not at all), 3 (sometimes), and 5 (all of the time), their overall mean response was 4.03. This value suggests that subjects were relaxing and concentrating well.

Question 2 asked the subjects to rate the amount of material they were able to image during each training session. On a Likert scale of 1 (almost none), 3 (some of the content), and 5 (all of the content), their mean score was 3.91. Thus, subjects reported, in general, that they were able to visualize themselves shooting free throws well.

Vividness of imagery was also assessed by subjects. Their mean score was 3.82 on a Likert scale of 1 (not at all clear), 3 (sometimes clear), and 5 (very clear). This value demonstrates that, overall, subjects experienced relatively clear and vivid images.

The kinesthetic sensations of subjects' imagery was also assessed on a Likert scale of 1 (not at all), 3 (sometimes), and 5 (all of the time). The mean score was 3.38. This value indicates that, overall, subjects experienced some sensations of muscular movements during RAIR.

At the end of each training session, each subject was asked to visualize himself/herself successfully making five consecutive free throws. Question 5 asked each subject how difficult it was to accomplish this goal. On a Likert scale of 1 (not at all difficult), 3 (somewhat difficult), and 5 (very difficult), the mean score was 2.12. This value shows that visualizing five successful consecutive free throws was performed without great difficulty for most subjects.

Descriptive Statistics

The pretest and posttest mean free throw shooting scores for the RAIR (n = 18) and control (n = 17) groups are presented in Figure 1. The means and their standard deviations for free throw shooting with and without noise are reported in Table 1. Both RAIR and control groups recorded improvements in mean scores from pretest to each posttest. The RAIR group showed their greater improvement from the pretest to the no-noise posttest. The control group, however, showed their greater improvement in mean free throw shooting from the pretest to the noise posttest. Table 1 also reveals that the mean posttest performance scores for noise and no-noise conditions were identical.

Overall, RAIR group subjects were slightly more variable in their shooting performance than were control group subjects. The standard deviations for RAIR subjects were slightly higher for noise and no-noise posttest conditions than for control subjects.

Order Effects

The experimenter controlled for order effects by randomizing the order in which the two posttests were administered. However, the necessity to control for order effects was tested. Although both RAIR and control group subjects had slightly higher mean free throw shooting scores during the second posttest, Table 2 shows that these differences were not statistically significant (.05 level).

Effect of RAIR on Free Throw Shooting Performance

Table 3 shows that there was no significant difference (.05 level) in mean free throw shooting scores between RAIR and control group subjects. Thus, hypothesis 1 was accepted. RAIR was not effective

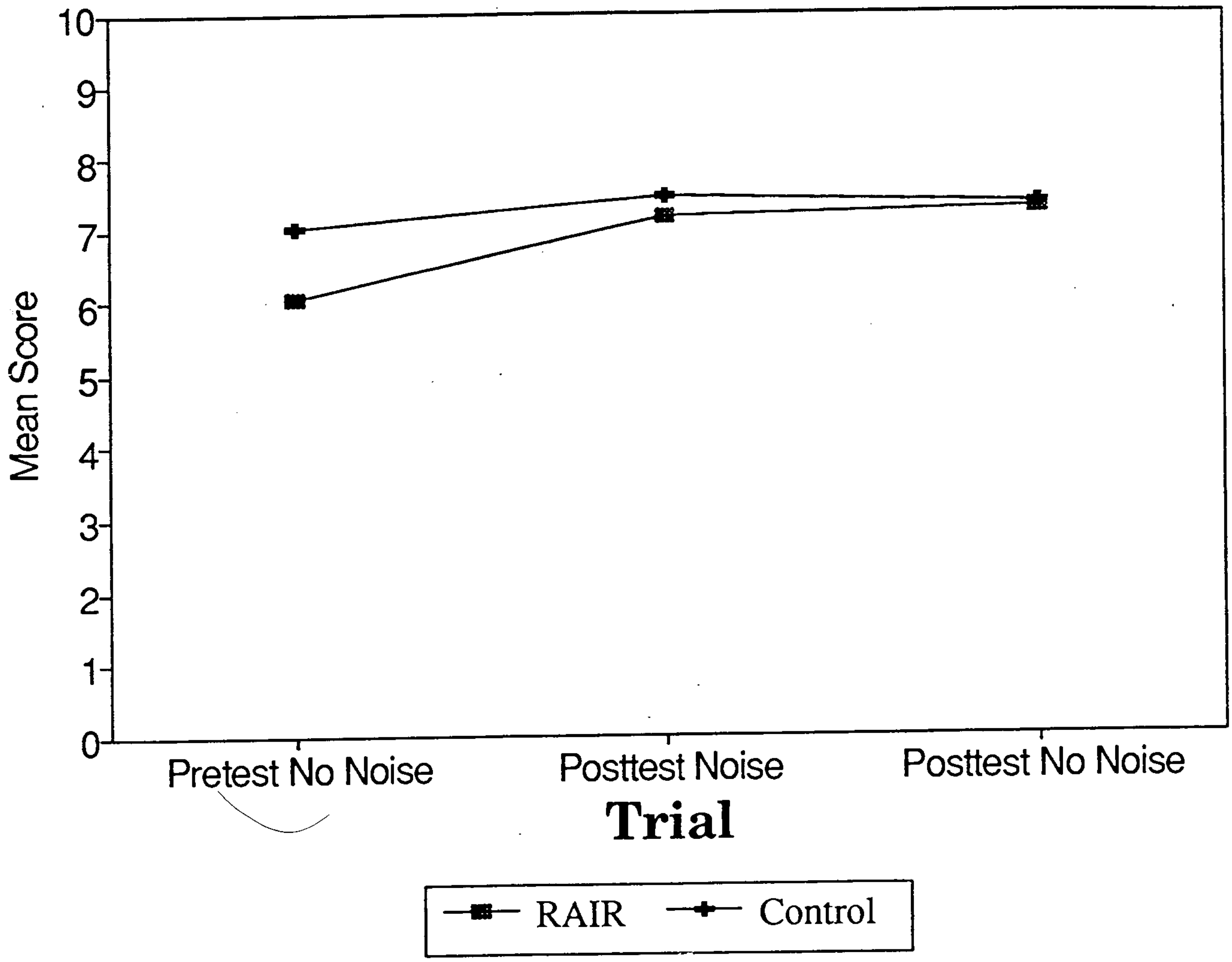

Figure 1. Pretest and posttest mean free throw shooting scores.

Table 1

Descriptive Statistics of Free Throw Scores

		Pretest (no noise)		Posttest (noise)		Posttest (no noise)	
Group	n	M	SD	M	SD	M	SD
RAIR	18	6.06	2.60	7.17	3.28	7.28	3.14
Control	17	7.06	2.86	7.47	2.70	7.35	2.34
Total	35	6.54	2.74	7.31	2.97	7.31	2.74

Table 2

ANOVA of Free Throw Scores for Posttest Order Effects

Source of Variation	SS	df	MS	F
Between Subjects				
Group	0.63	1	0.63	0.05
Error	380.46	33	11.53	
Within Subjects				
Group x Order	0.13	1	0.13	0.03
Order	18.41	1	18.41	3.91
Error	155.36	33	4.71	

Table 3

ANOVA of Free Throw Scores

Source of Variation	SS	df	MS	F
Between Subjects				
Group	5.57	1	5.57	0.39
Error	471.42	17	14.29	
Within Subjects				
Group x Trial	4.09	2	2.04	0.41
Trial	13.46	2	6.73	1.35
Error	328.69	66	4.98	

in increasing the free throw shooting performance of experimental group subjects.

Effect of Noise on Free Throw Shooting Performance

The effect of hostile crowd noise on free throw shooting performance was assessed. Table 3 shows that the main effect for noise did not reach statistical significance (.05 level). Therefore, hypothesis 2 was accepted. There was no significant difference in mean free throw shooting performance under noise and no-noise conditions.

Interaction Effects

Table 3 shows the results of a 2 (RAIR/control) x 3 (trials) repeated measures ANOVA for main and interaction effects. As shown, the Group x Trials interaction did not reach statistical significance (.05 level). Therefore, hypothesis 3 was accepted. Free throw shooting performance did not improve significantly across trials.

Summary

It was the purpose of this experiment to determine the effect of RAIR (relaxation and imagery rehearsal) on basketball free throw shooting performance under noise and no-noise conditions. Treatment adherence and quality of RAIR were assessed. Descriptive and inferential statistical procedures revealed that RAIR did not produce significant increments in free throw shooting performance. Further, a 2 x 3 ANOVA with repeated measures across trials showed that noise did not significantly affect performance. ANOVA also demonstrated that there were no significant order or interaction effects.

Chapter 5

DISCUSSION OF RESULTS

The effect of imagery rehearsal on skilled motor behavior has generated much research in sport psychology. On the other hand, an area in the sport sciences that has not garnered much research is the effect of hostile crowd noise on sport performance. The present study independently addressed each of these issues as well as their possible interaction effects on free throw shooting performance.

At the present time, some reviews of the literature suggest that imagery rehearsal has only a minimal effect on performance enhancement (Corbin, 1972; Feltz & Landers, 1983). Other researchers, however, are considerably more optimistic in their conclusions concerning the positive effects of mental imagery on motor performance (Martens, 1982; Paivio, 1985; Richardson, 1967a; Suinn, 1985).

Empirical evidence can be found supporting each position. However, more recent imagery research has focused not on whether imagery positively affects performance, but rather to what degree and when it affects motor skill. In a recent review, Paivio (1985, p. 24) noted that there was a need for imagery research that asks, "What kinds of imagery, under what situational conditions, and for what kinds of people is it likely to be effective?"

It was the purpose of this investigation to demonstrate the effects of a relaxation and mental imagery program on free throw shooting performance under conditions of hostile crowd noise. This chapter's contents include a discussion of the results of this investigation. The contents are organized by the hypotheses that were posed in chapter 1. More specifically, there will be a discussion of free throw shooting performance considering (a) RAIR vs.

control data, (b) noise vs. no-noise data, and (c) the interaction effects of RAIR and noise variables. A summary is included at the conclusion of this chapter.

RAIR vs. Control Data

The first hypothesis stated that there would be no significant differences (.05 level) in mean free throw shooting performance among subjects who participated in a 3-week RAIR program and a control group. This hypothesis was found to be tenable. RAIR did not produce significant results in mean free throw shooting performance. These results are not congruent with the conclusions of other researchers such as Martens (1982), Paivio (1985), Richardson (1967a), and Suinn (1985). These investigators concluded that imagery enhanced motor performance. The results from the present study also disagree with the conclusions of Corbin (1972) and Feltz and Landers (1983). They suggested that mental practice was better than no practice at all.

The findings of the current investigation also disagree with previous research on imagery and free throw performance. Clark (1960) studied the effects of visualization, as compared to physical practice, on the development of the Pacific Coast one-hand basketball foul shot for high school boys ($\underline{N}$ = 144). Both conditions produced significantly enhanced free throw shooting performance. Furthermore, Clark concluded that mental practice was as effective as physical practice under the conditions of his experiment.

The contrasting results between Clark's (1960) research and the present study may be explained by the age and skill level differences between the subjects. The subjects in the present study were college students and older than Clark's subjects. Different age groups may be more or less receptive to imagery. Perhaps younger subjects may be more inclined to use or adept at using imagery techniques.

Furthermore, it is apparent that the Pacific Coast one-hand foul shot was a relatively new technique to master for Clark's subjects. On the other hand, subjects in the present study verbally acknowledged that they had prior experience with the task. The mandatory 50% success rate in the free throw selection criterion test physically demonstrated that subjects were competent. It has been noted by researchers that skill level may influence imagery effects on performance (Feltz & Landers, 1983; Richardson, 1967a).

The findings from the present investigation, however, do agree with other research on free throw shooting and imagery. Lane (cited in Suinn, 1982) examined the effectiveness of VMBR training on members ($\underline{N}$ = 16) of a boys high school basketball team. Lane failed to discover any statistically significant difference in free throw accuracy for a VMBR group as compared to a control group.

Hall and Erffmeyer (1983) investigated the effects of VMBR on the free throw shooting performance of 10 highly skilled female members of an intercollegiate basketball team. The subjects were randomly assigned to either a VMBR (videotape modelling) condition or a progressive relaxation and visual imagery (no modelling) condition. Assessment of free throw scores was completed by recording percentages of a set of 20 daily free throws over a 5-day period. The VMBR group showed a significant improvement in free throw performance. Even so, Hall and Erffmeyer's results also supported the findings of the present investigation. Their progressive relaxation and imagery treatment did not produce significant differences in pretest to posttest mean free throw scores. This treatment without modelling was similar to the RAIR program of the current study. Hall and Erffmeyer (1983), therefore, concluded that relaxation and imagery rehearsal did not significantly affect free throw shooting scores, unless of course it was accompanied by videotaped modelling.

Wrisberg and Anshel (1989), on the other hand, concluded that relaxation combined with imagery rehearsal was a useful preshot cognitive strategy to enhance free throw shooting performance. They examined the individual and combined effects of various cognitive mental training techniques (relaxation and imagery) on the basketball free throw shooting performance of 10-12 year old boys ($\underline{N}$ = 40). Mental imagery, when coordinated with arousal adjustment, was found to significantly enhance free throw shooting accuracy.

Kolonay (1977) also concluded that VMBR training led to a significant increase in free throw shooting performance. She studied the effects of VMBR, visual imagery alone, and relaxation alone on free throw accuracy of males ($\underline{N}$ = 72) from eight intercollegiate basketball teams. The VMBR group listened to a 10-min relaxation and free throw audiotape prior to physical practice. The other groups listened to either the relaxation alone or the imagery tape alone or engaged in irrelevant activity. Only the VMBR group showed a significant increase in pretest to posttest scores. Kolonay, like Wrisberg and Anshel (1989), concluded that the component parts of VMBR need to be used in combination if significant results are to occur.

Though Kolonay (1977) suggested that VMBR led to significant increases in free throw shooting performance, her statistical analysis did not demonstrate whether the differences among the groups were significant. There are, however, other reasons to explain why some VMBR experiments reached statistical significance while those of other imagery research and the RAIR group in the present study did not.

An obvious explanation concerns a natural law of statistics. It is difficult to gain statistical significance when the number of subjects per group is small. The present study had group sizes of 18 and 17 members. Therefore, the degrees of freedom were small, and the $\underline{F}$ value needed to gain statistical significance was large.

Another obvious explanation concerns the quality and the quantity of the imagery experience. Imagery rehearsal that is not competently or systematically practiced may not facilitate performance (Smith, 1987). It was an important goal of the present study to monitor how subjects experienced RAIR. Questionnaire data suggested that subjects became competent in relaxation and concentration aspects relating to RAIR. The questionnaire data also indicated that subjects had vivid and clear visualizations for a majority of the content presented in RAIR training. However, subjects were only moderately competent in controllability and kinesthetic aspects of their imagery practice. The questionnaire data revealed that the specific conditions believed to facilitate imagery effects were developed. RAIR subjects, in general, experienced relatively competent imagery.

Because the results of this study were not statistically significant (.05 level), the questionnaire data suggests that relatively competent imagery practice has no effect on sport performance. This conclusion is in opposition to researchers who explained the lack of imagery effects on performance as a result of mentally practicing in a non-competent manner (Feltz & Landers, 1983; Smith, 1987).

However, one reason why RAIR did not produce significant results in free throw shooting performance may have been the length of the training period. Investigators have suggested that the higher the number of mental rehearsal sessions, the greater the effect on performance (Smith & Harrison, 1962; Smyth, 1975). Gauron (1984) suggested that daily mental practice may be necessary for as long as 3 months before effects on performance are evident. Thus, 3 weeks of competent RAIR, in the present study, may have been too short to produce changes in motor performance.

Perhaps the degree of competence developed and the duration of the practice for imagery in the present study were insufficient. Although the experimental treatment was issued over a 21-day period, the investigator can only guarantee that subjects were exposed to six sessions of RAIR. Furthermore, there are no objective measures (other than subjects' personal statements) to indicate whether subjects were actually participating in RAIR.

Another related factor that may have contributed to the lack of statistical significance in the present study was the motivation of subjects. Kolonay (1977) recruited varsity basketball athletes, but the subjects in the current investigation were selected from undergraduate exercise and sport sciences courses. It is reasonable to assume that basketball athletes may have a greater vested interest in improving their free throw performance levels than non-basketball college students. Perhaps motivation may have influenced other aspects that are critical for imagery rehearsal effects. For example, motivation may affect the amount and quality of mental practice in the laboratory or home setting (Singer & Milne, 1975).

College athletes may also differ from college students in other critical areas that concern mental imagery. Richardson (1967a), for example, noted that skill level, imagery ability, intelligence, kinesthetic ability, gender, and motor ability influence the effectiveness of mental practice. Athletes, as a group, may be more adept in some of these aspects than other college students. It was beyond the scope of the present study to ascertain the influence of these variables on imagery and performance. However, it is recognized that any of the variables mentioned above may have confounded the results. Perhaps the effects of one of these variables could explain why the RAIR program in this study had no significant consequences on free throw performance.

In contrast to the findings from the present investigation, case studies have also indicated that imagery rehearsal can significantly enhance free throw performance. Meyers and Schlesser (1980) examined the effects of a cognitive intervention procedure on the free throw shooting performance of a male Division 1 varsity basketball player. Following a 7-week program of practicing relaxation and imagery, the subject's shooting accuracy significantly increased (.05 level).

Silva (1982), as part of a larger investigation, conducted a case study on a Division III male basketball player. A 3-step approach was used to administer a cognitive intervention program consisting of imagery rehearsal. Phase 1 consisted of identifying cognitive sets that were responsible for inadequate performance. The second phase involved cognitive restructuring. In the third phase, the subject was given self-instructional imagery paired with concentrative cues that were specific to the subject's case. Following a 10-week program of 4 hours of practice/week, the subject's shooting accuracy improved from 53.86% to 74.91%.

The case studies of Meyers and Schlesser (1980) and Silva (1982) indicate the importance of tailoring the imagery program to meet the specific needs of the individual. Wollman (1986) suggested that single-subject methodology may be better suited than group designs in working with skilled athletes who will not improve much from pretraining levels. Wollman also stated that imagery experiments with single-subject behavioral monitoring lend themselves well to tailoring imagery programs to meet the specific demands of the individual.

In the current investigation, the researcher did not address the need to specifically tailor and monitor imagery programs. However, it is readily recognized that individual differences and preferences cannot be adequately addressed by a mental imagery program that is rigidly administered to a group. Thus, it is suggested that tailoring an imagery program to meet the exact needs of the individual is an important aspect of cognitive interventions.

Another methodological factor that may have accounted for the lack of effectiveness of the RAIR program on free throw shooting performance was the coordination of physical practice with imagery rehearsal. Suinn (1985) noted that mental practice appears best when used in combination with physical practice.

The importance of coupling physical practice with imagery was shown by Ziegler (1987). She studied the effects of three types of imagery techniques on the performance of free throw shooting by university students ($N = 93$). Subjects were randomly assigned to a control, physical practice only, passive imagery, active imagery, and imagery with physical performance. The results indicated that the active imagery group (actual movement without a ball) and the imagery with physical performance group performed significantly superior to a physical practice group. The lack of significant effects of the RAIR program in the current project may have been due to the failure to coordinate mental and physical practice.

In summary, the results of the present study are in opposition the findings of Clark (1960), Kolonay (1977), Meyers and Schlesser (1980), Silva (1982), and Wrisberg and Anshel (1989). They all reported that relaxation and imagery rehearsal successfully enhanced free throw shooting performance. Although there is supporting evidence (Lane, cited in Suinn, 1982; Hall & Erffmeyer, 1983; Ziegler, 1987) that RAIR does not enhance free throw shooting performance, the majority of the literature (Feltz & Landers, 1983; Martens, 1982; Paivio, 1985; Richardson, 1967a; Suinn, 1985) suggests that imagery does have some beneficial effects on motor performance. The task for researchers is to further define the effects of certain variables that moderate the relationship between imagery and sport performance.

Noise vs. No-noise Data

The second hypothesis stated that there would be no significant differences in mean free throw scores under the noise and no-noise conditions. This hypothesis was found to be tenable. Mean free throw shooting performance was not affected by noise.

Other research on noise effects and performance support the conclusion of the current investigation. Kryter (1970), for example, concluded that noise did not affect performance on intelligence tests. Moller (1980) examined the effects of noise on mathematical problem solving of college students (N = 30). She also concluded that noise did not affect performance. These studies, however, represent intellectual functioning skills. The present study investigated the effects of noise on physical performance.

There is no overwhelming body of literature to suggest that physical functioning is or is not affected by noise. The conclusions of the current investigation on noise effects and motor performance, however, are supported by other research. Arnoult et al. (1986) examined the effects of continuous and intermittent aircraft noise on a perceptual motor rotary tracking task. They concluded that subjects' (N = 80) performance was unaffected by the aircraft noise. Arnoult et al. suggested that the noise (60, 70, & 80 db) was not loud enough to have any effect on performance. Though the volume level in the present study was not assessed, perhaps the noise was not loud enough to have a significant effect on motor performance.

Lewandowski and Fink (1988) studied the effects of acoustic interference on reaction time and sprint running performance. Elite level men (n = 84) and women (n = 60) sprinters served as subjects. All subjects individually ran 12 block-start 30-m races. Six trials were run under noise (95 db), and the other six trials were run with no noise. An acoustic signal (135 db) started all races. There were no significant differences in reaction time and running performance under the noise and silent conditions.

There are some relationships between the present study and the research by Lewandowski and Fink (1988) that may explain the similar conclusions. Lewandowski and Fink suggested that no effects were found because of the simplicity of the task (running). The task in the current study (free throw shooting) can also be considered simple because subjects were performing a well-learned, closed motor skill. Task complexity may represent an important moderating variable for noise effects on the performance of physical tasks.

An important difference between the present study and Lewandowski and Fink's (1988) investigation concerned the qualitative characteristics of the noise. Lewandowski and Fink examined the effects of white noise at a constant volume (95 db). The current investigation utilized intermittent hostile crowd noise.

The results of the present study suggest that intermittent hostile crowd noise does not affect free throw performance. Other researchers (Loeb, 1981), however, have shown that the quality of the noise does have an effect on sport performance. Paul (1981) examined the impact of psychic factors on the weightlifting performances of 127 subjects. His conclusions strongly suggested that training in weightlifting should be adjusted to the conditions in which the competition takes place (noise, public, platforms). Thus, Paul indirectly indicated that crowd noise may affect sport performance.

The current investigation utilized hostile crowd noise. A major component of the canned noise consisted of repeated and loud chanting of the word choke. In a related study, Leith (1988) concluded that even the mere mention of the word choke can lead to decrements in free throw shooting performance. Leith's conclusions are in direct contrast to the findings of the present study.

There is a possible explanation for the discrepancy between the two studies. The word choke in the present study was introduced as hostile crowd noise and was not initially associated with poor performance by the experimenter. Although Leith's (1988) subjects did not perform in a noise condition, the preperformance speech on choking was introduced with biased connotations of poor performance and expectations of failure. The difference in conclusions between the present study and Leith's research may be explained by Mech's (1953) generalizations. He stated that the meaning ascribed to noise by subjects can influence its subsequent effects on performance.

Subjects in Leith's (1988) experiment also performed their free throws while other subjects watched. All subjects in the present investigation performed their task with only the experimenter present. Therefore, the introduction of audience effects may have confounded Leith's study and resulted in significantly poorer free throw performance.

In summary, the effects of noise on performance represent an ongoing debate among members of the scientific community. Contrary to popular beliefs that noise degrades performance, investigators have found evidence to support a number of opposing positions (e.g., Loeb, 1981). Some researchers (Mech, 1953; Paul, 1981; Poulton, 1980) have shown that noise affects performance. The results from the present study, however, support researchers (Arnoult et al., 1986; Kryter,1970; Moller 1980; Lewandowski & Fink, 1988) who concluded that noise has no effect on performance.

The noise in the present experiment may not have affected free throw shooting performance for a number of reasons: the small sample size, the volume and other characteristics of the noise, and the complexity of the task. Or, more simply, noise may just not affect motor performance.

Still, it must be remembered that only a limited amount of research on noise effects and sport performance has been conducted. In light of this fact, it would appear unwise to disregard the claims that the effects of noise on performance and its nature depend on the kind of noise, the type of activity, and certain psychological attributes of the performer (Loeb, 1981). More specific research that considers the factors mentioned above is required before more precise conclusions on noise effects can be drawn.

The Interaction Effects of RAIR and Noise Variables

The third hypothesis stated that there would be no significant interaction effects of RAIR and noise variables on free throw shooting performance. This hypothesis was found to be tenable. The results of the current study suggest that free throw shooting performance was not significantly affected by any combination of the variables examined.

Specific studies examining noise and imagery rehearsal on free throw performance were not found by this investigator. Evidence provided by Lane (cited in Suinn, 1982), however, suggested that significant interaction effects between imagery rehearsal and hostile crowd noise on free throw performance might have been found in the present study. Lane studied starters (N = 6) from a boys' high school basketball team. Three subjects received VMBR over the course of a season, and the other subjects refused treatment. Analyses showed that the VMBR players demonstrated significant increases in free throw shooting accuracy over their previous season's performance. The control subjects did not significantly improve their free throw performance from the previous year. More importantly, however, further analyses also showed that the VMBR players demonstrated their most significant increases in free throw shooting performance at away games as opposed to home games. Thus, Lane (cited in Suinn, 1982, p. 518) concluded that "under the most extreme conditions of competition . . . (away games) the advantages of VMBR became most clearly evident."

The primary purpose of the present study was to isolate the positive effects of imagery in the absence of physical practice. It was suggested by the present researcher that RAIR may facilitate the maintenance of performance levels under conditions thought to adversely affect motor skills. Various researchers (Lane as cited in Suinn, 1982; Leith, 1988; Loeb, 1981) suggested that a condition of hostile intermittent crowd noise may detrimentally affect motor performance.

Feltz and Landers (1983) noted that imagery research should be theory based. The current study attempted to build a foundation from which further research could be conducted concerning attentional theory (Wine, 1971) and imagery rehearsal in sport performance. A study on sport performance utilizing a distraction factor was believed to provide a tenable framework from which to ascertain the importance of attentional focusing properties of imagery.

Unfortunately, however, the results from the current investigation show that the distraction of intermittent hostile crowd noise had no effect on free throw shooting performance. Therefore, these findings negated the opportunity to examine the maintenance effects of RAIR under conditions that are detrimental to motor performance.

Despite the theoretical setback of the present investigation, the attentional aspects of imagery should still warrant future research. After all, it is still logical to assume that an optimal mental focus is intrinsically developed by the practice of any well-developed imagery rehearsal program. And, if an optimal mental focus facilitates motor behavior and sport performance in any way (acquisition, maintenance, or retention), the benefits of an imagery rehearsal program, in part, may be attributed to its attentional focusing dimensions. The challenge of future researchers is to first establish effective distraction conditions that are known to detrimentally affect motor behavior before implementing an imagery program. Perhaps, then, the positive effects of imagery rehearsal in the absence of physical practice may become more apparent.

The importance of this exploratory study, however, was still validated by studying the interaction of imagery and noise on sport performance both independently and as possible moderators of one another. As mentioned previously, the effects of many moderating variables associated with imagery training are still not fully understood. The findings from this study suggest RAIR and intermittent hostile crowd noise do not interact to affect free throw performance.

The current investigation represents an exploratory study. It was concluded that there are no significant interaction effects between RAIR and noise on free throw shooting performance. The results of the present study are in opposition to the very limited amount of related literature (Lane, cited in Suinn, 1982) that suggested imagery effects on free throw performance were most beneficially salient under extreme conditions. The present study was based on attentional theory which suggests that imagery practice may direct the athlete's attention to task relevant thoughts and prevent task irrelevant thoughts. Though the results did not support the value of imagery rehearsal, it is suggested that future research in this direction is still warranted.

Summary

In summary, the findings of the current investigation do not support researchers who found that relaxation and imagery rehearsal or noise significantly affected free throw shooting performance. The three hypotheses that were posed in chapter 1 were discussed. The first hypothesis stated that there would be no significant differences (.05 level) in mean free throw shooting performance among RAIR and control subjects. This hypothesis was accepted. RAIR did not produce a significant effect on free throw shooting performance. These findings were discussed in relationship to previous research. Variables such as the small sample size, motivation, age, and physical practice may have affected the results. The second hypothesis stated that there would be no significant differences (.05 level) in mean free throw scores under noise and no-noise conditions. This hypothesis was accepted. Intermittent hostile crowd noise had no significant effects on free throw shooting performance. These findings were discussed in relationship to previous research. Variables such as the characteristics of the noise and the complexity of task may have affected the results. The third hypothesis stated that there would be no significant interaction effects (.05 level) of RAIR and noise variables on free throw shooting performance. This hypothesis was also accepted. The findings suggest that RAIR and noise variables did not interact to significantly affect free throw shooting performance. Based upon attentional theory, it was suggested that further research on the effects of imagery on sport performance under adverse conditions was warranted.

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study investigated the effects of RAIR (relaxation and imagery rehearsal) on basketball free throw shooting performance under the conditions of intermittent hostile crowd noise and no noise. The subjects were college-aged students ($\underline{N}$ = 35) enrolled in undergraduate courses at a private institution in upstate New York. This 5-week study was conducted during the 1990 fall semester. All volunteer subjects demonstrated an initial minimal skill level of 50% in basketball free throw performance. Most subjects had no prior experience with imagery rehearsal.

Following a pretest that consisted of 15 free throws, subjects were randomly assigned to experimental ($\underline{n}$ =18) and control ($\underline{n}$ = 17) groups. The experimental group practiced RAIR once daily for 21 days. Both groups were told to abstain from physically practicing free throws throughout the experiment. Following the 3-week treatment period, all subjects took two posttests. Each posttest consisted of 15 free throws. One posttest was performed under a no-noise condition identical to the pretest. The other posttest was performed under conditions of potentially distracting auditory stimuli (intermittent hostile crowd noise). The administration of the posttests was randomly assigned to neutralize order effects.

Descriptive and inferential statistical procedures were used to analyze the data. Group means and standard deviations were calculated for free throw shooting performance. These results are found in Table 1.

A 2 (RAIR/control) x 3 (trials) repeated measures ANOVA was used to test for main and interaction effects on free throw shooting performance. A .05 level of significance was established for all tests. The first null hypothesis stated that there would be no significant differences in mean free throw shooting performance among subjects who participated in 3 weeks of RAIR and a control group. The second null hypothesis stated that there would be no significant differences in mean free throw shooting performance under conditions of noise and no noise. The third null hypothesis stated that there would be no significant interaction effects between RAIR and noise variables on mean free throw shooting performance.

Main and interaction effects (Table 3) did not reach statistical significance at the determined level (.05 level). Therefore, based upon the above analysis, the three null hypotheses were accepted.

Conclusions

The results of this study yield the following conclusions regarding the effects of RAIR on free throw shooting performance under conditions of hostile crowd noise and no noise:

1. RAIR (without physical practice) does not affect basketball free throw shooting performance.

2. Intermittent hostile crowd noise does not significantly affect free throw shooting performance.

3. RAIR does not affect basketball free throw performance under conditions of intermittent hostile crowd noise.

Recommendations

The following are recommendations for further study:

1. The effects of RAIR (without physical practice) on motor behavior should be further studied utilizing adverse conditions known to detrimentally affect specific populations (e.g., low skilled athletes in the presence of a discriminating audience).

2. The interaction of personality characteristics and imagery rehearsal on free throw performance should be studied (e.g., high self-efficacy vs. low self-efficacy).

3. Further research should assess the effects of various noises on motor performance. Some characteristics to consider are volume and content of the noise.

4. The interaction of personality characteristics and noise on motor performance should be studied (e.g., extroverts vs. introverts).

Appendix A

INFORMED CONSENT FORM

1. a) The Purpose of the Study: This study will investigate the effects of mental imagery rehearsal on the performance of basketball shooting.

   b) Benefits: Participation in this study will be a positive and informative experience. As a subject, you will receive the opportunity to gain experience in mental imagery rehearsal. Also, as a subject you will gain valuable first hand experience in the research process.

2. Methods: As a subject, you will be asked to perform the task once or twice to establish a baseline score. You will also be guided through a mental imagery rehearsal session and then asked to perform the physical skills once again. The duration of this entire process will take no longer than 2 hours.

3. Risks Involved in Participation: No physical or psychological risks are evident.

4. Need More Information? Additional information can be obtained from Mark Tadeson (272-3917), Dr. Craig Fisher (274-3112), or Dr. W. Straub (272-3152). All questions are welcomed and will be answered.

5. Withdrawal from the Study: Participation is voluntary. You are free to withdraw your consent and discontinue at any time during the study.

6. Confidentiality of Data: All data will be confidential. Once data are collected, names of subjects will be discarded and replaced by subject number (e.g., Subject 22).

7. I have read the above and understand its contents. I agree to participate in the study. I acknowledge that I am 18 years of age or older.

Signature ______________________ Date __________

Appendix B

PRETREATMENT IMAGERY SPEECH AND INSTRUCTIONS

My name is Mark Tadeson. I would like to welcome you to this mental imagery seminar. This is a very exciting program for me to teach you. I hope that it will be an exciting program for you to go through. I am confident it will be. I 'd like to lay out the ground rules of this particular program to you. It is probably going to be different than any class you've ever taken or any practices you've ever been to before because basically you are going to be enhancing your imagery skills.

But before we begin, I'd just like to clear up a few things about mental imagery. If you are like most people you will initially be very hesitant to accept the fact that imaging a physical skill in your mind can actually lead to better physical performance. But this is scientific fact. It has been demonstrated in over 100 studies since the early 1900s. However to be honest, what makes me believe in mental imagery is that as a young boy I used to practice it all the time, without knowing it, and I'll bet you did too. You see, the key to mental imagery is that the body and the nervous system cannot tell the difference between a real experience and one that is vividly imagined.

As a child did you ever imagine that there was a monster under your bed? Was it real? No, but think how you acted. You wouldn't move for fear it would grab you. Or did you ever have a nightmare and wake yourself up yelling? Yelling about what? Something in your imagination. What about playing your favorite sport? Did you ever have a dream that you were playing sports? Did you score or miss? Did you get all the way down and then mess up at the last second? Or did you battle away until you finally achieved your goal? How did you feel? Why?

You may feel this way because, as I indicated previously, your nervous system cannot tell the difference between reality and vivid imagery. Therefore, if you vividly imagine practicing a skill in your mind, your nervous system reacts to this mental practice much the same as if you were physically practicing.

Now as we go through the imagery program I want you to feel as if you and I are conversing one-on-one, as if I am talking directly to you. I want you to feel confident and self-assured because if you do and you diligently apply the systematic techniques to your imagery practice, I know you are going to benefit from imagery practice, much like Steve Stone did, a former pitcher from the Baltimore Orioles. He went from an average season one year to becoming the winningest pitcher in baseball the following year. When asked what was he doing differently, he answered that the only difference was, that he would go through the other team's line-up the night before his start and mentally imagine striking each hitter out. The next day when he faced that team he felt the mental edge of confidence because he had already seen himself strike out the opposing batters. Remember a characteristic of successful people is that they visualize what they want to happen, but unsuccessful people see what they want to avoid.

There are a couple of things we need to go through before we begin;

1. You will come to this room twice weekly to be led through an imagery session as a group. I will personally lead this session. This will take no longer then 15 min, and attendance is mandatory. If you can't make the times with the rest of the group, speak to me after. I am very flexible with my schedule so we can make a time.

You will also receive a cassette tape for home practice (show tape) and a diary to record your experience with imagery practice. The way you go through this program is before you begin any mental practice session you find yourself a quiet spot for about 10 min. This should be a place where there will be no distractions while you are doing your mental imagery practice. When you perform your imagery practice you must relax and put any problems you have aside in order to give your full undivided attention to the program. This is very important. Remember, you must be relaxed and focused during the time you listen and practice your imagery. The best way to develop this is to concentrate on something that is natural to you. What is more natural than breathing? This is why you will first be led through breathing exercises to calm your body and focus your mind.

2. In the sessions that I lead and also in your taped versions, it is critical that you listen through the entire process. You must follow the directions as closely as you can, but the key is to simply let yourself focus because imagery is natural. You will notice that the exercise is between 8 and 12 min long. This is for a special reason. It will aid the imagery process by allowing the optimal time you need to be tuned in while performing your visualization practice.

3. An important aspect to remember is that imagery is a natural skill. We are all born with this ability. The key is to use and develop this skill. As with any skill, to maintain and develop it, it must be systematically practiced. Jack Nicklaus, the Golden Bear, was the most dominant pro golfer during the 70s. He used and still uses imagery before every shot. In fact Nicklaus will not shoot until he has visualized each shot perfectly. Since that time many younger pro players have adopted his imagery techniques.

4. I am giving you the taped version of your imagery program to help you develop your imagery skills at home. It is very important that you listen to your tape once daily between the two weekly mental practice sessions that I will lead. No matter how time constrained you may feel, 10 min of imagery practice must be a priority, and, in fact, it will be beneficial for you. You will actually look forward to this time because I know that you will find it relaxing and refreshing.

Immediately after each practice, take a minute to answer the questions on your diary sheet. Please, it is very very important that you maintain complete honesty on these sheets. If you miss a day of mental practice at home simply report that and continue your imagery rehearsal the next day. But, in order to prevent skipping a day, it is a good idea to schedule a consistent time for your practice over the next 3 weeks. If you go home for a weekend, take your tape with you and practice.

Perhaps the best times to find a quiet spot to practice are right before you go to bed at night, when you wake up in the morning, or even after dinner. Another good place is to go to the fifth floor of the library and use a cassette player during your spare time while at school.

Appendix C

RELAXATION AND IMAGERY REHEARSAL PROGRAM

Get comfortable in your chair. Now, put both feet flat on the floor and your hands on your knees. In order for you to relax, I want you to concentrate on your breathing. Inhale through the nose filling your lungs and elevating your chest, hold for a moment, and then exhale through your mouth. This will help your body relax and keep your mind alert. Now close your eyes, relax, and take a slow deep breath. Slowly inhale and hold it . . . 1, 2, 3 and slowly exhale through your mouth . . . breathe in deeply . . . 1, 2, 3 and slowly exhale. Repeat this. With each breath, hold the inhalation and then breathe out fully. Each time you inhale, feel that you are pulling all your worries, cares, and tensions into your lungs and expelling them with each breath. Feel more and more relaxed with each breath out. Every time you exhale more and more of your cares and tensions disappear. Continue this breathing pattern. I will give you this time to become more and more relaxed.

(Pause 30 s)

Now imagine a place of great relaxation. A place where you can leave the hustle and worry of academic life behind. Take yourself to the warm white sands of a tropical beach where crystal blue waters slowly break against shore and sea gulls gracefully glide through a clear blue sky. Behind you a green jungle of tropical foliage isolates you from the outside world. Feel yourself peacefully stretched out on the warm white sand. Sense the cool sensations of pulsating waves gently rolling in to trickle by your feet and inch slowly up your legs. Feel the rays of heat from a hot tropical sun warm your skin to a rich bronze tan. Now gently relax in this place of paradise. Feel the pleasure of the warmth from the sun, the refreshing sensations from the ocean waves. Breath and relax.

(Pause 30 s)

Keeping your eyes closed, picture yourself at the foul line ready to shoot a basketball. Look down at the wood floor. Your one foot is slightly ahead of the other. You look above the rim, see the backboard. Notice how confident you are. You are in total control of the situation. You are going to make all your shots. Look at the basketball in your hands. See its tan color . . . feel the dark ridges of the seams with your fingertips. See and feel it with as much detail as you can. Sense the texture of the ball. The basketball feels just right in your hands.

Now holding the ball, get into your slight crouch and go through your ritual of bouncing the ball, take the ball to the shot position, feel the ball on your fingertips as your head is held high and your eyes are focused above the rim. The guide hand is on the side of the ball. The shooting hand is behind it. Your arm is in an L position. You sense confidence. Look above the orange rim, sight that as the target . . . inhale . . . exhale and settle. You bend and lift your heels off the ground. You gently push upwards from the balls of your feet. Your knees slowly extend, and you push the ball upward over your head. The elbow extends, then your wrist flexes as the fingers point to the ceiling then SNAP toward the rim. Your shooting hand forms a duckbill. The ball floats. Watch only the one best spot above the front rim. See the ball pass over the rim and SWISH through the white net. Feel the pride.

You feel confident, and trust your abilities completely. Feel the importance of every shot going in the basket. You feel good shooting the ball. Now, go through the process again. Feel the ball in your hands . . . go through your ritual bouncing, prepare for your shot and sight above the front rim as your target . . . breathe . . . release . . . settle. Now begin the motions . . . shoot and SWISH see the ball go through. And one more time now . . . feel the ball . . . Sight your target . . . Shoot . . . and SWISH see the ball go through.

Remember your breathing. Inhale deeply, hold, and exhale. See yourself at the foul line, look up at the backboard, and sight above the front rim as your target. Feel the ball in your hands. Sight the target, shoot, and see the basketball rip through the net, hear it SWISH like a diver through water.

As you listen to the music that follows, practice your free throw shooting. Relax and visualize yourself confidently making every shot. Remember your procedure. Feel the ball . . . sight the target . . . shoot and see the ball go through. Take your time, remember to breathe . . . and trust yourself to make every shot. Realize that every shot is important. You know you can make every one because you control your performance. The more you mentally practice successful free throws the more likely your physical performance will improve. Each time you shoot the basketball through the hoop remember the success as you become more and more confident. Your success reinforces your further success. Take some shots while the music plays. Breathe and relax between each trial. Remember to practice your procedure for success. Feel the ball . . . sight the target . . . shoot . . . see the ball go through.

(Music plays 2 min)

Continue to keep your eyes closed. Concentrate on your breathing. Breathe out any cares that you might have. Feel more relaxed with each breath. As each day goes and you continue your systematic mental practice, your imagery will become more and more vivid. You will see that negative thoughts and outside distractions will have no impact on you. If a shot misses, simply refocus, slow down the shooting pace, and utilize your strategy to regain control. Feel the basketball in your hands . . . sight above the front rim as your target . . . shoot . . . and see the ball go through, hear it swish. Now as the music plays again, shoot five successful free throws in a row and then relax. Wait for my signal, then count to 10 and slowly open your eyes. Remember, feel the ball . . . sight the target . . . shoot and see and feel the ball go through. Begin your five successful free throws now.

(Music plays 2 min)

Appendix D

PERSONAL IMAGERY ASSESSMENT JOURNAL

Using the rating scale below please indicate the following.

1. How well were you able to relax and concentrate during today's imagery session?

Not at all		Sometimes		All of the time
1	2	3	4	5

2. How much of the material presented in the imagery exercise were you able to image?

Almost none of the material		Some of the material		All of the material
1	2	3	4	5

3. How clearly and vividly were you able to visualize the scenes presented in the imagery exercise?

Not at all clear		Somewhat clear		Very clear
1	2	3	4	5

4. Did you image or get a feel of any sensations of the muscular movements involved in shooting a free throw during the imagery exercise?

Not at all		Sometimes		All of the time
1	2	3	4	5

5. How difficult was it to sink the final five free throws in a row at the conclusion of today's imagery exercise?

Not at all difficult		Somewhat difficult		Very difficult
1	2	3	4	5

Comments about today's imagery practice.

____

____

Appendix E

INSTRUCTIONS AND CONTENT ON NOISE CASSETTE

Instructions: Please listen carefully to the following instructions. This is a test of your free throw shooting proficiency under conditions of crowd noise. The crowd noises you will hear vary in duration and content and are separated by periods of silence. Now, stand slightly behind the foul line. You will notice the cart of basketballs to your immediate right. When you are told, pick up a basketball from this cart, and shoot, trying your best to score. Do not attempt to retrieve this ball. If it rebounds directly back to you, you may shoot that ball again. If the ball bounces away, stay in your position at the foul line, select another ball from the cart, and shoot your next shot. Continue shooting until you have made 15 attempts. The experimenter will keep count of your shots and inform you of your score every five shots. Remember to try your best to sink as many baskets as you can. You may begin with your first shot now.

Content (presented in sequential order)

Silence . . . 12 s

Cheering crowd . . . 5 s (applause, screaming, yelling, etc.)

Silence . . . 3 s

Cheering crowd . . . 5 s (applause, screaming, yelling, etc.)

Silence . . . 5 s

Hostile crowd noise . . . 10 s (repeated "choke, choke" chanting)

Silence . . . 10 s

Air horn . . . 12 s (5 successive blows 2 s apart)

Hostile crowd noise . . . 9 s (negative cheering, booing, etc.)

Air horn . . . 12 s (5 successive blows 2 s apart)

Hostile crowd noise . . . 12 s (repeated "miss, miss" chanting)

Content repeats cycle again.

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