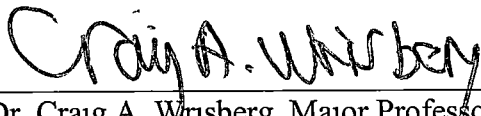


To the Graduate Council.

I am submitting herewith a thesis written by Andrew J. Ploszay entitled "The Effects of Multisensory Imagery in Conjunction with Physical Movement on Putting Performance." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Human Performance and Sport Studies.

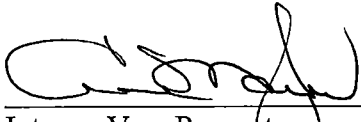

Dr. Craig A. Wrisberg, Major Professor

We have read this thesis and
recommend its acceptance.


Dr. William Morgan


Dr. Charles Thompson

Accepted for the Council:


Interim Vice Provost
Dean of The Graduate School

**The Effects of Multisensory Imagery in Conjunction with
Physical Movement on Putting Performance**

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Andrew Justin Ploszay

August 2000

DEDICATION

This thesis is first dedicated to my family and my best friend. Jim, Joan, Stephanie, Bill, Jim, Mead, and Kelly. You are the reason I try, am able to, and want to succeed at everything I do in life. In some way all that I do, including this work, is my sincere effort to repay you for all the wonderful gifts, memories, and graces you have bestowed upon me. I know I can never repay you, but that will not deter me from trying. I love you all.

This work is also dedicated to the athletes with whom I have worked with in this study, and the athletes I will counsel in the future. Maybe someday, with my help, you will achieve your athletic dreams. And, like a proud parent, I'll humbly stand on the sideline, knowing you had it in you all the time, and thanking you for taking me along for the ride. Conceive the inconceivable then accomplish it.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank God for blessing me with the ability to accomplish this undertaking and for making each day of my life better than the next.

Thank you

I would also like to thank my committee members, Dr. Craig Wrisberg, Dr. William Morgan, and Dr. Charles Thompson, for graciously providing me with their time, tutelage, experience, and most of all, patience.

Dr. Wrisberg: Thank you for seeing the potential in me, however raw, and accepting me into your sport psychology program. Throughout this process, I have continued to marvel and how giving you have been with your time and help and how easy you make this process look. Then again, the great ones always do.

Dr. Morgan: I can honestly say, I respect you as a teacher and as an intellectual as much as any person I have ever met. Thank you for lending your time and consideration to my research, I greatly appreciate it.

Dr. Thompson: Thank you for teaching me how to truly communicate with people. Your class and the lessons I learned in it, not only made accomplishing this thesis even easier, but also will undoubtedly be some of the most practical and profound lessons I will learn and use in my career and life. Go Tribe!

Finally, I would like to thank Emily Roper, Karen Appleby, and Joe Whitney. Emily, the time and effort you put into this study was invaluable to me and unbelievably appreciated. Without your help, I'd still be in the office. Karen, my "thesis soul mate", may you someday realize just how intelligent and talented you are, and put faith in these

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Andy.

ABSTRACT

In this study, the effect of multisensory imagery in conjunction with movement on golf putting performance was investigated. Four intercollegiate golfers, two men age 19 and 20 years old, and two women age 19 and 20 years old, competing at the NCAA Division I level participated. Using a multiple-baseline across subjects design (Kazdin, 1978), performance was evaluated prior to and following the imagery intervention, which was introduced to participants in a staggered fashion over a period of one week. Visual inspection of the results, and social validation by participants, revealed that the imagery intervention was effective in enhancing the performance of all four golfers.

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CHAPTER I

INTRODUCTION

The present study was conducted in an attempt to assess the effectiveness of multisensory imagery in conjunction with movement on the putting performance of elite golfers. Despite the abundance of evidence regarding the benefits of “mental training” and even more specifically various types of “imagery” techniques, there are only three studies in the literature on the psychology of sport that have examined the effects of multisensory imagery in conjunction with movement on athletic performance. Considering the importance of sport in today’s society and the growing interest of athletes and coaches in mental training, assessing a potentially new and effective means of performance enhancement is worthy of further investigation.

William James, the most prominent psychologist of the twentieth century, was once asked at a meeting of the *American Psychological Association*, what he thought was the most important finding of the first half-century of university research, “Oh that’s easy”, he said, “People by and large become what they think of themselves” (Rotella, 1995). That simple statement, “thought precedes action,” is the basic premise of imagery interventions in sport psychology. However, there is considerable debate regarding the most efficient and effective means of practicing imagery in order to enhance sport performance.

As of 1999, over 200 published studies have examined the relationship between mental training and sport performance (Martin, Moritz, & Hall, 1999). Considered collectively, these studies have shown that mental training can improve the physical performance of sport skills to a greater extent than no practice at all (Driskell, Cooper, & Moran, 1994; Feltz & Landers, 1983). Corbin (1972) more cautiously concluded that studies in this area have contained too many methodological, task, and individual differences to draw definitive conclusions. In other words, with the diversity of skills (open and closed), the diversity of sports (team and individual), and the various skill levels of athletes present in sport (novice and expert), definitive generalizations about the benefits of mental training remain tenuous.

More recently, Wollman (1986) concluded that, "The effects [of mental training] are far from consistent. Certainly the results are too inconsistent to reasonably guarantee experimental success in any given motor performance situation (p. 135)." So where does that leave the athlete and the practitioner and what should be the direction of future research on mental training?

The available research on the positive effects of imagery on performance is rather consistent (Epstein, 1980; Mahoney & Avenier, 1977; Shelton & Mahoney, 1978). However, it appears that the success of imagery interventions lies in the specificity of their application. Thus, sport psychologists need to recommend types of imagery that are specific to each athlete and his/her needs.

The available research suggests that the type of imagery introduced, visual or kinesthetic, should be determined by the following: (1) the most effective imagery perspective (internal or external), (2) the type of skill to be practiced (open or closed),

(3) the skill level of the athlete (novice or elite), and (4) the interactive influence of imagery techniques and other movements or mental training techniques. Only after these four factors are taken into consideration should a mental training intervention that includes imagery be introduced to the athlete

The mental training intervention selected for this study, designed to help elite golfers improve their putting performance, was derived following careful consideration of each of the four factors.

It has already been determined that imagery is an effective means of performance enhancement (Driskell, Cooper, & Moran, 1994; Feltz & Landers, 1983). Imagery, however, is a broad term. Visual imagery involves picturing the process or outcome of a particular skill or sport. Kinesthetic imagery involves using body movement to aid in the creation of images that are viewed in the mind. The kinesthetic sense is particularly important for athletes because it involves the sensation of bodily position or movement through space. Researchers recommend the involvement of as many senses as possible when creating or recreating the “feel” of images performers are trying to execute in a particular task (Weinberg & Gould, 1995, p. 281). The more vivid the image, the more effective the imaged movement will be when practiced. The present intervention utilized kinesthetic and visual imagery because it was determined that a combination of the two allows the participant to create the most vivid images (Vealey & Greenleaf, 1998), provides the deepest encoding of movement-related information, and fosters the greatest transfer from practice to play.

The imager’s perspective, whether internal or external, is a factor that may influence the impact of mental rehearsal. A third-person perspective (like watching

yourself on television) characterizes external imagery, while a first person phenomenological perspective distinguishes internal imagery. An exploratory study by Mahoney and Avenier (1977) found that, within a sample of elite gymnasts, the more successful athletes relied primarily on internal images while their less successful counterparts depended more on external images. In some cases it appears that internal imagery makes it easier to bring in the kinesthetic sense, or feel of the movement.

However, Hardy (1997) cautioned that the current research on the most effective imagery perspective is inconclusive (Murphy 1990, Murphy, 1994). Hardy did note that regardless of the imagery perspective used, kinesthetic imagery always had a beneficial effect upon performance. Hardy suggested that whichever perspective, internal or external, allows the performer to create the desired “feel” of the movement is the perspective to be used. Finally, he suggested that if the task requires the performer to make relatively simple movements, like putting, then the combination of internal imagery plus kinesthetic and visual imagery might be optimal. Thus, an internal perspective of imagery was chosen for the skill to be imaged in the present study.

The next factor considered was the type of skill to be practiced. It has been suggested that golf is a sport in which its participants can benefit from adopting psychological strategies involving visualization (Kirschenbaum & Bale, 1980, Rotella & Bunker, 1981). Highlen and Bennett (1979) suggested that the distinction between open- and closed-skill sports could be an important determinant of imagery effectiveness. They hypothesized that gymnastics (like golf), a closed-skill in which the environmental surroundings are stable and the player initiates the action, is more amenable to psychological strategies like imagery than an open-skill sport where movements are

executed in a constantly changing environment. Therefore, it was reasoned that kinesthetic and visual imagery would provide a sensible mental training technique for golf putting, a closed-skill

Research has indicated that although both novice and expert performers can improve skill by using imagery (Hall et al. 1994), experienced athletes have shown greater gains in performance via imagery practice (Feltz & Landers, 1983). It may be that lower ability players benefit more from actual physical practice of a skill they have not mastered than from mental rehearsal, while more advanced players' success is more often determined by how consistently they perform, instead of their skill level. As the level of skill among sport participants rises, the difference in physical talent decreases (Weinberg & Williams, 1993). Therefore, psychological factors are often crucial in determining success in competition. That is another reason why imagery with an internal perspective was selected as the intervention for the elite golfers in this study.

Andre and Means (1986) found that imagery alone did not produce a consistent effect on sporting performance. However, Hall and Rodgers (1989) observed that applied sport psychology mental training interventions often utilize a combination of techniques that is more effective in enhancing performance.

In a rather unique study, Meyers et al. (1982) had female collegiate basketball players use imagery and self-talk exercises in combination with their physical performance during the intervention sessions. This combination of mental practice and body rehearsal of physical movement created better transfer between the practice and playing environments. It was these findings as well as the research of Hall and Rodgers

(1989) that suggested physically integrative multisensory imagery would be a potentially fruitful intervention for the golfers in the current study.

A secondary goal of the present study was to examine sport performance by utilizing a single-subject design. A growing volume of research has shown that single-subject designs are particularly appropriate in sport psychology field studies (Bryan, 1987; Wollman, 1986), often fostering results that are both internally and externally valid. Meyers et al (1982) utilized a modified multiple baseline design, to examine the effects of cognitive behavioral interventions on athletic performance

It was reasoned that a single-subject design, accompanied by social validation, would provide the most capable means of assessing the effectiveness of the intervention used in the present study.

Statement of Problem

Despite the abundance of evidence regarding the benefits of “mental training” and even more specifically various types of “imagery” techniques, there are only three studies in the literature on the psychology of sport that have examined the effects of multisensory imagery in conjunction with movement on athletic performance. Therefore, the present study is directed toward filling the above research void.

Statement of Purpose

The purpose of this study was to determine the effects of a physically integrative multisensory imagery intervention on the putting performance of elite-level golfers

Definition of Terms

In this study, the following definitions and, in some cases, operational definitions were employed:

Closed-Skill: an internally paced activity that occurs in a stable environment (i.e. bowling)

External Imagery: an imagery perspective in which the imager views himself/herself from the perspective of an observer (much like watching oneself on television).

Internal Imagery: an imagery perspective in which the imager experiences the imaged activity as she/he would during actual performance

Open-Skill: an externally paced activity performed in an unstable and changing environment, requiring anticipation, prediction, and adjustment to moving objects (i.e. returning a tennis serve).

Physically Integrative Multisensory Imagery: a type of imagery in which the performer imagines the feel of the movement process, from an internal perspective, simultaneous with a visual picture of the desired outcome of a specific skill, and physically moves the body in a fashion designed to produce the desired outcome. In this study, the imaged activity and movement were of a successful putting stroke in golf

Assumptions

The following assumptions were made in this study:

- 1 Each participant was committed to personal performance improvement and approached the intervention technique seriously.

- 2 The participants, to the best of their ability and memory, honestly and accurately answered the questions posed to them during the interview sessions

Limitations

The following limitations existed in this study

1. Only NCAA Division I athletes were used in the study. Therefore, findings from this study cannot be generalized to other athletes of differing ability levels.
2. Participants performed the putting task on the same putting green during both the pre and post-treatment phases. The familiarity each participant gained by attempting putts from generally the same spots day after day may have influenced the results
3. Participants followed the instructions provided to them during the study on how to utilize the imagery intervention correctly when the researcher was not present during specific trials to ensure that they did.

Significance of the Study

The primary significance of the study lies in determining whether or not physically integrative multisensory imagery is an effective technique for enhancing golf putting performance. Those who stand to benefit the most from this study are the athletes who participated. However, it is also possible that other players on both the men's and women's collegiate golf teams as well as other golfers, elite and novice alike, may benefit

from the findings as well. This study was designed to provide athletes with a basic imagery intervention they could employ during practice and in competition in hopes of improving their putting performance.

A primary aim of sport psychologists is to enhance the performance and sporting enjoyment of athletes. Most all golfers are trying to accomplish these same goals. Determining a cognitive-behavioral method by which athletes can improve their performance should be beneficial for all parties involved. It is also possible that the results of this study will add to the existing literature on the psychology of sport, more exactly the effects of imagery on performance.

The implementation of mental training is not uncommon in elite-level athletics and has received considerable research attention (Gould et al 1989; Orlick and Partington, 1988). Data supporting the effectiveness of mental training, and more specifically imagery, are abundant. However, little information currently exists concerning the effectiveness of imagery in conjunction with physical practice and/or movement as a unified performance enhancement service. The present study represented an attempt to examine a combined intervention package.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The literature concerning mental training techniques, including imagery, is principally found in the field of sport psychology. Mahoney and Avenier (1977), Meyers, Cooke, Cullen and Liles (1979), and Morgan and Pollack (1977) suggested that athletes could be trained to adopt beneficial cognitive strategies, and consequently improve their competitive performances. Several investigators have acted on these suggestions and some have conducted extensive reviews of these studies (Richardson 1967a, 1967b; Corbin, 1972; Feltz & Landers, 1983). The general consensus is that mental practice does enhance performance. Imagery is a frequent component of many mental training interventions (Kendall, Hrycaiko, Martin, and Hall, 1990, Beauchamp, Halliwell, Fournier, & Koestner, 1966)

In this chapter, literature is reviewed that addresses the factors that are most relevant to the development of imagery protocols. The factors include: theories of imagery, type of perspective (internal vs external), type of skill (open and closed), and skill level of the performer (novice, intermediate, advanced). Additional sections of this review are devoted to discussions of imagery as a solitary technique or as a component of an intervention that combines various techniques and to the merits of single-subject research design such as the one used in this study.

Theories of Imagery

Carpenter (1894) first proposed the “ideo-motor principle” which posited that any idea that dominated the mind finds its expression in the muscles. Jacobson (1931) later supported the ideo-motor principle and further specified a relationship between the nature of imagery modality and concomitant response. He inserted bipolar needle electrodes into the biceps of participants and asked each to “imagine bending their right arm.” Muscular activity was found to occur in the biceps on more than 90% of these trials.

After Mahoney and Avenier (1977) categorized visual and kinesthetic images into internal and external perspectives, Lang (1979) proposed a “bio-informational theory of emotional imagery” which assumes the image of an activity or movement in the brain is an organized set of propositions which function as a preparatory set to respond. Basically, it infers that external images are primarily composed of response propositions that allow the imager to “see” a movement or activity, while internal images are generally stored as muscular activity response propositions that allow the imager to “feel” how a skill or movement is to be performed (kinesthetic imagery).

Hale (1982), furthered this line of research by examining the effects of internal and external imagery on muscular response. Hale recruited 48 male university students to perform an imagery test while hooked up to electrodes that measured the muscle activity in their biceps brachia. Participants were either assigned to a delayed imagery condition (25-30 minutes after overt weight lifting, $n = 24$) or an immediate imagery condition (5-10 minutes after overt biceps curls, $n = 24$).

While reclining on a cot, half of the participants in each group underwent the internal imagery protocol first and the other half received the external imagery

instructions first. To begin, each person viewed five filmed trials of a person performing a biceps curl from either the first- or third-person perspective. Each participant then performed 10 6-second trials of each imagery perspective for a total of twenty trials. In the internal imagery perspective, participants were urged to “imagine what it feels like in your bicep to lift the 25 lb. dumbbell” (i.e. muscular response propositions; Lang, 1979), and before the external condition, the emphasis was to “visualize what it looks like to lift the 25 lb dumbbell” (i.e. ocular response propositions; Lang, 1979). Participants were continually encouraged to remain relaxed between trails and not to contract their biceps or flex their elbows. The results revealed that the internal imagery perspective produced substantial localized muscular activity while the external imagery perspective did not

This result suggests that an imagery perspective that involves the individual in the visual and kinesthetic experiences more fully is more likely to produce neuromuscular activity. Thus, it might be concluded that an internal perspective contributes to subsequent physical performance of the skill because the neuromuscular feedback arising from the imagery experience allows continuous “perfection” of the motor action plan in the brain.

However, a discussion of the mechanisms underlying mental practice would not be complete without devoting some attention to the most commonly mentioned alternative to the psycho-neuromuscular explanation for mental practice effects. This explanation, termed the symbolic learning hypothesis (Sackett, 1934) states that mental practice allows the performer an opportunity to cognitively rehearse the sequence of movements as symbolic components of the task. Imagery then is thought to function as a cognitive coding system to help athletes acquire or understand “mental blueprints”

(Vealey & Walter, 1993) for movement patterns. Imagery practice presumably strengthens these blueprints, enabling movement sequences to become more familiar and possibly better executed through automation.

According to the symbolic learning hypothesis, mental practice facilitates motor performance only to the extent that cognitive factors are inherent in the activity. Research suggests support for this notion (Minas, 1978, Wrisberg & Ragsdale, 1979). Two early experiments by Sackett (1934, 1935) demonstrated that mental rehearsal improved the performance of a finger maze task, assumed to be high in elements that could be symbolized. Although Sackett's work did not deal with tasks high in motor elements, he questioned whether or not mental rehearsal would have much influence on the learning or retention of such motor skills as dart throwing. It should be noted that in Sackett's studies, mental practice improved performance on cognitive tasks (such as the maze), but did not affect motor tasks that are low in cognitive elements (e.g. dart throwing).

As a result, it could be inferred that motor tasks that are classified as having more "cognitive" components, in that they are primarily cognitive with the motor response merely representing a means to carry out the action, would lend themselves more readily to mental training than motor tasks low in "cognitive" components.

Morrisett (1956), who assumed that a task could be characterized in terms of independent dimensions such as motor and symbolic, made the first direct test of Sackett's hypothesis. Following Sackett, Morrisett proposed that learning on tasks that have strong symbolic components would be facilitated by mental practice, whereas tasks without relatively strong symbolic components would not show beneficial effects. He

performed three experiments, the first being a finger dexterity test, judged to be high in motor elements and low in cognitive elements (Ryan & Simons, 1981). He found no difference between the physical and mental practice groups. A second experiment using a two-handed graphic recorder, considered low in motor components and high in symbolic components, showed no difference in two groups receiving differing amounts of physical practice but having the same amount of mental practice. Finally, Morrisett performed an experiment on dart throwing (high motor components) and found no difference in dart throwing performance between the mental practice and no practice groups, and the performance of both groups was inferior to that of the physical practice groups.

Following much the same hypothesis as Morrisett (1956), Wrisberg and Ragsdale (1979) also selected two tasks presumed to differ on the motor-cognitive dimensions. For the task higher in cognitive elements, mental practice resulted in performance comparable to that of physical practice. For the task low in cognitive elements, no difference was found between no-practice and mental practice, and both types of practice were inferior to physical practice.

More recently, Ryan and Simons (1981), had 39 male college students learn to model perceptual motor tasks differing in demand across a cognitive-motor continuum, under conditions of physical practice (PP), mental practice (MP), and no practice (NP). On each task the PP group was given 12 performance trials, the MP group received one performance trial, nine mental trials, and two more performance trials. The NP group received one performance trial, 10 minutes of rest, then two more performance trials. The results showed no difference in learning between the MP and NP groups on the

predominantly motor task, while the PP group performed superior to both. On the predominantly cognitive task, however, the MP group performed comparable to the PP group, and both were superior to the NP group. These findings confirmed the major hypothesis. On a motor-cognitive continuum, the task near the cognitive end of the continuum was enhanced by mental practice, whereas the task near the motor end of the continuum showed little or no improvement. This was consistent with the findings of Sackett (1934), Morrisett (1956), and Wrisberg and Ragsdale, (1979)

Since, the average golf putt requires the golfer to account for the speed of the green, how much the putt breaks, and how hard to strike the ball it might be concluded that the putt requires a large amount of cognitive thought and the relatively simple motor skill would benefit from mental imagery as explained by the symbolic learning theory and cognitive-motor continuum. However, as in the case of the golf putt and other closed-skills (e.g. pitching a baseball, bowling), the two previously mentioned theories fall short in accounting for the effectiveness of imagery when applied to a skill that falls on the middle of the cognitive-motor continuum.

One approach that has attempted to account for various imagery applications is Paivio's (1985) analytic framework for imagery effects. According to Paivio, imagery influences motor behavior through its impact on both cognitive and motivational response systems. Specifically, behavior can be affected by the imagery of motor skill components and general game performance strategies (cognitive functions of imagery) (Martin, Moritz, & Hall, 1999). In addition, imagery of goals [the successful completion of a putt in golf], the activities related to goal achievement, and the physiological arousal

and affect that accompany imaged success and failures can influence performance through motivation

Paivio's framework has been used to explain the positive effects of imagery on self-confidence (Moritz, Hall, Martin, & Vadocz, 1996). Advocates of this confidence enhancing strategy generally believe that imaging one's successful performance of a task may enhance the performer's belief that he or she can successfully execute the task (Feltz, 1984, Martin & Hall, 1995).

In 1999, Martin, Moritz, & Hall proposed an imagery model that centers on the type of imagery used by the athlete (i.e. the function or purpose that imagery is serving) as a primary determinant of cognitive and behavioral outcomes. Earlier Paivio (1985) advocated this perspective and contended that what the athlete images determines the system (cognitive or motivational) the imagery will affect most. Likewise, Sunn (1996) emphasized that, "The content of the imagery is determined by which goals the clinician seeks to achieve, including self-efficacy training (p. 31).

Despite the relevance attached to imagery type, this topic has received very little attention. Until recently, the only studies of imagery type were those that examined the effects of positive and negative performance imagery (Woolfolk, Parrish, & Murphy, 1985). These studies revealed that imagery of a successful performance outcome produces better performance than imagery of an unsuccessful outcome. Thus, it appears that if an image is interpreted positively, it can produce corresponding effects on self-efficacy that in turn enhances performance.

Recently, Hall et al (1998) developed a taxonomy for classifying the different types of imagery used by athletes. The two types that are of interest to the current study

are: Motivational General-Mastery (Mg-M): Imagery that represents coping and mastery of challenging situations, and Cognitive Specific (CS). Imagery of a specific sport skill such as a penalty shot in hockey or soccer

The bulk of imagery studies have examined the use of cognitive specific imagery of skills as a technique for enhancing the learning and performance of motor skills. A few experiments have examined the effects of different types of imagery on the learning and performance of motor skills. In one study, the effect of imagery on sit-up performance was examined (Lee, 1990). Participants who used a MG-M strategy (i.e. imaged a situation associated with feelings of confidence and happiness) showed no improvement. However, participants who used a CS imagery strategy (i.e. imaged themselves successfully doing sit-ups) significantly improved their performance over baseline measures. Taken together, these findings suggest that CS imagery may be the more effective imagery strategy for promoting athletic performance of individual motor skills, like putting a golf ball.

The link between self-efficacy and self-confidence are two important sport-related cognitions that may be affected by imagery use. Work by Bandura (1997) and studies like that of Woolfolk, Parrish, & Murphy (1985) have suggested that positive visualizations enhance self-efficacy in situations where athletes may tend to question their own abilities. Some researchers have found that imagery of task performance (CS imagery) is sometimes associated with increased task self-efficacy for certain participants or tasks in sports such as figure skating (Garza & Feltz, 1998), soccer (Callery & Morris, 1996), and dart throwing (McKenzie & Howe, 1997).

Denis (1985) contends that for imagery to have beneficial effects (i.e. enhanced self-efficacy and performance) the content of the imagery must accurately reflect an intended outcome that is associated with success and competence and the type of imagery must accurately coincide with the skill and skill level of the athlete utilizing it.

Internal and External Imagery Perspectives

One of the factors that must be taken into consideration when developing an imagery protocol is the perspective from which the athlete images the skill to be practiced. Although Jacobson (1931) was the first to study differences in imagery perspective, Mahoney and Avenier (1977) were the first to classify imagery perspective as either internal or external. An internal perspective is one in which athletes see the image from behind their own eyes as if they were inside their bodies actually performing the action. An external perspective is one in which athletes see the image from outside their bodies as if viewing the action as a spectator. Whether athletes should use an internal or external perspective depends on the skill to be performed (Hall, Schmidt, Durand, & Buckholz, 1994)

An exploratory study by Mahoney and Avenier (1977), examined the cognitive strategies utilized during training and competition of thirteen male gymnasts competing during the final trials for the U S. Olympic team. Results revealed that the more successful athletes, those who qualified for the Olympic team, relied primarily on internal images while their less successful counterparts depended more on external images

Another study of gymnasts showed that kinesthetic (internal) imagery, but not visual (external) imagery, was related to the successful execution of a gymnastics move (Start & Richardson, 1964).

In spite of the research noted above, some caution is clearly necessary when it comes to offering advice about visual imagery perspectives. Hardy (1997), in a paper he wrote challenging the myth that performers should always use internal imagery instead of external imagery, stated that the current research is inconclusive (Murphy 1990; Murphy, 1994). However, Hardy did note that regardless of the imagery perspective used, kinesthetic imagery always had a beneficial effect upon performance. Further, he suggested that whichever perspective, internal or external, allows the performer to create the desired “feel” of the movement is the perspective to be used. Finally, he suggested that if the task requires the performer to make relatively simple movements, like putting, then the combination of internal imagery plus kinesthetic and visual imagery might be optimal.

Since, the skill to be imaged in the present study is putting, an internal perspective of imagery was chosen for the current participants.

Open and Closed Skills

Another factor that is important for the development of effective imagery protocol is the type of motor skill being performed (Gentile, 1972, McBride and Rothstein, 1979). Open-skill sports are executed in constantly changing environments, while closed-skill sports take place in relatively stable environments. Closed-skill sports are internally paced, meaning the participant determines when the action starts and stops. It is easier to

imagine that closed-skills lend themselves to imagery rehearsal more readily because there is time for the performer to collect his/her thoughts, image a positive performance, and focus on each movement attempt (Woolfolk, Parrish, & Murphy, 1985).

This opportunity is not often afforded in open-skill sports like basketball or hockey. Perhaps not surprisingly, little research has examined the effects of imagery on open-skill sports.

Highlen and Bennett (1983) examined two groups of elite athletes from open- and closed-skill sports and hypothesized that closed skill athletes would utilize more visual strategies than elite open-skilled athletes. Participants were 39 elite wrestlers (open-skill) and 44 elite divers (closed-skill). All participants completed two different surveys assessing psychological factors associated with training and competition, including imagery. The results revealed no significant difference between the groups on imagery usage, but did indicate that closed-skill athletes used more self-talk than their open-skill counterparts.

Woolfolk et al (1985) investigated the effects of imagery on the closed-skill of putting a golf ball. Thirty college students were blocked by ability and placed into one of three groups. (a) positive imagery, (b) negative imagery, and (c) control. Participants were asked to take 20 putts from varying distances based on their pre-determined ability levels. Baseline levels were established and then the imagery intervention was introduced. Participants in the positive imagery group were instructed to imagine themselves making "a gentle but firm back swing and stroking the putt smoothly down the line and rolling into the cup". The negative imagery group was instructed to imagine

the same sequence, except they were to imagine their ball “narrowly missing” the cup in the end. Participants in the control group were simply told to try to make each putt.

Results revealed that the control group improved slightly over the course of several days, while the positive imagery group improved significantly. Interestingly, the group using the negative imagery showed a significant decline in performance compared to the control group over the same time period.

Skill Level

A number of studies have revealed that successful athletes may be more likely than their unsuccessful counterparts to engage in mental imagery (Highlen & Bennett, 1983; Mahoney & Avenier, 1977). According to Gould, Weiss, & Weinberg, (1981), self-confidence has been the most consistent factor in distinguishing highly successful from less successful athletes. Furthermore, advocates of this confidence-enhancing strategy generally believe that imaging one's self successfully performing a task may convince an athlete that he or she can successfully perform that task (Martin, & Hall, 1995).

An obvious extension of the symbolic learning theory is to relate mental practice to the stage of learning where cognitive elements are most prevalent. This stage, of course, would be the initial verbal-motor stage of development where Schmidt (1982) has suggested that mental rehearsal should have its greatest impact because automation of the skill has not yet been encoded. At this stage of learning, the participant is still cognitively and possibly verbally, going through the steps of the movement in their mind that will produce the desired outcome or skill. Although some evidence supports this view (Wrisberg & Ragsdale, 1979), most reviews of mental practice literature have

arrived at the opposite conclusion; that is, mental practice is more effective following initial physical practice or for participants pre-selected to have some prior experience with the task (Corbin, 1967; Phipps & Morehouse, 1969). Frequency of imagery use in elite athletes supports this conclusion

The use of imagery by elite athletes appears to be widespread and provides social validation for the effectiveness of imagery as a means of performance enhancement. Of 235 Canadian Olympic athletes who participated in the 1984 Olympic games, 99% reported using imagery (Orlick & Partington, 1988). Further, an analysis of the mental preparation strategies of U.S. wrestlers during the 1988 Olympics found that the wrestlers' best performances involved adherence to positive mental imagery before their matches (Gould, Eklund, & Jackson, 1992).

In 1977, Mahoney and Avenier examined the psychology of the elite athlete and found similar findings to those previously mentioned. Thirteen male gymnasts were given a standard questionnaire during the final trials for the U S Olympic team to assess the psychological factors and strategies they used in their training and competition. Results revealed that the use of mental imagery was strongly associated with successful and superior gymnastic performance. Specifically, those athletes that qualified for the Olympics reported a higher frequency of imagery use than their less successful counterparts. In addition, the better athletes reported a higher frequency of "internal" imagery than "external" imagery.

Other research has shown that, compared to non-elite athletes, elite athletes are more likely to practice imagery from an internal perspective (Orlick & Partington, 1986). Rotella et al (1980) performed a study on the cognitions and coping strategies of elite

skiers. Forty-seven participants, including members of the U S Olympic Ski Team, a world cup race winner, members of various U.S. and foreign ski teams, U S. Junior Olympic Champions, and other high-level skiers were surveyed. Participants filled out two questionnaires that assessed the cognitive strategies they used when practicing and performing their sport

Results revealed that better skiers visualized the course from the same view it would be seen from during the race (i.e. internal perspective), rather than seeing their entire body skiing down the course (i.e. external perspective). Rotella et al. (1980) hypothesized that the more successful skiers could focus mainly on the course because they had mastered the mechanics, whereas less successful skiers viewed their body in their visual rehearsal because they had not mastered the physical technique and thus could not devote attention to the mental details of the course.

Noel (1980) posited a similar hypothesis in a study examining the effect of visuo-motor behavior rehearsal (VMBR) on tennis service performance. VMBR involves (a) an initial relaxation phase, (b) visualizing performance (imagery) during a specific stressful situation, and (c) performing the skill during a simulated stressful situation.

Fourteen male tennis players of varying ability levels were selected to be in the study. Seven participants were trained in relaxation 10 days before a major tournament, and then given a relaxation and visualization audiocassette tape to use on a daily basis prior to the tournament. The visualization part of the tape instructed them to imagine themselves performing in their first tournament match, and guided them in repetitive practice of their serves.

The seven other participants also competed in the tournament but did not receive the VMBR training. The higher ability group achieved a significant improvement in their percentage of successful first serves, while the lower-ability training group declined in their accuracy. In addition, self-reports of service performance from participants in the VMBR group indicated that they believed they had served better than usual.

It is not clear why interactions between mental practice effectiveness and athletic ability have occurred in some studies but not in others, but Noel (1980) speculated that the task used in his study (i.e. the tennis serve) was a difficult movement for most players to master. Thus, the lower-ability players might be expected to benefit more from actual practice than from mental rehearsal of this skill.

There is an old adage, "practice makes permanent." This is true, regardless of skill level, but it would be beneficial for practitioners and athletes alike to be more aware of what is being reinforced when imagery is used as a supplement to physical practice.

Imagery in Combination with Other Techniques

One aspect of mental skills training that has received considerable research attention over the years is the effect of mental training interventions that combine techniques on sporting performance. In 1990, Kendall, Hrycaiko, Martin, and Kendall implemented a mental training program consisting of imagery, relaxation, and self-talk that was designed to improve the defensive skills of a group of basketball players.

Participants were four female intercollegiate basketball players. A pre-treatment performance assessment was established for at least seven games prior to the introduction of the intervention. During the five-day intervention participants received instructions on

imagery, relaxation, and self-talk training. And, were instructed to combine the mental training techniques when practicing the defensive skill of cutting off the offensive player's forward movement by forcing them to the baseline.

The results revealed improved performance of all four participants from pre-treatment to post-treatment phases. Similar results have been reported in several other studies examining the effectiveness of packaged programs (Noel, 1980, Sunn, 1976)

Fewer studies have evaluated the effectiveness of isolated mental training techniques. An example is a study by Andre and Means (1986) that examined the effect of imagery alone on sport performance. The participants were 66 male introductory psychology students, of novice skill level, at the University of Montana. The performance task chosen for the investigation was the "putting" stroke involved in the game of Frisbee golf—the flying disc sport analogous to golf. The task involved the short throw of the disc into a net

Participants were randomly assigned to one of three treatment groups. Prior to receiving the intervention, each participant performed 50 throws. One group then received instruction on how to use visual and kinesthetic imagery on their throws. A second group essentially received the same instructions, except that participants in this group were told to practice their imagery in slow motion. The final group acted as a control and received no additional instructions. After these intervention sessions, each participant again performed 50 trials of the throw. Results revealed no significant differences between the groups

Corbin (1972) has cautioned that studies in the area of sport psychology contain too many methodological, task, and individual differences to draw definitive conclusions

as to the effectiveness of imagery alone on sport performance. Therefore, based on the results of this study and the findings of another (Meyers, Schleser, & Okwumabua, 1982), one alternative is to use a combination of psychological and physical skills.

In 1982, Meyers, Schleser, and Okwumabua examined whether cognitive behavioral interventions affect physical performance directly, or indirectly, through the modification of the athlete's reaction to the game situation. The participants were two female members of an intercollegiate basketball team. The first, a 19 year-old center was experiencing problems with anxiety when shooting foul shots. The second, a 21 year-old forward, reported similar problems with anxiety, except when shooting from the field.

A modified multiple-baseline design was used in the study. Following a 7-game baseline, the center was seen after practice 23 times over 6 weeks, from the eighth through twentieth games of the season. The cognitive strategies were discontinued for the final 11 games of the season. The forward was seen after each practice, 15 times over 5 weeks. The intervention began after a 19-game baseline and continued for the final 12 games. The first couple of sessions were devoted to assessing each athlete's naturally occurring relaxation and imagery skills. The next eight sessions were devoted to imagery and self-instruction. In each session, athletes were asked to imagine a scene. Scenes were presented hierarchically, beginning with successful performances and moving towards increasingly problematic situations. All imagery exercises involved visual and kinesthetic components and both athletes were asked to use an internal imagery perspective (Mahoney & Avenier, 1977).

In the remaining sessions for each athlete the imagery and self-instruction exercises were combined with physical rehearsal of the movement, in this case shooting a

basketball. The athlete then went through the cognitive exercise while completing the physical performance of the imagined action. Then the cognitive exercises were faded gradually, so that the physical performance was shaped towards better performance than what was generally achieved during baseline. Further, physical performance was shaped towards the competitive situation by adding noise and visual distraction (e.g. shouting and waving arms) during the practice

Each practice day, team members shot 10 to 50 free throws. Results were recorded and game free throw and field goal shooting percentages were obtained from the games' official scores. For the center, during the baseline she made 41.3% of her free throws. She was successful on 54.8% of her free throws during the 13-game intervention, but she made only 28.6% of her free throws during the 11-game return to baseline. During the baseline, the forward made 36.7% of her field goal attempts, but she increased this rate to 52.2% during the intervention. Due to time constraints, the forward did not return to baseline. These results confirm that an intervention that combines cognitive strategies and bodily rehearsal of the movement can improve athletic performance compared to using only physical or mental practice alone.

Meacci and Price (1985) performed a similar study on the acquisition and retention of golf putting skill. A total of 77 undergraduate students (55 males and 22 females) participated in the study. Initially, participants completed a questionnaire to assess confidence levels in their putting skills. The second purpose of the questionnaire was to establish talent distribution among the groups involved in the study. Putting talent was categorized as follows: *above average* – at least 40% of all putts being successful, *average* – less than 40% but more than 30%, and *poor* – 30% or less. The seven

participants categorized as above average were distributed evenly across experimental groups, two in each group, and one participant was placed in the control group. Of the participants categorized as *average*, eight were placed in the traditional repetition group and five were placed in each of the three other groups. The remaining participants, having poor or novice skill, were evenly distributed among the groups.

Each group was given a number and titled by learning method. Group 1 – relaxation, visualization, body rehearsal intervention (n = 15), Group 2 – repetition (n = 25), Group 3 – combination of relaxation, visualization, body rehearsal intervention, and repetition (n = 15), and Group 4 – control (n = 22). The learning method used by Group 1 (RVR) was divided into three segments: (a) Relaxation – a 20-sec series of breathing inhalations and exhalations; (b) Visualization – the participants closed their eyes and visualized for 3 minutes their putters striking the golf ball, and the ball rolling along the proper line and falling into the hole. The RVR group was also trained to visualize during body rehearsals and physical putts; (c) Body rehearsals – this was a combination of visualization with eyes open and physical rehearsal of 25 successful putting strokes (no ball). Group 2 (repetition) physically hit 25 putts during each learning session. Group 3 (combination of RVR and repetition) performed the RVR segments that were followed by 25 physical putts. Group 4 (control) did not utilize any learning methods.

The experimental groups attended 30 learning sessions, lasting 50 minutes each, over the course of 10-weeks. The members of each group were given identical skills tests during the first, fifteenth, thirtieth, and retention sessions. The retention session occurred 60 days after the thirtieth session. The skill tests consisted of 25 putts from a distance of 6-ft. on a relatively flat putting green.

Results revealed that the RVR type cognitive intervention was as effective as traditional practice (repetition) in acquiring a motor skill, and a combination of the two methods was superior compared to using methods separately (Price & Braun, 1983). These results directly support the findings of Meyers et al. (1982) and one other study that utilized the same type of intervention.

Price and Braun (1983) used undergraduate college students to compare three methods for acquiring basketball foul shooting skill: (a) relaxation, visualization, and body rehearsal intervention (RVR); (b) traditional repetition; (c) a combination of the two. The investigators deduced that RVR was as efficient as repetition, and a combination of the methods was superior to the methods used separately.

The aforementioned studies utilized interventions that combined imagery and rehearsal of physical movement to enhance performance. The positive results of these studies suggest that such a combination is an effective means to utilize when attempting to improve sport performance in a closed-skill. However, it was the paucity of research (Meyers et al., 1982, Meacci & Price, 1985, Price and Braun, 1983), in the sport psychology literature that has illuminated a void that needs to be studied further to confirm earlier published results.

Does combining physical movement with multisensory imagery provide the athlete an effective means to improve athletic performance by indirectly increasing self-efficacy? Or, are positive results obtained by combining physical and mental practice, thus leading to a more thorough integration of the cognitive and motor components of sport tasks? Answering these questions, as well as determining a research design that

will provide the most effective and efficient means of testing these questions was of principle concern in the current study.

Single-Subject Research Designs

Alderman (1984) predicted that in the field of sport psychology over the next 20 years, "research will become more applied and technique-oriented" (p. 53). Singer (1985) and Thueson and Jarman (1985) pointed to future directions in sport psychology research that emphasize performance enhancement, particularly factors affecting elite performers. Martens (1987), contends that "sport psychologists can acquire knowledge much more rapidly by developing solutions to practical problems" (p. 53)

Traditionally, evaluation of mental training techniques has been achieved through the use of experimental designs in which different groups are exposed to different treatment conditions (Bryan, 1987, p. 284). Typically, such evaluations consist of comparing the performance of a group or groups exposed to treatment(s) to that of a non-treatment control group. However, as Zaichowsky (1980) has pointed out, group designs like this pose several problems for researchers in sport psychology. For example, there is the ethical issue of having a no-treatment control group, which may be considered not only unethical but also unacceptable to coaches and athletes, all of whom wish to improve their performance.

Fortunately, there is an alternative methodology for evaluation that eliminates the problems posed by group designs: the single-subject design. The rationale of single-subject designs is similar to that of traditional research designs (Hersen & Barlow, 1976, Kazdin, 1978). Both types compare performance under different conditions. In single-

subject research however, the individual's behavior is observed for a period of time prior to the implementation of the experimental condition or treatment. Successive alterations in conditions or phases then provide additional opportunities to collect information on performance changes. Single-subject designs eliminate the need for a no-treatment control group and permit the investigation of individual athletes who are working on a specific aspect of their performance.

Wollman (1986) has made a strong argument for utilizing single-subject designs in research involving mental practice, noting that experiments with single-subject designs lend themselves well to tailoring specific programs for individuals engaged in athletics. Another advantage of the single-subject design for imagery research is that the link between imagery and its effects/non-effects on motor performance are made more apparent. Single-subject designs allow the detection of successful effects for certain individual participants who otherwise might have their improvements masked in a group design. Successful individuals/performances can be examined more thoroughly to determine which factors contributed to improved motor performance.

It should also be noted that single-subject methodology might be better suited than group designs when working with skilled performers who do not experience large gains in performance from pre-training levels. Small but consistent changes may be seen in a single-subject design that would not be evident in a group design.

One type of single-subject design that is relatively simple and represents a practical alternative to group designs for evaluating sport psychology interventions is the multiple-baseline design. In this design, evidence that a particular intervention has produced a change in behavior is obtained by demonstrating that behavior change occurs

when, and only when, the intervention is applied (Bryan, 1987) Stable baseline performance must first be obtained in order to determine whether changes occur between baseline and post-intervention as well as to determine causality. Extreme variability in baseline and treatment phases would obscure any treatment effects that might occur (Sidman, 1960)

Data may be collected across multiple baselines for several behaviors (multiple baseline across behaviors), for one behavior of one individual in several settings (multiple baseline across settings), or for one behavior of several individuals (multiple baseline across individuals). The multiple-baseline across individuals is probably the most useful design for applied sport psychology researchers (Dorwick & Dove, 1980; Komaki & Barnett, 1977; and Allison & Allyson, 1980). For example, Koop and Martin (1983) used a multiple baseline across participants design to evaluate error-correction coaching strategy designed to reduce swimming errors in 7- to 12- year old swimmers

The error correction intervention consisted of the trainer describing the correct performance, and then modeling both incorrect and correct performance out of the pool. The swimmer then imitated (out of the pool) both correct and incorrect behaviors until she/he could differentiate the two

The swimmer then practiced correct performance in the pool for several laps. If incorrect performance was observed the swimmer was tapped on the shoulder. If three errors occurred in one lap, the swimmer was stopped and asked to practice again. Correct performance was reinforced with verbal praise. Initially, baseline error rates for freestyle strokes were recorded in blocks of five (one trial = 50 strokes) for the five swimmers. The error correction procedure was then sequentially administered to four out of five

swimmers. Swimmer 5 served as a control (although such a condition is not necessary with this design). Following the initial phase, two maintenance phases were implemented to record error rates over the same baseline test.

The results revealed that the procedure was effective for three of the four swimmers. The effectiveness of the procedure was also demonstrated by the fact that error rates decreased only when the treatment was applied.

Wollman (1986) has recommended that researchers using single-subject designs monitor the internal experience (i.e., thoughts, emotions, etc.) of participants in addition to obtaining performance data. Social validity should be attained along several dimensions, including the selection of target behaviors that are important to the individuals involved, behavior changes large enough to be considered significant by the individuals, and the use of procedures considered acceptable by all participants (Martin & Hryciak, 1983).

Summary

As the previous review indicates, there have been a number of studies conducted on the effects of imagery on sport performance and probably even more experimental literature devoted towards speculation as to why certain types of imagery are effective in enhancing performance. Factors to consider when creating an imagery protocol include: the imagery perspective, the type of skill, and the skill level of the athlete.

The vast majority of research indicates that imagery can be an effective means of enhancing performance, but opinions differ as to the type and form of imagery that should be used, with whom, when, and how. Based on the review of literature, it was

determined that the most effective means of enhancing performance of the golf putt, a closed-skill, for elite athletes would be to utilize physically integrative multisensory imagery.

It was determined that multisensory imagery (using an internal perspective) is more effective than visual imagery, alone, for a closed-skill, when an elite athlete is trying to create a vivid image of the desired outcome. It also was expected that this type of imagery would allow for the greatest transfer between practice and competitive performance.

Based on the recommendations of Wollman (1986) and Bryan (1987), a single-subject design was utilized in order to ensure internal and external validity. In addition the internal experiences of the participants were obtained, in order to ascertain their perceptions of the effectiveness of the treatment intervention.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to determine the effect of a physically integrative multisensory imagery intervention on the putting performance of elite golfers. This chapter includes a description of the participants, the experimental design, and the methods and procedures.

Participants

The participants selected for this investigation were four Division I intercollegiate varsity golfers at a large southeastern university. Two males, a 19-year-old and a 20-year-old, and two females, a 19-year-old and a 20-year-old, agreed to participate in the study. The golfers selected for this study were chosen because they were not starters on their respective teams. Thus, they were available to participate because they did not travel to the regular tournaments.

Experimental Design

A single-subject design, referred to as a multiple-baseline across participants design (Kratochwill, 1978), was employed in this study. Baseline observations were collected for all participants. The design requires that a stable pretreatment assessment of the dependent variable be obtained. When stability of the baseline is achieved for one

participant, the intervention is introduced to that person (P1) while remaining participants continue with their normal protocol. This process is repeated until all participants receive the intervention. The effects of the treatment are demonstrated by introducing the intervention to each participant at a different time (staggered baseline). If a graphical change in performance level from baseline to post-treatment occurs, the effects of the treatment can be attributed to the intervention rather than to any extraneous variables such as maturation or history since the participants serve as their own control (Kazdin, 1982, p. 126).

Methods and Procedures

The putting green at the varsity golf practice facility was the setting for the observations of the dependent measures. The putting green is relatively flat and measures 75 ft x 125 ft. approximately, thus providing ample room in which to perform the putting test. The hole selected for use during the putting test was changed on a random basis so that the participants did not become too familiar with the putts they were asked to perform. This helped ensure external validity and created the potential for greater transfer between the practice environment and actual golf competition.

Before the preliminary interview, baseline testing, and imagery intervention commenced, each of the four golfers was introduced to the purpose and requirements of the study. A major requirement of the study was that participants' were not allowed to change their personally established practice routines from the first day of the study until the last. This did not however present much of a problem since each of the golfers was a

member of a collegiate team and they were already following a fairly regimented weekly practice schedule.

Next, each participant signed a consent form explaining the nature and duration of the study, how the study might enhance their own performance or the performance of others, and how their own confidentiality was to be ensured (Appendix A). Finally, permission was obtained to conduct observations and interviews.

First, an open-ended interview was conducted with each participant to discover whether they used imagery in any way when practicing or playing golf. Specifically, they were asked the question, "Describe how, if at all, you have used imagery when practicing or competing in golf." The content of these interviews was transcribed and evaluated to identify possible explanations for the results that were ultimately obtained.

All four participants performed a putting test once a day for five days during the same 7-day interval. After the completion of the first week, it was determined that participant #1 (P1) would receive the treatment first because he had demonstrated the most stable performance during baseline. Thus, P1 received the imagery intervention during week #2, while the other participants again performed the putting test on five different days during the second week. P2, P3 and P4 also received the intervention during weeks #3, #4 and #5, respectively, based on the stability of their baseline data and the staggered method of intervention introduction. They, like P1 received the intervention for one week and returned to the original putting test the following week to gather post-treatment performance results. This staggered method of intervention deployment is depicted in Table 1.

Table 1. Order of Intervention Introduction

Participant	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
#1	Baseline	Treatment	Post-test			
#2	Baseline	Baseline	Treatment	Post-test		
#3	Baseline	Baseline	Baseline	Treatment	Post-test	
#4	Baseline	Baseline	Baseline	Baseline	Treatment	Post-test

The putting test consisted of four putts from each of the following five distances (8, 12, 16, 20, and 24 feet) Each participant was required to begin at the 8-ft. distance and perform four putts from that distance around the hole in a star pattern In other words, the four putts took place from equidistant locations north, south, east, and west around the hole Hence, the location of each putt during the test varied from one putt to the next The remaining putts from the four larger distances from the hole were attempted in the same fashion and in an ascending order of distance from the hole. Performance measures included the number of putts made and the distance from the hole (in inches) on each missed putt

Intervention Procedures. During the treatment phase, which lasted one week, participants were instructed not to perform the putting test, but to instead practice their putting by using a type of imagery called physically integrative multisensory imagery

Each participant was presented with a list of instructions describing how to

practice this type of imagery (Appendix B). In essence, the instructions informed each participant that they were to spend 15 minutes a day for five days during a one-week period imagining putting. They were further informed that the instructor would only be present on Days 1, 3, and 5 of the intervention week.

The keys to this type of imagery are: (1) physical movement of the arms and consequently the putter as if striking a ball, but in reality only visualizing the ball, and (2) imagery of a successful outcome each and every time a practice putt is attempted. Participants were also informed that they were to imagine taking and making all putts. Further, they could not repeat the same putt twice, but instead were required to change the location and/or distance of each imagined putt they took.

The body rehearsal, or movement of the arms and putter in unison with the imaged experience of striking a golf ball, was essential to the intervention and the correct execution of said act was an aspect closely examined by the instructor each day he was present.

Day 1 of the intervention week consisted of a 15-minute guided introduction to the imagery intervention instructions. Also, participants were provided with a 15-minute guided introduction to the actual utilization of the imagery protocol during practice. On Day 2 each participant was asked to perform the 15-minute imagery intervention alone on the putting green, without the aid of the researcher, to help create autonomy over the newly introduced skill. On Day 3, the participant was once again observed and guided by the researcher, who was again there if questions or problems arose in the implementation of the imagery intervention. On Day 4, each participant was asked to perform the

intervention alone, and on Day 5, the final day of the treatment phase, the researcher was once again present to ensure the participant was performing the imagery satisfactorily.

The length and time period of the intervention used in the present study is based on the work of Kendall, Hrycaiko, Martin, and Kendall (1990) who performed a successful intervention examining similar participant matter. In their study, they examined the effects of imagery, relaxation, and a self-talk package on basketball game performance. They also utilized a multiple baseline across individuals design and instructed their participants to utilize the intervention for 15-minutes a day during their sporting season. The mental training program in that study provided a strong precedent to follow because their intervention was found to be clearly effective in enhancing the defensive basketball skill they targeted for improvement.

Post-treatment Interviews. Individual interviews were conducted after the completion of the study with each golfer to determine individual attitudes towards the effectiveness of the treatment (Kazdin, 1982). A summary of the interviews was performed to assess the golfers' perceptions of the effectiveness of the treatment on their putting performance.

Treatment of the Data. The raw scores obtained during data collection were plotted according to the number of successful putts made and the total distance away from the hole (in inches) on misses. The mean scores of these numbers were calculated and compared across days and between pre- and post-intervention results. Visual inspection of the data using the following criteria were used to identify the presence of an effect. The immediacy of an effect following the introduction of the intervention, the number of overlapping data points between the pretreatment and treatment phases, the

size of an effect after the intervention was introduced, and the number of times the effect was replicated across participants (Martin & Pear, 1988). As mentioned previously, data were summarized to determine participants' perceptions of the effectiveness of the intervention

CHAPTER IV

RESULTS

Introduction

In this chapter, the method of data analysis is discussed followed by a presentation of the results. Further, a summary of the transcribed pre-treatment interviews is presented in order to characterize each participant's individual experience with and use of imagery, in any fashion, prior to inclusion in the current study. Also, a summary of the transcribed post-treatment interviews is presented in order to characterize each participant's assessment of the effectiveness of the intervention in improving their putting performance.

Data Analysis

Each pre- and post-test of putting performance was conducted and recorded in a performance log by the researcher and after each participant completed the required number of pre- and post-treatment performance trials, total made putts and total distance from the hole (in inches) on missed putts, were calculated. These data were then graphed for each golfer and a visual examination of the results was used to evaluate the effectiveness of the treatment in influencing putting performance.

Results

The effects of the imagery intervention on the participants' putting performance are shown in Figure 1 and Figure 2. Treatment effects were noticeable across participants, and for both made putts and the distance of missed putts, with the later showing the most profound improvement. Variability in performance was expected initially as participants became accustomed to the putting test, the fact they were in a study, and the presence of the observer. The mean number of successful putts made for all four participants during the last five trials of the pretreatment phase was 24.3%. The mean during the post-treatment phase was 30%. The mean distance of missed putts from the hole for all four participants in the pretreatment phase was 15.3 inches. The mean distance of missed putts during the five trials of the post-treatment phase was 11.3 inches, a performance increase of 27%. Although the number of putts made showed a smaller effect than the distance of missed putts from the hole, both measures indicated improvements in performance between the pre-treatment and post-treatment phases.

The immediacy of the intervention effect was more consistently and clearly shown for the distance from the hole measure than for the number of successful putts. However, performance levels on both dependent measures immediately after intervention were generally higher than performance levels immediately prior to intervention. For all four participants, there was more overlapping of data points between pre-treatment and post-treatment data for the number of made putts, with the possible exception being P4. P1, slightly improved in the average number of putts made between pre and post-testing. However, there was an immediate and large positive effect on the distance of missed putts for P1 after the imagery intervention was introduced.

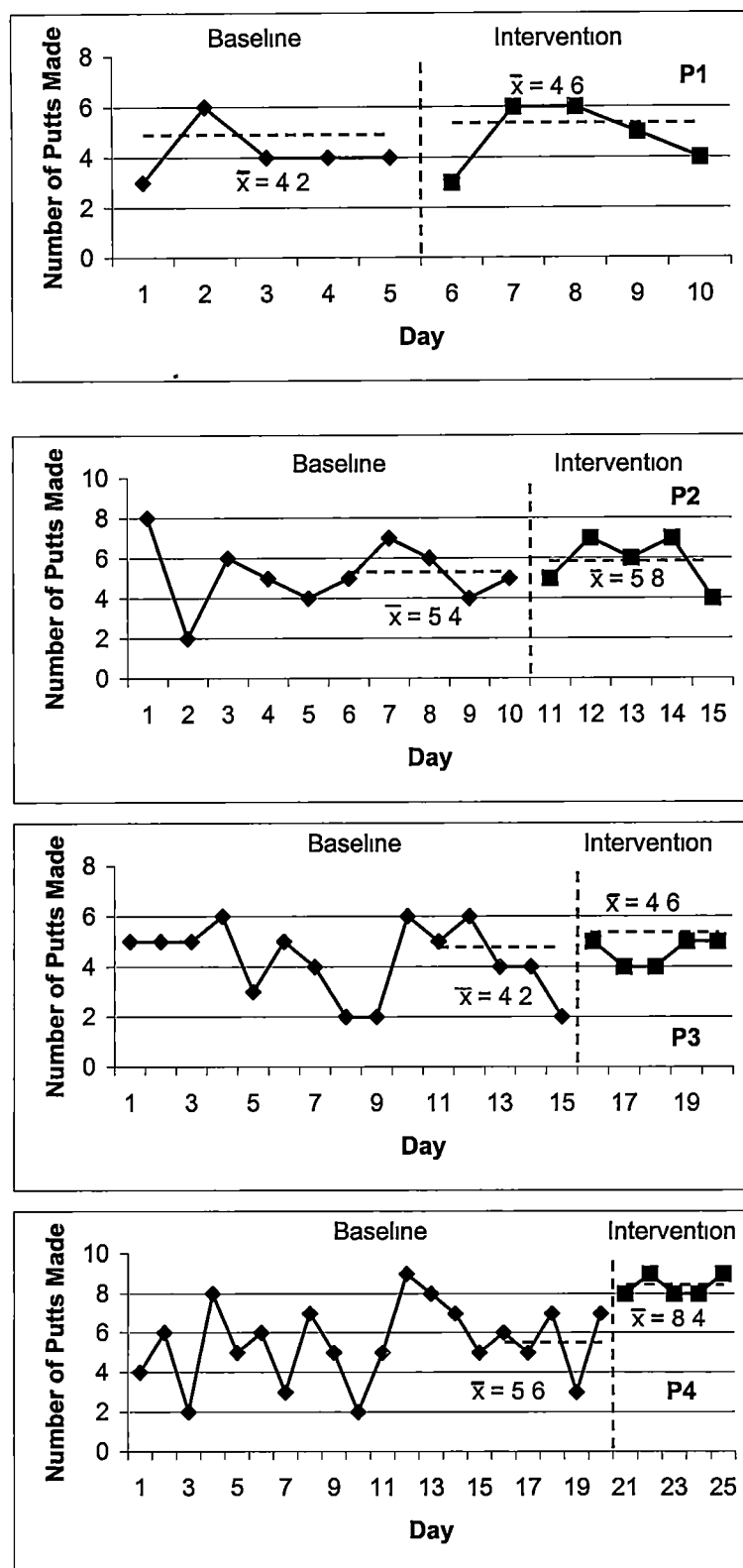


Figure 1. Number of putts successfully made across days. Each data point represents the average number of putts made per day.

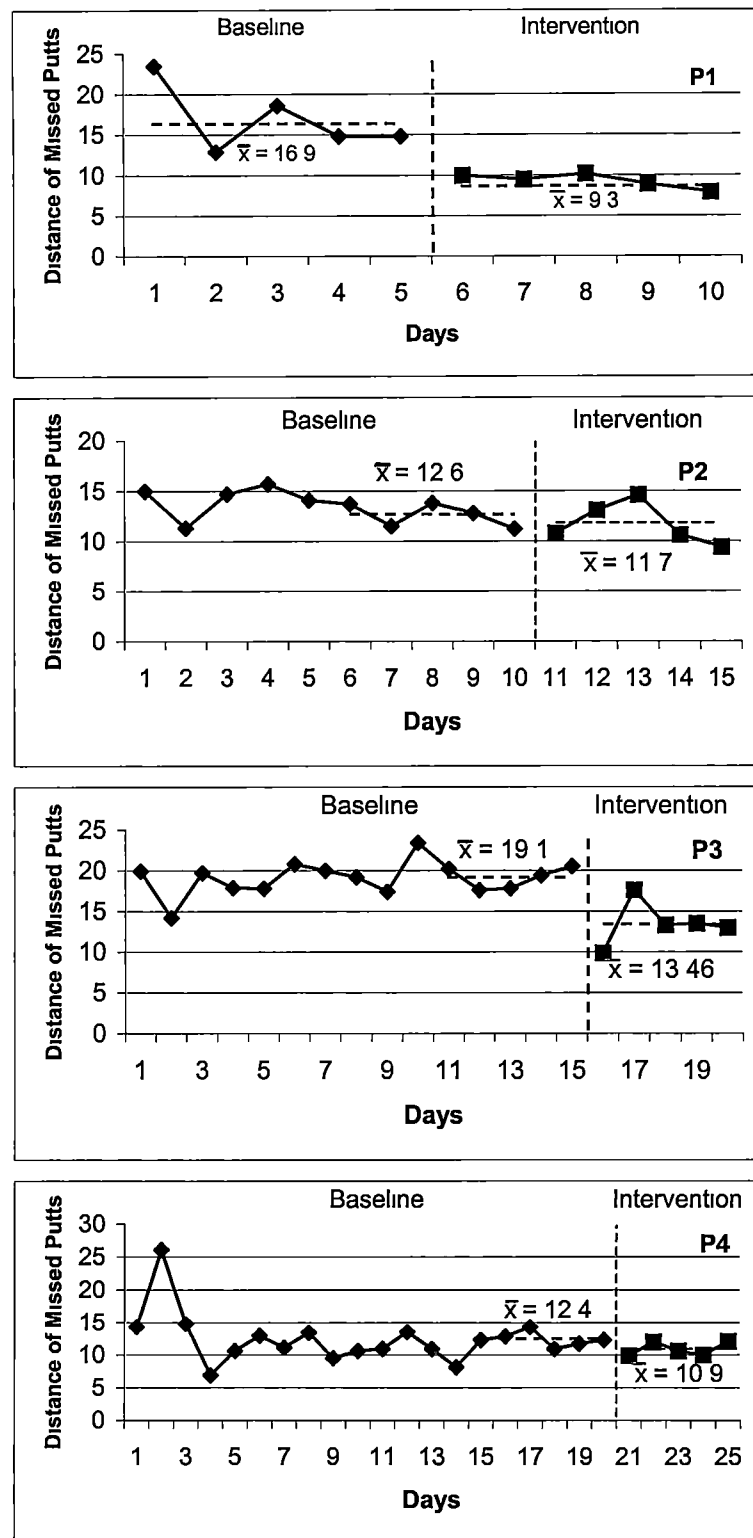


Figure 2. Distance (in inches) of missed putts across days. Each data point represents the average distance of missed putts per day.

The mean distance of missed putts for P1 was 16.9 inches from the hole during the pretreatment phase and 9.3 inches during the post-treatment phase, an improvement of 45%

P2 experienced the smallest positive effect of the intervention for both made putts and the distance of missed putts. However, P2 achieved a 6.9% increase in the number of putts made and a 7.2% increase in the average distance of their missed putts.

The data of P3 were similar in pattern to those of P1. There was a small positive effect between pre- and post-treatment scores for the number of made putts (8.7% increase). But, like P1, P3 demonstrated a large effect for average distance of missed putts. P3 missed the hole by 19.1 inches on average prior to the treatment phase and by 13.46 inches on average during the post-treatment phase, a performance increase of 30%. The results for P4, like those of the other participants, revealed a positive effect after the intervention, but P4 demonstrated the largest improvement in the number of putts made between pre- and post-treatment phases. P4 made 28/100 putts during the pretreatment phase and made 42/100 putts during the post-treatment phase, an increase of 50%.

A summary of the pre-treatment open-ended responses, in regards to experience using imagery, is presented in Table 2. Inspection of these responses suggests that only one participant, P2, had used imagery on a consistent basis prior to the study, and interestingly, P2 had used the type of imagery introduced in this study. This may explain why P2 demonstrated the least improvement in performance and also indirectly suggest support for the validity of the current design.

Social Validation. Researchers of cognitive-behavioral interventions have called for social validation to assess participant reactions to treatment procedures and

experimental outcomes (Kazdin, 1978; Wolf, 1978). Each participant was asked to answer the following question upon completion of the study, "Do you consider the physically integrative imagery intervention an effective method to enhance your putting performance?" A summary of the post-treatment open-ended responses, in regards to the effectiveness of the imagery intervention, is presented in Table 3. The results indicated that all four participants thought that the intervention program used was helpful, worthwhile, and effective

Table 2. Open-ended responses to, “Describe how, if at all, you have used imagery when practicing or competing in golf.”

Participant	Comment
P1	I have used imagery in the past, never on a regular basis and usually only when I’m playing, not practicing. Sometimes over certain shots I try to see the shot before I hit it I use the concept, “See it, feel it, trust it” Then I hit
P2	I have used imagery since I was 12 [seven years] I used to imagine that I was playing the perfect round of golf before I went to bed each night Sometimes before a tournament I would imagine myself playing the course I was to play the next day In high school, I bought some sport psychology books and started using imagery more regularly I’d say 4 times a week, before I went to bed I would be in my bedroom with my putter and imagine I would make twenty putts into an imaginary hole with an imaginary ball before I went to sleep Lately, though, maybe the last seven months, I haven’t done that at all. I’m just too tired and busy to spend like twenty minutes before I go to bed putting I still use imagery when I’m playing and practicing I always visualize the shot I want to hit before I hit it.
P3	I don’t believe I use imagery at all when playing or practicing. I just play
P4	I sometimes imagine a shot I want to hit like when I’m in the trees or have a weird stance or shot, but generally, I don’t think I use imagery a whole lot.

Table 3. Open-ended responses to, “Do you consider the physically integrative multisensory imagery intervention an effective method to enhance your putting performance?”

Participant	Comment
P1	Yes, I do. I believe the intervention helped improve my distance control around the hole on missed putts. I believe that I am getting the ball closer to the hole now than at the start of the study. These shorter putts I’m leaving myself will surely help me avoid three-putting and save me a stroke or two per round.
P2	I have used this style of imagery before so obviously I believe it is effective, or else I would not have used it. However, I do believe that my performance did get better because I was once again practicing with the imagery intervention on a regular basis. Lately, I had gotten away from using the imagery at night before going to bed.
P3	Definitely! I really believe the intervention has allowed me to make more putts now than I have been in the past. I’m just seeing the line better on the greens and I really think I have a better sense of distance and feel now.
P4	Without question. I’m making more putts now than I ever have. I really can see the putts going in before I putt them. I think it just helped me to look at the green more and picture the line my ball was going to take before hitting it. Now, by imagining the line my ball is going to take I can picture where I should aim better to get the ball in the hole. Also, I’m much more confident. I really think I’m going to make every putt I take and I know that has helped me make more putts.

CHAPTER V

DISCUSSION

The purpose of this study was to assess the effectiveness of physically integrative multisensory imagery on the putting performance of elite golfers. The participants, four collegiate golfers, were each given a putting test to determine baseline scores and introduced to the treatment intervention at staggered intervals. A comparison of pre- and post-treatment putting scores was used to determine the effectiveness of the imagery intervention. In this chapter, the results are discussed relative to current theory and practice in sport psychology. In addition, conclusions and recommendations for future research are offered.

Visual inspection of the dependent measures, number of putts made and distance of missed putts from the hole, suggest that physically integrative multisensory imagery was effective in enhancing the putting performance of the four elite golfers who participated in this study. These results are consistent with the findings of similar studies (Meyers et al., 1982; Meacci & Price, 1985; Price & Braun, 1983).

Improvements in performance were greatest for the three golfers (P1, P3, and P4) who had not utilized imagery on a regular basis before in their practice routines (Table 2). The results of P1 and P3 were very similar, both improved very little in the average number of putts made between pre- and post-testing. However, both demonstrated an immediate and large positive effect on the distance of missed putts for both participants. Before the imagery intervention was introduced P1 produced a mean distance of 16.9

inches from the hole on missed putts P3 missed the hole by 19.1 inches on average during the pre-treatment phase. However, after the imagery intervention P1's mean distance fell to 9.3 inches, an improvement of 45%, and P3 missed the hole by 13.46 inches on average, a performance increase of 30%.

For P4, the data, like that of P1 and P3, revealed a positive effect of the intervention but P4, unlike the other two golfers showed a greater improvement in the number of putts made on average P4 made 28/100 putts during the pretreatment phase and made 42/100 putts during the post-treatment phase, an increase of 50%.

Golfers, typically, utilize one of two possible approaches when putting: make it or get it close. It is beneficial for the golfers to not only try to make the putt, but to strike the ball with the proper speed so that if they miss, their ball still ends up near the hole, therefore making the second putt easier to make. In other words, by making their goal more specific the margin of error on missed putts decreases, thus leading to second putts that are closer to the hole. P4's data during the five weeks of total testing showed a greater average number of putts made than any other participant. It's therefore possible that P4 experienced a greater number of made putts because of a shift in style from a "get it close" to a "make it" mentality, as a result of the intervention.

P2 demonstrated the smallest gain in performance, as measured by both made putts and the distance from the hole of missed putts. P2 increased the number of putts made by 6.9% and decreased the average distance of missed putts by 7.2%. The minimal positive effect on performance of P2 was perhaps due to the fact that P2 had utilized physically integrative multisensory imagery on a regular basis for many years. Perhaps more importantly, this finding suggests indirect support for the validity of the

experimental design selected for this study. That is, less post-treatment improvement would be expected for a participant who had previously experienced the selected intervention.

It is important to understand that at elite levels of sport, especially golf, athletes are near the limits of their performance potential. Therefore, it is often difficult for an intervention to result in a significant improvement in performance. However, even minor improvements in performance at the elite level could make a major difference in the outcome or results of a competition. For example, in golf, one or two strokes are almost always the difference between first and second place in a 72-hole professional event. This means that out of 280 strokes, on average, over the course of 72 holes of golf, one stroke, maybe a missed 3-foot putt, determines the winner.

Therefore, it might be argued that the improvements P1, P3, and P4 experienced in the mean distance from the hole on missed putts after receiving the imagery intervention could be significant in actual competitive performance. A putt that is 6 or 7 inches closer to the hole may help a golfer eliminate a costly miss on a short putt.

Furthermore, the results of the post-treatment interviews indicated that all four golfers thought the imagery intervention was effective (Table 3). As a group, the general consensus was that the imagery intervention helped each golfer make more putts and decrease the distance of their misses because by using the intervention their ability to read the green and visualize their putt improved. Further, P4 stated that the intervention improved her confidence, which in turn, she thought improved her performance.

These results could be even more important than the actual performance data because they suggest an increase in each golfer's confidence in their ability to read

greens, visualize the line they want their ball to take, and overall putting ability. And, as previous literature has found increased confidence leads to improved performance (Bandura, 1997, Woolfolk et al., 1985). Moreover, research has shown that an intervention that has been socially validated is a more effective means of performance enhancement (Bryan, 1987)

The demonstrated effectiveness of physically integrative multisensory imagery on performance might be explained in a number of different ways.

Hale (1982) and Morrisett (1956) determined that an internal perspective is more effective than an external perspective when imaging a self-paced action. An internal perspective makes it easier to incorporate the kinesthetic sense and generate the feel of the movement (Weinberg & Gould, 1995)

The results of the current study, in which an internal perspective was used to successfully improve performance, are consistent with those of previous studies (Feltz, 1984; Martin & Hall, 1995). Woolfolk, Parrish, and Murphy (1985) demonstrated that positive imagery (i.e. seeing the putt go in the cup) increased golfer expectations of success and resulted in improved putting performance. Expectations of success have been demonstrated to enhance athletic performance in a number of studies (Ness & Patton, 1979; Weinberg, Yukelson, & Jackson, 1980)

Furthermore, advocates of this confidence enhancing strategy generally believe that imaging one's self successfully performing a task may convince an athlete that he or she can successfully execute the task, thus leading to successful performance

The results of the current study are also consistent with studies addressing similar material (Meyers et al., 1982; Meacci & Price, 1985; Price & Braun, 1983). In these

studies positive imagery in conjunction with body rehearsal or movement, were utilized to improve closed-skill performance. Meyers et al. (1982) and Price and Braun (1983) utilized positive physically integrative imagery to improve basketball free throw shooting, while Meacci & Price (1985) combined visualization and movement and improved putting performance in golfers. Taken together, these findings, and that of the current study, suggest that physically integrative imagery may be an effective intervention to increase athletic performance for a broad range of closed skills.

The success of physically integrative mental training may be partially explained by another theoretical concept found in the motor behavior literature, the encoding-specificity principle (Tulving & Thompson, 1973). According to this principle the extent to which a skill that is practiced mirrors the performance in the target setting (e.g. competition), the more likely the particular skill is to be retained. Presumably similarity between the contextual conditions in which encoding and retrieval occur enhances skill retention because the performer encodes more than just the information related to the skill itself.

It might therefore be predicted that having golfers perform the positive mental imagery on a putting green, outside, with their own putter, moving their body in tune with the image of a successful stroke and putt, promotes the encoding of positive mental images of successful performance. Then when faced with the a similar environment, a putt on a putting green during competition, the likelihood that the golfers would recall a successful performance in the past is increased. And, if such retrieval occurred, confidence should be higher and the probability of a successful performance increased (Ness & Patton, 1979, Weinberg, Yukelson, & Jackson, 1980).

A single-subject design was used to evaluate the effectiveness of the mental training intervention in this study. The design, similar to those used in other studies (Kendall, Hrycaiko, Martin, Kendall, 1990; Meyers, Schleser, Okwumabua, 1982, Hamilton & Fremouw, 1985), appeared to be effective in controlling internal validity confounds, allowing a determination of the intervention effects as they related to each athlete, and the behavior under consideration. Further, the single-subject design utilized in the current study allowed the small but significant improvements in performance of each participant to be seen graphically, a result not likely to emerge in a group design

However, one element that is difficult to control in any study is the Hawthorne effect (i.e., a change in performance that occurs merely as a function of being in an investigation, Drew, 1976). According to Drew (1976), the effect is more likely to occur immediately after a person's routine is altered and declines as the individual becomes acclimated to the new routine. It was assumed that the single-subject design used in the present study provided a sufficiently long baseline period to show an accurate evaluation of the intervention effects on putting performance.

Conclusion

Based on the results of this study, the following conclusion appears warranted: A physically integrative imagery intervention can enhance the putting of elite golfers, particularly with respect to a reduced distance from the hole on missed putts.

Recommendations

The following recommendations are offered for the consideration of future investigators

1. Different types of closed-skill sports and different levels of sports competition (e.g. high school, NCAA Division I, II, III, and professional, etc) should be examined to assess the effects of physically integrative multisensory imagery on performance.
2. Transfer of physically integrative multisensory imagery to performance in competitive settings should be explored

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APPENDICES

Appendix A

Consent Form

In this research study I intend to examine the effects of multisensory imagery in conjunction with movement on golf performance. The project is part of the requirements for the Master of Science degree in Education. During this study I will conduct a preliminary and post-interview with you in order to gain an understanding of your current use or non-use of imagery in your prior golfing experiences and your opinion as to the effectiveness of this intervention. The preliminary and post interviews will last for no longer than five minutes and address the following questions: (1) "Do you use imagery in any way when practicing or competing in golf? If so, how and when?" and (2) did you find the imagery intervention effective in helping to improve your putting?

It should be noted, you are **not** allowed to change your current practice habits in regard to your golf putting for the duration of this study. Further, I will supplement your current practice routine by asking you to perform several putting tests and utilizing a form of imagery when practicing your putting for one week. The interview, putting tests, and imagery intervention will be conducted at the University of Tennessee Golf Practice Facility, and will last approximately three to six weeks. The interview and your performance data will be kept strictly confidential and used only for research purposes. At no time will your identity be revealed in published reports. In addition, I may require a later half-hour follow up interview to obtain additional information from you. This consent form will be stored at the University of Tennessee for 3 years past the completion of this study. The interview and performance data sheets will be erased or destroyed immediately following the completion of this study.

Your participation in this study is based solely on your interest and, thus, it is voluntary. If you have questions about the study and/or your participation, please call me (Andrew J. Ploszay, M S , 144 HPER Building) at 974-8768. Once the study is completed, I will discuss the findings with you.

I, _____ (print name), understand that my participation in this study is voluntary and I can withdraw my consent at any time without penalty or prejudice towards me, and still obtain information about the study results in a later meeting.

Name _____ (print name)

Signed _____ (Date)

Witnessed _____ (Date)

APPENDIX B

Physically Integrative Multisensory Imagery Instructions

You are asked to perform the following task for 15 minutes a day for five days during the next seven days. Read the instructions carefully and should you have any questions, please ask me before commencing with the first treatment session. Read on and pay close attention to the words in **bold** print, they are emphasized to make a **point**. You are to perform the imagery treatment while on the putting green and while using your own putter. Okay, here is what you do:

Using your own putter, you are to visualize successfully putting the ball in the hole while you physically perform the putting action. In other words, go through the same routine you normally would when practicing your putting, read the green, pick a target, align your body, use practice strokes. Whatever you normally do, do now. The difference will be that instead of actually striking a golf ball, you are to imagine that you are, when in reality you will **not** use a ball during this drill. You are to use your putter to swing at your "imaginary ball." Move the putter the same amount you would back and through as if you actually had a real putt from that distance, and imagine making the putt.

The **keys** to this type of imagery are (1) you physically **move** your arms and consequently your putter as if you were striking a ball and (2) that you imagine a **successful** outcome each and every time you take an imaginary putt. To do this you want to make that image as real as possible. **See and feel** the putter strike your ball, see the ball roll and skip on its line to the hole, watch it go in, note where it enters the hole, hear the ball rattle around in the cup. The more "**real**" you can make this image in your mind, the better.

Also, note the following **requirements** when you practice using this imagery intervention. Practice "imagery" putting from various distances, but stay between 8-24 feet around the hole on the putting green, and never repeat the same putt at a particular distance or from the same location in a row. You don't get two chances when you are playing for real, so make the imagery experience as real as you can. Finally, and I can't stress this enough, remember to move the putter as if you were striking a real golf ball and imagine a successful outcome, **you** making the putt on each and every attempt.

VITA

Andrew Justin (A.J.) Ploszay was born in Philadelphia, Pennsylvania, on September 3, 1977. He graduated from Archbishop John Carroll High School in Radnor, Pennsylvania in June 1995. A.J. attended the University of Richmond, Virginia, where he received a Bachelor of Arts degree in Psychology with a minor in Sport Science in May 1999. During his four years of undergraduate study, A.J. participated on the Men's Varsity golf team. While at the University of Richmond, A.J. was inducted into the Psi Chi (Psychology), Pegasus (Sport Science), and Golden Key National Honor Societies and was named a scholar-athlete by the Colonial Athletic Association and the University of Richmond. It was also during these four years that he would discover sport psychology, thus providing an avenue through which he could pursue his two passions, sport and psychology, and proactively help athletes in their attempts to achieve their own dreams.

In August 1999, A.J. entered graduate school at the University of Tennessee, Knoxville to study Sport Psychology. While matriculating that year, he was awarded the A. W. Hobt Memorial Award for excellence in teaching for his work as a Graduate Teaching Associate in the department of Physical Education. In early August 2000, A. J. will graduate with a Master of Science degree in Human Performance and Sports Studies with a concentration in Sport Psychology. In late August 2000, he will begin the doctoral program in Sport Psychology also at the University of Tennessee, Knoxville.