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Fantasy Rehearsal and Motor Performance of Softball Players

by

Jennifer Beeger

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Masters of Arts.

Faculty of Physical Education and Recreation

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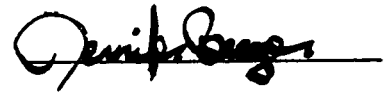

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ABSTRACT

This study evaluated the effectiveness of 3 different training strategies for the sport of women's fastball. The 3 strategies assessed, consisted of the following: physical practice (PP), fantasy rehearsal (FR), and fantasy rehearsal *during* physical practice (FR/PP). In the PP group, participants followed a basic technique of throwing a ball with a partner for 10 minute sessions. In the FR group, participants incorporated fantasy style images into the imagery rehearsal of throwing a ball to a target for 10 minute sessions. This strategy, through mentally creating or recreating an experience with fantasy like images, provides the imager with an opportunity to eliminate any extraneous distractions while creating the most facilitating atmosphere within which to perform the skill. The 3rd strategy, FR/PP, combined the elements of both strategies 1 and 2 and was exercised in 10 minute sessions. The focus of the current study was to examine the performance effects generated by the 3 training strategies and more specifically, to assess the efficacy of a new method, FR/PP, as it compares to the use of FR and PP on their own. In total, 28 participants took part in this study with 2 groups of 9 participants and 1 group of 10 participants. Each participant completed the Vividness of Movement Imagery Questionnaire (VMIQ), Imagery Use Questionnaire (IUQ), pretest target throwing trials, group training, and posttest target throwing trials. Based on ANCOVA, it was demonstrated that there was a significant difference between groups after adjusting for pretest scores. Further, post hoc test results indicated, that the FR/PP group had the most significant amount of improvement when compared to PP. The overall findings of this study suggest that potentially, through the use of FR/PP, enhancement of performance could be achieved more effectively than using either PP or FR alone.

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I. INTRODUCTION

Throughout history, sports have evolved from simple contests of strength and speed to more complex exertions of precision and skill. With these evolutionary changes in sport, the need to find strategies which maximize performance has arisen.

The physiological and technical components involved in training for sport have progressively advanced due to research in exercise physiology and biomechanics. As a result, a greater understanding of movements and the execution of those movements as they relate to the individual performing them, has contributed to the enhancement of sport performance. In conjunction with these areas of study, a broad range of mental training approaches and theories has also arisen for sport performance enhancement. This emergence of mental training strategies has spawned a substantial amount of research and study striving to develop the most effective, all encompassing training program. Approaches such as Suinn's (1976,1984) visual motor behaviour rehearsal (VMBR), Lang's (1979) bioinformational theory, Sackett's (1934) symbolic learning theory, and Hale's (1981) psychoneuromuscular theory have all, by directing attention to the mental aspects of performance, raised the understanding of specific and general movements to a tangibly higher level. These approaches and theories encompass the use of training variations ranging from simple mental practice (external perspective- visually directed), to VMBR (relaxation-internal perspective-visually and kinesthetically directed). Further, the most recently evolved training programs tend to cover all the components involved in the mental side of skill training with the exception of two things; first, mentally rehearsing the skill within a *hyper-ideal* environment - 'fantasy rehearsal';

and second, the actual act of executing the skill *while* using fantasy rehearsal - again hyper-ideal. If 'ideal' is imagery rehearsal which replicates the actual environment in which the skill *would be* performed in, then *hyper-ideal* can be considered an exaggerated and perhaps, even more facilitating imaging of the environment for the skill *to be* performed in. Instead of simply recreating and reintegrating the image of actually being in a competitive environment (including all the visuals, feelings, sounds etc.), the individual creates a *more* ideal than real environment image within which to perform the skill. An example of this in the current study is having the fastball pitchers and catchers, throw a ball within a tunnel to a target where the individual can only move within that tunnel and unfailingly hit the target. Further, a hyper- ideal state may also be accomplished by mentally altering his/her body action when creating an image. An example of this is, in throwing a ball down the tunnel, the individual exaggerates their arm extension by stretching it all the way down to the end of the tunnel placing the ball directly in the target. Cognitively, a hyper- ideal state may be generated by enabling an individual to assume the mental sensation that there is no outside distraction (focus oriented image). This can be utilized in a situation where an individual gets consistently distracted by fans or other external stimuli and needs to control their emotions to maintain focus on the task at hand. This cognitively generated mental/physical state is fostered by the perceived enclosure of the tunnel and the ability to focus solely on throwing the ball.

The main purpose of imagery has been to aid or enhance performance by facilitating the refinement and self-evaluation of skills, facilitating focus, and replacing

physical practice (when it is not available). The purpose of incorporating a *hyper-ideal* form of imagery rehearsal into *this* study was to develop and assess a form of imagery that could be used by performers during physical practice or movement, that could achieve all of the above noted, but in the most facilitating 'cannot fail' state possible. This hyper-ideal state of mental imagery rehearsal has been coined by the researcher as Fantasy Rehearsal.

Justification for the Study

From those who use imagery rehearsal devoutly to enhance their sport performance, to those who succumb to the skepticism underlying any alternative approach to performance-betterment, imagery rehearsal remains a dominant force in the world of sport. Although imagery rehearsal programs are useful in many dimensions of life (i.e. physical/mental health, performing arts, academics, recreation, sport, etc.) the focus of this study has targeted the skills of pitching and catching in the sport of fastball. This choice was made based on many years of personal experience in the sport of fastball and with the use of mental imagery strategies, as well as exposure to previous supportive literature (Efran, Lesser, & Spiller, 1994; Hanrahan & Vergeer, 1998). It was hypothesized that by implementing this study's most newly developed form of imagery rehearsal training - fantasy rehearsal- into the sport of fastball, the results could indicate the significant potential of the strategy. Hypothetically, the essential elements included in fantasy rehearsal demonstrate the potential capacity to manipulate an individual's mental direction such that they create a hyper-ideal or 'cannot fail' environment which may enhance and foster optimal performance. Through guiding an individual to create his/her

own hyper-ideal mental environment for rehearsal, we broaden the spectrum of potential techniques available for the individual to improve performance in both practice and competitive settings. Furthermore, based on past literature (Hinshaw, 1991), it is evident that physical practice is the foundation for any training regimen and as such, the merging of physical practice with the fantasy rehearsal strategy merits investigation into the possibility that this combination could provide the most effective program for the enhancement of performance. As previous imagery rehearsal programs have already been compared to physical practice and proved less effective (Hinshaw, 1991), it was determined by the researcher that a comparison of fantasy rehearsal alone (FR) and during physical practice (FR/PP) against other forms of imagery rehearsal, was not essential. Perhaps if there were more participants available it would have provided interesting data, however this was not the case in this particular study.

Purpose

The purpose of this study was to assess and compare three training programs designed to enhance skill performance in the sport of fastball. In this study, using female fastball pitchers and catchers as participants, the following three training programs were employed: physical practice (PP), fantasy mental imagery rehearsal (FR), and fantasy mental imagery rehearsal during physical practice (FR/PP).

Specifically, the efficacy of FR/PP was assessed and compared to both FR alone and PP alone. The following questions guided this study: Will fantasy rehearsal alone enhance performance *more so* than physical practice alone? Will fantasy rehearsal during physical practice, enhance performance *more so* than fantasy rehearsal alone or physical

practice alone?

Rationale

This program evaluation study was exploratory in nature. Some literature indicates however, that on their own, fantasy style images (Efran, Lesser, & Spiller, 1994; Hanrahan & Vergeer, 1998)- which involved the incorporation of abstract or hyper-ideal images into a typical imagery rehearsal session-, as well as movement during fantasy style images (Hanrahan, Tetreau, & Sarrazin, 1995; Hanrahan & Salmela, 1990), may enhance performance. For example, in Hanrahan et al. (1990, 1995) participants felt that the fantasy images incorporated into their imagery strategies were effective in improving performance. Furthermore, the quantitative data obtained in these studies, indicated that the fantasy images did work (in some cases). This literature supports the potential effectiveness of the current study's fantasy imagery rehearsal during physical practice training strategy. As such, it was proposed that the present study could potentially contribute to the literature in the quest for greater enhancement of individual performances.

Assumptions and Limitations

It was the general assumption of the researcher that after assessing results of the Vividness of Movement Imagery Questionnaire (VMIQ) and Imagery Use Questionnaire (IUQ) the participants had not received any formal mental imagery training prior to the beginning of this study. It was further assumed that if they had, the method used to assign participants to groups would compensate for potential differences regarding participant experience and ability levels. This was accomplished by ensuring an even

distribution across groups of the low, medium and high scorers based on the questionnaire and pretest score data.

Another assumption of this study was that the participants answered the questionnaires truthfully and completely.

A limitation of this study was that only two types of skills were used as a basis for measuring the effectiveness of the mental imagery components; a fastball throw to second base, and pitching. This limits the generalizability of the results and the usefulness of the mental imagery components across alternative sports and activities.

Another limitation of this study was that there were not any other imagery groups (forms of imagery) used in comparison to FR and FR/PP due to the constraints of participants and time. This limits the significance of the conclusions drawn from the data and again indicates a need for future research with a greater number of participants and time to compare strategy effectiveness.

Summary

It was expected that this study would generate information useful to fastball pitchers, catchers, and their coaches in the pursuit to design the most effective imagery training program. Specifically, if the hypotheses of this study were supported by the data, information pertinent to the creation of an effective imagery training program for fastball training would be yielded. It was anticipated by the researcher that the following would occur:

Hypotheses

1. The group using physical practice and fantasy rehearsal combined will perform better than the physical practice group.

2. The group using physical practice and fantasy rehearsal combined will perform better than the fantasy rehearsal group.

3. The physical practice group will perform better than the fantasy rehearsal group.

II. REVIEW OF THE LITERATURE

The enhancement of sport performance through the use of imagery rehearsal strategies has, in recent years, undergone a considerable amount of research. Research has primarily focussed on whether imagery rehearsal is beneficial, which theory best describes how imagery rehearsal works, which imagery perspective provides the most benefit to performance, and what role the kinesthetic and visual elements play in imagery rehearsal. In this review of the literature an overview of these topics, as well as some more recent topics of research, will be conducted followed by a brief discussion examining the inclusion of fantasy in imagery rehearsal.

Mental Imagery Defined

Arieti (1976) describes mental imagery as "a way of dealing with the 'absent', of giving it a psychological presence or existence (p. 50)." Furthermore, he claims that " imagery has the function of reproducing what is not available, and it also acquires the function - at least in its rudimentary forms - of producing what was never present (p. 50)" and "whatever is known or experienced, by means of images and subsequent cognitive processes, tends to become a part of the individual who knows and experiences it (p. 45)".

Arieti's suggestion supports Richardson's (1969) definition that essentially, mental imagery is the psychologically contrived self-conscious awareness of both the sensory and perceptual experiences of performing a skill used for the purpose of skill rehearsal during the absence of the actual sensory stimuli and perceived sensations

generated by actual physiological activity.

Mental Imagery in Sport Psychology

The term 'mental imagery' is often used and understood as a varied or diversified term ranging in conceptual meaning from simple mental practice to complicated, multi-modal, multi-dimensional imagery rehearsal (Suinn, 1993).

As mental imagery is now considered to be simply a generic term, specific kinds of mental imagery have emerged such as VMBR (Suinn, 1976, 1984), imagery rehearsal (Suinn, 1985) and/or fantasy rehearsal (current study). Although definitions of imagery rehearsal and mental imagery are not considered interchangeable academically, it is important to note that imagery rehearsal's basic concepts stem directly from the broad, generic concepts of mental imagery.

Suinn (1993) makes a simple comparison of mental practice (imagery) versus imagery rehearsal. He points out that Corbin's (1972) description of mental imagery rehearsal as the "repetition of a task, without observable movement, with the specific intent of learning (p. 94)" is an indefinite and broad definition that does not pay specific attention to characteristics researchers (Suinn, 1993; Vealey & Walter, 1993) now identify as integral parts of an imagery rehearsal program. Suinn (1993, p. 498) indicates that the effectiveness of a program depends largely on the program's inclusion of visual, proprioceptive, auditory, and emotional components. With the more recent focus on multi-modal, multi-dimensional elements within mental imagery programs, imagery rehearsal has emerged as a new term with its roots simply stemming from mental practice imagery.

To create an understanding of mental imagery (as a varied or diversified term including imagery rehearsal) in performance enhancement, Vealey and Walter (1993) describe imagery as "using all the senses to recreate or create an experience in the mind (p.201)". As they eliminate the 'mental' portion of mental imagery, they venture on to explore what characteristics imagery is comprised of. They discuss three keys to understanding imagery in order to create a better comprehension of its characteristics and functions.

The first of the three keys Vealey and Walter (1993) suggest is that through imagery we are able to recreate as well as create experiences in our mind. Sometimes, we simply imitate the actions of others, making a mental blueprint that we can relate back to, for our performance. We use this memory or blueprint and experience it internally by reconstructing external events or the observed action of others, in our minds. Following symbolic learning theory logic, Vealey and Walter (1993) also point out that we can *recreate* our *own* previous performances or create new ones to learn about, evaluate and possibly correct these performances.

The second of the three keys according to Vealey and Walter (1993), is the view that mental imagery is a polysensory experience. To create more vivid images, mental imagery can and should involve all the senses, including the visual, auditory, olfactory, gustatory, tactile, and kinesthetic senses. The authors suggest that "The more vivid the image, the more effective it is [for the enhancement of performance] (p. 202)".

Lastly, Vealey and Walter (1993) suggest that imagery requires no external stimulus antecedents. Richardson (1983) (as referred to in Vealey & Walter, 1993),

posits that "when individuals engage in vivid imagery and absorb themselves into the context of their images, the brain interprets these images as identical to the actual external stimulus situation (p.205)". This concept seems possible as a suggestion although not necessarily to the degree that it is insinuated. The notion, however, that vivid imagery could replicate to a *certain degree*, the experience attained through physical practice *does* seem plausible. Additionally, if we were to develop an imagery program where an individual could image a hyper-ideal, 'cannot fail' situation while simultaneously physically practicing the skill being rehearsed, the effect may prove to generate a more optimal model of the actual external stimulus situation and in turn, raise the overall enhancement in performance.

History and Relation to Psychology

From the introspective era to present day research, imagery has endured varied interest and popularity. According to Paivio (1991)

> imagery is the most prototypical, enduring, and fertile member of the mentalistic family [and] runs as a theme through all ages and all approaches to psychology from the mnemonic systems of the ancients to the computer simulation models of today . . . [it] has even found its way into their [behaviourists] analyses under such labels as conditioned sensations and private seeing (Mowrer, 1960; Sheffield, 1961; Skinner, 1953; Staats, 1968). (p. 185)

Today, imagery rehearsal researchers are determined to find its most beneficial use, stemming from an eclectic collection of fields such as dance literature (Hanrahan, Tetreau, & Sarrazin, 1995) cognitive science (Paivio, 1991) behavioural and brain

science (Kosslyn, Pinker, Smith, & Schwartz, 1979), psychophysiology (Lang, 1979), motor learning (White & Hardy, 1995) developmental psychology (Bandura, 1977,1986), and sport psychology (Suinn, 1993).

Imagery Rehearsal Theories

General theories (Jacobson, 1931; Sackett, 1934; Corbin, 1972; Lang, 1979; Bandura, 1977, 1986; Denis, 1985; Schmidt, 1987; Suinn, 1993; etc.), have been directed at understanding the processes of imagery rehearsal. The theories most widely discussed in sport psychology will be the focus of this review.

Psychoneuromuscular theory. According to researchers (Hale, 1981; Mackay, 1981; Suinn, 1987; as cited in Murphy, Tennant, & Singer, 1993) the psychoneuromuscular theory supports that imagery rehearsal can replicate the effect of the motor pattern that it is rehearsing. Although it is noted that imagery rehearsal stimulates neuromuscular innervations to a much *smaller* degree than physical practice, it is still thought to be ample enough for the enhancement "of the motor schema in the motor cortex or the priming of the corresponding muscle movement nodes" (Murphy et al., 1993, p. 493). This suggests that imagery rehearsal is best when rehearsal is of an ideal performance, so that the best motor pathways or schemata for performance are primed.

Potentially, through using ideal performance imagery rehearsal simultaneously during physical practice, the interactive effects generated by the two could lead to a more thorough priming of the motor cortex and muscles. As noted by researchers (Hale, 1981; Mackay, 1981; Suinn, 1987; as cited in Murphy, Tennant, & Singer, 1993) that both

imagery and physical practice potentials can individually prime pathways similar to those stimulated by physical activity, it is plausible to assume that the combination of the corresponding muscle movement node pathways primed by both physical practice *and* imagery rehearsal congruently should lead to a greater facilitating effect than either one used alone. This is notable in that when assessing the results of this study in respect to the postulated hypotheses the differences measured between groups may still be observed however to a 'much smaller degree' than actually anticipated.

Suinn (1993) adds that " the motor-efferent patterns generated in imagery rehearsal are identical with those achieved for learning or correction or enhancement of performance through physical practice" (p. 493). Evidence (Anderson, 1981; Harris & Robinson, 1986; Jacobson, 1930; Jowdy & Harris, 1990; Schick, 1970; Schramm, 1967; Suinn, 1980) for the premise that imagery rehearsal is accompanied by small but measurable neuromuscular activations consistent with the task imagined supports the following suggestion. Neuromuscular activations matching the motor patterns associated with actual tasks performed, provide an individual with a greater opportunity to learn and correct skills on their own through the use of imagery rehearsal. This hypothetically would come as a result of the implied messages sent/delivered to the muscles (theoretically creating a memory for the muscles by enforcing motor patterns) through the muscle innervations/activations created by imagery rehearsal.

The psychoneuromuscular theory is criticized by the argument that the meagre amount of controlled research is insufficient for evaluation (e.g. Suinn, 1993). Others contend that the theory does not demonstrate the electric potential to be causal of

enhancement (Murphy & Jowdy, 1992), meaning that generally, the innervations of the muscles stimulated by the use of imagery, do not have a strong enough impact on muscle memory of motor patterns to identify them as being effective. Furthermore, in research that has been controlled, the findings have provided the researchers with mixed results concerning the validity of the psychoneuromuscular theory (Hale, 1982; Harris & Robinson, 1986; Jowdy & Harris, 1990).

Symbolic learning theory. The second theory delineated is the symbolic learning theory. Parallelled to a mental blueprint, it is suggested by Vealey and Walters (1993)

> That imagery may function as a coding system to help athletes acquire or understand movement patterns. All movements that we make must first be encoded into our central nervous system - we must have a blueprint or plan for this movement. (p.205)

Essentially, this idea proposes that imagery rehearsal helps an individual learn and understand how a movement or skill is to be performed. It acknowledges and substantiates symbolic components into our central nervous system and, in turn, facilitates an individuals coordination of those components creating a more familiar and automatic movement enhancing the performance of the skill. Murphy and Jowdy (1992) point out that tasks (i.e. pitching) lying more on the cognitive (symbolic/familiar) end of the continuum would realize the greatest effects through imagery rehearsal. Although numerous studies support the existence of the process proposed by the symbolic learning theory (Bandura, Jeffrey & Bachicha, 1974; Shea, 1977; Carroll & Bandura, 1982; Denis, 1985; Richardson, 1985) Murphy and Jowdy (1992) warn of its simplicity and

ask questions such as "where [do] the beneficial effects of mental practice occur? Do the 'cognitive' effects of mental practice occur in the encoding of the skill, the retrieval of the skill, or the execution of the skill?" (p. 237).

Many sensory-motor behaviours are learned by imitation, particularly complex movements (Adams, 1987). This being so, theories of social learning and development are quite relevant in the acquisition of sensory-motor skills.

Social learning theory. Bandura's (1977, 1986) social learning theory claims as one of its primary principles that the highest level of observational learning is achieved by first organizing and rehearsing the modelled behaviour symbolically and then enacting it overtly. In the current study, participants acquired the learning strategy of fantasy rehearsal of a physical skill, organized and rehearsed the modelled behaviours symbolically, used fantasy rehearsal *during* physical practice (enacting the skill overtly), and then performed the physical skill in the test trial sessions. Social learning theory (Bandura, 1977, 1986) suggests furthermore, that an individual may model the re-creation of his/her own behaviour through the use of mental imagery. Internalization of an external model (or model of self) seems to parallel the basic concept of the symbolic learning theory. Basically, the pertinent principle of the social learning theory is that a transfer of learning occurs because of previously encountered similar situations, as well as how those situations were responded to. In the sport world, these situations could be encountered in physical practice, imagery rehearsal, or both.

Bioinformational theory. The last approach discussed here is the bioinformational theory (Lang, 1979). Vealey and Walter (1993) summarize the theory in their meta-

analysis by suggesting that through imagery, individuals may attain activations of stimulus propositions which describe the content of a situation/skill, as well as response propositions that communicate how to react to the stimuli in that situation. Vealey and Walter (1993) also note that "by repeatedly accessing response propositions for a particular stimulus situation and modifying these responses to represent perfect control and execution of a skill, imagery is predicted to enhance performance" (p. 205). Lang (1979) concluded in his experimental study of the bioinformational image that,

> the image is a prototype in the brain for overt responding, that it has the status of a perceptual-motor set which controls contextual behaviour . . . it is the processing of the affective image in therapy [or rehearsal], the alteration of its cognitive and programmatic motor structure, which mediates significant behaviour change. (p. 506)

Consequently, by attaching meaning to image, behavioural change, or in this case improvement in performance, seems greater for those images that evoke some more personal or purposeful meaning to the individual.

Hecker and Kaczor (1988) (as referred to in Vealey & Walter, 1993) suggest that "images should contain not just the conditions of the situation (swimming in a pool, rough water, championship meet), but also the athletes' behavioural (swimming strongly, right on pace), psychological (feeling confident, focusing on the race), and physiological (feeling energized) responses to the situation (p. 205)". Generally, the concept of the bioinformational theory seems to suggest that through gathering more information about an image, more meaning is given to that image. If images contain multi-modal or

multidimensional components giving meaning to the image, better reproduction or focus on an activity may be fostered, hence creating better learning.

In comparison, the symbolic learning theory integrates a process that seems to be one of trial and error. The individual "can think about what kinds of things might be tried, the consequences of each action can be predicted . . . and the learner can perhaps rule out the inappropriate course of action." (Schmidt, 1982, as cited by Suinn, 1993, p. 494).

The bioinformational theory suggests incorporation of the environmental, behavioural, psychological, and physiological components into an individual's imagery rehearsal. Since the present study's focus lies in the skills of fastball pitching and catching, the following discussion of the fantasy images designed by the researcher and used in this study will show how certain components suggested by the bioinformational theory are incorporated. These images were intended to enhance the precision of the participant's throws as well as create an atmosphere that facilitates and allows the participants to maintain focus. Further, the following discussion of fantasy images may support how enhancement of fastball players' performance could potentially be accomplished.

The following fantasy element was incorporated within the imagery rehearsal. The environment was imaged as being a narrow tunnel more conducive to accurate performance. In the tunnel image the pitcher narrowed her focus by imagining she was within a tunnel and could only move within that tunnel space. Only seeing the target at the end of the tunnel assured the participant that the ball had only one place to go - to the

target. It was hoped that the tunnel reduced distractions and guided the pitcher to stay in line with the target. An imagery program that incorporates these fantasy components may provide more meaning and focussed and/or distorted reality to the image at hand thereby creating a more facilitating learning environment in the individual's mind. This being so, potential enhancement of performance seems possible as an outcome.

Further adding to the attributes of fantasy rehearsal's 'cannot fail environment', physical practice was added to the rehearsal. When including physical practice in fantasy rehearsal (the physiological component suggested by the bioinformational theory) participants engaged in movement of the skill, while imaging and focussing on what the body should ideally be feeling like while engaging in the movement of their skill. Therefore, through this, contributing to the more kinesthetic element needed for learning/performing a skill by attending to the individual's actual movement. According to bioinformational theory logic, when the environmental element is combined with this physiological element, the potential is heightened for a greater overall enhancement of performance.

Mental Practice versus Physical Practice

Hinshaw's (1991) critical evaluation and meta-analysis of the effects of mental practice on motor skill performance provides a summary of the relative merits of mental practice versus physical practice. According to Hinshaw (1991), there is a typical design that researchers tend to use when comparing performance levels of participants who practice mentally with those who do not. Hinshaw's (1991) review has not come to any significantly different conclusions than prior reviews (Feltz & Landers, 1983; Martens,

1982). Hinshaw (1991) concurs with Corbin's (1972) proposal when she notes that, in most studies

> participants are divided into three groups: a no practice control group, a mental practice group, and a physical practice group. Studies may be as short as two minutes or as long as eight weeks; for the duration of the study, all experimental groups meet and practice regularly ... At the end of the experimental period, performance is measured for all participants and means are compared to determine if performance differs as a result of experimental conditions ... a general finding in the field is that the performance of the physical practice group is superior to that of the mental practice group and that both are significantly superior to the no practice control group. (p. 6)

In support of this data, Martens (1982) (as cited in Vealey & Walter, 1993) in his review of sport and motor behaviours literature, concluded that

> imagery is an effective technique to improve performance and [that it] documented improvement in the following sport skills through imagery practice: basketball free throw shooting, football place kicking, swimming starts, dart throwing, alpine skiing, karate skills, volleyball serving, tennis serving, and golf. (p. 202)

In their meta-analysis, Feltz and Landers (1983) concluded that "mental practice enhances performance and is better than no practice at all" (p. 41). Based on the consistency of previous research demonstrating superiority of mental practice and physical practice over no practice at all, it appears likely that the use of either one, or

both, would provide better results than no practice at all. This being the case, the researchers excluded a 'no practice' control group from the present study on the basis that it was redundant. Further to that, it is important to note that the interest here was to evaluate three training strategies to determine which group demonstrated the greatest improvement, not how much improvement would occur in comparison to no practice.

Hinshaw (1991) directs attention toward Suinn (1985) and Bell's (1983) contribution regarding the efficacy of mental practice in their description of the "transfer of training" phenomenon which suggests that

> the greater the similarity between practice and performance conditions, the greater the transfer of training. Using the mind as a 'playing field,' mental practice allows for simulated complete control over the training situation such that, with a skilled imager, the mental 'picture' can closely mirror actual performance conditions. (p. 7)

Furthermore, Hinshaw (1991) noted that "Mental practice allows for complete control over environmental conditions as well as performance outcomes; practice trials can be mentally 'slowed down' to examine technique and correct problems, or it can be redirected if things go wrong" (p. 7). In contrast, physical practice is very difficult to accurately slow down for examination of technique. Potentially, if physical practice is used simultaneously with the hyper-idealized images of reality in *fantasy rehearsal,* higher potential may be induced for further enhancement of performance *beyond* imagery rehearsal's typically ideal or actual conditions. In application, the tunnel image used in the current study contains the environment and prevents the ball from going

astray facilitating a funnelling type of action of the ball - to the target. By enabling the pitcher to image themselves pitching in a tunnel and in turn hitting the target more often, the image becomes hyper-ideal. As they go through the motions of the throw while they are imaging, they are able to become more closely aware of how their body is moving through the 'tunnel' space, as well as seeing themselves, thus making modifications to their performance easier to pinpoint and evaluate.

Internal Versus External Imagery

There are two different perspectives from which an individual can image from: internal and external. The internal is composed of two primary modes, kinesthetic and visual. The kinesthetic mode enables the individual to experience the physical sensation as if they were actually performing it (Hinshaw, 1991). The internal 'visual' aspect according to White and Hardy (1995) denotes that the individual is required to "form a visual image from a first-person perspective and therefore to see the view that would be seen during the actual performance of the task"(p. 172).

Mahoney and Avener (1977, p. 137) describe the external imagery process as occurring when "a person views himself [or herself] from the perspective of an external observer (much like in home movies.)". It "typically involves no kinesthetic sensation; the participant is somewhat removed from and not personally involved in the "action" of the image." (Hinshaw, 1991, p. 12).

Throughout the sport research literature, the issue of which imagery rehearsal perspective is more effective has been a primary source of debate. It has been noted that even though the internal perspective is most effective in performance enhancement, the

general consensus, based on research findings, has been that external imagery rehearsal has been most commonly used. Most often, the external perspective is utilized by individuals in the absence of prior experience or instruction (Schick, 1970), in the learning of a new skill (White &Hardy, 1995), in retention of that learned skill (White & Hardy, 1995), as well as in error detection and analytic properties (Jowdy, Murphy & Durtschi, 1989). White and Hardy (1995) maintain that "following the observation of a model, external visual imagery should provide the learner with the opportunity to visually rehearse the key visual parameters extracted from the model and plan the appropriate motor responses" (p. 171).

Furthermore, White and Hardy (1995) suggest that

> for tasks where the form of the movement is important, we might anticipate that external visual imagery would be a more efficient imagery perspective. Indeed, it would appear to be very difficult to learn such a motor task without the assistance of an external visual image [or model]. (p. 171)

In contrast, empirical findings (Epstein, 1980; Mahoney & Avener, 1977) support that internal imagery rehearsal is more effective for the enrichment of performance than external imagery rehearsal. Epstein (1980) ascertains, based on her research as well as on the literature, that performing mental practice images from an internal perspective is seemingly most effective. She concludes, based on the findings of various studies (Epstein, 1980; Epstein & Mahoney, 1979; Mahoney & Avener, 1977) that the trend of using the external imagery perspective tends to associate negatively with motor performance. An example of this could be an individual who uses external

imagery rehearsal to relate to undesirable attributes (i.e. past failures, poor self-confidence etc.) (Epstein, 1980). Individuals may in fact be viewing themselves or a role model, executing the skill incorrectly, and due to the exclusion of the kinesthetic element (which is typically present in the internal perspective), error correction is more difficult to accomplish and does not occur hence, performance is not enhanced to a very significant degree and the motor learning of a skill is minimal.

Mahoney and Avener's (1977) study on gymnasts trying to qualify for the Olympic team also yielded results suggesting that the internal perspective is more effective. In this study, qualifying gymnasts used internal imagery rehearsal in a significantly larger proportion than nonqualifiers.

According to Hinshaw's (1991, p. 12) interpretation of internal imagery rehearsal data, it is generally conceded that internal imagery fosters "the facilitative effects [that] relate to the muscles and mind already being prepared to execute the imagined act, having previously 'rehearsed' during the imagery process". Conceivably, when imagery rehearsal is combined with physical practice, the potential of muscle memory/action due to imagery rehearsal would be added to the real muscle potential such that the combined muscle potentials (mentally rehearsed and physically practiced) would be augmented and more precise/ideal than during physical practice or imagery rehearsal alone.

White and Hardy (1995) relate to the Bioinformational theory when they submit that through imaging from an internal perspective, the representation of the rehearsed task is more accurate. Changes in the visual field may be more easily recognized and

may help in planning to respond to the field, thus, improving the readiness of the system. This readiness of the system seems comparable to the stimulus-response aspect of the bioinformational theory. Lang (1977) theorizes, that stimulus propositions describing the content of an image are activated through accurate internal perspective imagery rehearsal of the task. Further, situation-specific response propositions are triggered, which, in turn, help in response planning and readying the system. In short, this theory suggests that an internal perspective facilitates the learning of a skill.

Fantasy rehearsal also facilitates a readying of the system concept in which it allows the individual to create some sort of exaggerated reality circumstance where they can always feel comfortable and familiar with their surroundings and skill techniques. For example, if an individual has a fear of performing in front of large groups of people, and they have been rehearsing their skill as if they were inside of a tunnel during practice, that may enable them to block out the crowd of people during their performance. This ability to separate themselves from non-task related stimuli in order to provide themselves with a familiar and comfortable environment enables them to maintain a more concentrated focus on the task at hand. This in turn, readies the system for any potential distraction or obstacles fostering a readiness to focus attention on the task in various situations prior to any actual exposure to a situation while enhancing performance to the best of an individuals ability.

It is important to note, however, that regardless of the context in which imagery is being used, quite often a participant seems to venture out of one perspective and into another during the same imagery session (Harris & Robinson, 1986). Thus, it has been

difficult for researchers to know *exactly* which perspective is being used by a participant and in which circumstances each perspective is best used (Epstein,1980).

Visual Versus Kinesthetic Imagery

Whether it is more effective to use a visual mode versus a kinesthetic mode during imagery rehearsal has been discussed in numerous studies (White & Hardy, 1995; Jowdy & Harris, 1990; O'Halloran & Gauvin, 1994). Recently, results have supported an imagery rehearsal session which includes the use of both modes in combination. Suinn's (1976) VMBR program replicates reality experiences through imagery rehearsal by integrating all of an individual's sensory-motor sensations as well as neuromuscular and physiological attributes into the imagery rehearsal experience. Since the development of the VMBR, it has been subject to research validation (Nideffer, 1971; Kolonay, 1977; Lane, 1980; Noel, 1980; Weinberg, Seaborne, & Jackson, 1981) yielding reasonably consistent support for its efficacy. Comparatively, this inventory of VMBR components coincides almost directly with the suggested image specifications inferred by the Bioinformational theory and exemplified earlier by Hecker and Kaczor (1988).

Further support for use of the kinesthetic element in performance enhancing strategies lies in the three phases of motor skill learning (Fitts & Posner, 1967). Fitts and Posner (1967) have denoted three phases of motor skill learning: the cognitive , the associative, and the autonomous phase. Focus here will be on the cognitive and associative phases as they are most applicable to this study in particular. The cognitive phase is basically the beginning stage in which the individual initiates the process of learning and understanding how a skill is to be performed. A motor program begins to

develop as the athletes have the skill described and demonstrated to them and vision is the dominant sensory system. Through visual feedback (either from mirrors, video, or imagery rehearsal images) and or feedback from their coach, the athletes can effectively adjust their skill technique modifying their motor program to learn and perform the skill correctly. Eventually, "the cognitive phase is complete when the athletes can reasonably execute the skill the way it was demonstrated and can now begin practicing" (Christina & Corcos, 1988 in Fischman & Oxendine, 1993 p. 13). At this point the athlete is ready to move into the associative phase; where visual control of movement was once dominant, proprioceptive control (feel) takes over (Fitts & Posner, 1967). Now the athletes are ready and able to be aware of their proprioceptive cues. Fischman and Oxendine (1993) note that "it takes many practice trials before athletes come to associate the feel of their movements with the outcomes that these movements produce" (p. 13). They further conclude, based on Schmidt's (1975) expected sensory consequences, "that we expect our movements to feel a certain way, and we can use such sensory feedback to evaluate the correctness of our movements. ... In general, athletes improve their performance during this phase to the point of mastery" (p. 13).

The last stage of learning is termed the autonomous phase. At this point the individual has perfected the skill to its optimum level and does not need to concentrate on technique anymore as it has become automatic for them. This stage takes a long time to achieve, and even when an individual reaches this point, precision and focus may still need attending to. In a situation such as this, fantasy rehearsal (as an extension of imagery rehearsal/kinesthetic awareness) performance enhancement technique may aid

with precision of skill, direct focussed attention, and maintain skill level by preventing poor or lazy habits from developing. Further, it may serve in remedying slumps in performance by enabling an individual to re-evaluate their performance or technique quickly, effectively and conveniently.

Use of Fantasy in Imagery

In a recent study conducted by Efran, Lesser, and Spiller (1994), imagery rehearsal incorporated a metaphoric/distorted reality element for the enhancement of performance. By metaphoric it is meant that an element of fantasy such as a tunnel, a bubble, or anything that is outside the natural realm of an individual's performing environment, representing specific cognitive, physical, and/or emotional effects, is eligible. Participants (children and adolescents) were asked to visualize themselves enclosed in a bubble, cocoon, or chrysalis in order to separate themselves from nontask stimuli. The purpose of this was to help them learn to focus on the task as well as to learn and perform more efficiently. This effect of separation-of-self from nontask stimuli may prove useful in support of the current study, where a fantasy tunnel is incorporated into the image of pitching or throwing a fastball.

In the Efran, Lesser, and Spiller (1994) study, the researchers evaluated the effectiveness of this metaphorical strategy, through the analysis of instructor evaluations of the participant's concentration, attitude, and skill improvement, as well as, participant self-report rating scales. The researchers reported that students who were taught to use the metaphor boundary method had higher ratings in concentration, enjoyment, motivation, maturity, and appropriateness of behavior when compared to control group

participants. Further reported was that these students appeared to learn more efficiently, derive more benefits from their experience, and had a greater likelihood for improvement in performance.

In a recent report, Hanrahan and Vergeer (1998) explore the multiple uses of performance enhancement imagery by modern dancers and address the question of whether athletes can learn to use these strategies to enhance their own performance. Their data was qualitative in nature, as they asked dancers specifically what strategies they use to improve their performance while maintaining the assumption that the techniques being described by the professional dancers were being used because they were believed to be effective. It is important to note here that there has not been any evidence to validate the effectiveness of these images described by the dancers but based on the dancers own experiential and personal belief systems, and their belief that the strategies they were using aided them in their performance this data is important to include. In this work, Hanrahan and Vergeer describe various imagery techniques, many of which include a fantasy component, that show potential for gain in the athlete's world. They outline eight basic forms of imagery: inspiration imagery, atmospheric imagery, specific movement imagery, metaphysical imagery, emptying out images, filling up imagery, projection imagery, and finally mental practice imagery. Of these forms, specific attention shall be directed towards, and include, two that are directly applicable to the skill of fastball pitching.

Atmospheric imagery. - This strategy entails "imagining a form of energy outside the body which acts on or moves the whole body" (p. 6). This type of imagery helped the

dancers to focus on kinesthetic factors. Similar images may provide the opportunity for an athlete to make up his/her own atmospheric ploys to accompany them toward the successful execution of a skill. For example, a fastball pitcher could create a mental tunnel for herself to move within or through, which extends off the front outline of her body and narrowing downward toward the catcher's target. This forces her (and the ball) to stay contained within the parameters of the tunnel (toward the target) while at the same time, providing her with the opportunity to focus on kinesthetic factors and maintain attentional focus while blocking out all irrelevant external stimuli and limiting incorrect movement. In this circumstance, the tunnel provides an environment outside the body and does not actually act on or move the body. It does however, provide the individual with a space for her body to move within hence, providing a guide for both the body and the ball to follow eliminating any unnecessary movements that the pitcher may habitually display.

Specific movement imagery. - These are images that enhance or create an understanding for specific movements. In this type of imagery, the pitcher might, in trying to habitualize a particular arm movement, image that her arm extends all the way into the catcher's glove which in turn, would help substantiate the technique necessary to keep her arm in that position during the pitch.

The basic purpose of incorporating these various types of imagery from another field into *this* study, is that using images that include fantasy elements, provides an athlete with additional opportunities to enhance areas of performance. By implementing fantasy images, stronger cognitive, affective, and motivational/focus oriented values are

stimulated and reflected in the performing of the skill. If these values are stimulated through the use of fantasy images, then we are able to find support for their use in theories such as the bioinformational theory (Lang, 1979) which indicate that "it is the processing of the affective image in therapy [or rehearsal], the alteration of its cognitive and programmatic motor structure, which mediates significant behaviour change" (p. 506). Furthermore, in using these fantasy images, the environment or body composition in which the individual rehearses, becomes or takes on a *more* ideal state which imagery rehearsal/kinesthetic awareness can not provide. Imagery rehearsal /kinesthetic awareness is ideal, potentially real, but fantasy rehearsal is hyper-ideal, allowing the individual to extend his/her images into a changed reality, stretching the boundaries of the real, and aiding in the achievement of a desired level of learning, or performance enhancement. Efran et al.(1994) and Hanrahan and Vergeer (1998) present new ideas to a constantly changing branch of performance enhancement thus, meriting further exploration and research into *fantasy type images* within sport imagery rehearsal programs such as the current study.

Knowledge of Results and Knowledge of Performance

Knowledge of results is the external presentation of information about the outcome of a response (Magill, 1993, p. 193). *Knowledge of performance* is information generated through conscious sensory awareness regarding the movement characteristics that led to the outcome of a response (Magill, 1993, p. 193). In relation to the fantasy rehearsal strategy used in this study, the above two concepts provide tangible support for the potential benefits that could be acquired through its use.

Knowledge of results (KR), comes as a result of something completely external such as error-related feedback and/or direct communication of a response outcome. It is suggested by researchers (Salmoni, Schmidt, & Walter, 1984) that the guidance nature of KR is an integral part of enhancing performance if used as a proper tool. They also propose however, that in receiving KR for every trial, an individual becomes dependent on KR for guiding performance. If this occurs, a failure to "develop an internal error detection and correction mechanism" (Salmoni, et al., 1984, p. 93) could result, hindering the ability to correct one's own actions. If, on the other hand, athletes are presented with KR in a *feedback summary*, maintenance or enhancement of performance could be accomplished more readily on their own. When combined with KR, imagery or fantasy rehearsal techniques may aid in providing an individual with tools enabling detection of potential technique /performance error, mentally creating the opportunity to make corrections to the task on their own and prior to actually executing it. Through this technique, the pre-experienced corrections to the task already experienced through imagery or fantasy rehearsal may facilitate less overall physical error for athletes. In the current study, it may be presumed that the physical practice group would have an advantage over other groups due to the immediate feedback of target score outcomes (external KR). This is not necessarily accurate. All participants were to continue engaging in normal physical practice opportunities with their own teams, where in, the opportunity for error correction, through KR (i.e. physical practice group), use of other strategies (i.e. training strategies) and/or other practice, would remain equal for all. Minas (1980) suggests that for imagery to be effective the individual must have some

knowledge about the task that they are trying to image. It is also suggested, that even if the individual doesn't have direct experience with the task, but the task involves known movements, imagery may still be effective despite the lack of experience with the actual task. KR feedback, either qualitative (i.e. you are taking too big a step) or quantitative (i.e. you need to shorten your step by about one foot), provides an individual with information about where their skill level is at , and where it should be (Magill, 1993). In doing that, KR allows the individual to proceed in figuring out how to execute the skill correctly, and to regain focus on KP.

Researchers (Newell & Barclay, 1982, in Thomas, et al., 1993) have identified two factors which individuals learn and remember about their actions; "the association between the movement and its consequences, and a knowledge of variables or factors that affect outcome" (p. 93). These factors epitomize the basic concepts involved in KP.

Knowledge of performance primarily relies on the use of kinesthetic awareness as a feedback system. Demonstration of the importance of the kinesthetic component is presented predominantly in the literature dealing with human movement. In an article by Glenna Batson (1993), a somatic learning model is discussed which suggests the basic premise that "the body learns improved movement organization and movement quality by consciously sensing and directing sensory awareness while moving or in thinking about moving (p. 132)". It is further ascertained, that in organization of movement, what is felt through kinesthetic and proprioceptive tactics, is of utter importance in somatic learning (Juhan, 1987).

Knowledge of performance denotes that the kinesthetic element is integral in the organization of movement (Juhan, 1987), and quality of movement (Batson, 1993); similarly, imagery rehearsal (which most typically includes a kinesthetic focus) tries to enhance performance through learning (organizing) and mastering (giving quality to) movement patterns. In the present study, an example of using KP could be a pitcher closing her eyes and feeling the way her body is moving, focussing primarily on her performance (instead of outcome) and trying to adjust her technique based on that kinesthetic information (FR/PP group).

Polkis (1990, in Thomas, et al., 1993) raises an important point regarding the usefulness of KP stating that, as "many tasks require continual adjustments from one performance to the next" (p. 93), individuals must be able to "adjust to a changing environment" (p. 93), in which, "the learner must practice under a variety of circumstances and detect the relationship between the parameters selected and performance outcome" (p. 93). As the opportunity to practice in a variety of different environments or situations is not always available, fantasy rehearsal as an extension of imagery rehearsal/kinesthetic awareness may provide an opportunity to create or reproduce varied situations for rehearsal experience in the absence of actual external stimuli. Batson (1993) notes, that through better use of the self (kinesthetically, proprioceptively, etc) awareness of the mind/body, and control over their functions, becomes a conscious discipline. In doing so, "the student learns to sense her/himself in the moment, often the moment just prior to action, to recognize and inhibit unnecessary muscle tensions, and simultaneously to direct sensory responsiveness to respond more

appropriately and accurately" (p.133).

The ideas presented in Batson (1993), lend support for the current study's logic in incorporating movement (physical practice) into an imagery program involving kinesthetic awareness. "The body learns improved movement organization and movement quality by consciously sensing and directing sensory awareness *while moving* or in *thinking about moving*" (Batson, 1993, p.132, [italics added]).

Imagery Ability

Hall and Buckholz (1983) note that it is often expected or assumed that there will be a positive relationship between imagery rehearsal ability and imagery rehearsal's effectiveness on the learning and performance of motor skills. However, consistent failure to demonstrate a relationship between the two merits further examination of both the imagery tests and validating tasks employed (Hall et al., 1985).

Hall, et al. (1985) discuss the difficulties surrounding the measurement of imagery ability including; types of tests employed, the nature of the task being imaged, and the individual's personality.

The type of test employed to measure individual differences in imagery ability basically falls into two categories; subjective, self-report, and objective, behavioural in nature (Katz, 1983, in Hall, et al., 1985). Katz (1983) more or less encourages the use of a subjective test with the rationale being simply, that they are more closely associated with the constructs involved in imagery than objective tests. He does however follow, that subjective (self-report) data does not yield consistent support due to "validity, reliability, and response biases" (p. 109).

Hall, et al. (1985) came to the conclusion, that based on research (Katz, 1983), scores on imagery tests cannot be assumed to demonstrate the accurate effect of an imagery strategy or an individuals ability to use that strategy, reliably across all people. They further concluded, that "the nature of the task and the individual's personality interact to determine when and how imagery strategies will be utilized" (p. 110). These conclusions would lead one to believe that using any type of imagery test is a futile and wasted effort. However, when faced with the challenge of designing an instrument that could measure imagery ability effectively, Hall, et al. (1985) developed the Movement Imagery Questionnaire (MIQ). They found that the MIQ successfully measured "individual differences in both visual and kinesthetic imagery of movement . . . [and] possess['] . . . stable internal structure and very respectable reliabilities" (p. 116). Although this is not the instrument used to assess the status and potential regarding imagery ability/use across groups in the current study, it provides evidence that tests for imagery ability have evolved to an effective and useful standard.

Possibly stemming from the work and designs of Hall, et al. (1985), the need to assess movement-related imagery, as well as to identify individual differences in the visual imagery of movement and imagery of kinesthetic sensations associated with movement motivated researchers (Isaac, Marks, & Russell, 1986) to develop the Vividness of Movement Imagery Questionnaire (VMIQ). The VMIQ has twenty-four items relevant to visual imagery of movement as well as imagery of kinesthetic sensations. This questionnaire uses Likert scale questions to indicate the imagery ability level of the participant based on the participant's responses. One portion of the

questionnaire asks participants to rate the vividness of their image as if they were watching someone else perform the task, and the other portion to rate the vividness of their image as if they were actually performing the task themselves. The functional value of using this questionnaire in the current study, lies in its ability to assess these imagery skills, as well as an individual's general ability to image from both an internal and external perspective. Furthermore, it provides the data necessary and tangible, in determining if an individual is a high, medium or low ability imager.

To further establish the equality of imagery ability/use means across groups, the researcher employed the use of the Imagery Use questionnaire (IUQ). Hall, Rodgers, and Barr (1990), developed the IUQ, which questions athletes directly about their use of imagery in various situations and time periods. Furthermore, the participants were to report the vividness and controllability of those images. Hall, et al. (1990) determined that the characteristics of imagery use by athletes such as; when, where, and how they use it, can to some extent, be successfully determined and/or assessed, through the use of the IUQ. The disclosure of this kind of data is important when determining equality of means across groups, as the experience, or lack there of, of a participant, could *potentially* hinder or help her ability to execute the strategy. The IUQ's capacity to assess an individual's imagery use facilitates, in conjunction with the VMIQ, the evaluation and control of means across groups.

Additionally, in relation to the current study, it is important to note that the IUQ has been specifically designed to facilitate the incorporation of various sports where in other researchers are encouraged to revise the components accordingly to fit their sport

skills, techniques and framework. Hall, et al. (1990) note, that since the original publication of their article (Hall, et al., 1990);

> versions of the IUQ that are more detailed and for which procedures for formal psychometric instrument evaluation have been executed . . .[and, new versions are] currently available for the sports of rowing and figure skating. . . .[furthermore,] the test-retest correlation across all questions on the rowing version of the IUQ is 0.71. (Hall, et al, 1990, p. 4)

Based on the findings of the sport psychology literature discussed, the use of the two questionnaires in the current study seemed appropriate for measuring imagery ability and use. In examining the potential and present status of participants imagery use and ability, it was expected that the questionnaires (VMIQ and IUQ) would sufficiently provide enough data *before* exposure to the strategies to effectively facilitate an equality of means in the dispersion of participants across groups which the researcher deemed important for the validity of the current study.

Literature Review Summary Statement

To summarize, this review of the literature shows support for the hypothesis that fantasy rehearsal during physical practice will be more effective than fantasy rehearsal alone or physical practice alone. Conceivably, based on ideas from both the bioinformational theory and the psychoneuromuscular theory, if fantasy rehearsal (as an extension of imagery rehearsal) is combined with physical practice, the potential of muscle action due to fantasy rehearsal would be added to the real muscle potential such that the combined muscle potentials (both mentally rehearsed and physically practiced)

would be augmented and more precise, more ideal, than either physical practice or fantasy rehearsal alone. Again, as noted by Glenna Batson (1993), "the body learns improved movement organization and movement quality by consciously sensing and directing sensory awareness while moving or in thinking about moving" (p. 132). Furthermore, by using fantasy rehearsal as an extension of imagery rehearsal, the environment or body composition is facilitated in becoming or taking on a *more* ideal state which imagery rehearsal/kinesthetic awareness cannot provide. Characteristically, imagery rehearsal/kinesthetic awareness is more of the actual or ideal that an individual images, potentially real. Fantasy rehearsal is hyper-ideal, allowing the individual to extend his/her images into a 'cannot fail' reality enabling them to stretch the boundaries of the real, aiding them in achieving a desired level of learning, or performance enhancement.

Through the data collected from the questionnaires and the analysis of test trial scores, the individual group effects, as well as the potential combined effects of the training strategies may be investigated. It was hypothesized that:

1. The group using physical practice and fantasy imagery rehearsal combined, would do better than the physical practice group alone.
2. The group using physical practice and fantasy imagery rehearsal combined, would do better than the fantasy rehearsal group alone.
3. The physical practice group would do better than the fantasy rehearsal group alone.

III. METHODS AND PROCEDURES

Participants

Through the cooperation of local bantam and midget level fastball coaches, 28 female fastball pitchers and catchers from Calgary and surrounding areas with a background of 4-5 years of experience at their respective positions were recruited through pitching and catching clinics over the 1997-98 winter season. Participants were between the ages of 14 and 18 years of age ($M = 16$, $SD = 1.74$).

Two weeks prior to the onset of the study, all participants received an informed consent form which was completed by themselves and their parent or guardian, and returned to the experimenter before the start of the first session.

Regarding adherence to the training programs, participants as well as parents or guardians, were informed of days and times required of them as well as the importance of an unfaltering commitment. If there was any question in the minds of either participant or guardian in regard to the participant's ability to adhere to the commitment, they were then asked to withdraw immediately so as not to hinder results due to failure of compliance. This occurred with only one participant.

At the first session, participants were given 3x5 index cards indicating their identification (I.D.) number. As each participant received her card, the experimenter recorded her name on a matching index card to be stored in a locked file cabinet. This was just a precautionary measure taken in the case that a participant may lose or forget her I.D. number which was to be used for both questionnaire and test trial data

collection. Upon receiving their I.D. numbers, participants completed both the VMIQ1, VMIQ2, and IUQ as well as part one of the pretest.

Design

A program evaluation comparing three training strategy groups via a pretest-posttest design was used in this study. The three training strategy groups were: physical practice (PP) (n=9), fantasy rehearsal (FR) (n=9), and fantasy rehearsal during physical practice (FR/PP) (n=10). Participants were assigned to groups through systematic progression of random assignment based on the results of the pretest trial scores, and scores on the VMIQ1, VMIQ2, and IUQ. Details about the procedure used to randomly assign participants into groups are provided in Appendix L.

Experimental Conditions

The first group (PP), physical practice participants actually threw the ball. The second group was the fantasy rehearsal group whereby participants applied fantasy imagery rehearsal images such as, performing the specified skill within a 'tunnel' and, exaggerating the extension of their arm to reach and hit the center of the target, from an internal perspective (movement was not physically present in group two). The third group was fantasy rehearsal *during* physical practice, which combined the elements of both groups one and two. Movement was present for participants in this group *as well as* actually throwing the ball.

Measures

Motor Performance

Data collected for this program evaluation were obtained through a method of observational recording. Observers recorded test trial scores obtained by each participant during the test trials. The target consisted of eight rings, and the score recorded by experimenters was expressed as a result of the ring the participant hit the major portion of. In the case of a participant not hitting any of the rings, a score of ten was allocated to the test trial. On a scale of one to ten, one indicated the best performance score. The lower the average score on either the pretest or posttest, the better the performance of the participant. Scores from 20 trials (10 scores x 2 sessions) were averaged for each participant. Posttest average scores were also obtained using the same procedure. This was completed to determine whether or not there was a marked improvement in performance.

Questionnaires

The Vividness of Movement Imagery Questionnaire. The first questionnaire was the Vividness of Movement Imagery Questionnaire (VMIQ) (Isaac, Marks, & Russell, 1986). This questionnaire measures the vividness of imagery from both an external perspective (VMIQ1) and an internal perspective (VMIQ2). First, the questionnaire asks the participant to image as if they were watching someone else perform the task, and second it asks the participant to image as if they were performing the task themselves. As the perspectives are divided into two separate sets of 24 questions, they are individually distinguished by allocating the names VMIQ1 to the external perspective set of

questions, and VMIQ2 to the internal perspective set of questions. This allocation was employed by the researcher to facilitate the analysis of each portion of the questionnaire separately. This questionnaire uses a Likert scale format which results in two subscales indicating the ability level of the participant based on the participant's responses. It was utilized to measure imagery ability before the first training session began (in the introductory session) to aid in creating a balance of imagery ability across groups (see Appendix L and A).

The Imagery Use Questionnaire. The Imagery Use Questionnaire (IUQ) (Hall, Rodgers, & Barr, 1990) was distributed at the beginning of the introductory training session. It was modified to suit fastball players and only included components of the original IUQ (Hall, Rodgers, & Barr, 1990) that were pertinent to the current study. In its modified form, it contained forty-three questions. The IUQ was modified to measure and extract information about the participant's past and current imagery use. The results from this questionnaire were also used to assign participants to groups (Appendix B and L).

Strategy Use Questionnaire. The Strategy Use Questionnaire (SUQ) was an open-ended questionnaire designed by the researcher to extract subjective data about the participants' experience with their given training strategy program (see appendix C).

This questionnaire consisted of a series of open-ended questions and was completed after all the training sessions were completed in order to facilitate the interpretation of the results. It asked questions such as: What worked? What didn't? Why didn't it? Would it have been better if there were more training sessions? How often did they use it? And would they be interested in learning more?

Laboratory

A warehouse facility was available and remained set up consistently for all participants. All training sessions took place in this warehouse where one small portion of the warehouse was set up and isolated, strictly for the purpose of performing the pre and posttests. The other large portion of the facility remained open for the participants to perform their warm-ups and training session strategy rehearsal.

For each training session and/or test, the fastball equipment required included a pitcher's mound, a home plate, a second base, a measuring tape, and sixty official fastball balls. Each participant had her own glove. Further equipment needed for the experimenter's use, included a video camera, a tripod, a stopwatch, a score plotting record book, and pencils. The physical set-up for the test trials was arranged as follows (see Fig. 3-1) :

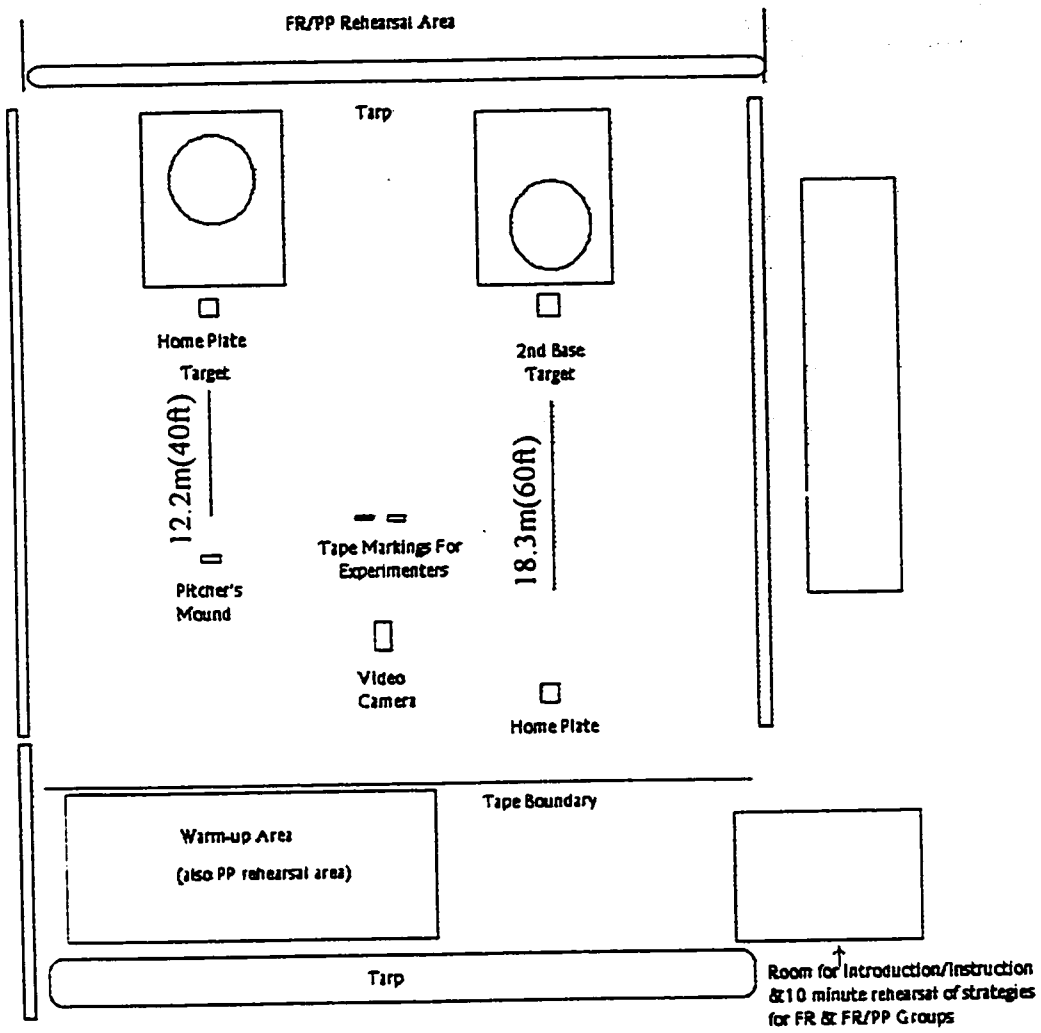

Fig. 3-1. Lab setup for test trial sessions. The item depicted is a top view perspective representing the (warehouse) lab setup used for the training sessions as well as the pre and post test trials. Figure is not drawn to scale.

A barrier dividing the training session section and testing section of the warehouse was set up. The test section was 7.6 by 27.4 metres (25 by 90 ft) in size. Two targets were set-up at the far end of the 27.4 metre (90 ft) area. The home plate and second base were placed in front of one of each of the targets (one for pitchers and one

for catchers). Two targets were used to cut down on setup time when for example, a pitcher was being tested immediately following a catcher or vise versa. The pitcher's target was setup with the standard distance between the pitcher's mound and the target (home plate) of 12.2 metres (40 ft). The catcher's target was setup with the standard distance between the home plate and the target (second base) of 18.3 metres (60 ft).

The bullseye style targets consisted of eight rings, in alternating black and white colours. Each ring was 8 cm (3 inches) apart from the next for a total of a 122 cm (48 inch) diameter (see Figure 2). They were drawn on a 425 gram (15 ounce) raw duck canvas, and mounted on a hanging tarp by hooks and grommets ensuring durability. Each target was set up specifically for the participant's position wherein, the pitcher's target centre was set 1.22 m (4 ft) above the ground, and the catcher's target centre was set at 0.6 m (2 ft) above the ground (see Fig.3-2).

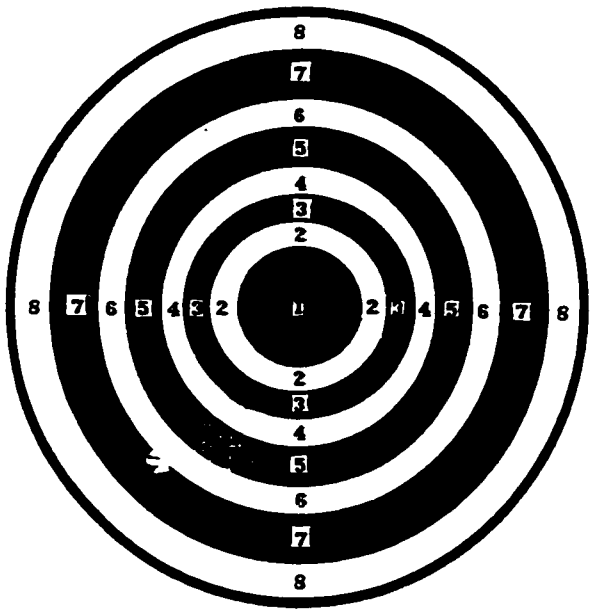

Fig. 3-2. Target design.

Two tape markings were placed 3 m (10 ft) back from targets and centered between throwing lanes to indicate observer position during test score outcome recordings. A Sony video camera mounted 1.22 m (4 ft) high on a Tameron tripod was positioned directly between, and 0.6m (2 ft) behind, the two tape markings to record test trial scores. If there was no discrepancy between the two observers trial score recordings after a pre or post test session, the Sony video tape was rewound and used for the next test trial session. A score recording book with four sets of ten, 2.5 cm (1 inch) lines allocated to each participant was used by each of the observers to record the results of participant test trials (see Appendix D). The observers were two highly experienced individuals from the sport of fastball. They were blind as to which group each participant was in to protect from bias, and both observers were exposed to the same debriefing of the study as the participants. The observers were told to record the participant's I.D. number on the score plotting sheet, and then each number on the target that the participant hit or came closest to in the test trials for each throw executed. When tallying the scores at the end of each test trial session, the observers simply added up the scores recorded, and any trials that had not hit any part of the target were assigned a number ten. When each of the two pretest test trial sessions were completed, the two total scores for each test session were averaged giving one score to represent each participant's pretest performance. The same scoring technique was used for the posttest.

Procedure

Each participant within her specified group underwent ten sessions in order to complete the study. Training provided to each of the groups is detailed in Appendicies E, F and G. An overview of the sessions is presented in Table 3-1.

Table 3-1

An Overview of Each Group's Training Session Curriculum.

GROUP	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Physical Practice (PP)	VMIQ IUQ PP Pretest #1	PP Pretest #2	Intro to TS	PP	PP	PP	PP	PP	PP Post- Test #1	Post- Test #2 SUQ
Fantasy Rehearsal (FR)	VMIQ IUQ PP Pretest #1	PP Pretest #2	Intro to TS	FR TS	FR TS	FR TS	FR TS	FR TS	FR TS Post- Test #1	Post- Test #2 SUQ
PP + FR (FR/PP)	VMIQ IUQ PP Pretest #1	PP Pretest #2	Intro to TS	FR/PP TS	FR/PP TS	FR/PP TS	FR/PP TS	FR/PP TS	FR/PP Post- Test #1	Post- Test #2 SUQ

Note. TS = Training Strategy, PP = Physical Practice, VMIQ = Vividness of Movement Imagery Questionnaire, IUQ = Imagery Use Questionnaire, SUQ = Strategy Use Questionnaire

Session One (Pretest, Part One)

All participants returned their informed consent forms before session one was initiated. The whole group of twenty-eight participants congregated for the first session during which they were given a brief overview as to what the study entailed including; the length of the experiment, general expectations of their cooperation, a generic

overview of the training sessions, and the importance of their honesty and adherence to the guidelines that were going to be later outlined in their individual groups. Concluding the overview of the study, participants completed VMIQ1, VMIQ2, and the IUQ. Following completion of the questionnaires, participants were broken into pairs, and began warming up at different intervals in order to allow for a twenty minute warm-up immediately prior to the actual test trials. The warm-up entailed; five minutes of cardiovascular exercise (running exercises), five minutes of stretching, and ten minutes of throwing. The pretest consisted of ten trials (10 pitches, or 10 throws to 2nd base).

Session Two (Pretest, Part Two)

All participants met the day after the first training session to complete the second half of the pretest. Participants were immediately broken into the same pairs as in session one, and completed a warm-up identical to the one they had in session one. Upon completion of their warm-up, participants were taken individually into a closed off section beside the warm-up area (the testing area) and instructed to throw 10 trials (either of the fastball pitch, or throw to 2nd base, each test lasting approximately five minutes per participant). Two observers were set up awaiting each participant to record test trial scores. Participants successively rotated through the warm-up intervals and followed into the test trials to complete their pretest. Once the participants completed their test trials, they were dismissed from training session two.

Analyses of VMIQ1, VMIQ2, and IUQ was completed immediately following session one. Tallying and analysis of the pretest scores was completed immediately following session two and the systematic assessment of both the questionnaires and

pretest scores was conducted for the purpose of randomly and homogeneously assigning participants into groups (see Appendix L). Participants were notified over the next two days as to what time and days they were scheduled to participate in the successive sessions.

Session Three (Introductory Session)

In this session, participants went through a twenty minute demonstration and instruction period relating to their training strategy (see Appendicies E,F,G,H,I,J). After an explanation of the specified training strategy unique to their group, a discussion period of ten minutes was allotted for questions or comments, followed by a ten minute rehearsal of their specified training strategy.

Sessions Four Through Eight

Training sessions #4-#8 were set up as follows; a twenty minute physical warm-up followed by ten minute rehearsal of *each* group's specified training strategy. Following the warm-up, participants from both the FR and FR/PP groups found her own personal space within her specified warm-up area and rehearsed her specified training strategy for ten minutes. Participants from the PP group threw the ball at the target for ten minutes during this time. Following each groups ten minute rehearsal, ten minute discussion/question and answer period was conducted. This discussion period was used as a communication tool. If a participant had any questions, concerns, interesting thoughts or experiences, this was the time they were able to share or discuss them. Primarily, the researcher used this to ensure the participants were rehearsing the strategy properly, and to collect potentially interesting and/or explanatory information regarding

the training strategies.

Session Nine (Posttest, Part One)

Upon completion of the training sessions, the participants completed the posttests. The structure of posttest session (part 1) was identical to training sessions #3-#8 with the exception that after each groups ten minute rehearsal of their specified training strategy (PP, FR, FR/PP), participants were broken into pairs, and began warming up at different intervals enabling then to warm up for only twenty minutes immediately prior to the actual 10 posttest trials (same as pretest sessions).

Session Ten (Posttest, Part Two)

Participants first completed the posttest (part 2). Participants were broken into pairs, and began warming up at different intervals warming up for twenty minutes immediately prior to the actual test trials (same setup for warm-up and testing as pretest one and two). Participants successively rotated through the warm-up intervals and followed into the last 10 test trials to complete their posttest. Upon conclusion of the posttest (part 2), the SUQ (strategy use questionnaire) was distributed and completed.

Throughout all of the test trials (pre and posttest trials), a video camera recorded the test trial scores for each participant. This was done to protect against any inconsistencies among the observers who were recording test trial scores manually. As there were no discrepancies between observers, the video tape did not have to be used.

Data Analyses

Pre-Training Analyses

Equality of means. To determine whether the assumption of group ability and

previous imagery experience equivalence was plausible, a one-way ANOVA was run on the following pretest data: the IUQ, VMIQ1, and VMIQ2. In addition, the same analysis was run on the pretest motor performance data which were obtained by averaging the motor performance test trial scores obtained on day 1 and day 2.

During this study, the probability of a type-I-error (alpha) was set at .05 for each test conducted.

Hypotheses #1, #2, #3. Upon verifying the equality of means across groups, analyses of the motor performance test score data was carried out. To determine the significance of the postulated hypotheses, a one-way ANOVA was run on the pre/post test difference scores. Due to the small sample size, lack of power was discovered (power = 0.49). Consequently, an ANCOVA was conducted on the posttest data using the motor performance pretest data as a covariate. When found statistically significant, the ANCOVA was followed-up by post-hoc t-tests completed on residual scores.

IV. RESULTS

Pre-Training Results

Equality of means test. Analysis of variance indicated no differences amongst groups on pretest and questionnaire means (see Table 4-2).

Table 4-2

Pre-training Means and Standard Deviations for Tests Run to Obtain Equality of Means Across Groups

Tests Conducted		PP	FR	FR/PP
Pretest	M	69.3	68.4	66.0
	SD	11.8	11.1	8.32
VMIQ1	M	2.13	2.24	2.14
	SD	0.64	0.75	0.58
VMIQ2	M	2.13	2.11	1.85
	SD	0.77	0.65	0.45
IUQ	M	3.83	3.37	3.92
	SD	0.54	0.99	0.78

It was therefore concluded, that all groups were comparable in terms of motor performance, current/potential imagery ability regarding both internal and external perspectives, and current imagery use prior to the implementation of training strategies.

This indicated that the efforts to create equivalent groups based on these variables was successful.

Post-Training Results

Motor performance. As there were no statistically significant differences across the groups when tested for equality of means prior to the initiation of the training strategies, a one-way ANOVA on pretest/posttest difference scores was thought to be adequate to reflect the effects of strategy on motor performance. The first analysis conducted on these difference scores was not statistically significant, $F(2,24)=2.74$, $p=.08$. However, due to the small sample size, the power of this test was very low (.49) and consequently a more powerful ANCOVA test was used. This test revealed a significant correlation between pre and posttest scores, $F(2,24)=14.82$, $p<.001$. In addition, the ANCOVA conducted on the posttest scores using the pretest scores as a covariate was statistically significant, $F(2,24)=3.7$, $p<.040$, indicating that the groups were significantly different after adjusting for pretest scores.

The pre and posttest score group averages as well as adjusted scores are provided in Table 4-3.

Table 4-3

Average Pre and Post Test Total Scores, Difference Scores, and Group Adjusted Scores for Each Group

	Pretest	Posttest	Difference Score	Group Adjusted Score Means
Physical practice (PP)	69.3	65.6	-3.7	60.2
SD	11.8	10.1	10.7	
Fantasy Rehearsal (FR)	67.6	60.5	-7.1	59.8
SD	11.1	9.3	7.1	
FR and PP	66	52.4	-13.6	58.6
SD	8.3	13.4	10.2	

Note: Adjusted pretest total score average was determined as an unequal score after adjustments. See appendix K for adjusted and residual scores. SD = Standard Deviation.

Post hoc test. Post hoc tests were completed using independent sample t-tests. Pairwise comparison of residual scores was completed. The comparisons of FR against PP, and FR against FR/PP were not statistically significant with alpha set at .05, $t(16) = -1.01$ and $t(17) = 1.8$ respectively. The comparison of the FR/PP group scores against the PP scores, *did* yield a statistically significant difference between groups, indicating that the FR/PP group enhanced their performance more than the PP group, $t(17) = 2.4$.

V. DISCUSSION

The results of the present study provided some support for the first hypothesis which stated that the FR/PP group would improve to a greater extent following the strategy training than the PP group. The other two hypotheses were not supported. Possible reasons explaining the support obtained for the first hypothesis are presented next.

Glenna Batson (1993) stated that "the body learns improved movement organization and movement quality by consciously sensing and directing sensory awareness while moving or in thinking about moving" (p. 132). The primary elements included in the current study's FR/PP training program tap into, and exercise both the consciously cognitive as well as kinesthetic components highlighted by Batson. Through the integration of these components into one training strategy, an individual gains the potential of reaching their most ideal and effective level of performance.

The effectiveness of the components within the current study's FR/PP training strategy are supported by a limited, but significant body of literature (e.g., Efran et al., 1994, Hanrahan & Vergeer, 1998). By examining the FR/PP training program, congruence with past literature is visible and in turn, provides some verification supporting the benefits elicited through its use (e.g. focus, concentration, and contained movements during the execution of a specified skill).

When examining the use of metaphoric boundary images presented in the study by Efran et al. (1994), a similarity with the current study can be observed. They found that through instructing participants to image themselves (as well as the immediate task

being performed) enclosed in a bubble, cocoon, or chrysalis while they were performing their skill, distraction and detrimental ideation was eliminated. As a result, the overall performance and study experience of the participants, was enhanced. In essence, supporting the findings of the current study, the use of an image with the purpose of containing an individuals physical body and mental mind set in an ideal position, including movement in that position, was found to be effective in enhancing the performance of the skill.

Similarities presented in Hanrahan and Vergeer's (1998) research, provide further support for the current study's findings and use of FR/PP. Through their research, Hanrahan and Vergeer (1998) found that professional dancers used, and felt confident in, the effectiveness of atmospheric and specific movement images (quite often used during the physical rehearsal of their skills), to successfully enhance the execution of specified skills. Although the data obtained by Hanrahan and Vergeer was subjective in nature, the success experienced through using the imagery styles (atmospheric and specific movement imagery) by the professional dancers replicates to a certain degree, the success experienced by the participants using the FR/PP training strategy images. In the current study, during the discussion portion of each training session, participants communicated some of the following feedback:

- " I can see the tunnel so clearly, and can feel my body moving through it, but I can only see the target some of the time."

-" When I see my arm reaching out towards the target it looks like one of those sticky hand gummy things but it always hits the target, I just can't see the tunnel very well."

- " I can see everything clearly, but I just can't hit the target every time."

- " Sometimes all I can see is the big black center of the target, and I hit it every time, but sometimes when I see the whole target, I only hit it part of the time."

- " Mostly I just see my arm extending towards the target but sometimes I can't let go of the ball."

- " I don't really see a tunnel surrounding me, I just know that there is nothing around me except blank space and it helps me see the target better, the only problem I have is that half the time I let go of the ball and it hits the target, but the other half of the time, I just see my hand reaching towards the target and putting the ball into the center of it."

- " I can feel the way my body is moving and know that I have to change some things to make myself move towards the target."

- " Its really cool the more we practice this thing because every time I come here I can see things more clearly, and I can feel a difference in the way my body is."

The comparable style of images employed in both the current study, and Hanrahan and Vergeer's (1998) research, were perceived and accepted as effective by both the dancers *and* the participants of the current study. As such, it may be inferred that the successful enhancement of performance in both studies came, at least in part, as a result of the training strategy employed.

In addition to this, it must be considered that the augmentation of a new or novel training strategy (FR) to an existing training regime (regular PP) may have heightened responsiveness to an already proven performance enhancing training style (PP). Further, it may also be surmised that the introduction of the new training strategy (FR) may have

occurred coincidently at a time where the existing training strategy (PP) was just beginning to yield performance enhancing results. Regardless, noting that randomization *was* taken into account, without further research, the FR training strategy must not be ruled out as a potentially effective strategy to enhance performance.

The use of a program which incorporates fantasy-style images in combination with physical practice, is supported by Vealey and Walters (1993) who state that "the more vivid the image, the more effective it is [for the enhancement of performance]" (p. 202). The FR/PP training strategy enables an individual to ideally, create the most vivid and conducive psychological training environment to rehearse a skill. Essentially, through using FR/PP, all the senses including the visual, auditory, olfactory, gustatory, tactile, and kinesthetic senses have the capacity to be stimulated and in turn, utilized to create the most vivid image attainable. By creating this type of image and rehearsing it during actual physical practice, the benefits associated with both FR and PP could be stimulated and ideally, facilitate an optimum level of performance enhancement.

Similarities presented by the studies of Efran et al. (1994), Hanrahan and Vergeer (1998), as well as Vealey and Walter (1993) provide support for the effectiveness of FR/PP, and the corroboration of hypothesis one. In addition to the previous studies noted, imagery theories predict the potential effects of the training strategy components which both support, and provide some explanation for, the results obtained in relation to all three hypotheses stated in the current study.

Through presenting the three hypotheses and relating them to previous imagery theory, it is anticipated that a more comprehensive understanding, in regard to how the

performance effects were generated by the three separate training strategies, will be achieved.

Hypothesis One

It was predicted by the researcher, the psychoneuromuscular theory and the bioinformational theory, that the FR/PP group would perform significantly better than the PP group alone. The statistically significant results obtained leading to the confirmation of the first researcher's hypothesis, coincide with the predicted outcome delineated by both the psychoneuromuscular and bioinformational theory premises.

According to the psychoneuromuscular theory, it is theoretically submitted that the FR/PP training strategy was able to prime corresponding muscle movement nodes to a much higher degree than the PP training strategy. Since it has been indicated in theory research (Murphy et al., 1993), that both imagery and physical practice can elicit muscle innervations, it is logical to accept that through the simultaneous use of both, a greater number of innervations would be activated. Furthermore, as the imagery component involved in FR/PP is polysensory, directing focus on kinesthetic sensations associated with the movement being performed, an even *greater* number of innervations may have the potential to be activated. Overall, the findings obtained for hypothesis one in the current study are supported by the predicted outcome of the psychoneuromuscular theory.

In accordance with the proposed premises of the bioinformational theory, it is also theoretically acceptable to support that the components employed through the FR/PP training strategy maintain the capacity to generate the most mentally and physically

inclusive body of information about the task being performed. As such, an individual would theoretically be able to enhance their performance to a higher degree than PP alone, since the PP group only acknowledges the physical properties associated with the performance of a specified skill. It is therefore observed, that the findings obtained for hypothesis one are consistent with both the bioinformational *and* psychoneuromuscular theory.

Hypothesis Two

It was predicted by the researcher, the psychoneuromuscular theory and the bioinformational theory, that the FR/PP group would perform significantly better than the FR group alone (hypothesis two). The current study's hypothesis two was rejected as the results comparing FR and FR/PP were not statistically significant. Although congruence was found between both the psychoneuromuscular and bioinformational theory's prediction and the current study's hypothesis two, the data analyses did not demonstrate the postulated effects.

Based on the premises stated in the psychoneuromuscular theory, it is plausible to infer that due to the polysensory, kinesthetically directed nature of FR, the degree of muscle innervation stimulated by its use may have been sufficient enough to minimize the distinguishable differences in the degree of muscle innervations between FR/PP and FR. Theoretically, this may have contributed to the lack of difference regarding performance outcomes between the two groups. In addition, a new and novel training strategy (FR) was introduced to participants of both groups which also may have produced a Hawthorne effect in both groups. This heightened performance effect may

have created a more equal improvement on performance of participants in both groups making the discrepancy between performance levels indistinguishable. It is important to note, that the results of the analysis testing hypothesis two do appear promising, however it is recommended that further research be conducted.

The predictions of the bioinformational theory were not supported while testing hypothesis two. In explaining these findings, it must be, once again, considered that the polysensory, kinesthetically directed nature of the FR strategy may have facilitated more of an equal effect across the two groups than anticipated. According to the bioinformational theory premises, the use of a polysensory, kinesthetically directed strategy should be able to generate enough information about a task being performed to foster an enhancement in performance on its own. If this is so, then the FR component of both the FR/PP and FR group may have heightened the level of performance in each group comparatively enough that the level of distinguishable difference between the groups was minimized. Furthermore, the enhancement generated by the PP component of FR/PP may not have produced enough of an effect to facilitate a significant difference between the FR/PP group and the FR group. Again, consideration must be given to the possibility of a Hawthorne effect where because participants were being observed, performance levels in both groups improved simultaneously with neither group improvement being statistically different from the other.

Hypothesis Three

It was predicted by the researcher and and is consistent with the psychoneuromuscular theory, that the PP group would perform significantly better than

the FR group.

The current study's hypothesis three was rejected as the results comparing FR and PP were not statistically significant. This finding conflicts with the above predicted outcome as it does not provide evidence indicating that either strategy was more effective than the other. Referring back to the explanation of hypothesis two, the possibility that the FR strategy may have been able to stimulate a higher degree of muscle innervations (in comparison to the small degree generated by a simple imagery strategy as noted in former literature; Hale, 1981) is of great consideration. If the differences between the FR strategy and PP strategy are indistinguishable, then it may be tentatively implied again, that the FR component generates a similar amount of muscle innervation to that generated by PP.

This seems very plausible, as the newness of FR to the participants may have facilitated an enhancement in performance on its own just by creating an environment where participants have to concentrate on the task at hand, set aside any of the other benefits potentially available to be gained from the FR strategy itself.

Contradicting the current study's hypothesis three, the premises of the bioinformational theory predict, that the FR group should perform better than the PP group alone. Since there was no significant difference between the FR and PP groups, this theoretical prediction was not supported. In explaining the rejection of hypothesis three based on bioinformational theory premises, properties associated with each strategy are examined. Firstly, in observing the data collected through the SUQ, participants from the PP group demonstrated no obvious use of other strategies (i.e. imagery, relaxation,

etc.) to help them in either the sessions or test trial performances. When asked in question "L", 'did you use any imagery at all through out the training sessions? and if yes, how much? and what kind of images did you use?' the participants of the PP group responded that they had not used any imagery through out the training sessions or test trials. As the PP strategy directs primary attention to the physical properties associated with the skill being performed, and the FR strategy directs polysensory attention to both the mental and kinesthetic properties *associated* with the skill being performed, the discrepancy between the effects generated by each may not be distinguishable. This conflicts with the premises of the bioinformational theory which suggest that the FR strategy would provide more information/meaning to an image and in turn generate greater performance outcomes. It does not however, take into account the undeniable effects to performance generated by the use of PP. Again, since neither strategy was found to be more statistically significant in affecting performance than the other, it is plausible to assume that they each may have provided similar performance enhancing effects. As physical practice has consistently elicited an enhancement in performance in the past (Hinshaw, 1991, Feltz & Landers, 1983), and since there was no statistically significant difference yielded between the FR group and PP group performance levels in the current study's analyses, we may infer that the FR strategy must also maintain a good deal of facilitating effects. Opposing this, we may also infer that the mere introduction of a new training strategy (FR) created a Hawthorne type of effect which led to the enhanced performance of the FR group. Thus, negating the implied FR effectiveness demonstrated by the lack of significant difference between performance levels of the PP

group and the FR group.

Limitations

Generalizability. In the current study, the researcher recruited participants with a background of 4-5 years of fastball experience, varied mental skill ability levels, and varying ages ranging from 14-18 years old. This limited the generalizability of the effects generated by the training strategies, to skills involved in, or similar to, the sport of fastball. Furthermore this also limited generalizability to individuals falling within the age range specified.

Sample size. Further threatening the validity of the statistical conclusions obtained, is the small number of participants obtained for the study. Since there was no support yielded by the analyses conducted on the data through using the ANOVA, coupled with the observed lack of power (.49), it is possible that the results obtained by using a larger sample size would have been declared statistically significant. As a result of the small sample size, and lack of support for the hypotheses based on ANOVA results, the more sensitive ANCOVA was run. Consequently, although ANCOVA analysis obtained significance regarding hypothesis one, these findings can not be firmly supported. As such, a warning of tentativeness regarding the conclusions drawn through alternative analyses must be submitted here, and a recommendation to replicate this study is suggested.

Time. As the duration of the study may not have allowed enough time to fully grasp the strategy techniques which, in turn, would have had an impact on the significance levels of the performance effects measured, a brief look at the possibility of

a novelty effect will be presented next to explain the possible limitations regarding the duration of the study.

In the current study, participants met Fitts and Posner's (1967) criteria for the associative phase of learning in regard to their physical skill level. When exposed to the training strategies however, participants of the FR and FR/PP groups met *cognitive phase* criteria. Whether the participants had enough time to fully and comprehensively use the introduced strategies (FR and FR/PP) can not be confirmed such that, the novelty or newness of the introduced strategies to the FR and FR/PP groups may have raised levels of performance in each group such that they would be observed with indistinguishable differences. As a result of this, the true benefits potentially associated with the imagery strategies may not have been illustrated.

As the FR and FR/PP participants progressed through the training sessions, comprehension and compliance was assessed/confirmed through the ten minute question and answer period at the end of each training session. This revealed participant's subjective perceptions demonstrating the status of participant's advancement in use and understanding of the training strategies, which in turn, became indicative of their improvement levels. Upon subjective assessment, (based on the question and answer discussion periods) regarding participants use and usability/ experience of the strategy at the conclusion of the study, it was observed by the researcher that participants had progressed sufficiently enough to confirm a general understanding and ability to use the FR and FR/PP training strategies. This being the situation, it may be deduced that participants may have actually just begun to experience the beneficial effects of the FR

training strategy, further demonstrating that the potential of the improvement that they actually did experience, was only a small indication of what they were actually capable of. Further, it may also be surmised that the effects may have waned later as the novelty of the strategy wore off, thus indicating that the impact of the training strategy was not as effective as hypothesized by the researcher. This raises questions regarding the notion that the learning and use of the training strategy was being accomplished, and that the results obtained came as a direct result of the training strategy employed. This being so, it is suggested that this study be replicated and that a longer study duration be incorporated to potentially reveal the full effects of the training strategies.

Further when considering future research, researchers must be aware of the possibility that participants may gain increased levels of confidence due to the newness and observational effects associated with the introduction of a new strategy.

The Hawthorne effect. Another threat to the construct validity of the present study is the possibility of a Hawthorne type of effect. The Hawthorne effect is the effect of improvement on an individual's performance due simply to their knowing that a change has occurred in some procedure or because they know they are being observed (Kalat, 1990). This may not only motivate an individual to perform better, but also heighten their focus on the task at hand such that performance is improved. Generally, however, in a skill where precision and technique play the largest role in the outcome of the results, it is plausible to submit that the participants may not have improved at a statistically significant level due to the observational effect generated through this research. Typically, when one suggests that the Hawthorne effect had some influence on

a study's results, the task being carried out by the participant is not one in which precision of technique affects the outcome of the results. The task is usually presented as a challenge of performing something that already exists in the individuals productivity, to a more efficient degree (i.e. faster, more often, being happier at their job, going from doing a task at an average pace, to a more efficient pace). This is not to say that the Hawthorne effect did not have some influence on the performance of the participants, however the possibility of the training strategies generating enhancement of performance should not be dismissed either. The possible limitation that is introduced by the Hawthorne effect in the current study, is whether or not it had some influence on the *reason* participants improved their performance and, to what capacity should the strategies introduced be given credit for the enhanced performance of the participants. To try and verify the existence or nonexistence of the Hawthorne effect, future studies could include a control group that only participated in the first and last two study sessions for the purpose of performing the pre and post test trials. Essentially, without a longer duration of study, more participants, and replication of the study, these questions may not be satisfied with an accurate answer which in turn, provides justification for further research regarding the validity and reliability of this study's training strategies.

General Implications

Results of the current study indicate, that comprehensive training programs (such as FR/PP) have potential to be an effective way to learn, practice, and master a skill in the sport of fastball and therefore, need to be taken into consideration when trying to determine the best training strategy to employ. When the enhancement of a

specified skill is desired, employing a training program where *all* dimensions of the skill are incorporated must be considered as an alternative to the traditional methods employed. FR/PP in its rudimentary form, contains the essential and universal elements required to yield a potentially significant improvement in skills of fastball and, potentially, skills of other disciplines that bear similar characteristics to the skills of fastball. As a result of FR/PP's versatile and modifiable characteristics, both facilitators and individuals can personalize this program to accommodate either simple or complicated training regimes in *potentially* any discipline. Although the findings of the current study must be replicated, what *has* been revealed through the current study, provides strong motivation to seriously consider employing the use of the FR/PP training strategy.

Future Directions

Although the *core* components of the current study have had a sporadic existence in past research endeavours, future researchers must notably consider the potential effectiveness demonstrated by the current study's uniquely *designed* FR/PP training strategy. As the results yielded regarding the FR/PP training strategy have shown significant potential, replication of this study is strongly recommended to clearly illustrate just how profound a program containing combined strategies such as this could be in the enhancement of performance. Further, the application of this study's essential components to other sports and disciplines is greatly encouraged, as the potential range of its usefulness in enhancing performance levels is widespread. As for the current status of this study, the effectiveness of this program could not be overwhelmingly supported.

However, in guiding potentially new research this exploratory study may prove to make a significant contribution to knowledge concerning fantasy rehearsal as a mental imagery program.

VI. SUMMARY STATEMENT

From the results, it was hoped that the researcher would be able to contribute a new imagery rehearsal program design where the components, in combined form, would provide the greatest potential to enhance performance. Through this, it was also hoped that future directions would be guided toward designing programs which incorporate combinations of multiple training strategies and alternative types of imagery components leading to performance excellence. Analysis of results obtained through the present study did indicate statistical significance. As such, encouragement for future research exploring the emergence of fantasy imagery rehearsal programs incorporated with physical practice remains highly recommended.

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Appendixes

Appendix A

Questionnaire #1 - Vividness of movement imagery questionnaire (part1 and 2)

Name: Age: Sex:

Years of experience:

Highest level of Competition:

Instructions:

Movement imagery refers to the ability to imagine a movement. The aim of this test is to determine the vividness of your movement imagery. The items of the test are designed to bring certain images to your mind. You are asked to rate the vividness of each item by reference to the 5-point scale. After each item, write the appropriate number in the box provided. The first box is for an image obtained watching somebody else and the second box is an image obtained doing it yourself. Try to do each item separately, independently of how you may have done the other items. Complete all items obtained watching somebody else and then return to the beginning of the movement imagery component of the questionnaire and rate the image obtained doing yourself. The two ratings for a given item may not in all cases be the same. For all items please have your

eyes CLOSED.

RATING SCALE The image aroused by each item might be:

Perfectly clear and as vivid as normal vision	....	RATING 1
Clear and reasonably vivid	....	RATING 2
Moderately clear and vivid	....	RATING 3
Vague and dim	....	RATING 4
No image at all, you only "know" that you are thinking of the skill.	....	RATING 5

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE.

Item		Watching somebody else \ Doing it yourself
1.	Standing	\
2.	Walking	\
3.	Running	\
4.	Jumping	\

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE.

Item		Watching somebody else \ Doing it yourself
5.	Reaching for something on tiptoe	\
6.	Drawing a circle on paper	\
7.	Kicking a stone	\
8.	Bending to pick up a coin	\

9.	Falling forwards	\
10.	Running up stairs	\
11.	Jumping sideways	\
12.	Slipping over backwards	\

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item		Watching somebody else \ Doing it yourself
13.	Catching a ball with two hands	\
14.	Throwing a stone into water	\
15.	Kicking a ball in the air	\
16.	Hitting a ball along the ground	\

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item		Watching somebody else \ Doing it yourself
17.	Running downhill	\
18.	Climbing over a high wall	\
19.	Sliding on ice	\
20.	Riding a bike	\

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item		Watching somebody else \ Doing it yourself
21.	Jumping into water	\
22.	Swinging on a rope	\
23.	Balancing on one leg	\
24.	Jumping off a high wall	\

Appendix B

Questionnaire #2 - IUQ

Please complete the following before answering the imagery use questionnaire. This information will provide a background of your experiences with mental imagery rehearsal techniques. Indicate the mental imagery rehearsal training techniques to which you have been exposed. This might have been through readings, courses, or discussions with fellow athletes, coaches and professionals.

C. Type of mental imagery rehearsal technique: _____ Definition: _____

_____

_____

Have you been exposed to this technique? Yes ____ No ____
If yes, how? _____
Have you had formal instruction? Yes ____ No ____
If yes, # of sessions in which it was taught: ____
Average length of each session: ____
Do you personally use this technique? Yes ____ No ____
If yes, why do you use this technique?

_____

_____

_____

Many athletes go through their skill/performance, or stages of that performance, in their minds before actually competing. Mental imagery rehearsal is a method of seeing yourself in action or seeing the action as you would perform but in your "mind's eye" (visualization). It can also include sensations and feelings associated with an action or the atmosphere and environment surrounding an event. This is a questionnaire designed to assess the USE of mental imagery rehearsal by fastball players. There are no right or wrong answers, but please try to answer as accurately as possible. If you need more space than is available, use the back of the page.

In the following questions where a scale is given, please circle the appropriate number corresponding to your degree of imagery use.

1. To what extent have or do you use mental imagery in your training?

1	2	3	4	5	6	7
Never						Always

2. To what extent have or do you use mental imagery in competition?

1	2	3	4	5	6	7
Never						Always

3. Have you used mental imagery:

a) before a practice	1	2	3	4	5	6	7
	Never						Always
b) during practice	1	2	3	4	5	6	7
	Never						Always
c) after a practice	1	2	3	4	5	6	7
	Never						Always
d) before an event	1	2	3	4	5	6	7
	Never						Always
e) during an event	1	2	3	4	5	6	7
	Never						Always
f) after an event	1	2	3	4	5	6	7
	Never						Always
g) during another	1	2	3	4	5	6	7
unrelated activity	Never						Always
(i.e. running)							
h) during breaks	1	2	3	4	5	6	7
in a day	Never						Always
I) before/in bed	1	2	3	4	5	6	7
	Never						Always
j) during movement	1	2	3	4	5	6	7
	Never						Always

k) during a pitch 1 2 3 4 5 6 7

Never Always

l) during a throw 1 2 3 4 5 6 7

Never Always

4. When you use mental imagery, do you see yourself from outside of your body as if you are watching yourself on a video?

1 2 3 4 5 6 7

Never Always

If you do, how vivid is this image?

1 2 3 4 5 6 7

Not vivid Very detailed

How easily can you change that image?

1 2 3 4 5 6 7

Very difficult Very easy

5. When you use mental imagery do you see what you see what you would see as if you were actually performing a skill? (Internal perspective)

1 2 3 4 5 6 7

Never Always

If you do, how vivid is this image?

1 2 3 4 5 6 7

Not vivid Very detailed

How easily can you change that view?

1 2 3 4 5 6 7

Very difficult Very easy

6. When you are imaging, how easily do you see:

a) isolated parts of a pitch 1 2 3 4 5 6 7

Very difficult Very easy

b) entire parts of a pitch	1	2	3	4	5	6	7
	Very difficult						Very easy
c) isolated parts of a throw	1	2	3	4	5	6	7
	Very difficult						Very easy
d) entire throw	1	2	3	4	5	6	7
	Very difficult						Very easy
e) isolated parts of	1	2	3	4	5	6	7
hitting the ball	Very difficult						Very easy
f) entire action of	1	2	3	4	5	6	7
hitting the ball	Very difficult						Very easy
g) part of a catch	1	2	3	4	5	6	7
	Very difficult						Very easy
h) entire catch	1	2	3	4	5	6	7
	Very difficult						Very easy

7. When you are imaging, how often do you see:

a) someone else pitching	1	2	3	4	5	6	7
or throwing (i.e. to imitate)	Never						Always
b)yourself pitching or	1	2	3	4	5	6	7
throwing incorrectly	Never						Always
c) yourself losing a	1	2	3	4	5	6	7
competition	Never						Always
d) yourself doing a pre-	1	2	3	4	5	6	7
event routine (warm-up)	Never						Always
e) the atmosphere of the	1	2	3	4	5	6	7
competition day	Never						Always
f) yourself winning a	1	2	3	4	5	6	7
competition	Never						Always

g) yourself receiving a gold medal	1 Never	2	3	4	5	6	7 Always

8. When you are using mental imagery to what extent do you actually feel yourself throwing?

	1 Never	2	3	4	5	6	7 Always

How easily do you feel:

a) the ball in your hand	1 Very difficult	2	3	4	5	6	7 Very easy
b) specific muscles	1 Very difficult	2	3	4	5	6	7 Very easy
c) body control	1 Very difficult	2	3	4	5	6	7 Very easy
d) quality of the ground surface	1 very difficult	2	3	4	5	6	7 Very easy

9. If you use imagery, does the amount that you use imagery vary during the year? If yes, how and why?_____

_____

_____

_____

_____

10. Are your imagery sessions structured (i.e. you know in advance what you will image and for how long)?

1 2 3 4 5 6 7

Never Always

11. Are your imagery sessions regular (i.e. at a specific time each day)?

1 2 3 4 5 6 7

Never Always

(i.e. are spontaneous) (i.e. very regular)

12. Do your imagery sessions always take the same amount of time? If yes, how long?_____

_____

_____

If no, what range of time?

_____

13. In preparation for your all-time best performance, how much mental imagery did you do?

1 2 3 4 5 6 7

None Less than Usual More than Usual

14. Are there some ways you use mental imagery which are not covered in this questionnaire ?

_____

_____

_____

_____

15. Are there any further comments you would like to make regarding your mental preparation for fastball ?

Thank you for your time.

Appendix C

Questionnaire #3 - Strategy Use Questionnaire (General, subjective, open-ended questionnaire)

a) Did the training strategy work for you? If yes, why do you think that it did? If no, why do you think that it didn't?

b) What part of the strategy do you think helped you the most?

c) What part of the strategy do you feel helped you the least?

d) How often did you use the strategy?

d1) Did you use the strategy outside of the training sessions?

e) If there were more training sessions (more time to work with the strategies), do you think that you would have gained more benefit ?

f) Will you continue to use this strategy?

g) Would you be interested in exploring other performance enhancing strategies?

h) Do you think that it could or will help you in other areas in your life (i.e. school, other sports, drama, dance, etc.)?

I) If you answered yes to the last question, what would those areas be and will you use you strategy to enhance the performance of that activity ?

j) Do you think that you would be interested in trying other performance enhancing strategies in the future?

k) How much physical practice did you have outside of the training sessions ?

l) If you were in the physical practice group, did you use any imagery at all through out the training sessions ? If yes, how much ?, and what kind of images did you use?

Appendix D

Sample Page of Score Plotting Record Book (for one participant)

Participant I.D.# ____

Session #1	Session #2	Session #3	Session #4
1 _____	1 _____	1_____	1_____
2 _____	2 _____	2_____	2_____
3 _____	3 _____	3_____	3_____
4 _____	4 _____	4_____	4_____
5 _____	5 _____	5_____	5_____
6 _____	6 _____	6_____	6_____
7 _____	7 _____	7_____	7_____
8 _____	8 _____	8_____	8_____
9 _____	9 _____	9_____	9_____
10_____	10_____	10_____	10_____

Appendix E

Lesson Plan for PP Group Training Strategy Session #1

Note There was no lesson plan for group #1 as they were just simply instructed to physically practice throwing 50 times at the target, equalling the duration of the time that groups #2 and #3 rehearsed their training strategy.

Appendix F

Lesson plan for group #2 (fantasy rehearsal alone)

1- Definition of imagery

2- Different elements or modes included in an imagery session (discussed the visual role, and the importance of kinesthetic awareness)

3- How to image from an internal perspective

4- How to work on making images vivid, clear and controllable

5- How to prepare oneself prior to engaging in imagery

6- Guided imagery exercise

7- How to use fantasy images in imagery rehearsal session (fantasy rehearsal explanation)

8- Discuss specific images that are to be included in imagery session (tunnel and arm extension)

9- Describe how those images are to be incorporated into regular images of performing the pitcher's pitch or catcher's pick-off throw

10- Have participants lie down, slow down breathing, relax all muscles, and then engage in fantasy rehearsal

Appendix G

Lesson plan for group #3 (fantasy rehearsal/physical practice)

1- Definition of imagery

2- Different elements or modes included in an imagery session (discuss the visual role, and the importance of kinesthetic awareness)

3- How to image from an internal perspective

4- How to work on making images vivid, clear and controllable

5- How to prepare oneself prior to engaging in imagery

6- Guided imagery exercise

7- How to use fantasy images in imagery rehearsal session (fantasy rehearsal explanation)

8- Discuss specific images that are to be included in imagery session (tunnel and arm extension)

9- Describe how those images are to be incorporated into regular images of performing the pitcher's pitch or catcher's pick-off throw

10- Describe how participants are to engage in the movements of physical practice while they use fantasy rehearsal

11- Have participants lie down, slow down breathing, relax all muscles, and then engage in fantasy rehearsal during physical practice

12- *Note* Starting at training session six, participants in this group actually began to throw the ball during their fantasy imagery rehearsal.

Appendix H

Guided Imagery Script (session #3): Field of Perception

In this exercise imagine stepping through a porthole into the 'field of senses'. Each sense - sight, hearing, smell, taste, and touch, - will be presented.

As you are introduced to each sense, imagine yourself experiencing the actual image as you have in the past, or would, if you were actually there. Absorb the vision of scenery, hear the sounds, smell the air and whatever you imagine in it, taste the flavour of the environment, and feel everything around you.

Close your eyes and follow your breath in . . . and . . . out . . .of your nose. Allow your body to become very relaxed and quiet as you breath in . . . and . . .out . . .
Now imagine that you are walking through a park and you see a large, beautiful ball diamond. This is the field of perception; the field of your senses. As you walk towards the field, the grass begins to appear vibrantly green glistening with morning dew. The refreshing smell of moist grass and freshly groomed shale intermix creating a medley of scents for you to breath in. As you walk a little closer, you notice that each base, as well as the pitcher's mound and home plate, have a symbol on them.

First base has an eye on it. As you approach the base, everything around you seems vividly clear and bright. The base is covered with a thick layer of dust. You kneel down beside it and begin wiping away the dust. As the eye symbol becomes clearer, you become aware of all the scenery and colors that surround you. The grass is greener than you have ever seen it and the light from the sun dances across the dew drops that line the thick blades of grass. The trees in the background, glow in their silhouette against the beams of light projecting from the rising sun. A small bird glides gracefully in the sky above and dramatically swoops down skimming the grass leaving an indefinite path through the dewey grass. You breath in and then look down at your hands. . . Every crease that lines your palm becomes strangely visible and you wonder what lies ahead at

the next base. You raise up from the ground and begin walking towards second base.

As you approach, you notice a large symbol of an ear covering the top of the base. Again it is covered by a thick layer of dust, and you kneel down and begin wiping away the dust. As the symbol of the ear becomes clearer, all the sounds that surround you become very clear and distinct. A slight breeze rustles the leaves in the distant trees, and the sharp chirping of a bird pierces the air with it's song. A small chain attached to the top of the backstop is gently clanging against the metal poles as the soft wind moves it back and forth. As you move to get up and walk to the next base you realize that everything has stopped moving and a peaceful silent calm surrounds you. You stop for a minute enjoying the tranquil silence suddenly becoming aware that the only sound you hear, is your own breathe . . . You then slowly begin to move to the next base . . . more aware of the shale crunching beneath your shoes, you smile.

As you near third base you notice the symbol of a nose covering the surface. Again you kneel down and begin wiping away the thick layer of dust covering it's surface. As the symbol becomes clearer, you become aware of the strong smell of wet grass and moist shale. You breath in deeply through your nose savouring the freshness that fill your lungs. A gentle breeze blows past your nose and you become aware of the smells coming from the distant concession stand. Popcorn aroma fills your nose briefly, . . . so strongly that you can almost taste the flavour of the buttery morsels. As the breeze passes, the fresh smells of the nature that surrounds you surges back into your nose and deeply into your lungs leaving you feeling energized and alive. You rise up from the ground in anticipation of what lies ahead at home plate.

As you begin to near home plate, you see a large tongue symbol covering it's surface. Again you kneel down and begin to wipe away the thick layer of dust that distorts the clearness of the symbol. As the symbol becomes clearer, you begin to become aware of the rich flavour of shale in you mouth that has been stirred up by you wiping away the dust from the plate. It reminds you of a time when you tasted the shale once before. As you reflect, the thought of salty sunflower seeds comes to your mind, and your mouth begins to salivate, craving the salty little bursts of flavour . . . At this point, you

have found yourself very thirsty longing for just one small sip of your favourite gatorade. As you lick your lips the sweet flavour of gathered lines your tastebuds and you once again feel refreshed. Now you become curious about what lies ahead at the pitcher's mound. As you rise up and take in a deep breath, you become aware that you can almost taste the fresh moist greenness of the grass. As you walk toward the pitcher's mound, you see a large symbol of a hand covering it's surface.

Again you kneel down to wipe away the dust from it's surface and suddenly . . . become aware of the coarse texture of the dust that shifts beneath your hands. You pick up a large rack lying beside the mound, and feel it's smooth sides. As you turn the rock over you see that it has a coarse design of texture acrsoss it's surface. You softly glide your fingers across the jagged surface and realize how sensitive your finger tips are. You place the rock down beside you, and touch the tips of your fingers together. After feeling the texture of the rock, your finger tips seems so soft and smooth. At this point, the sun has reached high up in the deep blue sky and it's warmth is beating down on your face.... You close your eyes raising your face up to the sun and all the muscles in your face become relaxed . . . You raise up your hand to shield the beams of light and warmth from hitting your face, and as you do, you become aware of only the small beams of sunlight that escape through your fingers reaching out to caress your skin. Just as you are about to get up a gentle breeze brushes across your skin leaving it feeling cool and refreshed. You can feel your hair gently moving in the breeze and feel energized and calm. As you rise up from the ground, you look around you and bask in all the splendour that surrounds you. Every sight seems clear and vibrant, every sound you hear is clear and crisp, every scent you smell is rich and pure, every flavour true and tantalizing, your body becomes strikingly aware of anything and everything that it touches or that touches it, and you feel completely whole.

You are now ready to leave the field of perception and as you begin to walk away your body feels light and free flowing . . .

You may now open your eyes.

Appendix I

PP Group Introductory Session

- Notification of what group they will be in for the next three weeks.

- Describe their role and it's importance to the study.

- Ask them not to use imagery for the duration of the study (to make a conscious effort)

- Remind them that they will be taught the imagery strategies at the end of the study.

- Tell them to look at being in this group as an opportunity for extra practice which is a good thing at this time of year.

Appendix J

FR and FR/PP Group's Introductory Session

- Notify them that they are in group's #2 and #3

- Importance of them not discussing strategies with anyone outside of their group including friends and siblings.

- Give reasoning for pre and post test and that the object is to find out if the imagery strategy works.

- Believe in it for it to work - emphasis here

Begin actual intro to strategy:

Define Imagery : Imagery as a blueprint - creating muscle memory - creating muscle innervations - leading to more accurate skill execution - practicing in your head.

Building a machine : muscle memory - as a process to improve performance of a skill.

Uses and advantages : General

Different elements or modes included in an imagery session : discuss visual role and the importance of kinesthetic awareness - using all your senses.

Discuss internal perspective : how it helps you *feel* the way you should be moving - provides added reality to the image sharpening the muscle memory of what it is supposed to do in reality - in comparison to just seeing yourself doing the skill (external perspective)

How to work on making images vivid and controllable:

Vividness:

- Drawing from previous peak performance experiences, you try to create a picture that is clear, precise, colorful, detailed, and uses all of the senses.

- Includes emotions or feelings associated with the performance.

- Use positive images, as negative images seem to overtake the mind and hinder performance.

Controllability:

- Like controlling what happens in your dreams.

- Changing negative images to positive images.

- Changing failure to success.

Preparing yourself prior to engaging in imagery

Find a quiet spot, close your eyes, and slowly begin to breathe in and out deeply. Feel your body begin to relax. Continue slowly breathing in and out. Now try to create the image.

Guided Imagery Exercise : See AppendixH

Describe what fantasy rehearsal is:

How to use fantasy images in imagery rehearsal sessions.
Discuss specific images to be used for study (tunnel/arm extension) and how to incorporate them into the regular motion images of the throw.

Guide participants through first session :

Guide fantasy imagery describing everything for them after they are relaxed and have their eyes closed.

Dismiss group two(FR) : teach group three (FR/PP) how to use fantasy imagery while going through the slow motions of the throw.

Note, all test groups were required to keep their eyes closed throughout the training sessions (with the exception of the physical practice group), to inhibit external visual input, enabling participant's focus to explore the effectiveness of other senses (primarily kinesthetic). Furthermore, in all test groups with the exception of the physical practice group, an internal perspective of imaging was used.

Appendix K - Adjusted and Residual Scores

Table K1

Group	Adjusted scores	Standard residual scores	Group adjusted score means
1	54.35	1.79	
1	69.41	.856	
1	63.67	.609	
1	52.58	.703	60.15
1	69.22	-.896	
1	62.2	1.52	
1	42.29	.498	
1	59.83	.407	
1	67.99	-.887	
2	66.38	0668	
2	61.93	-.334	
2	54.07	.137	
2	68.93	.143	
2	52.54	1.37	59.78
2	44.38	-.031	
2	66.98	-.611	
2	58.67	-.406	
2	64.18	.319	
3	62.25	1.42	
3	69.71	-1.40	
3	51.98	-.465	
3	57.93	-2.13	
3	49.6	-.460	58.59

Group	Adjusted scores	Standard residual scores	Group adjusted score means
3	59.62	-.011	
3	59.54	-.784	
3	52.81	-1.79	
3	59.89	-.771	
3	62.66	.517	

Appendix L

Participant Group Assignment Procedure

Prior to random assignment, an attempt to create three blocked groups was undertaken. As accurately as attainable, participants were categorized into the three ability level pools in order to randomly assign participants to one of the three training groups. To accomplish participants categorization into the three ability level pools the following occurred:

1. An ANOVA was run on all the pretest means to ensure an equality of means across all participants. No significance was found, therefore participants were accepted as being statistically equal in motor performance prior to initiation of training strategies

2. VMIQ scores were categorized as being either high, medium, or low. With a likert scale of one to five, one being the best score, the highest score was 1.3 and the worst score was 3.4. This being so, the original score cut offs for ability group categorization (high ability level: 1-2, medium ability level: 3, low ability level: 4-5) had to be put on a sliding scale of high ability level: 1.25-2.25, medium ability level: 2.25-3, low ability level: 3-3.5.

3. Upon completing assignment of participants to ability level groups based on the first stage of blocking (VMIQ scores), the IUQ scores were observed. With a likert scale of one to seven, seven being the best score, the highest score was 5.162 and the worst score was 1.348. This being so, the original score cut offs for ability level categorization (high ability level: 6-7, medium level ability: 4-5, low ability level: 1-3) also had to be put on a sliding scale. The scale used for categorization was as follows:

high ability level: 5.5- 3.75, medium level ability: 3.75-3, and low ability level: 3-1.25.

4. Blatantly obvious participant questionnaire scores regarding ability/use were first categorized into their respective groups, when scores were high on one questionnaire but lower on the other, participants were categorized into whichever group they were closest to, most commonly, the medium ability group. Also, if scores were still vague regarding which group the participant should be categorized, the pretest average score was also taken into consideration such that a poor pretest average score, would push them towards a lower ability level group.

5. Upon conclusion of the ability level categorization, random assignment into groups using the consecutive 3,2,1,3,2,1... group designation down the participant list of each ability level group was completed. Following the final assignment of participants to training groups, a test for correlation between questionnaires was completed. The results of the correlation tests were found to be significant, indicating that the groups were equal in regard to the distribution of 'ability levels' across groups.

Table L1

Average Score of Participants on Questionnaire Questions

GROUP	IUQ	VMIQ1	VMIQ2
Physical practice (PP-group#1)	3.795	2.133	2.1
Fantasy Rehearsal (FR-group#2)	3.376	2.244	2.06
FR/PP (group#3)	3.261	2.08	1.85

Note: IUQ = Average participant score per question for each group, VMIQ1 = Average participant score per question for each group, VMIQ2 = Average participant score per question for each group; VMIQ scores ranged from 1-5 a score of one being the best, IUQ scores ranged from 1-7 a score of seven being the best.