IMAGERY ABILITY AND IMAGERY USE IN INDIVIDUAL AND TEAM SPORTS

Ville Peltomäki

ABSTRACT

Ville Peltomäki. Imagery ability and imagery use in individual and team sports. University of Jyväskylä. Master's Thesis in Sport and Exercise Psychology. Department of Sport Sciences, University of Jyväskylä. 50 p.

The purpose of this research was to examine whether individual and team sport athletes differ in their imagery use and imagery ability, and to examine whether level of sport participation or weekly sport involvement are variables that differentiate between athletes on the basis of their levels of imagery ability and imagery use. Two measures were conducted. The Sport Imagery Ability Measure (SIAM) is a 48-item self-report measure that uses four sport related scenes to examine the dimensional, sensorial, and emotional characteristics of generating images. The Sport Imagery Questionnaire (SIQ) is a 30-item self-report measure that examines five characteristics associated with the cognitive and motivational aspects of imagery use. Participants (N=207) were recruited from high schools, sport clubs and university physical education courses in Finland. The athletes completed the Finnish translations of each measure within their specific organisational settings. Analysis involved the use of independent samples t -tests to compare means from individual and team sport groups.

Group comparisons revealed that individual athletes had significantly ($t = -3.121$, $p = .002$) higher means in kinaesthetic imagery ability compared to team sport athletes. This demonstrates that individual and team athletes have distinct abilities and characteristics when it comes to sport-oriented imagery. In addition, results showed significant differences in imagery use between these two groups. Score comparisons indicated that individual athletes had significantly higher use of motivation general-arousal (MG-A) ($t = -2.188$, $p = .03$) and motivation general-mastery (MG-M) ($t = -3.213$, $p = .002$) imagery. These findings offer some indication that individual and team sport athletes employ the motivational functions of imagery differently. Motivational general arousal may be an interactive oriented type of imagery that is specifically needed in individual sports because there are no teammate to psyc you up. When comparing national and regional level athletes, it was found that national level athletes had significantly ($t = 2.222$, $p = .027$) greater visual imagery ability than regional athletes. It appears that national level athletes are able to use their visual ability more efficiently. Results also showed greater use of motivation general-mastery (MG-M) by national level athletes, which suggest that ability to visual imagery and use of general motivational-mastery skills are important characteristics in differentiating national and regional athletes from each other. Time of weekly participation in training or competing seems not to be a differentiating factor in imagery ability. Still, comparison between high and low training groups showed that imagery use of the motivational general-mastery was significantly ($t = -2.236$, $p = 0.03$) higher with high training group (29.33 ± 6.0) when compared low training group (26.93 ± 6.2). Overall, these initial results support the proposition that individual and team athletes have distinct abilities and characteristics when it comes to sport-oriented imagery. The information of this study may help coaches and athletes to identify the mental preparation needs of specific sports and to present additional information about individual differences in sport imagery. This knowledge can be used in designing mental imagery rehearsal programs for the purpose of enhancing physical performance.

Keywords: imagery, sport, mental practice, visualisation, motivation

INDEX

INTRODUCTION

Mental imagery is widely accepted by sport psychologists, coaches, and athletes to be a useful psychological technique in the training of athletes for excellence (Janssen & Sheikh, 1994; Hall, 1998). Athletes use mental imagery extensively in their training and in conjunction with competition. Imagery serves two functions. The motivational function of imagery can represent emotion-arousing situations as well as specific goals and goal oriented behaviours. The cognitive function entails the mental rehearsal of skills and strategies of play.

Individual imagery ability is regarded essential determinant for the efficacy of mental training (Munzert, & Hackfort, 1999). In examining imagery research in sport, Murphy and Jowdy (1992) suggested that variability exist in imagery ability characteristics in relation to physical activity and athletic performance. To make imagery training maximally effective, practitioners need to establish an understanding of the athletes' ability to image (Moran, 1993) and identify individual differences (Hall, Pongrac, & Buckolz, 1985). Research in the area of applied sport psychology has examined athletes individual differences in imagery skills (Thomas, & Fogarty, 1999), differences in image content (Moritz et al., 1990), differences in types of performance enhancement image based strategies for specific sports (Defrancesco, & Burke, 1997), effectiveness of mental imagery strategies compared to relaxation and to positive self talk techniques (Kenitzer, & Briddell, 1991), and the important motivational and cognitive role of imagery in physical performance (Gammage, Hall, & Rogers, 2000). Unfortunately, the extensive positive evidence detailing the effect of imagery use in sport, has not been supported by studies that have specifically examined differences in mental imagery ability or use in athletes from individual and team sports.

The aim of this study is to examine imagery ability and imagery use in athletes from individual and team sports and to determine if substantial differences exist between these two groups. Moreover, this study examines the possible effects of competitive level of participation and sport involvement time on mental imagery characteristics. The information this study will provide may help coaches and athletes to identify the needs of specific sports and to present additional information which can be used in designing mental imagery rehearsal programs in order to enhance physical performance.

2 THE CONCEPT OF IMAGERY

2.1 Definitions of imagery

Several different terms have been used to describe an athlete's mental preparation for competition, including *mental rehearsal, visualisation, imagery*, and *mental practise*. These terms refer to creating an experience in ones mind, which is actually a form of simulation, believed to be similar to sensory experience, even though the entire experience happens cognitively. Images are created by recalling from memory pieces of information stored from all types of experiences and shaping them into meaningful representations. (Weinberg & Gould, 1995). When imaging a picture in ones mind the individual is consciously aware that imagery is occurring and this awareness distinguishes imagery from dreaming or daydreaming (Murphy, 1994).

Several straightforward definitions of imagery have been developed that relate directly to mental experience such as: "Mental imagery or the capacity to represent in the mind experiences of things that are not physically present" (Moran, 1993, p. 157). Another definition relates to the dynamic and creative properties of imagery and may be considered more relevant to imagery training. Denis (1985) stated:

"Imagery is a psychological activity which evokes the physical characteristics of an absent object (either permanently or temporarily absent from our perceptual field). It is worth emphasising here that imagery is not restricted to recollection of the appearance of static objects, but it extends to moving objects, objects undergoing transformations, in other words, to dynamic events. The scope of imagery is not limited to recalling objects or events that have been perceived in the past (recent or distant past) but imagery also refers to objects or events that have not yet been accomplished. Imagery allows people to anticipate future (or even purely theoretical) events (pp. 4S-5S)".

In a more specific sport psychology framework, Suinn (1976, 1983, 1984, 1993) examined the construct of imagery through review of imagery rehearsal research and the development of a specific method of imagery rehearsal known as visuomotor behaviour rehearsal (VMBR). Suinn (1993) defined imagery rehearsal as a covert activity where "a person experiences sensory-motor sensations that reintegrate reality experiences, and

which include neuromuscular, physiological, and emotional involvement". Suinn (1984) maintained that the rich multimodal (utilising all the senses) process of imagery rehearsal is holistic, under conscious control, and can closely replicate the original experience, even arousing emotions similar to those associated with the experience. Mahoney (1977) identifies imagery to be one of four elements of cognitive skills in man, others are self-efficacy, arousal regulation, and attention focus. Mahoney gives imagery a significant role in physical performance and suggests that imagery rehearsal is essential for successful learning of physical skills.

2.2 Theoretical models of imagery functions

Sport psychologists have proposed four main theoretical explanations for the relationship between imagery and physical performance (Table 1). Each theory offers some principles that can improve the effectiveness of mental practice, even though none of the theories are completely satisfactory (Hall, 2001; Suinn, 1993, 1997; Weinberg & Gould, 1999).

TABLE 1. The main four theories explaining imagery works in physical activity

Name of the theory	Author
Psychoneuromuscular theory	Jacobson, 1930, 1932
Symbolic learning theory	Sackett, 1934
Bioinformational theory	Lang, 1977
Arousal-activation theory	Schmidt, 1982

Jacobson (1930, 1932) proposed that imagery facilitates the learning of motor skills because of the nature of the neuromuscular activity patterns activated during the imaginal process. Even though neuromuscular impulses created are reduced in magnitude, they are almost identical to the actual performance pattern, and as result the neural pathways are strengthened and motor learning is enhanced. This is the psychoneuromuscular theory,

which is based on Carpenter´s (1894) earlier work with ideomotor principle of imagery. Vealey and Greenleaf (1998) suggested that although no specific movement occurs during the imagery, the low-level nerve impulses increase the correct firing sequence of the muscle. This is believed to make the execution of the movement easier (Janssen & Sheikh, 1994).

The psychoneuromuscular theory has been supported by a number of imagery rehearsal studies (e.g. Bird, 1984; Harris & Robinson, 1986; Jowdy & Harris, 1990) which monitored the motor-efferent patterns generated while participants imagine specific physical movements or sport activities (Watt, Morris, & Andersen, In press). Still, there are some concerns with this theory. Feltz and Landers (1983) found strong evidence of insufficiency in the psychoneuromuscular theory. They stated that that muscle innervation was not always localised to the muscle groups of the imagined movement. This fact restricts the usefulness of the theory in explaining how imagery enhances sport performance. Although the psychoneuromuscular theory does fail to a certain extent to explain mental practise outcomes, it has been written more attention to detailing psychophysiological mechanisms underlying motor imagery (Murphy & Martin, 2002).

The effects of mental imagery on performance can be seen as a result of operations within the central nervous system. The symbolic learning theory proposed by Sackett (1934) infers that imagery allows the performer to symbolise the required movement sequences in the brain resulting facilitating performance. Imagery may function as a coding system in order to aid the understanding and acquisition of movement patterns. These processes are based in the central nervous system and their execution does not involve peripheral musculature (Murphy & Martin, 2002). This means that athletes learn skills by becoming familiar with the requirements of successful performance and a "mental blueprint" is formed of the completed movement, and this facilitates the processing of the skill to an automatic status (Vealey & Greenleaf, 1998).

Prior research appears to offer strong support for symbolic learning theory and has demonstrated consistent benefits of its application. Mental practise tasks with large cognitive components introduced greater gains when compared to motor tasks (Ryan & Simons, 1982; Wrisberg & Ragsdale, 1979; Feltz & Landers, 1983). A number of studies support the notion of symbolic learning theory. First, it has been shown that mental

practice is more effective for tasks that have high cognitive component. Secondly, is has been argued that early stages of learning are primarily cognitive (Murphy & Martin, 2002.) Contrast with these findings Murphy and Jowdy (1992) concluded after an extensive analysis that "Without a rigorous explanatory framework, the symbolic learning approach cannot serve as a useful heuristic for future researchers" (p. 237). Even though it is likely that a slight association exists between the cognitive blueprint proposal and the imaginal representation of coded movement information, this theory still cannot serve as an strong explanation of how imagery works (Watt, 2002).

Lang's (1977, 1979) bioinformational theory uses an information-processing model of imagery and its primary assumption is that imagery in the brain is organised in precise ways, involving a infinite set of proportions about relationships and descriptions of images stored within the long-term memory. (Lang, 1979.) Vivid imagery involves activation of information about stimulus characteristics of the imaged situation, and response propositions, or the physiological and overt behavioural responses to the imaged situation. (Hall, Martin & Moritz, 1999.)

The modification of propositions may generate changes in overt behaviour. The model considered two types of propositions: stimulus propositions that describe specific characteristics of the imagery scene, and response propositions that describe typical behavioural outcomes, that include cognitive, physiological, and emotional responses to the imagined situation. Lang's theory assumes that any changes to learning, behaviour, or performance result from the linking of the two proposition types. Imagery represents a process that facilitates the strengthening of these links (Lang, 1979).

A number of studies have demonstrated performance enhancement outcomes from research applications of the bioinformational theory. Smith, Holmes, Whitemore, Collins, & Devonport (2001) examined the Langian imagery perspective to field hockey penalty flick performance. They concluded that the results supported the application of bioinformational theory to field hockey and indicated that imagery scripts should be laden with response propositions to maximise their effectiveness. Kremer and Pressing (1998) found greater improvement in pistol shooting performance for the group using stimulus only propositions when compared to a group using stimulus and response propositions.

This suggests an equivocal status for the influence of proposition type on performance. Although additional research to further test this theory is required, Hecker and Kaczor (1988) concluded "the strength of Lang's theory lies in its heuristic value since it provides a conceptual model that can guide research into imagery rehearsal" (p. 367).

Imagery's enhancing affect to physical performance may also be because of its influence to arousal and physiological activation. The activation-arousal theory was formed by Schmidt (1982) who suggested that imagery provides a method of closely approximating this optimal level of arousal or physiological activation. This approach recognises self-regulation of activation levels and optimal arousal levels as the primary outcomes of mental imagery rehearsals (Suinn, 1993).

Empirical data (Budney, Murphy & Woolfolk, 1994) that supports the arousal-activation theory has been generated indirectly by examining the function of general arousal in mediating imagery effects. Lee (1990) found that participants using positive images of actual physical performance produced significantly better scores on a sit up task compared to participants using imagery associated with the recall of task irrelevant positive moods. Lee concluded that the imagery effects on performance were not the result of arousal optimisation as indicated by positive mood state.

Feltz and Riessinger (1990) concluded that "in vivo emotive imagery" was more effective than performance feedback in enhancing both self-efficacy and performance of a muscular endurance task. Although the theory has a certain intuitive appeal (Feltz & Landers, 1983), the major weaknesses of this theory are that it fails to explain how imagery optimises arousal and attention (Vealey & Greenleaf, 1998).

In summary, all four theories assert that imagery can help prepare the athlete both physically and mentally, and all of them have support from research (Weinberg & Gould, 1995).

2.3 Other hypothesis of imagery functions

In addition to the four prevalent imagery theories, there are few other hypotheses about how imagery really works when it comes to enhancing physical performance. These are (a) the psychological skills hypothesis, (2) the triple-code model, and (3) the psychological state hypothesis.

The <u>psychological skills hypothesis</u> proposes that imagery works through the development and refinement of psychological skills. For example, through imagery one can rehearse coping with anxiety, improving concentration, and enhancing confidence – all-important psychological skills for maximising performance. (Weinberg & Gould, 1995).

According <u>the triple-code model</u> every image imparts a definite meaning or significance to the individual and therefore may have a different effect on different people (Ahsen, 1984.) It seems, that the same image can be interpreted differently (Murphy, 1990; Orlick, 1990) and in addition, different meanings of images can cause different reactions (Bandura, 1986.) This model shares an emphasis on the psychophysiological processes of imagery with Lang's (1977, 1979) bioinformational theory. Ahsen (1984), who defined three essential components within the analysis of the imaginal process, modified the information-processing model. This is also referred as the ISM-model. The first part of the triple code model is the image itself (I), the second part is the somatic response (S) that represents the psychophysiological stimulation the image may generate, and third is the meaning (M) or significance of the image to the individual must be evaluated. Ahsen (1997) recognised the importance of multi-sensory imagery. He noted "performance, especially in sports, is never sensory-specific in an absolute way, as it involves other senses, such as muscles and other visceral feelings" (p. 13).

Third hypothesis is <u>the psychological state hypothesis</u>, which examines the effect of imagery on a range of associated psychological states (Weinberg & Gould, 1995). Gould and Damarjian (1996) outlined the general nature of this relationship and stated that: "imagery is also thought to influence athletic performance through its effect on other psychological states, such as self-efficacy or confidence and anxiety" (p. 34). Examples of the specific investigations of imagery in relation to particular psychological states include (a) improvement in motivation through the imagination of superior performance (Perry &

Morris, 1995); (b) the acknowledgment of self-efficacy theory (Bandura, 1977) as a contributing factor in increased confidence, achieved via the use of imagery to vicariously model observed behaviour (Perry & Morris, 1995); and (c) the use of imagery-based programs to control and reduce anxiety as a component of performance enhancement (Gould & Udry, 1994). Even though a number of different theories provide broad evidence of imagery functions, imagery still remains an area of sport psychology that is yet to be fully explained.

3   USING IMAGERY IN SPORT

3.1 Mental practise and the role of imagery

Mental practise refers to mental training to competition (Weinberg & Gould 1995), and it is usually combined with physical practise to produce the greatest performance effects (Murphy & Martin 2002). Imagery rehearsal is an integral part of this entity, but it is also used other purposes than mental practise. In generally, imagery rehearsal can be visual, kinaesthetic, or emotional. There are basically two perspectives of imagery. Internal imagery occurs when imaging the execution of specific skill from your own vantage point. External imagery occurs, when you view yourself from the point of external observer. For example, from a videotape. Whatever kind of imagery is appropriate for an athlete should be practiced systematically along physical skills (Murphy & Martin 2002). Figure 1 shows the broad area of mental practise.

FIGURE 1. Types of mental practise (Murphy, & Martin, 2001).
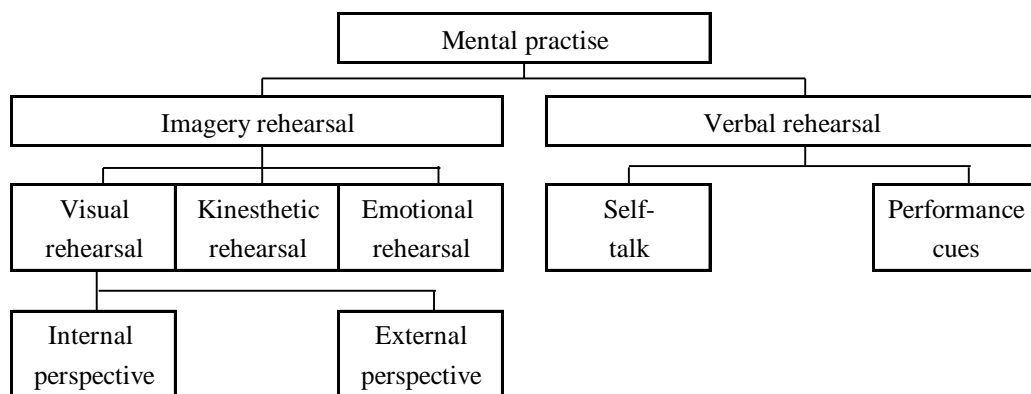
3.2 Athletes' ability to use imagery

Research has demonstrated the relationship between imagery ability and the learning and performance of motor skills (Goss, Hall, Buckolz, & Fishburne, 1986). Psychologists have tried to examine individual differences in imagery ability over the last decade, but unfortunately, in sport psychology have failed to specifically measure imagery ability

representative of the motor performance domain (Hall, 1985). Moreover, contemporary research suggests that imagery is ability as well as skills, and it can be improved through regular rehearsal, like motor skill (Rodgers, Hall, & Buckolz, 1991). Many authors have highlighted the need to assess imagery across a range of sensory modalities, which may include visual, auditory, kinaesthetic, olfactory, tactile, and gustatory senses (Hall et al., 1985; Hall, Rodgers & Barr, 1990; Richardson, 1969; Sheehan et al., 1983; White et al., 1977). Another area that has been included as a component of imagery and related more to the senses rather than dimensions is the experience of emotion (Suinn, 1993; Vealey & Walter, 1993). Ideally the assessment of imagery ability should be undertaken with a measure that examines those components that are utilised in formulating a set of images. Such a measure should include the dimensions of vividness, controllability, ease of generation, and duration, and specific sensory modalities such as visual, auditory, tactile, kinesthesis, olfactory, and gustatory, and the more general experience of emotion (Watt, 2003). Figure 1 demonstrates these components of imagery ability.

Imagery ability is typically measured before the start of psychological program to function as a guide to in designing the mental practise program (Watt, 2003). To assess athletes' imagery ability, one has to consider a wide range of variables because it may not be represented by a single measurable factor (Ernest, 1977; Hall et al., 1985; Richardson, J., 1988; Slee, 1988). The majority of studies reviewed conclude that imagery is comprised of several specific dimensional and sensory components. The two dimensions most regularly discussed are those of vividness and controllability (Denis, 1985; Moran, 1993; Richardson, 1977; Sheehan, Ashton, & White, 1983; Tower, 1981; White et al., 1977). Moran (1993) described these two dimensions and stated that: "The vividness of an image denotes its clarity and 'sharpness' or sensory richness, whereas, the term controllability refers to the ease and accuracy with which an image can be transformed or manipulated in ones mind" (p. 158). Additional dimensions include exactness of reference, duration, and ease of generation. Denis (1985) described exactness as important because it is "necessary that the figural content of the image accurately depicts what it is supposed to refer to, for instance, the dimensions of the objects, the distance from the subject to the objects, the direction of the movement, its magnitude, etc" (p. 95). Duration is simply the time an image may be clearly held in the mind once generated, while ease of generation is considered as the time taken to evoke an image.

```
┌──────────────────────────────────────────────────────────────┐
│                        Imagery Ability                         │
│                              │                                 │
│         ┌────────────────────┴────────────────────┐           │
│                                                               │
│   Dimension ──────────────┬────────── Modalities             │
│                    Visual     Emotion                         │
│                                                               │
│        ┌─Ease            Kinaesthetic ─┐                      │
│        ├─Duration        Tactile       ─┤                     │
│        ├─Speed           Auditory      ─┤                     │
│        ├─Control         Gustatory     ─┤                     │
│        └─Vividness       Olfactory     ─┘                     │
└──────────────────────────────────────────────────────────────┘
```
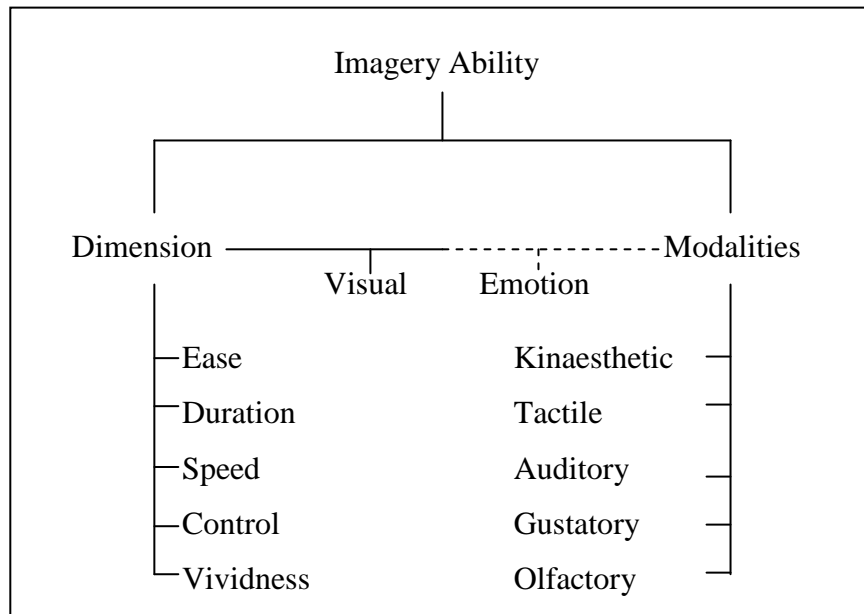
FIGURE 1. Components of Imagery Ability (Watt, Morris, & Andersen, In Press).

Several studies have reported that examining the imagery perspective is important in understanding imagery ability (Hall et al., 1985; Mumford & Hall, 1985). Initial research suggested that elite athletes favour an internal perspective, but this view has been refuted by Hall et al. (1990). White and Hardy (1995) argued that task differences might influence the adoption of an perspective, depending the requirement on specific sport performance. Imagery ability may contribute to differences in performance outcomes due to either an innate variation in imagery ability affecting physical performance or to the training effect in developing imagery ability through either physical practice, imagery programs, or both (Murphy & Jowdy, 1992; Vealey & Walter, 1993). Examining the existing research that has utilised specific measures of imagery ability has provided a restricted range of findings.

Epstein (1980) found a small positive correlation between dart-throwing ability and auditory and tactile imagery as assessed by a specifically designed but invalidated imagery questionnaire. A stronger positive relationship was found by Ryan and Simons (1982), with subjects who reported higher visual and kinaesthetic imagery on a short invalidated imagery questionnaire showing significantly greater improvement on a stabilometer task than those reporting weaker images.

One particular imagery ability measure, developed for use in the area of motor performance, the Movement Imagery Questionnaire has been used in a variety of studies. Examining subjects' self-ratings of both sporting ability and imagery ability, Hall et al., (1985) found significant correlations between self-reported swimming, track, and cross-country ability and the visual imagery score on the MIQ. Based on the results of 59 novices to senior skaters on the MIQ, Mumford and Hall (1985) reported that senior skaters proved to be significantly better kinaesthetic imagers than novice and junior skaters. In a similar study (Jopson, Henschen, & Schultz, 1989), 44 National Junior Gymnasts and 28 Class II level gymnasts completed the MIQ and the visual and kinaesthetic subsets of Switras' (1978) Survey of Mental Imagery. Analyses indicated that there were significant differences between the two groups, the junior elites showed a greater degree of external perspective of imagery, and a greater degree of kinaesthetic orientation of imagery.

Research seems to point to variability in imagery abilities between athletes from different sports. Watt and Morris (2001) found differences between the athletes from different levels of competitive involvement in imagery ability. They stated that participation level provides broader evidence of the specific characteristics of imagery ability that distinguish elite and non-elite athletes. Findings reported in similar studies (e.g., Eton et al., 1998; Isaac & Marks, 1994) lacked the detail generated from a multimodal, multidimensional measure of imagery ability. Athletes participating at a higher level appear better able to generate images related to their sport. Abma, Fry, Li, and Relyea (2002) investigated differences in imagery ability between high and low confident track and field athletes, and found out that high confident athletes used more imagery, but they did not have higher imagery ability skills than low confident athletes. In study by Vadocz, Hall, and Moritz (1997) kinaesthetic imagery ability and self-confidence were linked to better physical performance in roller-skating. In summary, it is likely that imagery ability does influence to the effectiveness of imagery use to enhance physical performance.

3.3 The role of image content

Moritz, Hall, Martin, & Vadocz (1996) suggested that imagery ability is correlated to image content, and that different types of abilities are associated with different image content. Suinn (1996) proposed that the content of imagery is determined by which goals are to be achieved, and that the functional distinctions are reflected in differences in imagery content. On the motivational side, imagery can represent emotion-arousing situations as well as specific goal-oriented behaviours, without necessarily engaging cognitive processes aimed to improve performance. On the cognitive side, imagery can be focused exclusively on performance-related aspects such as game strategies or specific motor skills (Hall, Mack, Paivio, & Hausenblas, 1998.)

Paivio (1985) identified that athletes use imagery for at least four primary purposes: self-motivation (motivational specific), coping and mastery of challenging situations (motivational general-mastery), arouse emotional experiences (motivational general-arousal), rehearse specific athletic skills (cognitive specific) and strategies related to competitive events (cognitive general).

FIGURE 2. Analytic Framework of Imagery Effects (Paivio, 1985).

	Motivation	Cognitive
Specific	GOAL ORIENTED RESPONSES	SKILL
General	AROUSAL AND MASTERY	STRATEGIES

Different individuals also interpret the meaning of the image in a unique way (Murphy & Martin, 2002). Research of image content has been focused mostly on the comparison of positive and negative imagery. Only during the past decade researchers have begun to identify other various types of images used by athletes (Hall, et al., 1998). It has been found that imagery can affect performance-related cognitions and emotions (Murphy,

1990), moreover, imagery can be used to increase confidence (Moritz et al., 1996), and to decrease anxiety (Vadocz, Hall, & Moritz, 1997).

3.4 Using imagery in sport situation

Athletes use mental practise in training, immediately prior to and during competition, and when rehabilitating injury (Martin, Moritz, & Hall, 1999). The main purpose for using imagery in to use mental training are for skill acquisition, skill maintenance, developing athletic plans and strategies, arousal and anxiety regulation, stress management, confidence, injury rehabilitation, exercise behaviour, and concentration and attention. (Murphy & Martin, 2002).

Imagery is used more for its motivational function than its cognitive function (Salmon, 1994), but personal and sport related differences have a major influence to imagery use. In study by Abma, Fry, Li, and Relyea (2002) profile analysis revealed that high confident athletes used more imagery. Imagery has been reported to be used more in relation to competition than practise (Hall et al., 1990), especially before competition (Weinberg, Butt, Knight, Burke, & Jackson, 2003), and that elite-athletes use of imagery more often compared to non-elite athletes (Salmon, 1994). Moreover, Hall et al. (1998) suggested that the type of sport might have an effect when employing imagery. Martin et al. (1999) developed framework for athletes to use imagery. It consists of four key components: 1) situation, 2) function of imagery, 3) imagery ability, and 4) outcomes associated with imagery use. Figure 3 displays this applied model of imagery use in sport.

Sport situation	Imagery Type	Outcome
Training Competition Rehabilitation	Cognitive specific Cognitive general Motiovational general-mastery Motivational general-arousal Motivational specific	Improved learning and performance of skills and strategies Modification of cognitions Regulation of arousal and anxiety

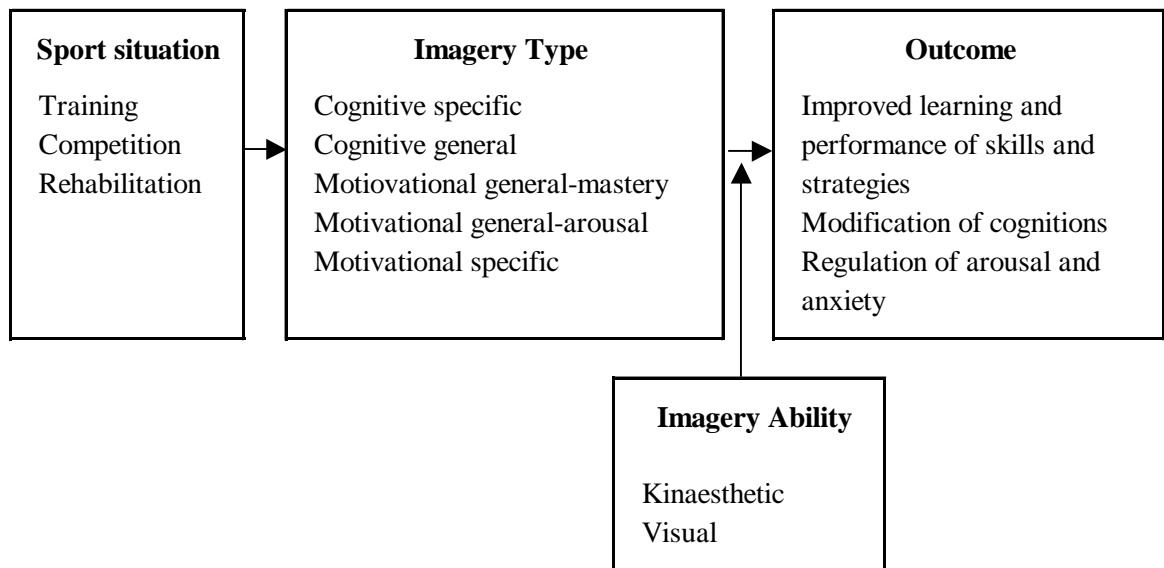**Imagery Ability**

Kinaesthetic
Visual

FIGURE 3. An applied model of imagery use in sport (Martin, Moritz, & Hall, 1999).

3.4 Other variables influencing the use of imagery

Type of motor activity appears to affect the way imagery is used. Patters of image use vary between athletes from different sports. The nature of sport defines the use of imagery in competition (for example Swimming vs. Hockey), and image content is usually related to the required performance. Sport type also affects the use of visual perspective, which can be either internal or external depending the sport. (Hall, 2001.) Recently, there has been an interest in examining whether participants from various activities possess varying levels of imagery abilities and the employ of imagery in different ways. There is some indication that certain sports may be differed from other sports in relation to imagery use in study by Hall et al. (1998), who hypothesised that team and individual sports may have distinct imagery characteristics. Munroe (2000) reported that examination between individual and team athletes showed no systematic differences in imagery use, but Weinberg et al. (2003) suggested that individual athletes use more motivation general arousal type of imagery compared to team athletes. No other support has been published to support these claims of systematic differences in imagery use or ability.

Level of skill was one of the early characteristics examined in sport imagery research. The use of imagery was thought to be most effective in the early stages of learning (lower skill

level), when cognitive processes play an important role (Wrisberg & Ragsdale, 1979). It has been suggested that imagery should be more effective in the performances of elite athletes, but findings from cognitive imagery research support the notion that athletes from all levels can benefit from using cognitive general imagery (Blair, Hall, & Leyshon, 1993). Hence, the effect of skill level needs to be examined more closely. At this stage the most consistent finding is that higher skill level results greater use of imagery (Hall, 2001).

There is little evidence that imagery is more effective for one gender or another. According to Munroe (1998), men and women do not differentiate in imagery use, even though some researchers have reported minor differences that are gender determinant. Weinberg et al. (2003) concluded that male athletes employed imagery more frequently and also viewed it to be more effective that female athletes, but this finding is not consistent with other studies that examined gender differences in imagery use (Salmon, 1994; Barr & Hall, 1992).

4   MEASUREMENT OF IMAGERY

4.1 Measuring imagery ability

Measurements of imagery ability in general psychology consist of following categories: self-report, projective, behavioural, and physiological measures (Tower, 1981). Unfortunately, none of these measures have achieved wide acceptance. In sport psychology most frequently used types are classified as either objective or subjective in their nature (Hall, 1998). Objective, meaning that individual is required to mentally perform spatial manipulations of stimulus objects, and then select an appropriate orientation from given alternatives (Hall et al., 1985). Subjective testing, questionnaires and self-report measures, are more commonly used techniques, which are based on individual's subjective experience. These test usually include 5- or 7-point differently formatted Likert scales. (Vealey & Walter, 1993.) Kats (1983) suggested that subjective procedures are more associated, and self-report material is more appropriate representation of phenomenon of imagery.

Problem with these kinds of tests might be the faking of responses and the influence of a social desirability factor (Richardson, 1994). Qualitative procedure, that approaches imagery using narrative techniques about subjective experience, can be seen as a third type of imagery measurement (Sheehan, 1983). Review of existing imagery ability measures can be found from appendix 4.

4.2 Measuring imagery use in sport domain

Betts (1909) was one of the first researchers that systematically examined imagery use in various situations. It has since come obvious that imagery is employed more with elite athletes (Hall, 2002). Orlick and Partington (1986) reported after extensive interviews "the extent to which the athletes could control their mental imagery and feel performance images from the inside, as if doing it, was directly related to performance outcomes". After these findings, imagery use by athletes has been examined through different types of

questionnaires, that are either general psychological measures of more specifically aimed to examine imagery use in sports.

Mahoney, Gabriel, and Perkins (1987) developed the Psychological Skills Inventory for Sports (PSIS), which is one of the most widely use general instruments in sports. The original PSIS was responded "true" or "false", but it has been modified (PSIS R-5) to 5-point Likert scale containing 45 items designed to measure anxiety control, confidence, motivation, team focus, and mental preparation. The alpha coefficient of these subscales varied between α=.53 and α=.59, but later on, the validity of this measure has been questioned by Chartrand, Jowdy, & Danish (1992), who recommended that PSIS R-5 optional research methods to study imagery.

Since then, a couple of tests have been developed to measure imagery use in sports. The Imagery Use Questionnaire (IUQ) was developed by Hall et al. (1990) to measure the use of imagery in numerous sports, and was also modified to rowing (Barr, & Hall, 1992) and to figure skating (Rodgers, Hall, & Buckolz, 1991) later on. A groundbreaking instrument, The Sport Imagery Questionnaire (SIQ), was developed by Hall, Mack, Paivio, and Hausenblas (1998) based on Imagery Use Questionnaire for Soccer Players (IUQ-SP) by Salmon, Hall, and Haslam (1994) and Paivio's (1985) framework. SIQ was developed to assess the motivational and cognitive functions of imagery functions, and it has proven to be appropriate tool for helping understand different types of imagery use (Hall et al., 1998).

5 AIMS OF THE STUDY

The aim of this study is to examine imagery ability and imagery use in athletes from individual and team sports and to determine if the groups differ in relation to these imagery attributes. Moreover, this study examined the effects of level of participation and time involvement in sport on mental imagery characteristics. The information of this study may help coaches and athletes to identify the mental preparation needs of specific sports and to present additional information about individual differences in sport imagery. This knowledge can be used in designing mental imagery rehearsal programs for the purpose of enhancing physical performance.

The aims of the program can be generally summarised as follows:

A) To compare differences in imagery ability and imagery use in athletes from individual and team sports

B) To examine whether level of sport participation, weekly time involvement in sport are variables that differentiate between athletes on the basis of their levels of imagery ability and imagery use.

The specific research questions of the program are:

1) What are the differences in imagery ability characteristics in athletes from individual and team sports?

2) What are the differences in imagery use characteristics in athletes from individual and team sports?

3) Does level of sport participation differentiate athletes in relation to imagery ability and imagery use?

4) Does weekly sport involvement time differentiate athletes in relation to imagery ability and imagery use?

6 METHODS

6.1 Participants

The participants (N=207) were recruited from high schools, sport clubs and university physical education courses in Finland and were involved with twenty-nine different sports (Table 1). The sample comprised 57 national level athletes and 150 regional level athletes whose average age was 20.2±4.7 years.

TABLE 1. Frequensies of the sports of participants (N=207)

Sport	Male	Female	N	% of Total
Basketball	3	10	13	6.3%
Gymnastics	13	1	14	6.8%
Floorball	2	13	15	7.2%
Swimming	7	9	16	7.7%
Track and field	9	12	21	10.1%
Skating	0	23	23	11.1%
Ice hockey	38	1	39	18.8%
Other[a]	36	30	66	31.9%
Total	108	99	207	100%

Note. Only sports that are represented by more than 10 participants are listed by name.

[a] Volleyball, Finnish baseball, Golf, Skiing, Soccer, Shooting skiing, Sport aerobics, Waterskiing, Skiingorienteering, Motocross, Downhill skiing, Am. football, Rinkball, Dancing, Wrestling, Table tennis, Martial arts, Orienteering, Tennis, Triathlon, Horse sport, Kayaking.

6.2 Measures

Personal details information sheet was administered in the beginning to gather detailed information about participant's gender, age, main sport interest, weekly training and playing time, and highest level of participation.

Sport Imagery Ability Measure (SIAM) developed by Watt and Morris (1997) is a task-oriented imagery ability measure where the participant decides on a sport specific version of each of four generic sport-related scenes and images each scene for 60 seconds. After imaging each scene, the participant responds to 12 items that assess five imagery dimensions (vividness, control, ease of generation, speed of generation, duration), involvement of six senses during imagery (visual, auditory, kinaesthetic, olfactory, gustatory, tactile), and the experience of emotion. Responses are made on 10-cm analogue scales. Each 10-cm line separates two opposing anchor statements for example, no feeling and very clear feeling (tactile). The test, thus, comprises 48 items. Twelve sub-scale scores are calculated by adding together the relevant dimension or sensory item scores for the four scenes (Appendix 1).

The internal consistency scores for each twelve subscales indicated adequate reliability with values ranging from $\alpha=.63$ (ease) to $\alpha=.80$ (olfactory). Test-retest reliability showed moderate correlations for all subscales, varying from $\alpha=.44$ (speed) to $\alpha=.83$ (gustatory). On the basis of the current findings and previous reliability and validity evidence, the SIAM is a suitable measure for use in both research and applied settings for the assessment of sport imagery ability (Watt & Morris, 1997; 1999a; 1999b; 2000; Elfving et al., 2000).

The Sport Imagery Questionnaire (SIQ) was developed by Hall, Mack, Paivio and Hausenblas (1998) to assess the motivational and cognitive functions of imagery. The items of the SIQ revealed five different factors, which corresponded well with the functions of imagery. (These are: 1) Cognitive specific (CS) imagery is that used to rehearse specific skills through imagery and it is generally accepted that CS imagery facilitates the learning and performance of motor skills. 2) Cognitive general (CG) function of imagery represents rehearsing entire game plans and strategies and previous research. (White & Hardy, 1998) indicated that CG imagery can facilitate athletic

performance. When athletes imagine specific goals such as being congratulated for a good performance, they are using 3) motivational specific (MS) imagery. Martin and Hall (1995) suggested that when enhancing motivation, goals and imagery might go hand in hand. 4) Motivational general-mastery (MG-M) imagery is associated with self-confidence, control, and successful management of challenging situations and it was reported (Callow, Hardy & Hall, in press) that an MG-M imagery intervention can improve sport confidence. 5) Motivational general-arousal (MG-A) imagery is related to arousal and competitive anxiety. MG-A is used by athletes to increase arousal levels and decrease competitive anxiety. (Hall, 2001).

The internal consistency estimates for each subscale are above alpha coefficient of $\alpha=.70$ and all items load on their appropriate factor above criterion level ($\alpha=.40$). The results of these experiments indicate that SIQ is an appropriate tool for helping understand different types of imagery use. (Hall, Mack, Paivio & Hausenblas, 1998).

6.3 Procedure

The SIAM and SIQ were translated into Finnish, and then back translated by an English-speaking person from Finland, who was not familiar with the measure. Participants were accessed through co-ordinations of the respective school, university or sport group. Standard consent procedures were followed. Parents gave signed consent for participants under 18 years old. Testing was undertaken in small groups at organizational settings, and was completed under standard conditions. The measures required approximately 35 minutes to complete.

6.4 Data Analysis

Data from both questionnaires will be grouped according to sport type, level of participation, and time of sporting involvement. Analysis involved the use of independent samples $\underline{t}$ – tests to compare means from individual and team sport groups. Differences in imagery ability and imagery use were examined in relation to sub-scale groupings of athletes according to level of participation, weekly time of sporting involvement.

7 RESULTS

7.1 Comparing team and individual sports

Participants were divided into two groups using sport type (team/individual) as differentiating factor (Appendix 3). This study found only one difference between team and individual groups concerning imagery ability. T-test comparison revealed a difference in kinaesthetic imagery ability, which was significantly ($t = -3.121$, $p = .002$) higher in individual athletes. These results demonstrate that individual and team athletes have distinct abilities and characteristics when it comes to sport-oriented imagery.

TABLE 1. Comparison of Imagery Ability of Athletes in Team and Individual Sports (n=207)

Subscale	Total (n=207)		Team Sports (n=84)		Individual Sports (n=123)		Difference Team and Individu	
	M	SD	M	SD	M	SD	t-value	p
Vividness	281.39	56.23	281.93	56.73	281.02	56.12	0.113	0.910
Control	276.78	62.22	274.38	62.36	278.42	62.34	-0.458	0.647
Ease	278.43	60.22	282.36	59.14	275.74	61.04	0.776	0.439
Speed	281.60	64.90	284.27	67.00	279.77	63.64	0.489	0.625
Duration	287.17	70.27	279.92	70.45	292.12	70.00	-1.229	0.221
Visual	295.69	55.12	298.27	56.03	293.93	54.64	0.556	0.579
Auditory	206.56	85.36	207.49	79.32	205.92	89.56	0.130	0.897
Kinaesthetic	240.06	77.89	220.04	77.57	253.74	75.40	-3.121	0.002*
Olfactory	100.65	75.13	110.29	80.90	94.07	70.51	1.530	0.128
Gustatory	91.69	73.68	94.01	71.54	90.10	75.36	0.375	0.708
Tactile	196.69	87.57	185.06	89.74	204.63	85.51	-1.585	0.114
Emotional	244.12	72.69	244.60	76.00	243.80	70.64	0.077	0.938

*p<.01

This study also examined differences in imagery use by comparing team and individual athletes. Results indicated significantly higher means in individual athletes when imagery was used for following variables: (MG) motivation general-arousal ($t = -2.188$, $p = .03$) and (MG-M) motivation general-mastery ($t = -3.213$, $p = .002$). These findings offer some

indication that individual and team sport athletes employ the motivational functions of imagery differently. Motivational general arousal may be an interactive oriented type of imagery, that is specifically needed in individual sports because there is no teammate to psyche you up (Table 2).

TABLE 2. Comparison of Imagery Use of Athletes in Team and Individual Sports.

Subscale	Total (n=207)		Team Sports (n=84)		Individual Sport (n=123)		Difference Team and Individual	
	M	SD	M	SD	M	SD	t-value	p
Motivation Specific	23.25	7.27	23.31	7.53	23.21	7.12	0.095	0.924
Motgeneral-Arousal	22.97	6.31	21.82	6.29	23.76	6.22	-2.188	0.030*
Motgeneral-Mastery	27.84	6.24	26.19	6.32	28.97	5.96	-3.213	0.002**
Cognitive Specific	25.54	5.71	24.74	5.74	26.08	5.65	-1.669	0.097
Cognitive General	29.63	5.97	29.11	5.75	29.99	6.11	-1.047	0.296

*p<.05   **p<.01

7.2 Effects of level of participation

The second part of this study examined the effects of level of participation in imagery ability and imagery use. The participants of study were divided into two groups depending of the level that athlete competed in his or her sport. First group comprised of national level athletes (n = 57) and the second group included regional level athletes (n = 150). When comparing these two groups, it was found that national level athletes had significantly ($t = 2.222$, $p = .027$) greater visual imagery ability than regional athletes. It appears that national level athletes are able to use their visual ability more efficiently (Table 3).

TABLE 3. Effects of Level of Participation to Imagery Ability (n=207)

Subscale	National Athletes (n=57)		Regional Athletes (n=150)		Difference	
	M	SD	M	SD	t-value	p
Vividness	291.72	58.50	277.47	55.04	-1.636	0.103
Control	281.37	63.05	275.04	62.03	-0.653	0.515
Ease	287.00	61.60	275.17	59.57	-1.265	0.207
Speed	293.89	68.68	276.93	63.01	-1.688	0.093
Duration	295.33	77.79	284.07	67.21	-1.031	0.304
Visual	309.37	57.00	290.49	53.67	-2.222	0.027*
Auditory	199.18	85.75	209.36	85.33	0.766	0.445
Kinaesthetic	242.74	82.43	239.05	76.35	-0.304	0.762
Olfactory	91.05	72.73	104.29	75.95	1.133	0.258
Gustatory	85.86	79.90	93.90	71.34	0.700	0.484
Tactile	199.53	99.96	195.61	82.72	-0.287	0.775
Emotional	246.60	74.17	243.18	72.34	-0.301	0.763

*p<.05

Results also showed greater use of motivation general-mastery (MG-M) by national level athletes, this difference was found to be significant (t = -2.164, p = .032). These findings suggest that ability to visual imagery and use of general motivational-mastery skills are important characteristics in differentiating national and regional athletes from each other (Table 4).

TABLE 4. Effects of Participation Level to Imagery Use (n=207)

Subscale	National Athletes (n=57)		Regional Athletes (n=150)		Difference National and Regional	
	M	SD	M	SD	t-value	p
Motivation Specific	23.96	7.99	22.98	6.99	-0.870	0.385
Motigeneral-Arousal	22.75	6.72	23.05	6.16	0.304	0.415
Motgeneral-Mastery	29.35	7.36	27.27	5.68	-2.164	0.032*
Cognitive Specific	25.19	6.71	25.67	5.30	0.532	0.595
Cognitive General	30.16	6.76	29.43	5.65	-0.720	0.437

*p<.05

7.3 Effects of weekly time of participation

The third part of this study examined the effect of differences in weekly time of participation in relation to imagery ability and imagery use. Athletes were divided into two groups. The first group, low weekly training group (LWT) consisted of those athletes that trained under ten hours per week (lower 33% of all participants). The second group, high weekly training group (HWT) consisted of those who trained fourteen hours or more per week (top 33% of all participants). Abma, Fry, Li, and Relyea (2002) examined differences in imagery content and imagery ability between high and low confident track and field athletes using a very similar procedure. This study did not find any significant differences in SIAM subscales between these two groups. The time of weekly participation seems not to be a differentiating factor in imagery ability (Table 5).

TABLE 5. Effect of time of weekly participation in sport (n=132)

Subscale	HWT (n=72)		LWT (n=60)		Difference level	
	M	SD	M	SD	t-value	p
Vividness	285.46	51.22	276.15	61.89	-0.946	0.35
Control	281.57	55.07	276.47	60.83	-0.505	0.61
Ease	279.33	57.74	279.02	62.86	-0.030	0.98
Speed	283.67	65.82	283.07	64.17	-0.053	0.96
Duration	287.10	65.48	283.60	76.19	-0.284	0.78
Visual	298.99	54.36	296.15	57.79	-0.290	0.77
Auditory	189.69	79.68	213.75	88.59	1.641	0.10
Kinaesthetic	238.69	79.10	239.77	79.72	0.077	0.94
Olfactory	87.69	74.11	113.33	83.66	1.866	0.06
Gustatory	90.40	76.06	85.58	73.87	-0.367	0.71
Tactile	197.82	95.76	213.10	78.75	0.988	0.32
Emotional	237.71	77.59	261.22	69.15	1.820	0.07

*p<.05

Comparison between groups showed that imagery use the motivational general-mastery was significantly (t = -2.236, p = 0.03) higher with HLT group (29.33±6.0) when compared LLT group (26.93±6.2). In sum, these results indicate that more you train the more motivational general-mastery imagery you may use (Table 6).

TABLE 6. Group comparison according time of weekly participation (n=132)

Subscale	HWT (n=72)		LWT (n=60)		Difference	
	M	SD	M	SD	t-value	p
Motivation Specific	23.99	7.77227	22.05	7.31477	-1.464	0.15
Motigeneral-Arousal	23.17	6.37336	22.68	6.82342	-0.420	0.68
Motgeneral-Mastery	29.33	6.05142	26.93	6.24599	-2.236	0.03*
Cognitive Specific	26.56	5.56116	25.18	5.65833	-1.400	0.16
Cognitive General	30.50	6.10472	29.20	6.46713	-1.186	0.24

*p<.05

8 DISCUSSION

The purpose of this study was to collect information about imagery ability and imagery use of athletes from various sports in Finland. More specifically, the aim was to compare athletes from individual and team sports and to determine if the groups differed in relation to these imagery attributes. Secondly, this study examined the effects of level of participation and time involvement in sport on mental imagery characteristics. The information this study will provide may help coaches and athletes to identify the mental preparation needs of specific sports and to present additional information about individual differences in sport imagery. This knowledge can be used in designing mental imagery training programs for the purpose of enhancing physical performance.

8.1 Type of activity

Kinaesthetic imagery ability was found to be higher for individual athletes. This may be the result of the nature of individual sports, where the performance is known in advance and the athlete can anticipate and rehearse this required movement pattern in a specific way. Also, individual sports often involve more movement around the vertical and horizontal axis and the need of kinaesthetic ability is higher in the actual performance. In fact, in this study over 30% of the participants in individual sports were from gymnastics and ice-skating, which require large amounts of vertical and horizontal movements. Many team athlete's sport performances are a series of continuously changing situations in which body movement can be predicted only partially (Griffin, Mittchell, & Oslin, 1997). Due to this feature when team athletes image specific sports performances, it seems that kinaesthetic imagery ability has a less important role compared to individual athletes.

Characteristics associated with the SIQ discriminating the two groups related to the motivational area of imagery use. Individual athletes may need to use imagery more for the purpose of independent motivation because they are often performing without the support of teammates in the completion of the training or competition elements of their sport. Athletes from team sports may not require the use of imagery for motivational purposes as the individuals they participate with provide a level of non-imagery

motivational support. Recent research by Weinberg et al. (2003) also reported a greater motivational function of imagery for individual athletes when compared with team athletes. Overall, these initial results support the proposition by Hall et al. (1998) that individual and team athletes have distinct abilities and characteristics when it comes to sport-oriented imagery.

8.2 Level of participation

The national level athletes were found to have greater visual imagery ability compared to regional level athletes. The explanation for this might be the greater amount of visual imagery training by national level athletes. Even though imagery is considered to an ability, research indicates (Goss, Hall, Buckolz, & Fishburne, 1986; Rodgers et al., 1991) that imagery is a skill as well an ability, and knowing that elite athletes have reported using imagery more often than non-elite athletes (Salmon, 1994), it is not surprising that elite/national level athletes possess higher visual imagery skills. Visual imagery has also been proposed as the key generational component in the imagery process (Vealey & Walter 1993).

Results also showed greater use of motivation general-mastery (MG-M) by national level athletes. These results support the findings of Hall et al. (1998) who suggested that the difference exists because national level athletes are usually more concerned with winning and the use of motivational imagery represents an appropriate and important strategy. In competition, athletes often need to reach the next level of performance, and they need to continually reinforce to themselves that they can do it. Thus, these situations call for self-motivation by using general-mastery imagery.

8.3 Time of weekly participation

This study did not find any significant differences in SIAM subscales between high and low weekly training groups, alternatively, SIQ's motivational general-mastery subscale turned out to be significantly higher with high training group who trained fourteen hours or more in week.

8.4 Towards understanding imagery rehearsal

Although the data of this is study was comprised athletes from various sports, the range of events was somewaht limited. In fact, from the twenty-seven different sports represented only seven major sports that had more than ten athletes. These sports included three team sports and four individual sports comprising some 70% of the data.

The personal details sheet gathered information about age, gender, level of participation and the athletes main sport. There are several problems with this sheet that might have had an effect on the results, and should have been considered before administering the questionnaires. We do know "the highest level of participation", but do not know specially "when" or "how long". Considering that the age of the athletes ranged from 12 to 44 years of age (M =20.2, SD =4.7), there is some uncertainty, that when somebody reported that his or her highest level of participation is national level, it could have happened several years ago, and therefore he or she may not be considered as a national level athlete anymore. Moreover, there is no knowledge whether these athletes have had some any training with imagery skills from their sport club, school or some other institution.

Overall, this study highlighted knowledge concerning the importance of recognising differences in imagery abilities and skills between athletes from various sports. There is a clear need to take individual differences into account when designing imagery training programs and future research should target to these factors

REFERENCES

Abma, C. L., Fry, M. D., Li, Y., & Relyea, G. (2002). Differences in imagery content and imagery ability between high and low confident track and field athletes. *Journal of Applied Sport Psycholgy, 14 (2),* 65-75.

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice Hall.

Barr, K., & Hall, C. (1992). The Use of Imagery by Rowers. *International Journal of Sport Psychology, 23,* 243-261.

Blair, A., Hall, C. R., & Leyshon, G. (1993). Imagery effects on the performance of skilled and novice soccer players. *Journal of Sports Sciences, 11,* 95-101.

Chartrand, J. M., Jowdy, D. P., & Danish, S. J. (1992). The Psychological Skills Inventory for Sports: Psychometric characteristics and applied implications. *Journal of Sport and Exercise Psychology, 14,* 405-413.

Defrancesco, C., & Burke, K.L. (1997). Performance Enhancement Strategies Used in a Professonal Tennis Tournament. *International Journal of Sport Psychology, 28,* 185-195.

Denis, M. (1985). Imagery and the use of mental practice in the development of motor skills. *Canadian Journal of Applied Sport Sciences, 10,* 4S-16S.

Elfving, T., Riches, D., Lintunen, T., Watt, A. & Morris, T. (2000). Reliability, Factor structure, and Criterion Validity of the Sport Imagery Ability Measure (SIAM) in Athletes from Finland.

Epstein, M.L. (1980). The relationships of mental imagery and mental practice to performance of a motor task. Journal of Sport Psychology, 2, 211-220.

Ernest, C. H. (1977). Imagery ability and cognition: A critical review. Journal of Mental Imagery, 2, 181-216.

Gammage, K.L., Hall, C.R., & Rodgers, W.M. (2000). More About Exercise Imagery. *The Sport Psychologist 14,* 546-559.

Goss, S., Hall, C., Buckolz, E., & Fishburne, G. (1986). Imagery ability and the aquisition and retention of movements. *Memory and Cognition, 14,* 469-477.

Hall, C. R., Pongrac, C., & Buckolz, E. (1985). The measurement of imagery ability. *Human Movement Science, 4,* 107-118.

Hall, C. R., Rodgers, W. M., & Barr, K. A. (1990). The use of imagery by athletes in selected sports. *The Sport Psychologist, 4,* 1-10.

Hall, C.R., Mack, D.E., Paivio, A., & Hausenblas, H.A. (1998). Imagery use by Athletes: Development of the Sport Imagery Questionnaire. *International Journal of Sport Psychology 29(1),* 73-89.

Hall, C.R. (2001). Imagery in Sport and Exercise. In Singer, R., Hausenblas, H., & Janelle, C. (Ed.), Handbook of Sport Psychology: second edition (pp 529-549). New York: John Wiley & Sons, Inc.

Harris, D. V., & Robinson, W. J. (1986). The effets of skill level on EMG activity during internal and external activity. *Journal of Sport Psychology, 8,* 105-111.

Hecker, J. E., & Kaczor, L. M. (1988). Application of Imagery theory to sport pspychology: Some preliminary findings. *Journal of Sport Psychology, 10,* 363-373.

Janssen, J. J., & Sheikh, A. A. (1994). Enhancing athletic performance through imagery: An overview. In A. A. Sheikh & E. R. Korn (Eds.), Imagery in Sports and Physical Performance (pp. 1-22), Amityville, NY: Baywood Publishing.

Jowdy, D. P., & Harris, D. V. (1990). Muscular responses during mental imagery as a function of motor skill level. Journal of Sport and Exercise Psychology, 12, 191-201.

Katz (1983). Assessing self maintenance: Activities of daily living, mobility and instrumental activities of daily living.

Kenitzer, R.F, & Briddel, W.B. (1991). Effect of Mental Imagery Strategies on Swimming Performance. Applied Research in Coaching and Athletics Annual. 259-273.

Lang, P. J. (1970). Imagery in Therapy: An Information-processing Analysis of Fear. *Behaviour Therapy, 8,* 862-886.

Lang, P.J. (1979). A Bio-informational Theory of Emotional Imagery. *Psychophysiology, 16,* 495-512.

Martin, K., Moritz, S., & Hall, C. (1999). Imagery use in sport: A literature review and applied model. *The Sport Psychologist, 13,* 245-268.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. *The Sport Psychologist, 1,* 181-199

Moran, A. (1993). Conceptual and methodological issues in the measurement of mental imagery skills in athletes. *Journal of Sport Behavior, 16,* 156-170.

Moritz, S. E., Hall, C. R., Martin, K. A., & Vadocz, E. (1996). What Are Confident Athletes Imaging? An Examination of Image Content. Human Kinetics, Inc.

Munzert, J., & Hackfort, D. (1999). Individual preconditions for mental training. *International Journal of Sport Psychology, 30 (1),* 41-62.

Munroe, K. (2000). Imagery Use by Athletes: Confirmation and Elaboration. *The Sciences and Engineering, 60,* 8-10.

Murphy, S. M., & Jowdy, D. P. (1992). Imagery and mental practice. In T. S. Horn (Ed.), Advances in sport psychology (pp 221-250). New York: Plenum Press.

Murphy, S. M. (1994). Imagery interventions in sport. *Medicine and Science in Sports and Exercise, 26,* 486-494.

Orlick, T. (1990). In Pursuit of Exellence (2nd ed.). Champaign, IL: Human Kinetics.

Richardson, A. (1969). Mental imagery. New York. Springer.

Richardson, A. (1977). The meaning and measurement of memory imagery. British *Journal of Psychology, 68,* 28-43.

Richardson, A. (1994). Individual differences in imaging: their measurement, origins and consequences. Amityville, NY: Baywood Publishing .

Rodgers, W. M., Hall, C. R., & Buckolz, E. (1991). The effect of an imagery training program on imagery ability, imagery use, and figure skationg performance. *Journal of Applied Sport Psychology, 3,* 109-125.

Ryan, E.D., & Simons (1982). Efficacy of mental imagery in enhancing mental practice of motor skills. *Journal of Sport Psychology, 4,* 41-51.

Sackett, R. S. (1934). The influences of symbolic rehearsal upon the retention of maze habit. *Journal of General Psychology, 13,* 113-128.

Sheehan, P. W., Ashton, R., & White, K. (1983). Assessment of mental imagery. In A. A. Sheikh (Ed.), Imagery: Current theory, research, and application (pp 189-221). New York: Wiley.

Slee, J. A. (1988). Vividness as a descriptor and index of imagery. *Journal of Mental Imagery, 12,* 123-132.

Smith, D., Holmes, P., Whitemore, L., Collins, D., & Devonport, T. (2001). The Effect of Theoretically-based Imagery Scripts on Field Hockey Performance. *Journal of Sport Behavior, 24(4),* 408-416.

Suinn, R. M. (1976). Visual motor behavior rehearsal for adaptive behavior. In J. Krumboltz & C. Thoresen (Eds.), Counselling methods. New York: Holt.

Suinn, R. M. (1983). Imagery and sports. In A. A. Sheikh (Ed.), Imagery: Current theory, research, and application (pp. 507-534). New York: Wiley.

Suinn, R. M. (1984)., Imagery and Sports. In W. F. Straub & J. M. Williams (Eds.), Cognitive sport psychology (pp. 253-272). Lansing, NY: Sport Science Associates.

Suinn, R. M. (1993). Imagery. In R. N. Singer, M. Murphey, & L. K. Tennant (Eds.), Handbook of research on sport psychology. (pp. 492-510). New York: Macmillan.

Suinn, R. M. (1997). Mental practice in sport psychology: where have we been, where do we go? *American Psychological Association, 12,* 189-207.

Switras, J. (1978). An alternate-form instrument to assess vividness and controllability of mental imagery in seven modalities. *Perceptual and Motor Skills, 46,* 379-384.

Tower, R. B. (1981). Imagery measurement in clinical settings: Matching the method to the question. In E. Klinger (Ed.), Imagery, volume 2: Concepts, results, and applications (pp. 79-92). New York: Plenum Press.

Vadocz, E. A., Hall, C. R., & Moritz, S. E. (1997). The relatioship between competitive anxiety and imagery use. *Journal of Applied Sport Psychology, 9 (2),* 241-253.

Vealey, R. S. & Walter, S. M., (1993). Imagery training for performance enhancement and personal development. In J. M. Williams (Ed.), Applied sport psychology: Personal growth to peak performance. (pp. 200-224). Mountain View, CA: Mayfield.

Watt, A. P. & Morris, T. (1997). The Sport Imagery Ability Measure. Unpublished manuscript, Victoria University of Technology.

Watt, A. P., Morris, T., & Andersen, M. B. (1998). Issues in the Development of a Measure of Imagery Ability in Sport. Victoria University of Technology, Australia. (unpublished manuscript).

Watt, A.P., & Morris, T. (1999). Reliability, Factor Structure and Criterion Validity of the Sport Imagery Ability Measure (SIAM). Proceedings of the 3rd International Congress of the Asian South Pacific Association of Sport Psychology (pp. 330-332). Wuhan, China: ASPASP.

Watt, A. P., & Morris, T. (1999b). Convergent and Disciminant Validity of the Sport Imagery Ability Measure (SIAM). Paper presented at the 5th International Olympic Committee World Congress on Sport Sciences, Sydney, Australia, November.

Watt, A.P., & Morris, T. (2000). Criterion Validity of the Sport Imagery Ability Measure. Poster presented at the 2000 Pre-Olympic Congress, Brisbane, Australia, September.

Weinberg, R.S., & Gould, D. (1995). Foundations of Sport and Execise Psychology. Human Kinetics: Champaign, IL.

Weinberg, R., Butt, Joanne., Knight, B., Burke, K., & Jackson, A. (2003). The Relationship Between the Use and Effectiveness of Imagery: An Exoloratory Investiogation. *Journal of Applied Sport Psychology, 15,* 26-40.

White, K., Sheehan, P. W., & Ashton, R. (1977). Imagery assessment: A survey of self-report measures. *Journal of Mental Imagery, 1,* 145-17.

White, A., & Hardy, L. (1995). Use of different imagery perspectives on the learning aand performance of different motor skills. *British Journal of Psychology, 86,* 169-180.

Wrisberg, C. A., & Ragsdale, M. R. (1979). Cognitive demand and practise level: Factors in the mental rehearsal of motor skills. *Journal of Human Movement Studies, 5,* 201-208.

APPENDIX 1. The Sport Imagery Ability Measure (Watt, & Morris, 2001).

Code:_____

Date:_____

Sport Imagery Ability Measure

Age:_____

Gender:_____

Highest Level of Sports Participation: (Tick appropriate box).

Local/school ☐

District ☐

State ☐

National ☐

Main Sport Interest:_____

Second Sport Interest:_____

Introduction

This questionnaire involves creating images of four situations in sport. After you image each scene, you will rate the imagery on twelve scales. For each rating, <u>place a cross on the line</u> at the point you feel best represents the image you produced. The left end of the line represents no image or sensation or feeling at all and the right end represents a very clear or strong image or feeling or sensation.
Ensure the *intersection* of the cross is on the line as shown in the examples below.

Correct   ├——————————X——————————┤

Incorrect   ├—————X——————————X—————┤
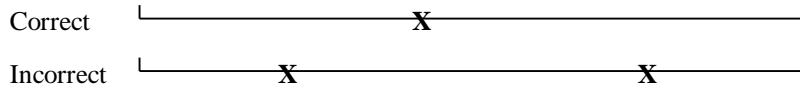
An **example** of the style of scene to be created is as follows:

You are at a carnival, holding a bright yellow, brand new tennis ball in your right hand. You are about to throw it at a pyramid of six blue and red painted cans. A hit will send the cans flying and win you a prize. You grip the ball with both hands to help release the tension, raise the ball to your lips and kiss it for luck, noticing its soft new wool texture and rubber smell. You loosen your throwing arm with a shake and, with one more look at the cans, you throw the ball. Down they all go with a loud "crash" and you feel great.

Below are some possible ratings and what they represent to give you the idea.
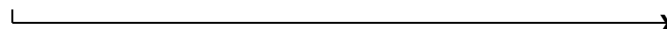
1. How **clear** was the Image?

no image   ├————————X—————————————┤   perfectly clear image
   This example shows an image was experienced but it was quite unclear

6. How well did you **feel the muscular movements** within the image?

no feeling   ├——————————————————X————┤   very strong feeling
   This example indicates very strong imagery of the feel of muscular movements

7. How well did you **hear** the image?

no hearing   ├———————————————————————X┤   very clear hearing
   This example reflects the strongest possible image, like hearign real sound

12. How strong was your **experience of the emotions** generated by the image?

no emotion   ├———————————————X————————┤   very strong emotion
   This example reflects a degree of emotion which is moderate

Do you have any questions regarding the imagery activity or the way you should respond using the rating scales? Please feel free to ask now.

<u>DO NOT TURN THE PAGE</u> UNTIL YOU ARE ASKED TO DO SO.

Please attempt the following practice question. Listen carefully to all the instructions. Note that this question does not count. It is here to help you get used to imaging and rating your experience
Fitness Activity

Imagine yourself doing an activity to improve your fitness for your sport. Get a clear picture of what you are doing, where you are, and who you are with. Take notice of what you can see around you, the sounds you hear, and the feel of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60 seconds to create and experience your image of the scene. When the 60 seconds is up, complete **all** 12 scales below. Don't spend too much time on each; your first reaction is best. Remember to place a cross with its <u>**intersection**</u> on the line.

1. How well did you get the sensation of **taste** within the image?

    no taste └───┘ very clear taste

2. How **long** was the image held?

    short time └───┘ whole time

3. How well did you **feel the texture** of objects within the image?

    no feeling └───┘ very clear feeling

4. How **clear** was the Image?

    no image └───┘ perfectly clear image

5. How well did you **hear** the image?

    no hearing └───┘ very clear hearing

6. How **easily** was an image created?

    difficult └───┘ very easy

7. How well did you **see** the image?

    no seeing └───┘ very clear seeing

8. How **quickly** was an image created?

    slow └───┘ very fast

9. How strong was your **experience of the emotions** generated by the image?

    no emotion └───┘ very strong emotion

10. How well did you **feel the muscular movements** within the image?

    no feeling └───┘ very strong feeling

11. How well could you **control** the image?

    unable └───┘ completely

12. How well did you get the sensation of **smell** within the image?

    no smell └───┘ very clear smell

Check that you have placed a cross on all 12 lines.
<u>**DO NOT TURN OVER**</u> **UNTIL YOU ARE ASKED TO DO SO.**

Your "Home" Venue

Imagine that you have just got changed and made your final preparations for a competition at your "home" venue, where you usually practice and compete. You move out into the playing area and loosen up while you look around and tune in to the familiar place. Take notice of what you can see around you, the sounds you hear, and the feel of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60 seconds to create and experience your image of the scene. When the 60 seconds is up, complete **all** 12 scales below. Don't spend too much time on each; your first reaction is best. Remember to place a cross with its <u>**intersection**</u> on the line.

1. How well did you **feel the texture** of objects within the image?

  no feeling └───────────────────────────────────┘ very clear feeling

2. How **clear** was the Image?

  no image └───────────────────────────────────┘ perfectly clear image

3. How well did you get the sensation of **taste** within the image?

  no taste └───────────────────────────────────┘ very clear taste

4. How **long** was the image held?

  short time └───────────────────────────────────┘ whole time

5. How well did you **hear** the image?

  no hearing └───────────────────────────────────┘ very clear hearing

6. How **easily** was an image created?

  difficult └───────────────────────────────────┘ very easy

7. How strong was your **experience of the emotions** generated by the image?

  no emotion └───────────────────────────────────┘ very strong emotion

8. How well did you **see** the image?

  no seeing └───────────────────────────────────┘ very clear seeing

9. How well did you **feel the muscular movements** within the image?

  no feeling └───────────────────────────────────┘ very strong feeling

10. How well could you **control** the image?

  unable └───────────────────────────────────┘ completely

11. How well did you get the sensation of **smell** within the image?

  no smell └───────────────────────────────────┘ very clear smell

12. How **quickly** was an image created?

  slow └───────────────────────────────────┘ very fast

Check that you have placed a cross on all 12 lines.
<u>**DO NOT TURN OVER**</u> **UNTIL YOU ARE ASKED TO DO SO.**

Successful Competition

Imagine you are competing in a specific event or match for your sport. Imagine that you are at the very end of the competition and the result is going to be close. You pull out a sensational move, shot, or effort to win the competition. Take notice of what you can see around you, the sounds you hear, and the feel of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60 seconds to create and experience your image of the scene. When the 60 seconds is up, complete **all** 12 scales below. Don't spend too much time on each; your first reaction is best. Remember to place a cross with its **i<u>ntersection</u>** on the line.

1. How well did you **see** the image?

no seeing └────────────────────────────────┘ very clear seeing

2. How **quickly** was an image created?

slow └────────────────────────────────┘ very fast

3. How strong was your **experience of the emotions** generated by the image?

no emotion └────────────────────────────────┘ very strong emotion

4. How **clear** was the Image?

no image └────────────────────────────────┘ perfectly clear image

5. How well did you get the sensation of **taste** within the image?

no taste └────────────────────────────────┘ very clear taste

6. How well could you **control** the image?

unable └────────────────────────────────┘ completely

7. How well did you get the sensation of **smell** within the image?

no smell └────────────────────────────────┘ very clear smell

8. How **easily** was an image created?

difficult └────────────────────────────────┘ very easy

9. How well did you **feel the texture** of objects within the image?

no feeling └────────────────────────────────┘ very clear feeling

10. How **long** was the image held?

short time └────────────────────────────────┘ whole time

11. How well did you **feel** the muscular movements within the image?

no feeling └────────────────────────────────┘ very strong feeling

12. How well did you **hear** the image?

no hearing └────────────────────────────────┘ very clear hearing

Check that you have placed a cross on all 12 lines.
<u>DO NOT TURN OVER</u> UNTIL YOU ARE ASKED TO DO SO.

A Slow Start

Imagine that the competition has been under way for a few minutes. You are having difficulty concentrating and have made some errors. You want to get back on track before it shows on the scoreboard. During a break in play, you take several deep breaths and really focus on a spot just in front of you. Now you switch back to the game much more alert and tuned in. Take notice of what you can see around you, the sounds you hear, and the feel of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60 seconds to create and experience your image of the scene. When the 60 seconds is up, complete **all** 12 scales below. Don't spend too much time on each; your first reaction is best. Remember to place a cross with its __intersection__ on the line.

1. How strong was your **experience of the emotions** generated by the image?

   no emotion └──────────────────────────────┘ very strong emotion

2. How **easily** was an image created?

   difficult └──────────────────────────────┘ very easy

3. How well did you **feel the texture** of objects within the image?

   no feeling └──────────────────────────────┘ very clear feeling

4. How well could you **control** the image?

   unable └──────────────────────────────┘ completely

5. How well did you get the sensation of **smell** within the image?

   no smell └──────────────────────────────┘ very clear smell

6. How **clear** was the Image?

   no image └──────────────────────────────┘ perfectly clear image

7. How well did you **hear** the image?

   no hearing └──────────────────────────────┘ very clear hearing

8. How **quickly** was an image created?

   slow └──────────────────────────────┘ very fast

9. How well did you get the sensation of **taste** within the image?

   no taste └──────────────────────────────┘ very clear taste

10. How **long** was the image held?

   short time └──────────────────────────────┘ whole time

11. How well did you **see** the image?

   no seeing └──────────────────────────────┘ very clear seeing

12. How well did you **feel** the muscular movements within the image?

   no feeling └──────────────────────────────┘ very strong feeling

Check that you have placed a cross on all 12 lines.
DO NOT TURN OVER UNTIL YOU ARE ASKED TO DO SO.

Training Session

Think of a drill you do in training that is really tough. Now imagine yourself doing the drill. As you get a picture of yourself performing the skill in practice, try to complete an entire routine or drill. Take notice of what you can see around you, the sounds you hear, and the feel of any muscles moving. Do you get the sensation of any smells or tastes? Can you feel the equipment and surfaces you are using? Do you get an emotional feeling from this activity? Now you have 60 seconds to create and experience your image of the scene. When the 60 seconds is up, complete **all** 12 scales below. Don't spend too much time on each; your first reaction is best. Remember to place a cross with its i**ntersection** on the line.

1. How well did you **feel** the muscular movements within the image?

no feeling   ⌐_____⌐   very strong feeling

2. How well could you **control** the image?

unable   ⌐_____⌐   completely

3. How well did you **hear** the image?

no hearing   ⌐_____⌐   very clear hearing

4. How **long** was the image held?

short time   ⌐_____⌐   whole time

5. How well did you get the sensation of **taste** within the image?

no taste   ⌐_____⌐   very clear taste

6 How well did you **see** the image?

no seeing   ⌐_____⌐   very clear seeing

7. How **easily** was an image created?

difficult   ⌐_____⌐   very easy

8. How strong was your **experience of the emotions** generated by the image?

no emotion   ⌐_____⌐   very strong emotion

9. How **quickly** was an image created?

slow   ⌐_____⌐   very fast

10. How well did you get the sensation of **smell** within the image?

no smell   ⌐_____⌐   very clear smell

11. How **clear** was the Image?

no image   ⌐_____⌐   perfectly clear image

12. How well did you **feel the texture** of objects within the image?

no feeling   ⌐_____⌐   very clear feeling

Check that you have placed a cross on all 12 lines.
DO NOT TURN OVER UNTIL YOU ARE ASKED TO DO SO.

APPENDIX 2. The Sport Imagery Questionnaire (Hall, Mack, Paivio, & Hauseblas, 1998).

Sport Imagery Questionnaire

Please fill in the blank or circle the appropriate answer:

Sport:_____   Sex: M   F

Level of Competition: Local/School,   District,   State,   National

Athletes use mental imagery extensively in their training and in conjunction with competition. Imagery serves two functions. The motivational function of imagery can represent emotion-arousing situations as well as specific goals and goal oriented behaviours. The cognitive function entails the mental rehearsal of skills and strategies of play. A strategy is a plan or method of achieving some goal. In sport, this is often referred to as a game plan. For example, playing a pressure game to create turn overs is a possible strategy to use in basketball, and this could be done executing various skills and tactics (i.e., the skills put together in a sequence) such as presses and man on man defences. Another example of a strategy would be playing a baseline game in tennis; how this is actually accomplished (i.e., the skills performed) would vary considerably over the course of the game. This questionnaire was designed to assess the extent to which you incorporate imagery into your sport. Any statement depicting a function of imagery you rarely use should be given a low rating. In contrast, any statement describing a function of imagery which you use frequently should be given a high rating. Your ratings will be made on a seven point scale, where one is the rarely or never engage that kind of imagery end of the scale and seven is the often engage that kind of imagery scale. Read each statement below and fill in the blank the appropriate number from the scale provided to indicate the degree to which the statement applies to you when you are practising or competing in your sport. Don't be concerned about using the same numbers repeatedly if you feel they represent your true feelings. Remember, there are no right or wrong answers, so please answer as accurately as possible.

Rarely			Often
1	2	3	4

1. I make up new strategies in my head   _____
2. I image the atmosphere of winning a championship (e.g., the excitement that follows winning a championship _____
3. I image giving 100% during an event/game _____
4. I can re-create in my head the emotions I feel before I compete _____
5. I image alternative strategies in case my event/game plan fails _____
6. I image myself handling the stress and excitement of competitions and remaining calm _____

7. I image other athletes congratulating me on a good performance _____

8. I can consistently control the image of physical skill _____

9. I image each section of an event/game (e.g., offense vs. defence, fast vs. slow) _____

10. I image the atmosphere of receiving a medal (e.g., the pride, the excitement, etc.) _____

11. I easily change an image of skill _____

12. I image the audience applauding my performance _____

13. When imaging a particular skill, I consistently perform it perfectly in my mind _____

14. I image myself winning a medal _____

15. I image the stress and anxiety associated with competing _____

16. I image myself continuing with my game/event plan, even when performing poorly _____

17. When I image a competition, I feel myself getting emotionally excited _____

18. I can mentally make corrections to physical skills _____

19. I image executing entire plays/programs/sections just the way I want them to happen in an event/game _____

20. Before attempting a particular skill, I imagine myself performing it perfectly _____

21. I imagine myself being mentally tough _____

22. When I image an event/game that I am to participate in, I feel anxious _____

23. I imagine myself appearing self-confident in front of my opponents _____

24. I imagine the excitement associated with competing _____

25. I image myself being interviewed as a champion _____

26. I image myself to be focused during a challenging situation _____

27. When learning a new skill, I imagine myself performing it perfectly _____

28. I imagine myself being in control of difficult situations _____

29. I imagine myself successfully following my game/event plan _____

30. I image myself working successfully through tough situations (e.g., a power play, sore ankle, etc.) _____

APPENDIX 3. Team and individual sports of the study.

Team	Individual
Am. football	Dancing
Basketball	Downhill skiing
Finnish baseball	Golf
Floorball	Gymnastics
Ice hockey	Horse sport
Rinkball	Kayaking
Soccer	Martial arts
Volleyball	Motocross
	Orienteering
	Shooting skiing
	Skating
	Skiing
	Skiing-orienteering
	Sport aerobics
	Swimming
	Table tennis
	Tennis
	Track and field
	Triathlon
	Waterskiing
	Wrestling

APPENDIX 4. Review of Sport Imagery Measures   (Watt, 2001).

Scale	Modalities	Dimensions	Items	Reliability	Validity
Questionnaire upon Mental Imagery Betts (1909)	Visual, auditory, cutaneous, kinaesthetic, gustatory, olfactory, organic	Vividness	150 Likert	Subscale correlations from 0.4 to 0.78	Expected single general factor
Shortened Questionnaire upon Mental Imagery Sheehan (1978)	Visual, auditory, cutaneous, kinaesthetic, gustatory, olfactory, organic	Vividness	35 Likert	Int. consistency 0.95 Test-retest 0.78	Homogenous factorial structure
Survey of Mental Imagery Switras (1978)	Visual, auditory, olfactory, gustatory, tactile, somathetic, kinaesthetic	Vividness, controllability	86	Int. consistency 0.68-0.95	Seven factor structure
Vividness of Visual Imagery Questionnaire Marks (1986)	Visual	Vividness	16 Likert	Int. consistency 0.83-.95 Test-retest 0.87	Single dimension factor structure
Vividness of Movement Imagery Questionnaire Russel (1986)	Visual, kinaesthetic	Vividness	24 Likert	Int. consistency 0.96 Test-retest 0.76	Convergent
Movement Imagery Questionnaire Hall & Pongrac (1983)	Visual, kinaesthetic	Vividness, ease of imagining	18 Likert	Int. consistency 0.87 Test-retest 0.83	Sport psychology
Gordon test of Visual Imagery Control Gordon (1949)	Visual	Controllability	12 Yes, no, unsure	Split-half 0.76 Test-retest 0.84	Convergent

Scale	Modalities	Dimensions	Items	Reliability	Validity
Individual Differences Questionnaire Paivio (1971)	Visual	Vividness, preference	86 True or false	Int. consistency 0.8 imagery and 0.83 verbal	Factor structure supports subscales
Group Mental Rotations Test Vandenberg & Kuse (1978)	Visual	Controllability	20-Choice of pictorial alternatives	Test-retest 0.7 to 0.83 Kuder-R 0.88	Convergent
Sport Imagery Questionnaire Vealey & Walter (1993)	Visual, auditory, kinaesthetic, emotional	Vividness, perspective, controllability	20 Likert, 4 yes or no	None reported	None reported

APPENDIX 5. Gender related differences in imagery ability and imagery use.

Imagery ability	Male (N=108)		Female (N=99)		
	Mean	SD	Mean	SD	p- value
VIVIDNESS	279.14	58.90	283.85	53.37	0.55
CONTENT	273.10	61.43	280.80	63.15	0.38
EASE	277.84	63.47	279.06	56.78	0.88
SPEED	280.26	65.01	283.06	65.09	0.76
DURATION	282.33	68.94	292.44	71.67	0.30
VISUAL	293.16	58.63	298.45	51.16	0.49
AUDITIVE	194.08	78.00	220.16	91.18	0.03
KINASTHETIC	228.94	76.28	252.19	78.19	0.03
OLFACTORY	105.87	74.88	94.95	75.38	0.30
GUSTATORY	96.59	68.69	86.33	78.77	0.32
TACTILE	190.56	90.76	203.38	83.89	0.29
EMOTIONAL	230.79	73.08	258.67	69.75	0.01
Imagery use	Mean	SD	Mean	SD	p- value
MS	23.88	7.42	22.57	7.08	0.19
MG-A	22.47	5.57	23.52	7.01	0.24
MG-M	28.22	6.30	27.42	6.18	0.36
CS	25.44	5.44	25.64	6.02	0.81
CG	30.45	5.63	28.74	6.22	0.04