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IMAGERY AND SPORT PERFORMANCE

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PREFACE

The current research programme has examined different aspects of imagery and sport performance using a variety of different research methodologies. A 'research training' approach was adopted during the period of study, whereby the research period was viewed as an opportunity to gain experience of carrying out research using both quantitative and qualitative methodologies. This approach also seemed appropriate for the study of imagery, due to its individual nature, and due to recent calls for more imagery research using qualitative and single-subjects designs (c.f. Hollman, 1986; Callery and Morris, 1993). The presentation of this thesis, which is written as a collection of research papers, each of which could be published independently, reflects the research training emphasis that was placed on the research. Indeed, one paper has already been published (see Chapter 2) and one paper has been submitted for publication (Chapter 6). Each of the experimental chapters (Chapters 2-6) contains a brief review of the directly relevant literature. Chapter 1 presents a general introduction to this programme of imagery research, and Chapter 7 presents a summary of all of the results of the experimental studies and general conclusions.

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SUMMARY

This research has investigated the effects of different types of imagery on motor skill learning and sport performance, using quantitative and qualitative methodologies. The first section of this thesis examined the effects of different visual imagery perspectives on the learning and performance of a slalom-type task and a gymnastic-type task. The use of an external visual perspective was found to enhance the speed of completion of the slalom-type task, and also enhance the recall of the gymnastic-type task. In contrast, internal visual imagery enhanced the accuracy of performance on the slalom-type task. However, no significant differences between high-level slalom canoeists and high-level artistic gymnasts in their ability to form visual imagery from different perspectives, suggested that athletes from both sports use both perspectives. The second section of the thesis employed a qualitative methodology in order to study the uses of imagery by high level slalom canoeists and artistic gymnasts. Consistent with Paivio (1985), it was found that imagery was used for both cognitive and motivational functions in both competitive and training environments. The nature of the sport was also reported to influence image content. The third section of the thesis examined the use of imagery by gymnasts to enhance emotion and motivation, using an Interacting Cognitive Subsystems framework. High levels of exercise-induced arousal without imagery were found to depress mood, motivation and efficacy expectations, however, imagery use stabilised these effects. The results of this research programme suggest that imagery is used by sport performers in a variety of ways to enhance learning and performance. Qualitative and quantitative evidence was found to suggest that the efficacy of imagery is dependent on the ability of the image to supply the athlete with information which is most appropriate for the purpose of the imagery.

CHAPTER 1.

1.1.1 Introduction

The use of imagery to enhance motor skill learning and performance has interested psychologists, since the turn of the last century (Galton, 1883; James, 1890; Washburn, 1916; Smith, 1896). Over the last three decades, imagery has regained popularity, particularly in cognitive psychology, where the role of imagery in cognition has been debated extensively (Paivio, 1969; Pylyshyn, 1973; Kosslyn, 1975). In sport situations, imagery effects have traditionally been examined using a mental practice model, in which the effects of mental practice on motor skill learning and performance are examined (Start and Richardson, 1964; Clark, 1960; Twining, 1949; Minas, 1978; Smyth, 1975; MacKay, 1981; Johnson, 1982). These studies have found that the mental practice is generally beneficial, although there are several variables which influence it's efficacy (see Corbin, 1972; Richardson, 1967a, 1967b; Feltz and Landers, 1983). Consequently, researchers' attention has turned to the mechanisms of imagery function, in order to clarify how imagery exerts its influence on motor skill learning and performance. However, theory development and research methodologies still lag far behind the needs and uses of imagery by elite sport performers, who report using imagery in a variety of different ways (Orlick and Partington, 1988; Jones and Hardy, 1990; Hemery, 1986).

1.2.1 Direct Effects of Imagery on Motor Skill Learning and Maintenance

The majority of studies examining imagery effects and motor skills have concentrated on the use of mental practice for the purpose of developing skill and also for skill maintenance. An early study of the use of mental practice for motor learning was performed by Vandell, Davis and Clugson (1943), and a similar research design has been employed by a number of studies. Typically, the efficacy of mental practice for motor skill learning is compared to that of physical practice, combined mental and physical practice, and a control group.

Variables which have been manipulated using this paradigm include the motor task, experimental period or experience of the subjects. Generally, these studies have found that the combination of mental and physical practice enhances motor skill learning more than either mental practice or physical practice in isolation (Weinberg, 1981; Clark, 1960). However, these effects could be attributed to contextual interference effects, whereby the mental practice intervention serves as a rest period in the combined physical and mental practice group (Fitts and Posner, 1967). With regard to the efficacy of mental practice alone, the results have been equivocal, as some studies have found large effect sizes (Clark, 1960; Oxendine, 1969, Vandell et al., 1943), and some have found small effect sizes for mental practice (Smyth, 1975; Shick, 1970; Wrisberg and Ragsdale, 1979). In order to clarify these results, a meta-analysis of all the research studies of this type, integrating results from independent studies into one data set, found that there was a modest overall effect size of 0.48, suggesting that mental practice was only better than no practice at all (Feltz and Landers, 1983).

1.2.2 Theoretical Perspectives

Two theoretical explanations have been proposed for mental practice effects. The Symbolic Learning Theory (Sackett, 1934; Morrisett, 1956) proposes that mental practice is a form of implicit practice which enables the individual to rehearse movement sequences as symbolic elements, and therefore exert it's effect at higher levels of control. Two specific predictions of this theory have been tested. Firstly, as the efficacy of mental practice for the learning of motor tasks is dependent on the presence of cognitive components within the motor task, mental practice effects have been proposed to have greater effects for skills that are more cognitive in nature. There has been some support for this contention in the research literature (Morrisett, 1956; Wrisberg and Ragsdale, 1979; Minas, 1978; Lutkus, 1975). However, again there are studies which have found large mental practice effects for motor tasks with fewer symbolic elements (Rawlings and Rawlings, 1974; Clark, 1960; Woolfolk, Parrish and Murphy, 1985). Secondly, the Symbolic Learning Theory predicts that mental

practice effects will occur in the early stages of learning, consistent with Fitts (1962). This prediction has received less support in the research literature (Wrisberg and Ragsdale, 1979), as mental practice effects have also been found in the later stages of learning (Corbin, 1967, Phipps, 1968). These effects have been explained in terms of further important variables which might mediate the relationship between mental practice and skill learning such as imagery experience and ability (Smyth, 1975; Start and Richardson, 1964), and task complexity (Oxendine, 1968).

Despite the influence of these variables, the equivocal nature of the mental practice research literature can be explained by the numerous methodological differences which exist, such as differences in mental practice instructions, duration of practice, differences in control conditions, and differences in subject characteristics (Richardson, 1967b; Corbin, 1972). Furthermore, mental practice studies are subject to additional design issues such as the explanation of mental practice effects as motivational or Hawthorne effects (Mackay, 1981; Corbin, 1972). At a theoretical level, the Symbolic Learning Theory can only be tested indirectly, via the nature of the task. This paradigm is certainly limited by the dichotomous categorisation of physical skills as motor or cognitive tasks when they should be viewed as being placed on a continuum (Feltz and Landers, 1983). Indeed, the theory itself can be questioned. Since mental practice has been defined as "the symbolic rehearsal of physical activity in the absence of any gross muscular movements" (Richardson, 1967a), it would not seem surprising that the mechanism by which it facilitates the learning of motor skills is by the symbolic rehearsal of movement skills!(Hardy and Wyatt, 1984). The Symbolic Learning Theory also cannot explain the reports of the use of mental practice by expert performers (Orlick and Partington, 1988; Jones and Hardy, 1990).

In contrast, the Psychoneuromuscular Theory (Arnold, 1946) suggests that mental practice exerts its influence at lower levels of control. Based on the observations of Jacobsen (1930; 1931), it has been proposed that mental practice of movements results in low level muscular innervation of specific muscle groups, which provides kinesthetic feedback and enables the

tuning of motor responses. This theory has also been tested indirectly by the "mirror hypothesis", whereby researchers have examined the patterns of muscular tension occurring during imagery of movements, and compared this muscular activation with the muscular activation that occurs during the actual performance of the imagined motor skill. The localisation of concomitant muscular innervation has been found in several research studies (Harris and Robinson, 1986; Suinn, 1980; Bird, 1984), although other studies have found a general pattern of innervation (Shaw, 1938; Hale, 1981). Thus, there is little support for this particular hypothesis.

Studies examining this theory also have methodological problems, such as the number of and placement of electrodes used to record patterns of muscular patterns, and also the nature of imagery instructions (Murphy, 1990). At a theoretical level, the Psychoneuromuscular theory also cannot be directly tested, and at a practical level, it does not explain the positive effects of mental practice at early stages of learning (Wrisberg and Ragsdale, 1979). Furthermore, more recent research using a paradigm which overcomes the design difficulties of the more traditional mental practice studies has found that mental practice effects cannot be explained by concomitant muscular activity, but are more likely to be explained as a function of higher levels of control (Johnson, 1982; Kohl and Roenker, 1980). Despite the lack of support for the Psychoneuromuscular Theory, clinical psychologists have indicated that concomitant muscular and emotional activation during mental practice play an important role in the effectiveness of imagery (Lang, 1979; Suinn, 1976).

1.2.3 Factors Influencing the Relationship between Mental Practice and Motor Skill Learning and Performance

In an attempt to maximise the potential of mental practice, research has focused on variables which might mediate the relationship between mental practice and motor skill learning. Based on the mental practice research literature, it has been suggested that the nature of

mental practice and individual differences in subjects might influence this relationship (Corbin, 1972; Richardson, 1967a, 1967b). Variables such as the duration of mental practice sessions, distribution of practice, type of mental practice and the nature of the task have been proposed to influence the nature of mental practice. Individual differences such as skill level, imagery ability, kinesthesis, gender, creativity, motivation and intelligence, have all been suggested as influences on the ability of the individual to use imagery effectively. A number of these possible influences upon imagery are discussed below.

1.2.4 Imagery Ability

The individual difference variable most frequently studied by researchers has been imagery ability. Imagery ability is defined in terms of the components of vividness and controllability, where vividness is concerned with the clarity and reality of the image, and controllability is concerned with the individual's ability to control and manipulate the image (Murphy, 1990;1994). Imagery ability can be assessed in different modalities, such as visual, kinesthetic, tactile, auditory, olfactory and gustatory (Betts, 1909; Sheenan, 1967). More recently, tools have been developed to measure imagery ability for movements. For example, the Vividness of Movement Imagery Questionnaire (Isaac, Marks and Russell, 1986) provides a measure of movement imagery in a visual modality, and the Movement Imagery Questionnaire (Hall and Pongrac, 1983) provides a measure of imagery ability in visual and kinesthetic modalities. Such tools enable the researcher to determine imagery ability in sport performers and therefore examine it's mediating influence on sport performance. Studies examining the influence of imagery ability, have found that subjects with high visual and high kinesthetic imagery ability recall movement patterns more accurately than those of lower imagery ability (Goss, Hall and Buckholz, 1986). Start and Richardson (1964) found that subjects who scored lower performance scores for a gymnastic task, were able to form vivid but less controllable images. Descriptive studies which have examined the psychological characteristics of successful and unsuccessful elite performers have found that successful performers report being able to form more vivid and

controllable images (Meyers, Cooke, Cullen and Liles, 1979; Highlen and Bennett, 1983; Orlick and Partington, 1988).

1.2.5 Imagery Perspective

Mahoney and Avener (1977) found an additional variable which distinguished between the qualifiers and non-qualifiers of the 1976 US Olympic gymnastic team. This variable was defined as imagery perspective. It was found that team qualifiers reported using more imagery from an "internal" perspective, which was defined as "requiring an approximation of the real-life phenomenology such that the person actually imagines being inside his/her body and experiencing those sensations which might be expected in the actual situation". An "external" perspective was defined as occurring when "a person views himself from the perspective of an external observer (much like in the home movies)". This view was supported by Rotella, Gansneder, Ojala and Billing (1980) in a similar correlational study of successful slalom skiers, but was not supported by a correlational study of racquetball players (Meyers, Cooke, Cullen and Liles, 1979).

Studies that have manipulated imagery perspective conditions have found no difference in motor skill performance. Epstein (1980) found no differences between internal and external perspective use in dart throwing performance, and Mumford and Hall (1985) found no differences between perspectives for figure skating performance. Mumford and Hall made a further distinction between visual perspective and modality, classifying the three treatment groups as internal visual, external visual and internal kinesthetic imagery. Thus, the possible presence of a kinesthetic component in internal imagery was identified.

Neurophysiological studies have found that subjects using internal perspectives experienced more muscular activity (as measured by EMG patterns) than those using external perspectives (Hale, 1982; Harris and Robinson, 1986). As internal imagery has been shown to produce more efferent activity, and the quality of imagery experience is enhanced by the

experience of kinesthetic imagery (Suinn, 1985; Hall and Erffmeyer, 1983), the applied research literature has often strongly advocated the use of internal perspective imagery (Nideffer, 1986; Morris and Bull, 1991). However, internal kinesthetic and external visual imagery are most frequently used as treatments in imagery perspective studies, and consequently the use of kinesthetic imagery alone during the internal condition could account for any results obtained.

The conflicting nature of the imagery perspective literature can be explained in terms of inconsistent definitions of internal imagery, over-generalisation from correlational studies, and differences in imagery measures. It has also been suggested that differences in the task/sport requirements might determine the efficacy of imagery use (Highlen and Bennett, 1979, 1983), and therefore might indicate when it is most appropriate to use particular imagery perspectives (Vealey and Walter, 1993; Smith, 1987). Finally, Murphy (1994) recommended that future research addressing imagery perspective should investigate the role of the features of different perspectives on influencing aspects of performance such as self confidence, technical analysis or kinesthesis.

1.2.6 Task Differences

Much attention has been given to task characteristics and how they might influence the efficacy of mental practice. More recently, researchers have distinguished between motor tasks and sports in terms of open and closed skills (Gentile, 1972). Open skills are classified as skills carried out in an ever-changing environment, in which the athlete modifies movement patterns in response to environmental stimuli. In contrast, closed skills are carried out in a constant and static environment, in which an athlete attempts to perform a consistent complex movement pattern. Highlen and Bennett (1983) compared the psychological characteristics of successful and unsuccessful elite wrestlers (open skill) and elite divers (closed skill), and found that imagery only differentiated between success and failure for elite divers. In this case, successful divers reported experiencing images that were

more clear and controlled than unsuccessful divers. However, imagery did not differentiate performers from the two sports. These results were interpreted as suggesting that imagery would be used to the same extent, but perhaps in different ways for open and closed sports. Studies using the mental practice paradigm, usually measure performance on only one task, from which a decision about the efficacy of mental practice is made. Within a sport, there are likely to be situations in which open skills are used and other occasions when closed skills are used. The equivocal nature of the research literature, particularly for the imagery perspective issue, could be explained by the necessity of matching the appropriate imagery perspective to the task and situational requirements (Murphy, 1990, 1994; Grouios, 1992). If several different aspects of performance were measured such as form, timing or amplitude, it may be found that certain components of performance are affected positively while others are affected negatively (c.f. Whiting and Den Brinker, 1981). Thus a masking effect may occur if several different measures are not taken. Additionally, if the components of the task that are enhanced by the type of mental practice play only a small part in the execution of the task, the type of mental practice may be inappropriate. These issues seem to have been largely ignored by sport researchers studying the effects of mental practice.

1.2.7 Criticisms of the Research Literature Examining the Effects of Imagery

The research literature examining the direct effects of imagery on motor skill learning and performance has been criticised at a number levels. In reviews of the research literature, Murphy (1990, 1994) identified problems with the lack of theoretical development, inconsistencies in experimental treatments, and a lack of experimental control. His principal criticism was directed at the disregard for theory, particularly in the mental practice research, where interest has centred around the benefits of mental practice relative to those of physical practice. He claimed that research has not adequately tested the mental practice theories and therefore conflicting results in the research literature can rarely be explained. Furthermore, the experimental designs used rarely reflect common everyday practice, which has succeeded in divorcing the use of imagery in applied sport settings from the research

literature. In the clinical psychology literature, it has been suggested that sport situations provide many opportunities to assess somatic and other responses to imagery (Ahsen, 1984), thus Murphy argued that the clinical theories which have been developed, could easily be applied to sport contexts.

Murphy also criticised the research literature for the lack of consistency between experiments. As a starting point, he used Suinn's (1983) definitions of imagery and mental practice, where imagery is defined as a mental process and mental practice is defined as a particular technique. In the past, imagery has often been assumed as being synonymous with mental practice. Thus self-talk processes or any form of covert rehearsal has been incorrectly classified as "imagery" (Suinn, 1984). In order to understand the way in which imagery functions, Murphy suggested that the script used or instructions given to subjects should be recorded by experimenters. This would also facilitate the replication of studies, by controlling the imagery intervention variable. Furthermore, it encourages researchers to design more specific imagery interventions by attending to the nature of the cues provided, and strengthens control over the imagery intervention by decreasing the range of possible imagery experiences. Murphy suggests that neglection to state the exact procedure followed implies a lack of control of the treatment administration.

Throughout the mental practice research, there is an unwritten assumption that the use of a mental rehearsal programme will enhance the performance of everyone, or at the very least that it will affect everyone in a similar way. Without exploration of individual difference issues and more detailed studies on individuals, Murphy claimed that factors influencing the relationship between imagery and motor skill learning and performance might have been missed. A great problem with research into imagery is that one cannot be exactly certain of what the subject experiences or whether the cues that they are given will be interpreted in the same way by every subject. This represents a serious control issue in imagery research in all fields of psychology, as a subject who cannot image exactly what the experimenter wants, is not excluded from the experiment. Murphy states that for this reason, post-

experimental questions in the form of an interview or questionnaire should be a routine procedure, to ensure that subjects were able to comply with the experimental treatments.

Differences in the imagery abilities of subjects was also indicated as a variable which has been disregarded by mental practice research. Murphy suggested that imagery training should be described if it is provided, or the imagery abilities of subjects should be measured. However, he indicated that the measurement of imagery ability can also be problematic, as procedures for the assessment of imagery are often inadequate due to the dynamic nature of imagery.

Currently, there are two commonly used tools available for the measurement of individual differences of movement imagery. The Vividness of Movement Imagery Questionnaire (Isaac, Marks and Russell, 1986) measures the vividness and clarity of imagery from different visual perspectives for movement on two 5 point rating scales; whilst Hall and Pongrac's (1983) Movement Imagery Questionnaire uses two 7 point scales to differentiate the visual and kinesthetic aspects of movement imagery. However, Murphy suggested that it may be more beneficial to measure imagery ability in different modalities, using tools that might provide a more accurate assessment of subcomponents of imagery such as multidimensional scaling (Fenker and Cox, 1987) and the magnitude estimation scaling technique (Stevens, 1975).

1.3.1 Other Functions of Imagery/Mental Practice

There is much anecdotal evidence from elite performers, supporting the use of imagery not only in the context of skill learning and maintenance, but also for skill performance (Jones and Hardy, 1990; Orlick and Partington, 1988). This has been supported by the few studies that have examined the ways in which imagery is used by sport performers of different skill levels and from different sports (Hall, Rodgers and Barr, 1990; Salmon, Hall and Haslam, 1994). Hall, Rodgers and Barr (1990) found that sport performers of all ability levels

reported using imagery; however there were differences between ability levels in the ways in which imagery was used and the situations in which it was used. There are several ways in which imagery has been reported to be used. It has been suggested that imagery can be used to simulate competition (Mace and Carroll, 1985; Orlick and Partington, 1988), to reduce anxiety (Schwartz and Davidson, 1976), to review past performance (Syer and Connolly, 1984), to enhance self efficacy (Woolfolk, Parrish and Murphy, 1985) or to increase motivation (Martin and Hall, 1995). However, despite the variety of different potential functions of imagery, the vast majority of research studies have examined it's influence on skill learning and maintenance.

1.3.2 Indirect Effects of Imagery on Learning/Performance via Motivation

Paivio (1985) suggested that imagery exerts an influence on motor skill learning and performance via a direct cognitive mechanism and also via an indirect motivational mechanism. In addition, he proposed an analytic framework to summarise these effects, in which the two functions of imagery were further indicated as functioning at a specific and a general level.

	Functions of Imagery	
	Motivation	Cognition
Specific Level	Goal-oriented Responses	Specific Skills
General Level	Affect and Arousal	Strategies

Figure 1.1: The analytical framework of imagery effects proposed by Paivio (1985)

Imagery was proposed to function in a direct cognitive fashion to improve isolated skills at a specific level, and to improve strategies at a general level. In addition, imagery was proposed to serve a motivational function by improving motivation towards specific goal

oriented responses at a specific level, and by enhancing affect and arousal at a general level. Thus, the types of images used might also have an influence on the function that imagery serves. For example, at the general level, the content of imagery might involve visual scenes related to anticipation of an opponents response in an individual sport, or might involve seeing pattern formations in a team of players. The images which might enhance affect and arousal might be related to successful outcomes or successful processes. However, the specific functions of imagery are likely to be of the specific skills to be performed by the individual and therefore are more process oriented in nature .

Salmon, Hall and Haslam (1994) developed a sport specific soccer questionnaire to investigate the dimensions of the model proposed by Paivio (1985). They found that the soccer players used imagery in the context of all four cells of Paivio's model. However, they found it difficult to differentiate the cognitive function of imagery use at a general and specific level. In terms of the ratings of imagery use for each cell, they found the highest ratings for the motivational function of imagery at a general level, and the lowest ratings for the cognitive function of imagery at a general level. This was interpreted as suggesting that soccer players use imagery more to energise themselves to play and practice soccer, rather than to rehearse specific strategies. Furthermore, it indicated that the motivational function of imagery is clearly important.

Cognitive Evaluation Theory predicts that interventions such as imagery should specifically influence intrinsic motivation via the information supplied by the image (Deci and Ryan, 1985). An image of successful performance should provide positive information about the performer's competence, and therefore enhance intrinsic motivation for the task imaged. This improved intrinsic motivation would result in increased effort and persistence at the task in training. In the applied literature, imagery has been suggested for use with experienced performers in this context, to offset the negative impact of negative feedback from physical feedback and to sustain motivation to persist with practice (Orlick, 1990). The hypothesis that imagery would enhance intrinsic motivation despite negative feedback

about task performance was examined in a recent study of beginners learning a golf putting task (Martin and Hall, 1995). The results showed that subjects in the performance imagery group practised more than subjects in the control group. They also reported setting higher goals for themselves, had more realistic expectations and adhered more to the out of training practice programme they had been set. Thus, there was clear support for the use of imagery to enhance intrinsic motivation in a training situation. In addition to this effect, Martin and Hall (1995) suggested that if the subjects were more experienced imagery might enhance motivation via a self-efficacy mechanism, as more experienced performers would be able to image themselves performing movements successfully.

1.3.3 Indirect Effects of Imagery on Learning/Performance via Self-Efficacy

Studies examining the psychological characteristics of successful performers have frequently found that successful performers reported higher feelings of confidence than unsuccessful performers (Mahoney and Avener, 1977; Orlick and Partington, 1988; Mahoney, Gabriel and Perkins, 1987; Highlen and Bennett, 1979). In order to establish whether there is a causal relationship between self-efficacy and sport performance, more controlled studies have been carried out, and self-efficacy theory (Bandura, 1977) has been used by sport psychology researchers as a theoretical approach to understand behaviour in sport situations (Feltz and Mugno, 1983; Feltz, 1982; Gould and Weiss, 1981; Lee, 1982; McAuley, 1985; Weinberg, Gould and Jackson, 1979). Self-efficacy cognitions are defined as the belief that an individual has the ability to successfully execute a behaviour, in order to achieve a particular outcome; it is therefore regarded as a situationally specific form of self-confidence. Bandura (1977) proposes that these efficacy expectations are determinants of level of effort, activity choice and amount of persistence, and consequently mediate motivation and behaviour. Furthermore, efficacy expectations are proposed as developing from four sources of efficacy information- performance accomplishments, vicarious experiences, verbal persuasion and emotional arousal.

The use of different strategies and psychological interventions by coaches and performers can have an important influence on self-efficacy cognitions by supplying efficacy information to the performer. Interventions which provide information related to performance accomplishment such as participant modeling (demonstration + guided participation of the learner) have been found to be the best techniques for improving self-efficacy and performance (McAuley, 1985; Feltz, Landers and Raeder, 1979).

Techniques which provide the performer with vicarious experience such as modeling (watching someone else successfully perform a skill) or video feedback, have also been shown to increase self-efficacy (Gould and Weiss, 1981; McAuley, 1985; Feltz, 1982). It has also been found that models with similar abilities to the performer have more beneficial effects on self efficacy than "expert" models (Gould and Weiss, 1981). Since imagery of oneself provides personally relevant vicarious information, it has been suggested as a strategy to enhance the self-efficacy of sport performers (Feltz, 1984, Martin and Hall, 1995). However, the ability of imagery to enhance self-efficacy is dependent on the image being of a successful performance. Bandura (1989) also indicated that if performance outcome is perceived by the performer as a failure (i.e. when imagery is not of a successful performance), then self efficacy will decrease. To date, no published studies have found that imagery mediates motivation or behaviour via a self-efficacy mechanism. Martin and Hall (1995) suggested that the use of imagery to influence self efficacy and subsequent performance would be likely to occur for more experienced performers than for beginners in training situations, as they would be able to form images with more detail. Studies of elite performers indicate that the mechanism of imagery effects via enhanced self-efficacy might be important in competitive situations (Orlick and Partington, 1988; Hall, Rodgers and Barr, 1990).

1.3.4 Indirect Effects of Imagery on Learning/Performance via Changes in Emotional Arousal/Mood

Interventions which manipulate emotional arousal have been found to be a less effective source of efficacy information to enhance self-efficacy (Feltz, 1982; Feltz and Mugno, 1983). However, strategies to enhance levels of arousal in sport situations have frequently been chosen by sport performers to use, in order to enhance tasks requiring speed, strength, endurance and gross muscular co-ordination (Gould, Weinberg and Jackson, 1980; Wilkes and Summers, 1984; Shelton and Mahoney, 1978; Caudill, Weinberg and Jackson, 1983). A few studies have examined the use of imagery to enhance arousal and mood using emotional imagery, which may be related or unrelated to the performance task (Kavanaugh and Hausfeld, 1986; Murphy, Woolfolk and Budney, 1988; Lee, 1990). In Paivio's (1985) framework, emotional imagery would exert it's influence at a general motivational level by enhancing arousal and affect.

Kavanaugh and Hausfeld (1986) examined the effects of emotional arousal on strength performance, using personalised imagery as a means of manipulating emotional arousal. They found that an induced positive mood produced significantly greater hand grip strength performance than a sad mood. This relationship was not found to be mediated by a change in self-efficacy, and therefore it was suggested that the change in the level of arousal might mediate this effect (Gould, Weinberg and Jackson, 1980). However, as the sad mood was expected to be equally arousing as the positive mood, an arousal based explanation could not account for the efficacy of the positive mood condition (Kavanaugh and Hausfeld, 1986). Murphy, Woolfolk and Budney (1988) found that the induction of fearful and angry moods by personalised emotional imagery increased levels of arousal but did not increase strength performance. However, emotional imagery inducing a relaxed mood led to decreased strength performance. Consequently, it was suggested that the relaxed mood was inappropriate for the strength task, and it was further suggested that the efficacy of an emotional imagery strategy might be related to the information value of the image. Hence, it

was proposed that task-specific imagery might enhance strength performance more than an emotional image which was not specific to the task.

Lee (1990) found that the efficacy of imagery to enhance a strength endurance task was determined by the ability of the image to focus attention on the task to be performed and not the ability of the image to enhance general mood. Although it seems that emotional imagery is most effective if it is task relevant, the research studies examining these effects have limitations in terms of ecological validity, as they have only examined laboratory tasks with student populations. Lee (1990) noted that the results from such studies must be treated with caution, as the psychological characteristics of sport performers differs from student populations, and subject responses in a laboratory situation would be very different to athlete responses in a competitive environment. Thus, we might expect different effects of imagery strategies with different subjects in different situations.

1.4.1 Alternative Theoretical Perspectives

Experimental and descriptive studies have clearly shown that imagery does not only exert it's effect in a direct manner on motor skill, learning and performance, but it also plays an important role in improving emotional and motivational variables which might indirectly influence performance (Orlick and Partington, 1988; Hall, Rodgers and Barr, 1990; Martin and Hall, 1995, Kavanaugh and Hausfeld, 1986). However, the theories used in the sport psychology literature do not really reflect the variety of uses and effects of imagery in sport contexts (Murphy, 1990). In an attempt to bridge this gap, many sport psychologists have applied theories and techniques from clinical psychology to sport situations (Suinn, 1983; Seabourne, Weinberg, Jackson and Suinn, 1985; Hecker and Kaczor, 1988; Hale, 1995). These theories are particularly concerned with the psychophysiological responses associated with imagery and the meaning of imagery to the individual (Lang, 1977; Ahsen, 1984; Suinn, 1976). Recently, a new information processing model has been developed which is able to incorporate a wide variety of imagery uses and a number of theoretical positions

from clinical and cognitive psychology. Interacting Cognitive Subsystems (Barnard and Teasdale, 1991) has already been used to explain short-term memory effects in language production (Barnard, 1985), has been applied to information processing in human-computer interaction situations (Barnard, 1987) and to help understand cognitive-affective relationships, particularly in the study of depression and contextual learning (Barnard and Teasdale, 1991; Teasdale and Barnard, 1993; Teasdale, 1993). Although it has not been applied to the study of imagery, it has the capacity to explain many of the uses and effects of imagery in a wide variety of situations.

1.4.2 Interacting Cognitive Subsystems Framework

Interacting Cognitive Subsystems (Barnard, 1985) is an information processing model which describes the organisation and function of structures underlying cognition. It differs from other information processing models and theories of cognitive psychology by proposing a unified theory of cognition, which emphasises the importance of the interaction of processing by all mental resources, rather than studying individual processes in isolation. Consequently, it has the capacity to integrate both experimental and experiential based psychological approaches to understanding cognition, within a single framework.

The Interacting Cognitive Subsystems framework (ICS) comprises nine separate subsystems, each handling qualitatively different types of information. The systems are arranged hierarchically, such that there are peripheral, intermediary and central subsystems. At the peripheral level, there are three sensory subsystems (acoustic, visual and body state), which encode raw sensory input received via internal or external receptors within the body. Two intermediate subsystems (morphonolexical and object) code information into units of recurring regularities, such that structural descriptions of acoustic and visual code are processed. For example, at the highest level of abstraction, the implicational and propositional subsystems encode abstract descriptions of semantic, propositional and sensory information, such that specific meanings are generated.

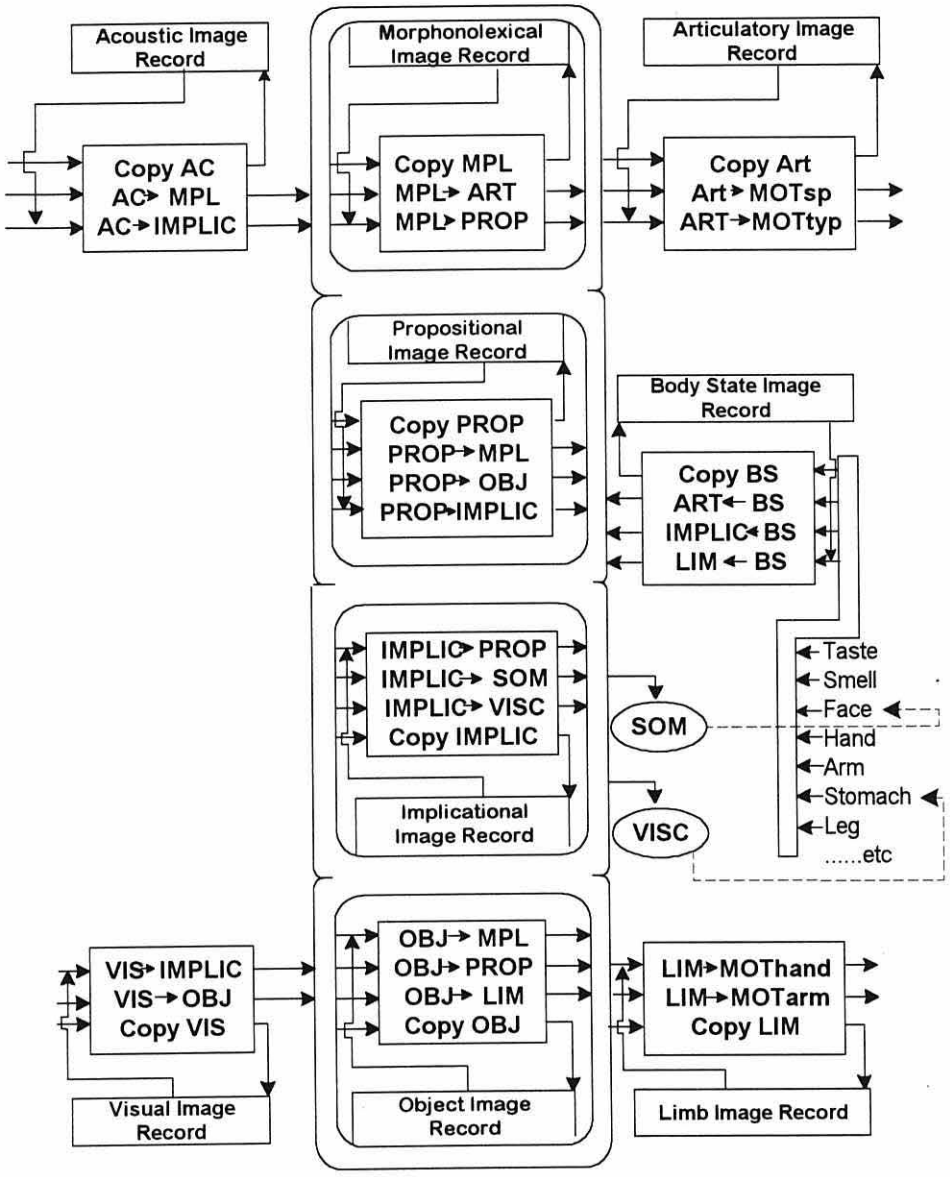

Figure 1.2: The nine subsystems of the Interacting Cognitive Subsystems framework. The figure illustrates the patterns of interaction of the subsystems.

By extracting co-occurrences across Morphonolexical and Object subsystem codes, Propositional code represents 'intellectual knowing' such as an understanding of exactly what someone is saying. Implicational code extracts co-occurrences in patterns across low-level sensory codes and high-level Propositional code to generate schematic models of experience, representing 'holistic knowing', such as a more general meaning of what someone is saying. Finally, two peripheral effector subsystems (articulatory and limb)

encode information related to verbal and motor responses such as force and timing of musculatures. The organisation of these subsystems is shown in Figure 1.2.

1.4.3 Processing Within Interacting Cognitive Subsystems

Each of the nine subsystems handles information of its own specific code, thus multiple representations are generated for each event. Information processing (cognitive activity) is marked by the transformation of information encoded by each subsystem into the specific code of another subsystem. This information processing activity can take place in two ways. Direct processing involves the successive transformation of information into other codes via both serial and parallel processing. In contrast, buffered processing involves the use of a copy processes within each subsystem, which stores an exact copy of all information processed in a particular subsystem into it's memory image record (see Figure 1.3). These memory image records store information that has passed through each subsystem and enable the transformation processes to extract co-occurring elements from streams of input data. An important feature of processing in a buffered mode is that the individual has greater awareness of the information being processed by particular subsystems. Thus, an ICS approach is able to recognise the value of subjective accounts of experience as markers of the product of processing within the system.

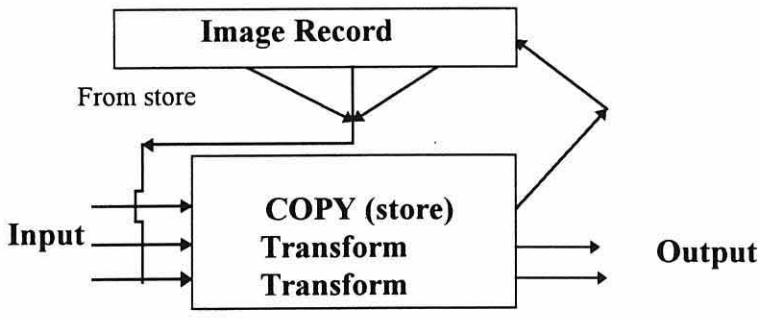

Figure 1.3: The basic structure of a cognitive subsystem illustrating the parallel organisation of transformation processes, the copy process and the memory structure (image record).

Within ICS, complex patterns of processing are possible, due to the interaction of peripheral and central subsystems. In addition to serial and parallel processing, the central subsystems can also interact reciprocally during information processing (particularly the implicational and propositional subsystems). The overall pattern of information processing is controlled by the interaction of the central subsystems, rather than by a central executive system proposed in other theories of cognition (e.g. Baddeley and Hitch, 1974).

1.4.4 Interacting Cognitive Subsystems In Operation

The complexity of the structure of ICS, and the recognition of two levels of 'meaning' enables predictions to be made about a wide range of cognitive processing. Further, the interaction of these two 'meanings' enables us to understand more complex cognitive functioning.

Information from the acoustic and visual subsystems related to environmental sound and light is transformed into morphonolexical and object codes respectively (AC → MPL, VIS → OBJ), which is subsequently transformed into propositional code. 'Intellectual meanings' are therefore derived by the propositional subsystem from visual and acoustic information, which may be related to events seen or the interpretation of what someone has said (MPL → PROP, OBJ → PROP). However, acoustic and visual information is also processed in parallel to the implicational subsystem, which can interpret sensory aspects of this information to give a more 'holistic' understanding of events(AC → IMPLIC, VIS → IMPLIC). For example, the implicational subsystem will interpret aspects of visual and acoustic information, such as tone or facial expression, which might indicate an instant 'emotional meaning' of the event. The propositional subsystem then generates information in implicational code for the use of the implicational subsystem (PROP → IMPLIC), where further interpretation of events in terms of situational and personal contexts is generated. This interpretation takes place as the result of the construction of an implicational schematic model by the implicational subsystem.

Implicational schematic models are developed from coherent elements derived from sensory aspects of the environment (AC → IMPLIC, VIS → IMPLIC), internal body states (BS → IMPLIC) and the 'intellectual meaning' of events (PROP → IMPLIC). Emotion will be elicited by the implicational schematic model if implicational codes are processed corresponding to affect related codes of past emotional events. These implicational codes may have an implicit informational content, and represent factors such as feeling nervous or confident, marking buffered processing in the implicational subsystem. Alternatively, further processing may indicate more physical experiences of emotion, such as butterflies in the stomach, increases in heart rate (IMPLIC → VISC), or motor-expressive components of emotion such as facial and postural changes (IMPLIC → SOM). Subjective awareness of these emotional states will indicate buffered processing within the body state subsystem.

Should further interpretation of the events be required, further processing from the implicational subsystem to the propositional subsystem will occur (IMPLIC → PROP) to either obtain more information or to generate propositional thoughts related to the event. The interaction between these two subsystems (PROP → IMPLIC, IMPLIC → PROP) provides the action of a 'central executive system'. It also plays a key role in interpreting events, controlling behaviour and the processing of high level cognitive tasks.

The ICS view of emotion production recognises the contribution of both cognitive and affective elements and therefore does not assign primacy to either cognition or emotion (Zajonc, 1984; Lazarus, 1984). In addition, an ICS account proposes that body state information can have a direct influence on the processing of implicational codes. This view contrasts with information processing models of emotion that stress the necessity of a cognitive appraisal of emotion (Beck, 1976), but is consistent with other theories of emotion (Leventhal, 1984; Lang, 1979). Further, ICS corresponds with clinical observations that indicate the possibility of experiencing an emotional belief about an event without being able to find a propositional reason for such a belief (Teasdale, 1993). Thus, ICS has important consequences for clinical psychology and the treatment of psychological illness,

as it suggests that the manipulation of cognitive beliefs will have no direct effect on emotion, and will only be successful, in so far as they are able to change higher order implicational meanings. Instead, ICS predicts that therapy should focus on replacing implicational code patterns related to dysfunctional modes with more adaptive implicational codes. Thus, a wide range of clinical therapies with no value at a propositional level (such as emotional imagery or exercise) could have a positive effect on emotional disorders.

The production of implicational schematic models is also able to account for the ability to recall past emotive events with the experience of concomitant past emotion (termed as 'hot processing'). However, processing that does not involve the generation of these implicational schematic models of experience, will not lead to the experience of emotion, even if the event recall is emotive (cold processing). This may occur if the streams of data entering the implicational subsystem are incoherent with those implicational elements of past experience, or if insufficient implicational elements are present. In addition, it may occur if the processing does not extend to the implicational system, but instead involves the retrieval of information from the object and morphonolexical subsystems. Thus, recalling an image of a past emotional event may not involve the experience of emotion, whereas constructing an imaginary emotional event will.

1.4.5 Interacting Cognitive Subsystems and Imagery

ICS has several important implications for the use of imagery in both clinical and sport contexts. The individual nature of imagery experiences (Ahsen, 1984; Murphy, 1990) can easily be explained by an ICS account, as the interpretation of images is dependent on past experience and therefore the content of the image records of each subsystem. Furthermore, the proposal of two separate 'meaning' subsystems (implicational and propositional subsystems) enables ICS to account for the distinction between "emotional meaning" of images (Ahsen, 1984) and "intellectual meaning" (Paivio, 1971), and also indicate the

potential importance of emotional meaning if imagery is used indirectly to enhance learning and performance via changes in emotion.

Using ICS as a framework, it is also possible to understand how imagery could operate via all of the potential mechanisms mentioned above, and how the precise nature of the image could influence its effect on performance. ICS can incorporate the importance of sensory components of images into their effects on emotion (Lang, 1979), as it recognises that proprioceptive and sensory information can be passed directly into the implicational subsystem, by-passing cognitive appraisal by the propositional subsystem; that is to say, ICS predicts that changes in peripheral body state can have a direct effect on the production of emotion (Leventhal, 1979). Thus, the sensory components of images can directly manipulate emotion depending on the emotional meaning of these components. This has very important implications for the use of imagery to enhance motivation, self-efficacy and mood, as it suggests that any body state information present during imagery will influence image interpretation.

The ICS model also has important implications for the precise nature of images and their direct effects on learning and performance. The presence of qualitatively different subsystems indicates that imagery can be multimodal in nature; thus, visual, auditory, kinesthetic and other sensory types of images can be formed for each event imaged. Furthermore, the essentially hierarchical nature of the ICS framework suggests that images of different modalities can exert their influence on performance or learning at different levels of control. For example, kinesthetic images may influence performance at lower levels of control, visual and acoustic images may influence performance at intermediate levels of control, and verbal (self-talk) images, produced by the interaction of the central subsystems may influence performance at the higher levels of control. The specific nature of the image might also influence different aspects of task performance, such that visual images might influence form and co-ordination, acoustic images might influence timing, kinesthetic

images might influence speed or force and self-talk images might influence patterns of intention such as strategy planning.

1.5.1 The current research programme

This thesis examines both the direct and the indirect effects of imagery on the learning and performance of motor skills, using Interacting Cognitive Subsystems as a framework. It is proposed that imagery effects will be found via both direct and indirect mechanisms. Furthermore, by using a variety of different research methodologies, it is predicted that these different effects of imagery will be quantitatively and qualitatively verified by high level sport performers. It is also proposed that the nature of imagery effects will be dependent on the form of the motor skill tasks to be performed, and also on the specific nature of the image. In order to examine these effects in detail, whilst controlling task and subject characteristics across studies, lab analogue tasks representing canoe slalom and gymnastics are used for the first study. Similarly, performers from these two sports have participated in the remainder of the studies.

The structure of the thesis comprises three related sections. The first section (chapters two and three) examines the direct effects of imagery to enhance motor skill learning and performance. Chapter two describes a laboratory experiment which investigates the influence of visual perspective on the learning and performance of different subcomponents of a slalom type task and a gymnastic type task. Chapter three examines whether there are any differences in imagery ability by perspective in high level slalom canoeists and artistic gymnasts. The second part of the thesis (chapters four and five) describes the uses of imagery by high level slalom canoeists and artistic gymnasts, and the specific details of their images, using a qualitative methodology. The third part of the thesis (chapter six) examines the influence of imagery on motivation and emotion, testing an Interacting Cognitive Subsystems prediction. More specifically, this chapter describes a study examining the influence of level of physiological arousal prior to imagery on the subsequent mood state,

motivation, and efficacy expectations of rhythmic gymnasts towards a future competition. Chapter seven presents a detailed discussion of the results of the studies within the thesis, together with the theoretical and methodological issues which arise from the present studies and also from imagery studies in general. Finally, conclusions are drawn with regard to the implications of this research programme and suggestions for future research.

CHAPTER 2.

Use of Internal and External Visual Perspectives on the Learning and Performance of Two Different Motor Skills[1]

2.1.1 Imagery Perspective Research Literature

Research examining the different imagery perspectives used by sport performers has been equivocal in its findings. Mahoney and Avener's (1977) retrospective introspection study found the use of internal imagery to be more frequently reported by successful US Olympic trial gymnasts than by those who were unsuccessful. However, further studies examining this phenomenon using a similar approach (Meyers et al., 1979; Highlen and Bennett, 1979), and a study involving the manipulation of imagery perspectives as an experimental treatment (Epstein, 1980) found no significant differences between successful and unsuccessful performers across a whole range of sports.

In an extensive review of mental practice research, Murphy (1990) identified several methodological weaknesses in the current research literature which may explain some of the inconsistencies. He identified experimental control as a major problem, criticised researchers for failing to supply sufficient details of studies to allow replication, and advocated the use of post-experimental questions to exclude subjects who did not or could not follow the required experimental procedures. This provision also has the advantage of allowing examination of individual differences in imagery experiences and interpretations. At a theoretical level, Murphy was critical of imagery being conceptualised as a unitary process and favoured the investigation of distinct subcomponents of imagery.

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[1] This study has been published. White, A. & Hardy, L. (1995). Use of different imagery perspectives on the learning and performance of different motor skills. British Journal of Psychology, 86, 169-180.

2.1.2 Problems with Imagery Perspective Research

The failure to treat imagery as a multidimensional concept may indeed be a weakness of previous research, as imagery perspectives and modalities are frequently not distinguished. Certainly, the questions which Mahoney and Avener (1977) asked in order to differentiate between internal and external imagery perspectives were ambiguous; for example 'when I mentally practice my performance, I see myself performing- just like I was watching a videotape' was taken by Mahoney and Avener to indicate that the subject had used an external visual perspective. However, it could be interpreted by subjects as a question about the clarity of images. Mahoney and Avener further stated that internal imagery required 'an approximation of real life phenomenology' and that this involved 'experiencing the sensations which might be expected in the actual situation.' Thus, they used the statement 'When I am preparing to perform, I try to imagine what it will feel like in my muscles' to isolate an internal perspective image. Although kinesthetic imagery is commonly considered to be of importance in the formation of internal perspective images (Murphy and Jowdy, 1992), it may also be possible to experience kinesthetic imagery with external visual imagery or without any visual imagery whatsoever. Furthermore, it has been suggested that kinesthetic imagery correlates more highly with the performance of gymnastics skills than visual imagery (Start and Richardson, 1964), and also that kinesthetic imagery is more beneficial for high level trampoline performance (Isaac and Marks, 1992). Consequently, Mahoney and Avener's findings may simply indicate that successful elite gymnasts make greater use of kinesthetic images than less successful performers. Finally, a causal relationship between imagery perspective and sporting success cannot be established by studies that are correlational in nature (Heyman, 1982). Murphy (1990, 1994) recommended that researchers' attention should focus on the features of imagery perspectives which might influence different aspects of performance. For example, he suggested that kinesthesis might be experienced more when using an internal perspective, and external imagery might have more task analytic properties.

2.1.3 External Imagery in Observational Learning

Literature examining observational learning suggests that the presence of a model facilitates the learning of certain types of motor skill (Bandura, 1977). Further research suggests that learning will occur if key information about the motor skill is accessible from the model. For example, a skill requiring precise timing should benefit from an auditory model (Doody, Bird and Ross, 1985), whereas a skill requiring co-ordination to achieve a particular form should benefit from a visual model (Whiting and den Brinker, 1981; Magill, 1993).

Imagery has been suggested as functioning in a similar way to covert modeling (Mendoza and Wichman, 1978; Grouios, 1992), by providing an internal model for response production and correction (Bandura, 1978). Visual models could be considered as external visual images of the skill, as they are viewed from a third person perspective. Indeed, a perfectly clear and vivid external image will consist of exactly the same perceptual features as would be seen when watching a model, despite being internally generated. A cognitive psychology perspective would propose that information extracted from the model is transformed into symbolic codes to be stored for some template of action, and that cognitive rehearsal processes will enhance this memory representation (Carroll and Bandura, 1985). Thus, following 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.

Consistent with the view that motor control is hierarchically organised, suggestions have been made that a model (external image) may assist the learner to extract higher order aspects of a skill, such as form (Annett, 1991; Whiting and Den Brinker, 1981). Thus, 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, which perhaps explains the popularity of visual aids such as wall charts and videos in many sports.

Whiting and Den Brinker (1981) suggested that learners initially master the qualitative representation of the form of movements (the image of the act) to produce a stable temporal and spatial patterning of movements. Once an image of the act is achieved, the quantitative movement changes required in response to changing environments (the image of achievement) can be developed. In order to examine the factors influencing the development of the 'image of the act', Whiting et al (1987) measured fluency, frequency and amplitude as subcomponents of performance on a simulated ski slalom task. A group of subjects who learned the skill with the aid of a skilful model were significantly more fluent than a group who learned the skill through discovery, thus demonstrating that a model (external image) was able to stabilise the movement pattern. Despite the fact that Whiting et al.'s dependent variables did not measure movement form in topographical terms, a replication study (Magill, 1993) measuring 'co-ordination of limbs', as analysed by the kinematic relationships between the limbs, found the same effect.

2.1.4 Internal Imagery and Task Analysis

The analysis of appropriate subcomponents of motor skills might facilitate a better understanding of the efficacy of different imagery perspectives. Many sports (particularly team sports) require the performance of complex movements within immediate body space and movements to both predictable and unpredictable locations in external space. Commonly, internal kinesthetic imagery has been associated with sport skills that require a complex set of movements to be performed in a relatively static environment, such as diving and gymnastics (Mahoney and Avener, 1977; Taylor, 1993). However, skills such as these, are more likely to be influenced by kinesthetic imagery because of the complexity of the motor action required.

Internal visual imagery, on the other hand, requires the performer 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 a task. It has been suggested that internal imagery may be better than

external imagery because an internal perspective is isomorphic with perceptual information seen by the performer and it is rare for an external perspective view of a motor skill to be seen by the performer during learning (Smith, 1987).

Internal visual imagery has other properties that might make it more appropriate for certain types of task which require modification of motor responses according to changes in the visual field as the performer moves through it. For example, during a canoe slalom, changes in the performer's visual field indicate when the performer should adjust his/her orientation within the field (e.g. reverse through a gate). For this type of task, the targets (gates) are in a fixed position, which the performer has to negotiate in a set pattern. Since internal visual imagery would represent a more accurate rehearsal of the task, the ability to see the changes in the visual field from a first person perspective might help in planning when to respond to the field and therefore improve the 'readiness' of the system.

Further variables such as the goal of the task, the skill level of the performer and the purpose of the imagery intervention have all been suggested as being crucial in determining an appropriate imagery perspective (Paivio, 1985). Jowdy, Murphy and Durtschi (1989) have proposed that external imagery may have more error detection and analytic properties, and may therefore be used early in motor skill development; whereas internal imagery may be used later in skill development when the athlete has improved kinesthetic abilities and internal representations of the skill. However, this proposal can only be tested if internal visual imagery is distinguished from kinesthetic imagery.

2.1.5 Hypotheses

In order to gain an understanding of the mechanisms of the function of imagery perspectives, it is clearly necessary to attempt to gain greater control over experimental treatments. A post-experimental interview, as proposed by Murphy (1990), was therefore included in the present study to monitor subjects' imagery experiences, to ensure that

subjects were able to comply with the experimental treatments, and therefore to improve experimental control. The purpose of the present study was to examine the relative efficacy of internal and external visual imagery perspectives for the learning and performance of two different types of tasks. The tasks were laboratory-based simulations of a canoe slalom event and a gymnastics type routine. It was hypothesised that internal visual imagery (IVI) would enhance the learning and performance of the slalom task whilst external visual imagery (EVI) would enhance the learning and performance of the gymnastics task.

2.2. Methodology

Participants were 48 able-bodied first year Sport Health and Physical Education students at the University College of North Wales who participated as part of their course requirement. None of the subjects had previously operated a wheelchair. Dancers and gymnasts (2 subjects) were excluded from task B.

2.2.1 Experimental Tasks

Task A: A slalom course was set up in a large general purpose hall. Fourteen skittles were used to create slalom gates as shown in Appendix 1A. Subjects were asked to negotiate the course in a manually operated wheelchair as quickly as possible with the minimum number of errors. The course involved turns and reversals through the various gates (see Appendix 1A).

Task B: Subjects were asked to complete a movement sequence composed of 10 static positions using a pair of Rhythmic Gymnastics clubs whilst seated in a chair. The sequence involved arm movements holding the Rhythmic Gymnastics clubs to different configurations in different body planes, and involved the performance of movements to both symmetrical and asymmetrical positions. The clubs were held such that they were free to move to different configurations and a straight line could be made between the arm and the club when required. In order to simulate the requirements of performing a gymnastic routine, it

was indicated to subjects that they should try to remember and reproduce as many positions as possible in the correct sequence since the routines would be scored on this criterion. Subjects were also told that the form of the static positions would be judged and that they should therefore concentrate on the accuracy of body and arm/hand lines. All of the subjects' trials were videoed.

2.2.2 Treatments

Subjects received one of two experimental treatments (internal or external visual imagery).
Internal Visual Imagery (IVI): Subjects were shown a video recording of a model completing the task three times (external perspective) and were then shown a video recording of the same task from a first person perspective once (see Halé, in press). Prior to each trial, they were asked to form a similar internal perspective image of themselves completing the task.
External Visual Imagery (EVI): Subjects were shown a video recording of a model completing the task four times (external perspective). Prior to each trial, they were then asked to form a similar external perspective image of themselves completing the task.

2.2.3 Design and Procedure

Two weeks prior to the experiment, all subjects completed the Vividness of Movement Imagery Questionnaire (Isaac, Marks and Russell, 1986) to determine whether they had a preferred imagery perspective or were able to image with equal ability from either perspective. In order to control for perspective preferences, subjects who scored less than 72 on each perspective (i.e. could image with both perspectives, n=24) were randomly assigned to one of the 2 treatment groups.

All subjects completed task A first, and then completed task B two weeks later. Subjects performed 5 blocks of 3 trials for both tasks with a 5 minute rest interval between each trial.

During this interval they were asked not to use imagery. Following each interval and immediately prior to each trial, subjects were asked to image the task once only from either an internal or external visual perspective, with their eyes closed. They were also asked not to image between trials and no time constraints were placed for either of the tasks. At the end of each of the five trial blocks, feedback was provided. For task A, verbal feedback about the time taken to complete the course, the number of gate errors, and the number of skittle touches was given with respect to the third trial of each block. For task B, the subjects were shown a video recording of the third trial in that block, followed by the initial recording of the model performing the movement pattern (from an external perspective). No verbal feedback was given.

One week after learning each task, the subjects returned to complete one further trial. For task A, a new slalom course was designed which required the subjects to negotiate the same gates in a different pattern. Subjects were shown a course map, allowed to see the course and asked to form an image of themselves going through the course from either an internal or external perspective, as in the learning period once only, immediately before completing a single attempt. For task B, subjects were asked image themselves completing the original routine from either an internal or external perspective as in the learning period, before attempting to reproduce as much of the original routine as possible. This performance was recorded on a video recorder. These transfer/retention tasks were chosen because they simulated the task requirements of performance conditions in slalom canoeing and rhythmic gymnastics.

Following completion of all the trials during the learning period and after the transfer and retention periods, subjects were asked a number of questions about the experimental procedures in order to confirm that control over the experiment had been maintained.

2.2.4 Measures

Task A: The time taken to complete the slalom course, the number of times subjects missed gates or went through them the wrong way (gate errors), and the number of times subjects touched one of the skittles with the wheelchair were noted. These scores were taken to provide time scores for the completion of the course, and scores for the total number of errors (course errors plus skittle touches).

Task B: Two people who had not taken part in the experiment were independently trained to judge the last trial in each block of each subject's attempts at the movement pattern. The judges gave two scores for each trial. A total of 6 marks was available for a form score. Deductions were made in accordance with the Code of Points used by gymnastics judges, such that a 0.05 deduction for was given for a minor arm fault and a 0.2 deduction was given for a major arm fault. From these judges scores, a measure of average form per element recalled (total form score divided by the number of movements recalled) was obtained for each of the two judges. A memory score (total of 4 marks) was derived from the sum of the score for the number of movements recalled (0.2 for each move remembered), a score for sequence (0.1 for each correct move following another but not necessarily in the correct absolute order), and a score for the absolute order in which the movements were recalled (0.1 for each element in the correct order).

Correlations between judges for form and memory scores revealed that this scoring procedure was very reliable ($r=0.974$, $n=20$ and $r=0.989$, $n=20$ respectively). The mean of the two judges' scores was used for the main statistical analyses.

2.2.5 Confirmation of Experimental Manipulations

For each of the tasks, a post-experimental interview was carried out to ensure that the subjects were able to adhere to their treatment instructions and did not experience any switching of imagery perspectives. These questions were used to exclude the data from subjects who did not experience purely IVI or EVI. Subjects were also asked, if they had

experienced any kinesthetic sensations during imagery, and to say how appropriate they felt the treatment had been for the task (a rating score out of 10).

2.3 Results

2.3.1 Data Analyses for Task A

The post experimental interviews revealed that 3 subjects from each group were unable to comply with the instructions (because they were unable to image without switching perspectives, or because they used an alternative strategy) and were therefore removed from the data set. The mean total VMIQ imagery ability scores for each perpective were IVI=92.33 (n=9), EVI=89.33 (n=9) for each group. The mean time and error scores of each block of three trials were determined except in the transfer trial (block 6), in which the subjects had only one attempt. Subsequently, the data from 18 subjects were analysed.

2.3.2 Time Scores

Learning: A group x block (2x5) analysis of variance with repeated measures on the block factor was conducted on the time scores. This revealed a significant main effect for group, $F(1,16)=18.44$, $p<0.01$, a significant main effect for block, $F(4,64)=124.7$, $p<0.001$, and a significant group by block interaction, $F(4,64)=13.54$, $p<0.001$. Follow-up Tukey's tests on the significant interaction showed that the external visual imagery group (EVI) was significantly faster than the IVI group across all trial blocks. Both groups got significantly faster across blocks 1-2, and blocks 2-3. However, Figure 2.1 suggests that the significant interaction was due to the IVI group performing particularly slowly in block 1, but partially catching up in later blocks. Follow-up Tukey's tests were not performed on the significant main effects because of possible confounding from the significant interaction.

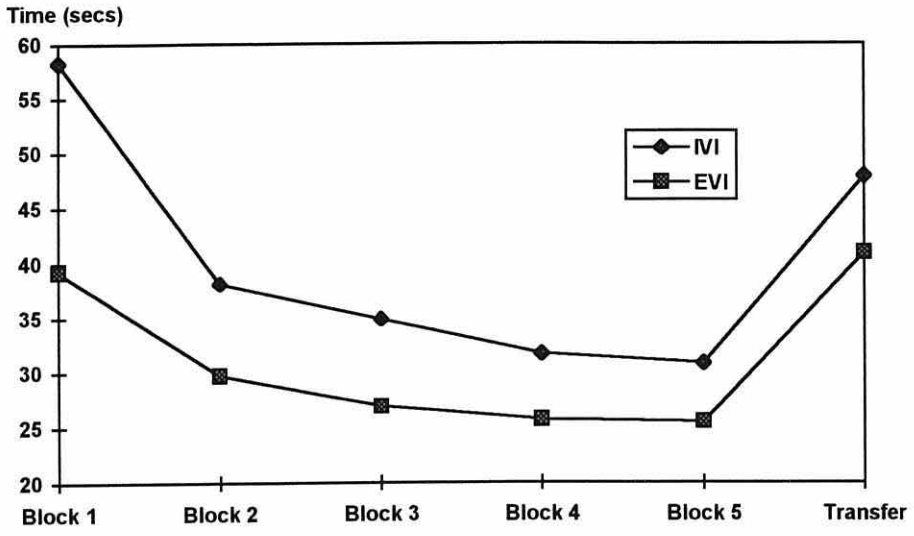

Figure 2.1: Slalom task. Mean time scores for IVI and EVI groups across all trial blocks.

Transfer: A one way analysis of variance was conducted on the transfer trial data from block 6. This showed significant differences between the IVI and EVI groups, $F(1,16)=5.41$, $p<0.05$, indicating that the EVI group was significantly faster than the IVI group.

2.3.3 Error Scores

In order to determine whether there was a relationship between treatment groups and the number of mistakes made on the slalom task, a chi-square test of independence was performed. It was found that there was no relationship between group membership and the occurrence of errors in the learning period (blocks 1-5). However, there was a significant relationship in the transfer trial (block 6) $Chi^2(1)=8.10$, $p<0.05$. In this instance, the IVI group made fewer mistakes than the EVI group (IVI=2, EVI=8).

2.3.4 Speed/Accuracy Trade-Off Analyses

Group by block analyses of covariance (accuracy scores serving as the covariate) with repeated measures on the block factor were carried out on the time scores for both the

learning block and the transfer block, to determine whether the results of the time and error analyses could be accounted for by speed/accuracy trade-offs. For the learning block, the main effect of group still remained even with the accuracy covariate, suggesting that a speed/accuracy trade-off could not account for the results. However, for the transfer block, the main effect of group became marginal for time scores when accuracy was treated as a covariate, suggesting that the results could be partially explained by a speed/accuracy trade-off.

2.3.5 Data Analyses for Task B

Subjects who reported that they were unable to comply with the treatments were removed from the dataset (IVI=4, EVI=3). These comprised the same six subjects who were removed from the Task A dataset plus one other, thus, data from 17 subjects were analysed. The mean VMIQ total imagery ability scores for each group were IVI=87.0 (n=8), EVI=89.33 (n=9).

2.3.6 Form Data

A group x block (2x5) analysis of variance with repeated measures on the block factor revealed no significant main effects or interactions for the learning data, and a one way analysis of variance revealed no significant differences between groups for the retention period ($p>0.05$).

2.3.7 Memory Data

Learning: A group x block (2x5) analysis of variance with repeated measures on the block factor was conducted on the memory data. This revealed a significant main effect for block, $F(4,60)=23.5$, $p<0.001$, no significant main effect for group, $F(1,15)=3.55$, $p>0.05$, but a significant group by block interaction, $F(4,60)=2.9$, $p<0.05$ (see Figure 2.2). Follow-up

Tukey's tests on the significant interaction indicated that there was a significant improvement in memory scores across both groups between blocks 1 and 2, but that the EVI group recalled significantly more than the IVI group in blocks 1 and 2. Follow-up tests were not performed on the block main effect because of the possibly confounding influence of the significant interaction.

Retention: A one way analysis of variance conducted on the memory scores for block 6 revealed significant differences between groups $F(1,15)=6.329$, $p<0.05$, showing that the EVI group had higher memory scores than the IVI group in the retention test.

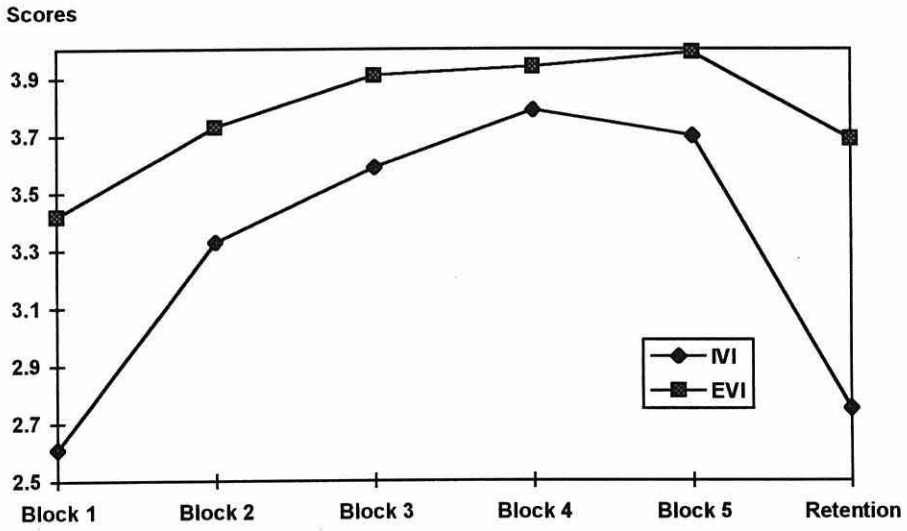

Figure 2.2: Gymnastic Task. Mean memory scores for IVI and EVI groups across all trial blocks.

2.3.8 Self-Assessment Scores

One way analyses of variance were carried out on the self-assessment ratings of how appropriate the subjects considered the treatments to be for each task. For both tasks, these revealed significant differences between groups; ($F(1,16)=7.3$, $p<0.05$) for task A, and $F(1,15)=30.6$, $p<0.001$ for task B. For task A, the EVI group gave significantly lower

scores (mean=4.055, sd=2.793) than the IVI group (mean=6.888, sd=1.054). This indicated that the IVI group rated the appropriateness of their treatment more highly for the slalom task than did the EVI group. In contrast, the same analysis for the task B data revealed that the subjects in the EVI group gave significantly higher scores (mean=9.00, sd=1.357) than the IVI group (mean=4.75, sd=2.013) for the experimental treatment that they had received, thereby indicating that they rated the appropriateness of their treatment more highly for the gymnastics task than did the IVI group.

2.3.9 Kinesthetic Imagery Analysis

Concomitant kinesthetic imagery was reported by both treatment groups. Consequently, in order to ensure that the results were not confounded by kinesthetic imagery, separate chi-square analyses were conducted on the data from the IVI and EVI groups with regard to the experience of concomitant kinesthetic imagery. Both of these tests were non-significant; $Chi^2(1)=0.275$, $p>0.05$ (task A) and $Chi^2(1)=0.007$, $p>0.05$ (task B), indicating that there were no differences between the groups in the number of subjects who reported kinesthetic imagery.

2.4. Discussion

The results of this study have demonstrated that different aspects of motor performance can be enhanced by different perspectives of imagery, supporting the view of Murphy (1990, 1994). In the slalom task, it was found that IVI subjects completed the transfer trial with significantly fewer errors than EVI subjects. This suggests that the internal visual perspective might have allowed rehearsal of required responses at each gate, thus improving the 'readiness' of the system by centring attention on the cues to be used in order to negotiate each slalom gate accurately. In contrast, the EVI group completed all of the learning trial blocks and the transfer block course, significantly faster than the IVI group. This suggests that the two imagery groups have different speed/accuracy trade-offs in the

transfer trial, whereby the IVI group made less errors, whilst the EVI group focused on the speed of completing each course. This was partially confirmed by the analysis of covariance (see 2.3.4).

It is possible that the slower scores for the IVI group were due to IVI subjects having an additional processing load, as they would have to transform information about the course from an external perspective to an internal perspective in order to mentally rehearse it. However, they were not required to do this during actual performance. Since the EVI group were consistently faster than the IVI group across all trials with no cost to accuracy during the learning period, it is also possible that EVI led subjects to compare themselves with their own image generated from an external perspective, thereby enhancing their competitive drive, and leading them to strive for faster times at the cost of more errors. Whilst such a motivational interpretation is obviously speculative, motivational effects for imagery have been previously proposed by Paivio (1985).

The results for task B provided no evidence to support the hypothesis that the form of the gymnastics routine would be enhanced by external imagery. Indeed, the only variable which was significantly enhanced by external imagery was the memory score, for which the EVI group recorded significantly higher scores than the IVI group in blocks 1 and 2, and in the retention test. There may be several reasons for this finding. Firstly, as the subjects were not gymnasts, they may have been unable to significantly improve the fine form of the movements due to physical constraints. Alternatively, the subjects may have been more concerned with the serial recall of the pattern of movements rather than demonstrating accurate form during this recall. In order to recall any of the movement pattern, it was essential that subjects recall the gross form of the movement pattern (image of the act). Thus, external imagery may have been used to rehearse this gross form rather than the fine detail of the form of each individual position (image of achievement). Such an interpretation is clearly related to the level of experience of these particular performers. It is possible that EVI can be used to enhance both the image of the act and the image of achievement, but

that the present subjects were not at a stage where they were capable of possessing an image of achievement (c.f. Whiting and Den Brinker, 1981). If this were the case, then EVI would seem to be a more effective strategy for learning tasks which require the production of complex movement patterns. However, it could also be the case that EVI and observational learning are only relevant to the image of the act, and not the image of achievement. If this were the case, then EVI could only be recommended as a strategy during the early stages of learning. Further research using more experienced performers is clearly necessary to resolve this issue.

Taken together, the results show that IVI was not beneficial for the learning and performance of a complex movement skill within immediate body space as has previously been suggested. In the present study, it was found that EVI enhanced the early learning and retention of the gymnastics type skill. This finding may account for the lack of support for Mahoney and Avener's (1977) proposed superiority of IVI over EVI (c.f. Highlen and Bennett, 1983), and supports the view that it is specific components of skills that are influenced by different imagery perspectives. The relative effectiveness of EVI and IVI appeared to be independent of kinesthetic imagery, as the kinesthetic analysis indicated that subjects in both the IVI and EVI group experienced kinesthetic imagery with the same frequency. This finding also indicates that it is possible to experience kinesthetic imagery concomitant with external visual imagery and not just concomitant with internal visual imagery, as has often been implied (see for example, Mahoney and Avener, 1977). Whilst it could be argued that kinesthetic imagery should have been specifically controlled in the present study, the experimenters considered that requesting subjects to refrain from using kinesthetic imagery would (even if they were able to comply with this instruction) place an artificial restriction on the nature of their imagery experiences.

Following Murphy's (1990) recommendations for experimental control, data from 6 subjects in Task A and 7 subjects in Task B were excluded from the analyses, representing a loss of approximately 25% of the data for each task. Taking these measures of control results in

statistical power being sacrificed at the price of 'clean' data uncontaminated by failure to comply with the experimental instructions. The post-experimental questionnaire gave a further indication of how the subjects felt about the type of imagery they used. The self-assessment scores showed similar trends to the performance data, as the EVI group felt that their treatment was more appropriate than did the IVI group for the gymnastics task, whilst the IVI group felt that their treatment was more appropriate than did the EVI group for the slalom task.

Further examination of how external and internal visual imagery might influence learning and performance is certainly warranted. Motivation and self-efficacy effects were not examined in the present study. However, such effects might be very important in situations where tasks have to be performed in front of an audience or under competitive pressure. Despite the shortcomings of laboratory-analogue tasks, this study has clearly shown that the controlled examination of internal and external visual imagery perspectives can provide information about the ways in which they influence the learning and performance on different types of motor tasks.

CHAPTER 3

The Ability of High Level Artistic Gymnasts and High Level Slalom Canoeists to Form Visual Images from Internal and External Perspectives

3.1.1 Movement Imagery Ability

Evidence from clinical psychology suggests that the success of imagery therapy will increase if subjects are able to form clear and vivid mental images (Dyckman and Cowan, 1978; Lang, 1979). In addition, visual imagery ability has also been related positively to the development, control and recall of motor skill performance (Ryan and Simons, 1982; Goss, Hall, Buckolz and Fishburne, 1986; Housner, 1984; Isaac and Marks, 1994). In view of the possible effect of imagery ability on the relationship between imagery and performance, Murphy (1990; 1994) recommended that individual differences in imagery abilities should be examined by researchers. More recently, studies have examined the visual imagery ability of athletes from different sporting populations. Isaac and Marks (1994) investigated differences in elite athletes' ability to form visual movement images, in a review of individual differences in imagery experience. They found that the most vivid movement imagers were elite trampolinists and gymnasts, and that swimmers, divers and track and field athletes were the least vivid visual movement imagers. These findings were explained by the differences in the need to generate accurate visual and kinesthetic plans of physical movement within each sport. It was suggested that imagery may be a more useful strategy to use for sports where an idealised action plan would be produced for the correction of performance (closed skills), rather than stimulus driven sports which interact with the environment (open skills). Consequently, lower visual movement imagery ability was associated with athletes from sports which did not require the development of elaborate action plans, possibly due to the lack of practice of using imagery strategies.

In a study investigating differences in the visual imagery ability of white water canoeists, trampolinists and swimmers, Eves, Barber, Hall and Davies (1994) found that white water canoeists were able to form more vivid stationary and moving images than the swimmers. This was interpreted as indicating a greater use of visuo-spatial information by white water canoeists than swimmers. However, the canoeists were only better than trampolinists in their ability to form more vivid movement images of themselves, suggesting that there were further differences in athletes' ability to form movement images in terms of whether the images are of themselves or of someone else. This may indicate a difference in ability to personally identify with certain images, or a difference in terms of imagery perspective ability.

3.1.2 Imagery Perspective and Different Sports

Mahoney and Avener's (1977) definition of imagery perspectives has been used most frequently in the research literature, where internal imagery is defined as requiring 'an approximation of the real-life phenomenology such that the person actually imagines being inside his/her body and experiencing those sensations which might be experienced in the actual situation.' In contrast, external imagery is defined as occurring when 'a person views himself from the perspective of an external observer' during imagery. Mahoney and Avener found that gymnasts qualifying for the US Mens Olympic Gymnastic team reported using more internal imagery than external imagery. However, further studies using wrestlers (Highlen and Bennett, 1979) and racketball players (Meyers, Cooke, Cullen and Liles, 1979) found no significant correlation between reported use of imagery strategies or imagery perspectives and team selection or performance ability.

It has been suggested that differences in sports in terms of open and closed skill activities (Gentile, 1972) might account for the generally equivocal nature of the imagery perspective literature. However, Highlen and Bennett (1983) found no differences between divers (closed skill sport) and wrestlers (open skill sport) in their use of different imagery

perspectives, and studies examining the imagery use of athletes from different sports have found that imagery perspective switching during imagery is common (see Smith, 1987; Hall, Rodgers, and Barr, 1990). Rotella, Gansneder, Ojala and Billing (1980) suggested that Mahoney and Avener's questionnaire may not be applicable to elite slalom skiing. Using the Coping and Attentional inventory which they developed specifically for slalom skiing, they discovered that more successful skiers (as determined by National Ski List Rankings) formed more visual images of the course from an internal perspective than less successful skiers, who tended to form more external visual images of their entire body skiing down the course. Although this was consistent with Mahoney and Avener's (1977) findings, imagery perspective was clearly distinguished only in terms of visual imagery, irrespective of kinesthetic components. Internal imagery has traditionally been considered as having kinesthetic and visual components, whereas external imagery has been considered as purely visual in nature (Mahoney and Avener, 1977; Taylor, 1993).

The previous experimental study which manipulated visual imagery perspectives as a treatment, found that an internal visual perspective enhanced the accuracy of the learning and performance of a slalom-type task, whereas an external visual perspective enhanced the learning and recall of a gymnastics-type task (chapter 2). It was suggested that internal visual imagery allowed the rehearsal of appropriate responses to changes in the performers' visual field and therefore was beneficial for the accuracy of performance of the slalom-task. In contrast, the external visual imagery provided the novices with information about the gross form of the movement pattern, enabling them to recall the series of movements more accurately. Furthermore, kinesthetic imagery was reported as being experienced with both imagery perspectives with equal frequency. On the basis of these findings, it was predicted that internal visual imagery would be used more frequently by high level performers in canoe slalom, as such imagery provides the most useful information for successful performance of this type of event. Conversely, external visual imagery was predicted to be used more frequently by high level gymnasts, as the form of the movement is important in

gymnastics, and external visual imagery provides more information than internal visual imagery about key visual parameters such as form.

The purpose of the present study was to examine the differences in visual movement imagery perspectives of elite artistic gymnasts and elite slalom canoeists. Consistent with Isaac and Marks' view that imagery ability is a function of the amount of use of particular imagery strategies, it was hypothesised that high level slalom canoeists would be better able to form clear and vivid internal visual images of movement than external visual images, and that high level artistic gymnasts would be better able to form clear and vivid external visual images of movement than internal visual images (c.f. Rotella et al., 1980).

3.2 Methodology

The subjects were fifteen elite artistic gymnasts (8 male, 7 female) and thirteen elite slalom canoeists (7 male, 6 female) all of whom were members of the British Junior or Senior Canoe Slalom and Artistic Gymnastics Squads. All of the subjects selected had regular international competition experience.

3.2.1 Procedure

All subjects were administered the Visual Movement Imagery Questionnaire (Isaac, Marks and Russell, 1986) independently in their sporting groups. The VMIQ instructs subjects to form visual images of someone else and of themselves performing different movements as separate subscales. The sum of these two scales is used as a measure of visual imagery ability. In order to derive an internal visual perspective score for visual imagery, subjects were asked to form the *images of themselves performing different movements from an internal perspective, such that they could see the view they would actually see if they were performing the movements*. An external perspective score for visual imagery ability was derived from subjects' scores for their *images of themselves performing the different*

movements from a third person's perspective. Subjects imaged the movements with their eyes closed and rated the vividness and clarity of each image on a five point Likert scale.

3.3 Results

3.3.1 Sport Analysis

Separate single factor analyses of variance revealed no significant differences between sports for internal perspective ($F(1,26)=0.248$, $p>0.05$), external perspective ($F(1,26)=0.018$, $p>0.05$), or total visual imagery scores ($F(1,26)=0.039$, $p>0.05$). The mean scores are presented below.

	External Perspective	Internal Perspective	Total Visual Imagery
Canoe Slalomists	43.38 (16.96)	44.81 (13.90)	88.19 (26.19)
Artistic Gymnasts	44.20 (15.58)	42.07 (14.00)	86.27 (24.83)

Table 3.1: Mean total visual imagery scores and mean visual imagery scores by perspective for high level canoe slalomists and high level artistic gymnasts.

3.4.1 Discussion

These results offer no support for either of the two hypotheses as there were no significant differences between high level gymnasts and high level slalom canoeists in their visual movement imagery abilities from different perspectives. No differences in movement imagery abilities suggests that the visuo-spatial requirements of each sport might be comparable, and that visual imagery strategies were equally important for elite performance of both artistic gymnastics and slalom canoeing. Furthermore, as it was found that these high level athletes were able to form visual images from both internal and external

perspectives with similar clarity and vividness, it seems unlikely that differences in imagery perspective abilities can explain why some elite athletes have reported using more internal perspective imagery (Mahoney and Avener, 1977; Rotella et al., 1980). The results also suggest that high level performers from both sports make equal use of both internal and external visual perspectives.

The movement imagery abilities of this sample of high level performers were high in comparison to other elite sporting populations (Isaac and Marks, 1994). Thus, ceiling effects in the data may account for the lack of significance in this study. Indeed, the VMIQ may lack the sensitivity to monitor differences in visual imagery perspective abilities of high level sport performers. It should be noted that the VMIQ has only been validated to measure imagery movement ability and has not been validated for measuring imagery ability of movement from internal and external perspectives. However, despite this, the VMIQ has been associated with movement experience from both first-person and third person perspectives within two and three dimensional space (Isaac and Marks, 1994). In addition, the results of this study should be treated with caution, as the sample size was small, due to the selection of high level athletes with international competition experience. This substantially increases the possibility of committing type II errors in this study.

In the present study, the gymnasts' movement imagery ability scores were comparable with those from a previous study (Isaac and Marks, 1994), although the high level slalom canoeists in this study had considerably better movement imagery abilities than the elite kayakers reported on by Isaac and Marks. However, the latter sample may have consisted of sprint kayakers rather than slalom kayakers, and because of its technical nature the slalom event may require more use of visual strategies than the sprint event.

As different visual imagery perspectives have already been shown to enhance different subcomponents of motor skills (chapter 2), it would appear that elite athletes are more likely to choose an imagery strategy that provides the necessary information to facilitate

successful task performance. However, imagery may also be used in training situations for a different purposes. In both sports there might be opportunities to use internal and external visual perspectives. For example, a slalom canoeist might use an external visual image of completing a slalom course whilst standing on the river bank, and then might choose to use an internal visual image of completing the same course from the start line. Thus, different imagery perspectives might be used in canoe slalom, in order to supply information useful to actual performance (an internal perspective) and also information about the stroke style required to negotiate the different gates (external perspective). An artistic gymnast might choose to form an internal visual image before performing a vault in order to view the position of the spring board and vault, and then might choose to form an external visual image for a balance on the floor, in order to focus on information about its form or shape. Each visual perspective would supply the imager with different perceptual information. An internal perspective might supply more information about changes in the visual field, whereas an external perspective might supply more higher order information such as form or line of movement. In addition to this, reports of athletes switching visual imagery perspectives at vital points during task performance (Smith, 1987; Epstein, 1980; Hall, Rodgers and Barr, 1990) would support this view.

In the present study, the VMIQ was used to measure visual movement imagery ability which has not been found to correlate with kinesthetic imagery (Isaac, 1985). However, there is evidence that closed skill performers report using kinesthetic imagery frequently (Hall, Rodgers and Barr, 1990) and make better use of kinesthetic images than visual images (Isaac and Marks, 1992). Past research has also considered kinesthetic imagery as being closely related to internal visual imagery (Mahoney and Avener, 1977; Taylor, 1993). Thus, when the VMIQ is used to measure imagery perspective ability, kinesthetic imagery may become an issue. Although the amount of concomitant kinesthetic imagery experienced was not tested in this study, there is no empirical support for the contention that internal visual perspective images would facilitate the production of kinesthetic imagery. Clearly,

further research should focus on the visual and kinesthetic imagery abilities of elite sport performers, in addition to imagery perspective abilities.

In conclusion, the results of this study suggest that any differences which might exist in elite artistic gymnasts' and slalom canoeists' use of imagery perspectives are not sufficient to be reflected in self report measures of imagery ability. This suggests that the wider uses of imagery by performers also warrants further investigation. Further research using more objective measures and examining the role of kinesthetic imagery ability is certainly warranted. Detailed qualitative research examining elite performers' use of imagery might also facilitate a greater understanding of how and what types of images they use during training and competition.

CHAPTER 4.

An In-depth Analysis of the Uses of Imagery by High Level Slalom Canoeists and High Level Artistic Gymnasts

4.1 Introduction

In recent years, sport psychologists' attention has been directed towards maximising athletic performance in applied sport settings. Sport performers' use of psychological skills such as goal setting, imagery, relaxation and attention control has been examined in an attempt to determine differences between performers of different skill and success levels. (Mahoney and Avener, 1977; Orlick and Partington, 1988; Mahoney, Gabriel and Perkins, 1987).

4.1.1 Research Examining Uses of Imagery by Sport Performers

It has been suggested that imagery can be used by sport performers in a variety of ways, such as to reduce warm-up decrement prior to performance (Ainscoe and Hardy, 1987), to analyse past performance (Syer and Connolly, 1984), as a strategy to reduce anxiety (Schwartz and Davidson, 1976) and to introduce stress innoculation into training (Mace and Carroll, 1985). More qualitative approaches have identified further applied uses of imagery. The mental rehearsal of race/match plan strategies has been reported to assist goal setting, to enhance self confidence, to improve concentration, to reduce stress and enhance the quality of elite performers' training (Jones and Hardy, 1992; Hemery, 1986; Orlick and Partington, 1988).

Traditionally, imagery research in the sport psychology literature has been conducted using the mental practice model, where physical and mental practice effects on motor skill learning and performance are examined (Corbin, 1972; Richardson, 1967; Weinberg, 1981). The results of studies of mental practice have been somewhat equivocal in nature, indicating

the complexity of the effects of mental practice on learning and performance. This has been explained in terms of the nature of the task, where tasks that are more 'cognitive' in nature have been suggested as gaining greater benefits from mental practice (Feltz and Landers, 1983; Lutkus, 1975; Minas, 1978; Ryan and Simons, 1981; Wrisberg and Ragsdale, 1979). However, positive mental practice effects have also been found for motor tasks (Gould, Weinberg and Jackson, 1980; Clark, 1960; Shick, 1970; Rawlings and Rawlings, 1974).

Although imagery has been reported as being used by sport performers for the purpose of learning and perfecting skills in training, mental practice effects are insufficient to explain the whole range of uses of imagery related to competition such as it's use to enhance motivation or control anxiety. Indeed, one of the only studies to examine the use of imagery by athletes from different sports found that the athletes reported using imagery more in conjunction with competition than training, and that they indicated a clear motivational function of imagery (Hall, Rodgers and Barr, 1990). However, as this study used an unvalidated questionnaire, the authors advised that the results should be treated with some caution.

Paivio (1985) proposed that imagery exerts its influence on performance and learning via a cognitive function and a motivational function, thus incorporating the variety of ways that imagery can be used in training and competition situations. Both functions of imagery are proposed by Paivio to operate at a specific level and a general level. Thus, for the cognitive role, imagery can be used to rehearse specific skills of the sport at a specific level, or it can be used to rehearse behavioural strategies at a general level. For the motivational role, imagery can be used to improve motivation towards specific skills (seeing oneself perform a move successfully) at a specific level, it or can be used to enhance motivation in general by creating an appropriate mood or arousal state for the activity at a general level. Salmon, Hall and Haslam (1994) devised a sport specific Imagery Use Questionnaire, in order to study the different ways that soccer players of different skill levels used imagery. They found that soccer players reported more imagery use for motivational purposes than for

cognitive purposes, and that there were differences in terms of image use by players of different skill levels.

Martin and Hall (1995) have found that imagery of successful performance can be used as a motivational tool, in order to increase on task motivation and therefore increase time spent in practice for a golf putting task. Thus, imagery may have motivational effects in the training situation, as well as in the competition environment. This effect of imagery was explained in terms of it's ability to provide vicariously experienced information about task performance, thereby enhancing intrinsic and on-task motivation (Deci and Ryan, 1985; Feltz, 1984). Thus, it may be the positive nature of imagery that exerts an effect on self efficacy and therefore leads to enhanced perceptions of competence and increased persistence. (Bandura, 1977).

The few studies that have studied imagery use, by athletes in competition and training environments (Hall, Rodgers and Barr, 1990; Salmon, Hall and Haslam, 1994), rather than its functional equivalence with physical practice, have employed quantitative surveys. The present study was designed to explore the differences in imagery use by high level athletes from two different sports, artistic gymnastics and slalom canoeing. As survey measures might lack sensitivity (c.f. Chapter 4) or might fail to identify critical variables, a qualitative research methodology was chosen to investigate imagery uses (Locke, 1989; Martens, 1987). In-depth qualitative interviews have already been used to gain a deeper understanding of how elite athletes use psychological skills (Orlick and Partington, 1988; Gould, Eklund and Jackson, 1992), to determine athlete defined sources of stress (Scanlan, Stein and Ravizza, 1991; Gould, Jackson and Finch, 1993) and to understand the positive and negative experiences of national champions (Gould, Jackson and Finch, 1993). It was hoped that the rich data provided by a qualitative methodology would facilitate a greater understanding of how imagery is used by gymnasts and slalom canoeists in competition, training and other environments, and also allow some understanding of the reasons for its

use. The purpose of this paper then, was to report the uses of imagery by slalom canoeists and gymnasts in different environments.

4.2 Methodology

The participants in this study were three members of the British Junior Canoe Slalom Team and three members of the British Women's Artistic Gymnastic Team (two female, one male and three females respectively). All athletes were aged between fifteen and eighteen years old, had experience of international competition, and had on average 6 years of competitive experience.

4.2.1 Procedure

All subjects volunteered to participate in live interviews which lasted between 39 and 55 minutes. The interviews were conducted in the athletes' training environment. Each participant was asked the same series of standardised open ended questions which were outlined in an interview guide (see Appendix 3A and 3B). The interviews were recorded using a Dictaphone, and were later transcribed verbatim into 100 pages of text.

4.2.2 Interview Guide

The interview questions were arranged within the interview guide into the following interrelated sections:- general uses of imagery, imagery instruction, details of competition imagery, imagery in training/in other environments and imagery effectiveness. However, for the purposes of this chapter, only the first two of these sections is described. The other sections of the interview are presented in the next chapter. The interview was preceded by an introductory section which explained the purpose of the interview, the procedures being used and provided orienting instructions in order to elicit the depth of detail required for each section of the interview. The introduction was followed by a demographics section in

order to obtain background information about the subjects, and then the questions of primary interest.

The following definition of imagery was read out to the subjects, prior to the open ended questions regarding uses of imagery, in order to check that they were in agreement with this definition.

> Imagery is an experience which mimics real experience. We can be aware of 'seeing' an image, feeling movements as an image, or experiencing an image of smell, tastes or sounds without actually experiencing the real thing. Sometimes people find that it helps to close their eyes. It differs from dreams in that we are awake and conscious when we form an image.

In the first section of the interview about general uses of imagery, the athletes were asked to identify different situations in which they have used imagery, and their reasons for its use. Subjects were then asked questions about how they learnt to image in order to gain further background information about any formal imagery training they had received, or any imagery exercises they had used in the past. In order to ensure that there were no serious omissions in the interview guide, with regard to the uses and details of imagery, subjects were asked if there were any other issues that they thought would enable us to understand how they used imagery.

After they had explained how they had used imagery in the past (and throughout all sections of the interview), subjects were asked general probes in order to ensure that all situations and reasons had been identified (example: 'Can you remember any other occasions when you have used imagery?'). In addition and where appropriate, subjects were asked specific elaboration probes, in order to encourage them to expand on their answers and to gain a fuller depth of understanding of their responses (example: Does imagery help any aspects of your performance?). These probes were standardised and asked in the same way to control

interview bias and to encourage subjects to respond to the questions with a similar amount of detail.

4.2.3 Data Preparation and Analysis

Based on the interview structure and the nature of the information provided by the athletes, quotes related to the use of imagery were extracted and used as raw data for the main analysis. A combination of inductive and deductive procedures was used to analyse the data, such that deductive processes were used to extract the data about imagery uses from data related to other issues. Deductive procedures were also used to organise the data in the initial stages of the analysis, and to make comparisons between the two subgroups of athletes. However, the main data analysis employed the inductive procedure, recommended by Patton (1980) and adapted to sport by Scanlan, Ravizza and Stein (1989) and Gould et al. (1992), which is outlined below.

A hierarchical content analysis was performed on the data as follows-

1. Tape recorded interviews were transcribed verbatim into 100 pages of text.

2. Two researchers, one of whom was also the interviewer, read and re-read the transcripts to become familiar with the text, and listened to the tapes where appropriate in order to pick up any additional information (other than the words) from the tapes.

3. Individual ideographic profiles on each of the athletes were then written by each researcher, in order to gain further familiarity with the scripts. Each profile was discussed until a consensus was reached, and a joint profile was identified (see Appendix 3C).

4. Each investigator identified an independent set of raw themes to characterise the responses of each athlete within each subsection of the interview. These raw themes were described as quotes or paraphrased quotes that are self-definable and self-delimiting in an

expression of a single recognisable aspect of the athletes' experience (Cloonan, 1971) - in other words, they encapsulated a distinct idea or concept which characterised an athlete's response within a subsection of the interview. Together, the researchers then discussed the identified themes and came to a consensus of agreement on each raw theme to be used in the analysis from all six subjects. Each raw theme was written on a card. Agreement had to be obtained on each raw theme. When disagreements occurred the investigators returned to the transcripts and re-discussed all of the points of contention.

5. The content analysis organised the raw data themes into categories using a combination of inductive and deductive approaches. For the inductive approach, emergent themes were developed by the clustering of themes according to their similarity of meaning. These clusters were labelled as in a factor analytic procedure (first order themes). Further, a hierarchical structure developed by the identification of relationships between clusters of first order themes was used to establish higher order themes (second and third order themes). Each higher order theme was more analytic and abstract (although in some cases raw themes could still be expressed at higher levels). Consensus had to be reached on each higher order theme.

6. An additional researcher carried out a further reliability check. This was performed by coding randomly selected quotes into the raw themes (see Scanlan, Ravizza and Stein, 1989), and then categorising second order dimensions into general (third order) dimensions. Reliability was 92% (23 out of 25 quotes correctly coded) and 100% (all higher order data themes correctly coded).

7. After higher order themes were identified, each descriptor was re-read to ensure that they made sense and could be understood. This was done to ensure an overall coherency of the analysis. Both researchers reached a consensus of opinion on the overall structure of the analysis.

4.3 Results

The purpose of this investigation was to determine the variety of ways in which high level gymnasts and slalom canoeists use imagery. The results are presented in the order in which the analysis took place, such that the raw data themes and lower order dimensions are described, followed by the emergent higher order themes. Situational differences and sport differences are also described where appropriate. Frequency counts or percentages are not included in the analysis due to the small subject numbers and the problem of misrepresenting the importance of the use of imagery to the individual. From 125 quotes and 43 subsequent raw data themes related to different uses of imagery, 10 first order dimensions and 3 second order dimensions were derived to form the general dimension 'Uses of imagery'. Initially, the first order data themes are described in terms of their composite raw data themes, and further illustrated using selected quotations.

4.3.1 Use of imagery in different situations

Five raw data themes emerged to form this first order dimension, which was a collective of quotes about the variety of different situations in which imagery was used. All of the subjects used imagery in association with both competition and training situations. The canoeists reported the use of imagery on the day of competition, before the warm up when they were planning how to do a course, 'I watched the other four runners and then walked the course, um, each section looking at it, watching the water and then thinking about how I was going to do it, imagining myself, watching myself do it'. They also reported using imagery before they got onto the water for a warm-up, 'I do one sitting in my boat before I get on.....I just go off to the side and do one there', and then as part of the warm-up, 'in my warm-up, I always do a full run in my head'. They often used imagery immediately before a run 'just two minutes before my run (I go) through sort of like down the course....I go through the lines....so if I'm sat properly, by the time I've finished, the next run's coming and

I can go down'. Another use of imagery in competition for the canoeists was in reviewing a run, 'you do it afterwards to review mistakes'.

The gymnasts reported using imagery 'the day before a competition', when they usually had a day off from training. Strangely, they did not report using imagery before the warm up, possibly due to their reports of feeling under pressure to use the warm-up time for physical practice: 'everything's a bit tense really, especially when you've only got three minutes to do your things and like everyone's trying to get on'; 'in the warm up....we didn't have enough time. You've got to get on it, do it, do your work and get off'. Imagery was most frequently used immediately before competing on a piece, 'just before I'm about to do it'; 'just before, like when a girl was on the floor and I was next, just before I went on'; and 'every time I was going to compete on a piece, I went through the mental routines in my head'. However, it was also reported as being used after competing on a piece of apparatus to re-focus on the next routine, 'like after each apparatus, thinking about the next one'; 'we had to wait until the rest, everyone had finished, so I was thinking of everything then'. Thus, there were similarities in the way that the canoeists and gymnasts reported using imagery in competition.

There were also similarities in the way they used imagery in training. It was most commonly associated with training for full runs or routines, 'I use it in full runs in training'; 'sometimes my coach will say to me 'lie down on the crash mat and think about, go through ten beam routines'; however, it was also frequently used for rehearsal of difficult moves or movement patterns in training. All subjects were in agreement that imagery was used much more in competition than in training, 'I do use it in training, but not as much as I do in racing'; 'In training, it's not used very often.....it's not as intense as in competition'. Imagery was also reported as being used in a whole variety of different situations including walking along the river bank, sitting on a bench, on the hockey pitch to see ways round the pitch, to navigate around rooms when the light is out, at school, in bed, at home and sitting on the toilet! Despite the diversity of situations in which imagery was used, none of the subjects felt that

they practised imagery enough in training, or used it to it's full potential: 'I think I should spend more time on it really'; and 'I don't use it to the extent of most people....I don't use it to it's full potential'.

4.3.2 Differences between competition and training imagery

This first order dimension was associated with raw data themes that were related to the differences between the experience of imagery in training and in competition. Most of these raw data themes were reported by both gymnasts and canoeists, and perhaps also partially explain the reports of more imagery use in and prior to competition than in training. In general, the training situation was perceived as far more relaxed than competition, 'in training it's....miles more relaxed and less pressure', 'very relaxed as compared to competition', 'very laid back....very relaxed as compared to competition'. Imagery was therefore less likely to be used in a goal directed way in training, 'you'd have done a couple of runs before (imagery), where you just paddle around and you mess around'; although it appeared that this was largely dependent on the amount of reinforcement of imagery use in training from the coach. Generally, the subjects were less likely to feel anxious or emotional, 'I wouldn't feel nervous in training', 'I'd be more tense in competition' and ' sometimes I get stressed out, 'cos I'm having a bad day, but not as much as in comps'. However, the more relaxed training environment had conflicting effects on two of the subjects' use of imagery (one gymnast and one canoeist). The gymnast felt that competition enabled her to focus more during imagery, 'I'm more focused than I am in training.....I'm sort of clear in my mind in what I'm doing', whereas the canoeist felt more focused in training, 'I find that I can focus more in training than I can in competition.' A further individual difference was mentioned by one of the canoeists, who stated that her images were more visual in nature in training than in competition, 'I can feel the movements, but see them a lot more'.

4.3.3 Uses of imagery in competition and other situations

This second order dimension comprised the two first order dimensions identified above, which emerged from 12 raw data themes induced from 41 quotations. In general, it reflected the variety of different uses of imagery, such as those in competition, in training, at home and in other situations such as in school. In addition, it identified differences in the nature of images in the different situations, such as differences in emotional states, modalities and purposes of the images.

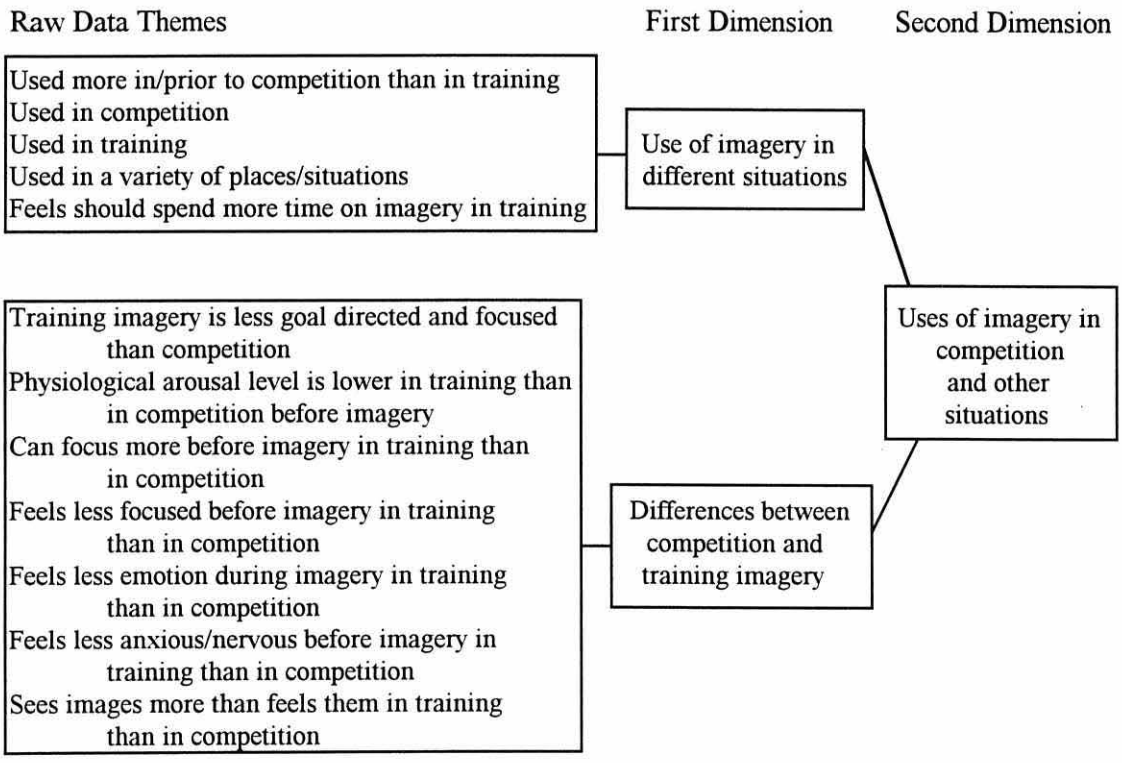

Figure 4.1. Uses of imagery: Hierarchical structure of second order dimension "Uses of imagery in competition and other situations".

4.3.4 Imagery used to acquire and rehearse skills

This category combined several different uses of imagery, including the use of imagery to learn and rehearse skills in training situations. Imagery was described by both gymnasts

and slalom canoeists as being used 'if you're learning a new move'; 'to go over how to do a move'; 'to get me more familiar with a move'; and for 'training purposes.....rehearsing skills'. Subjects also indicated that they used imagery for the analytical function of understanding moves in training; for example, 'to help get the timing and where each move comes'; and 'to know if....you're not going to make that gate'. In addition to understanding moves, the gymnasts reported that imagery enabled them to instruct themselves in training situations, 'I can understand what I am doing wrong, so I can help myself, instead of leaving it to the coach all the time'; and 'if I watch it in my mind, then I can think 'right, that is how to do it better'.

Reflecting the specific nature of slalom, canoeists identified imagery as being used to formulate and rehearse movement plans in both training and competition situations, 'I use it to know what I am doing on the course basically'; 'to know where to go.....orientation.....that's the thing'; 'in slalom you want to plan out what you are going to do....you don't go down and do what you feel is right at the time'. Furthermore, the canoeists felt that imagery had some functional equivalence to physical practice, as they reported the use of imagery to get extra practice in both training and competition situations, 'to sort of get...extra runs on the course really....so I go through it and sort of know a run'; 'every time you do a full length imagery, then you are getting an extra practice run, so the more you do it, the more you practice the course'.

4.3.5 Imagery used to perfect and automatise skills

This dimension emerged from a number of raw data themes associated with imagery use to finely tune movements and routines. Gymnasts strongly indicated that they used imagery to 'help me perfect that move more'; 'looking at everything and doing it so I would really get a high score'; and 'to go through routines to make sure that they're perfect' in both training and competition. This was achieved by focusing on particular small details of performance such as 'twisting in the right way or putting my feet in the right place' or by 'lifting your

head, or keeping your toes pointed'. The gymnasts also indicated that imagery was a means self-instruction in competition by reminding themselves of the minor details of performance, particularly when their coaches were not around to instruct them. During imagery they reminded themselves to 'make sure that everything's right like my feet are pointed and I'm not scraggy, ...I stand up all of my tumbles.....then when I have finished my last tumble, to finish off the routine as well'. One gymnast employed an interesting strategy of including instructions as an aural component to her imagery, in order to instruct herself, 'my coach.....can't shout at me when I'm in competition, so I imagine her shouting at me, so that I can do it properly.....so I can improve it and just get more marks'.

In contrast, the slalom canoeists reported using imagery to automatise their responses in competition and training. Quotes associated with this included 'I do it...so that on the run it just happens....because ultimately you want to be doing it subconsciously, just doing it really'; and 'to try and get myself on automatic pilot on the run'. This meant that the canoeists were able to 'guess a lot quicker' or think much less about their responses on their way down the course. One of the canoeists used imagery to focus specifically on emphasising the speed of performance, 'I do the imagery going fast, so that I know that if I am on the water, I can do it dead quick'. This high speed imagery may also have served a motivational function.

4.3.6 Imagery used to maintain skills

In the present study, this dimension was only representative of the gymnasts, as none of the slalom canoeists reported using imagery in order to maintain skills outside of competition or training environments. The dimension included two raw data themes. Firstly, the gymnasts reported using imagery of their routines at home when out of training 'if you've got the day off'; although imagery was most commonly used in this way on the days 'before a competition', when training was light. However, one of the gymnasts reported not practising much imagery outside of the gymnasium. She stated that she usually 'just tries to forget the gym, and like to try to lead a normal life'! The gymnasts also reported using imagery to

maintain skills when they were injured and unable to perform. One gymnast reported using imagery 'when I was in plaster, on my leg.....like every day I was doing it then'. Imagery in this case was used 'to keep the move and not to forget how to do it'.

4.3.7 Imagery used to review and adjust past performance

Both slalom canoeists and gymnasts reported using imagery to replay previous performances in training 'straight after a run'. They also indicated that imagery was used to restructure mistakes following a review, 'I can think of myself, and try to stand the move myself and then I can understand what I am doing wrong'. Only slalom canoeists indicated that they used imagery to review and adjust performance in competition, 'I would do it....afterwards to review mistakes' and 'if I've messed up my first run, I know where I've messed up, then I just think it out, I just go through it so it's not a problem'.

4.3.8 Imagery used for mental practice

This dimension emerged from 4 first order themes and 19 raw data themes, which were all related to the use of imagery to mentally practice skills and routines, thus representing a direct effect of imagery on learning or performance. These themes which are described above were: a) used to acquire and rehearse skills, b) used to perfect and automatise skills, c) used to maintain skills, d) used to review and adjust past performance.

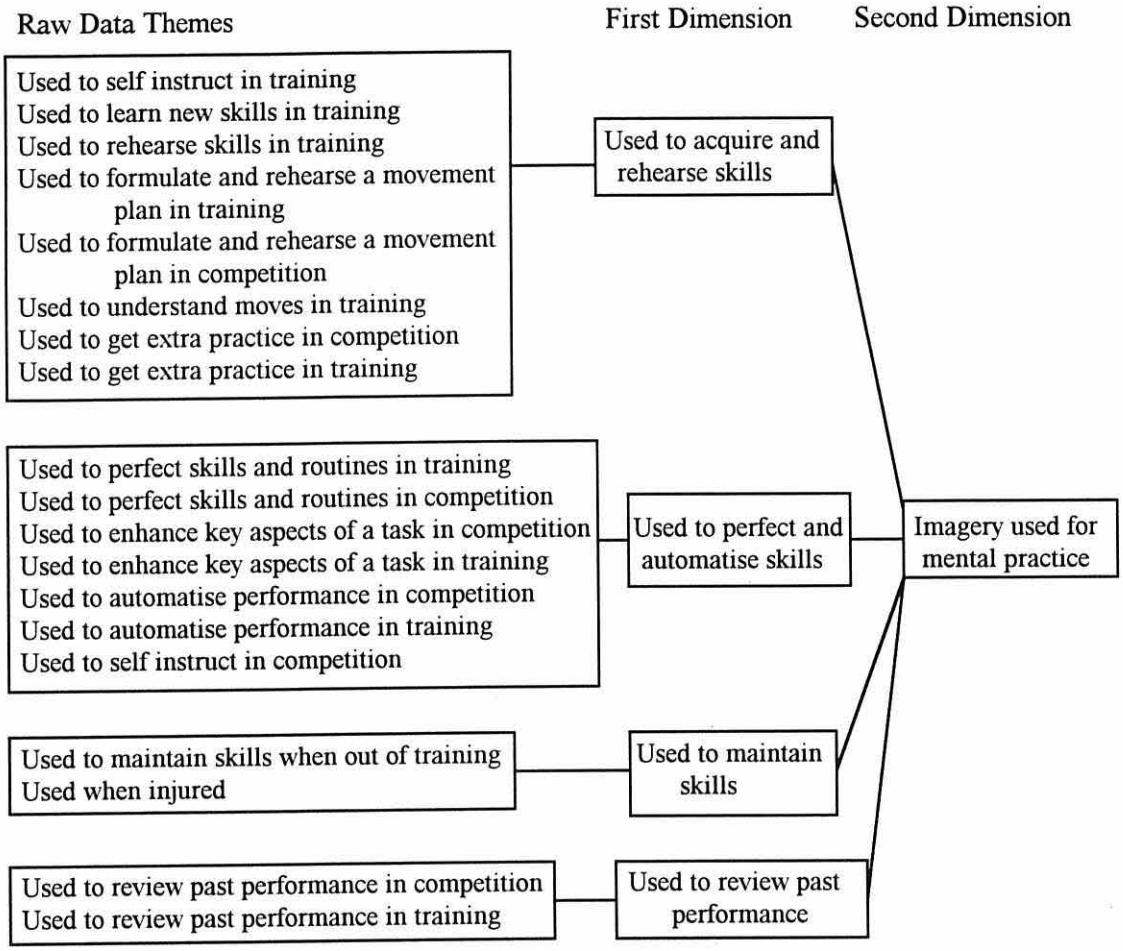

Figure 4.2. Uses of imagery: Hierarchical structure of second order dimension "Imagery used of imagery for mental practice"

4.3.9 Imagery used to enhance mood and emotional control

The use of imagery to enhance mood was only mentioned by the slalom canoeists, all of whom reported that they used imagery, in order to create the right mood state for the slalom runs in training and in competition. Terms that they used to describe the emotional effect imagery had included 'excited', 'hyped up' and 'aggressive'. These emotional effects seemed to be associated with the content of the image. Indeed, one canoeist reported that she emphasised the emotive content of her images by performing an 'angry prep.'. During an angry prep. she indicated that imagery was used to 'help psyche myself up.....imagining myself you know, really putting a lot of effort in' and that during the image, she would

'really sort of concentrate on imaging myself aggressively sprinting.....coming out of the gates and imagining myself really pulling hard on the bow rudder, really putting effort in on the sprints....and sort of really getting psyched up'. In contrast, the images she used when performing a 'mellow prep.' were more mental practice orientated 'my mellow preps. are just running through it, you know, with the physical bits....the muscles and that', and would have a different emotional state attached to it, 'it would be quite relaxing to just go through it being mellow and going through it and getting it all right.'

On the other hand, the gymnasts appeared to use imagery in order to control anxiety in training and in competition. In training situations, anxiety was associated with difficult or 'scary' moves, and imagery helped 'to sort it out, like if your scared of it, if you go through it in your head, then it will calm you down'. Other related quotes included 'if I'm scared of it, it might help me to get over it', and 'it calmed me down a lot'. The gymnasts also believed that a reduction in anxiety about the move following imagery, would help them to perform moves successfully: 'then you can actually do that move without falling.....you're not scared of it.' One gymnast reported that she would also feel anxious if she was not performing moves successfully in training, in which case she would use imagery for reducing 'anxiety, like me getting angry with myself for like doing a certain move that doesn't stick all the time'. In addition to this, she indicated that her coach would encourage her to use imagery if training wasn't going well in general, 'if I'm having a really rubbish day then my coach will say like 'just go through it in your head', in which case imagery would help her 'to relax....and not get psyched out about it....if it's not going right'. Only one canoeist expressed that she might feel a little anxious in training 'if you're getting stressed out about a move', or if she was 'a little anxious about hitting the first gate'. In each case, she indicated that seeing herself successfully performing the moves would make her 'feel less anxious'.

Most of the subjects, with the exception of one of the canoeists reported using imagery to deal with the stress of competition. Imagery was commonly quoted as helping them when

they were anxious or tense, 'to calm down' or 'to feel relaxed', but only if performance had been successful in the image, 'then I know I can do it'. The ability of imagery to reduce stress was clearly linked to its controllability. Indeed, if the imagery was not of a successful performance, it would increase the amount of anxiety experienced: 'Then I'm bound to feel even bigger stress than I was before without it'; 'if you weren't in control of it, then it could just psyche you out more than anything else'. However, this was not the only mechanism by which imagery was used to reduce anxiety. One canoeist found that the use of imagery in competition would make her feel 'more anxious, which is good.....because you're ready you know, you want to get on and do it'. Although imagery did not make her feel more relaxed, it did help her deal with competitive stress by preventing her from having time to worry about her performance, 'it brings you away and like you're not waiting, you're always doing something you know, it's relevant to the competition'.

4.3.10 Imagery used to enhance concentration and avoid distractions

All of the subjects reported that they used imagery, in order to increase their concentration in training. This was considered by the gymnasts to be very important, firstly to ensure some degree of success in performing the moves, 'if I'm not 100% concentrating on what I am doing, then I know it's.....pointless me doing it, I'm not gonna do it'. Imagery use in training to increase concentration was also considered important by gymnasts because of the risk of injury when performing some of the moves. As one gymnast said when asked about imagery use in training, 'it's to help me concentrate.....so I don't do anything stupid, 'cos if I lose my concentration, I'd just hurt myself'. The canoeists found that imagery was useful to maintain their concentration when practising runs with difficult moves in training, and especially when practising full length runs. One of them said that he used imagery as a part of special 'concentration sessions' that he would take part in once a month, which would involve concentrating on key visual features of the environment during imagery, 'the water movement.....just one part of the gate, the most important part' and his orientation relative to these features, 'getting before the gates.....gate line'.

In general, subjects reported less use of imagery to specifically enhance concentration in competition. One gymnast reported that imagery 'helped me to think clearer' which enabled her to 'not get all worked up'. However, the only other report of imagery to increase concentration in competition came from one of the canoeists, who reported that imagery helped her 'feel switched on and keeps her away from everybody'. Thus, the pure action of imagery was used in this case, to prevent her from being disturbed or distracted by other people or events.

4.3.11 Imagery used to enhance motivation and self confidence

Both gymnasts and canoeists indicated that they used imagery to enhance motivation in training and competition. This was reported at a general level where imagery was reported as making them feel 'more motivated, especially before a competition when I go through the moves' or 'wanting to do it like properly, the best I can'. At a specific level, several imagery strategies were reported to enhance motivation in competition. One gymnast reported using imagery just before arriving at a competition, when experiencing 'butterflies.....like a load of energy that can burst at any minute.....if I do imagery it gives me more, so I've got adrenaline to sort of push it out'. A canoeist recalled using imagery of previous courses or imaginary courses before a competition 'to switch on to a race.....It just makes me switch on to the competition and prime my body for a race and get the adrenaline going.' At a more abstract level, another canoeist reported using imagery of the year before, when he had performed well, 'I remember....getting up on the podium with the other two. So, I remembered that when I was going up there, and saying "I've got to do it again".'

The use of imagery to enhance self-confidence in both training and competition was reported by all of the subjects and represented the largest number of associated quotes (n=19). When used for this purpose in training, imagery was likely to be linked to situations where a move or set of moves were perceived as difficult and the subjects were unsure about their ability to achieve them. Examples of these quotes included, 'if you're unsure

about a move, the more times you go over it in your head, the more confident you feel' and 'if I'm nervous about something and then I think about it, the more I become confident with it'. However, this particular use of imagery depended on the experience of success during imagery, 'it just shows you what you want to see....you've been there and you've done it in a way, you just know it's gonna be okay', and 'when I can imagine myself doing it, that's when I know I can do it'. The necessity of imaging successful performance was strongly stressed by everyone. In general, imagery enhanced self-confidence when the athletes' were able to see themselves performing something successfully, but had the opposite effect the move went wrong during imagery. 'I do if it went well, but I wouldn't if it's not worked.....I wouldn't want to do the move if it went wrong'. One of the gymnasts indicated that she also used imagery to enhance self-confidence when she was injured and was unable to physically train. She felt that regular imagery practice whilst injured had no only enabled her to 'keep the move', but that she also felt more confident when returning to training 'I still knew I could do it, and it gave me more confidence'.

In competition, imagery was quoted as functioning in the same way as in training to improve self confidence, 'you know you can do it. As you go through it in your head you think 'I can do that in my head. I should be able to do that when I'm paddling', 'it's so I can do it and I know I can do it.....I'm confident to get from there, or when I get there I know this is going to happen to my boat' and 'it helps confidence, so you know you can do it because you've gone over it'. Imagery use to enhance self confidence in competition was also helpful for restructuring negative thoughts, as reported by one canoeist 'it gives me confidence because I don't go through it thinking 'shit, I'm going to mess this up.....it's always positive'. It also exerted an influence over subjects' feelings of outcome related confidence, 'every time you are going over it in your head, you are going over the winning race in your head' and more simply 'I know I'm not going to be last!'.

4.3.12 Imagery used to simulate competition

The use of imagery to simulate competition was reported by two of the canoeists and surprisingly by only one of the gymnasts. For the canoeists, the purpose of the simulation sessions was to 'put pressure on myself.....and to psyche myself up, so it is more under race conditions'. In order to achieve this, imagery would be an integral part training sessions including full course runs and time trials; 'if you were doing competition simulation runs, it would actually be the preparation of the course in the imagery'. The gymnast reported that her coach regularly encouraged her to use imagery to simulate competition, in order to 'like concentrate as if you are actually doing it on the day, like you're doing it in the room'.

4.3.13 Use of imagery to enhance motivation, concentration and affect

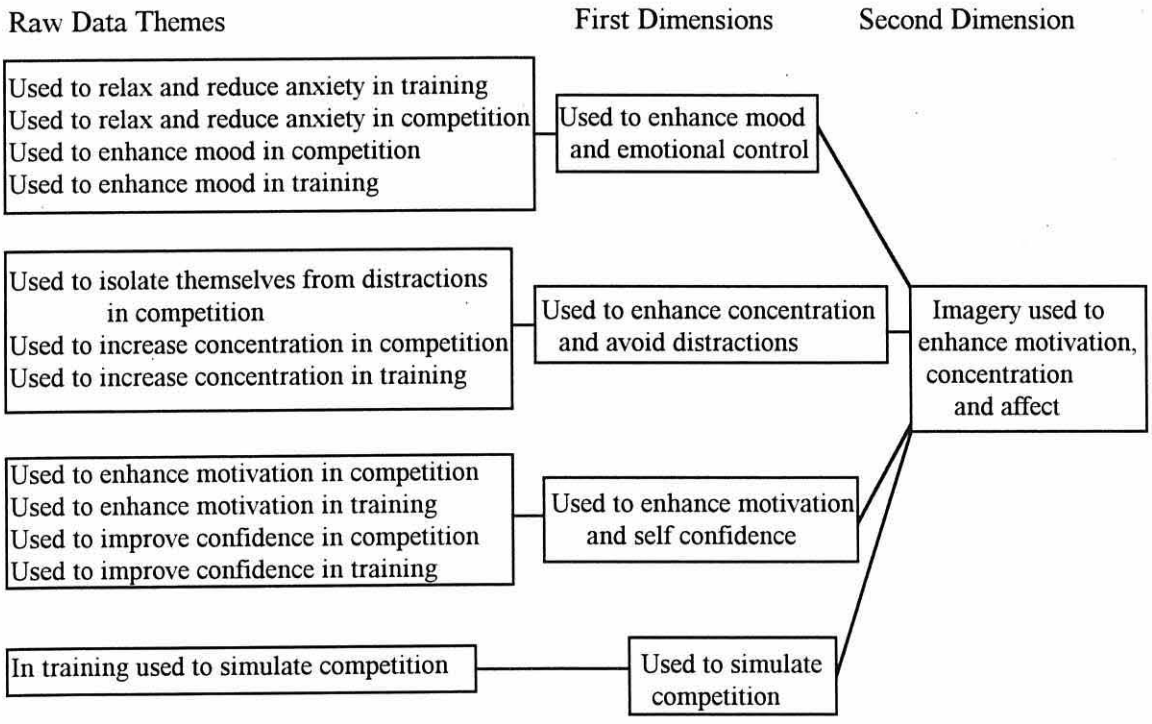

Figure 4.3: Uses of imagery: Hierarchical structure of second order dimension "Imagery used to enhance motivation, concentration and affect".

This second order dimension comprised four first order themes related to the use of imagery to enhance motivation, self-confidence and affect, to control anxiety and to simulate competition. The four first order dimensions were derived from 12 raw data themes; however, these themes were fairly highly representative of all subjects (44 quotes), indicating the importance of this dimension. The four first order dimensions described above were a) imagery used to enhance mood and emotional control, b) imagery used to enhance concentration and avoid distractions, c) imagery used to enhance motivation and self confidence and d) imagery used to simulate competition.

4.3.15 Uses of Imagery

Three second order dimensions emerged to form the third order dimension "Uses of Imagery". Figure 4.4 shows the structure of this third dimension, in terms of first and second order dimensions.

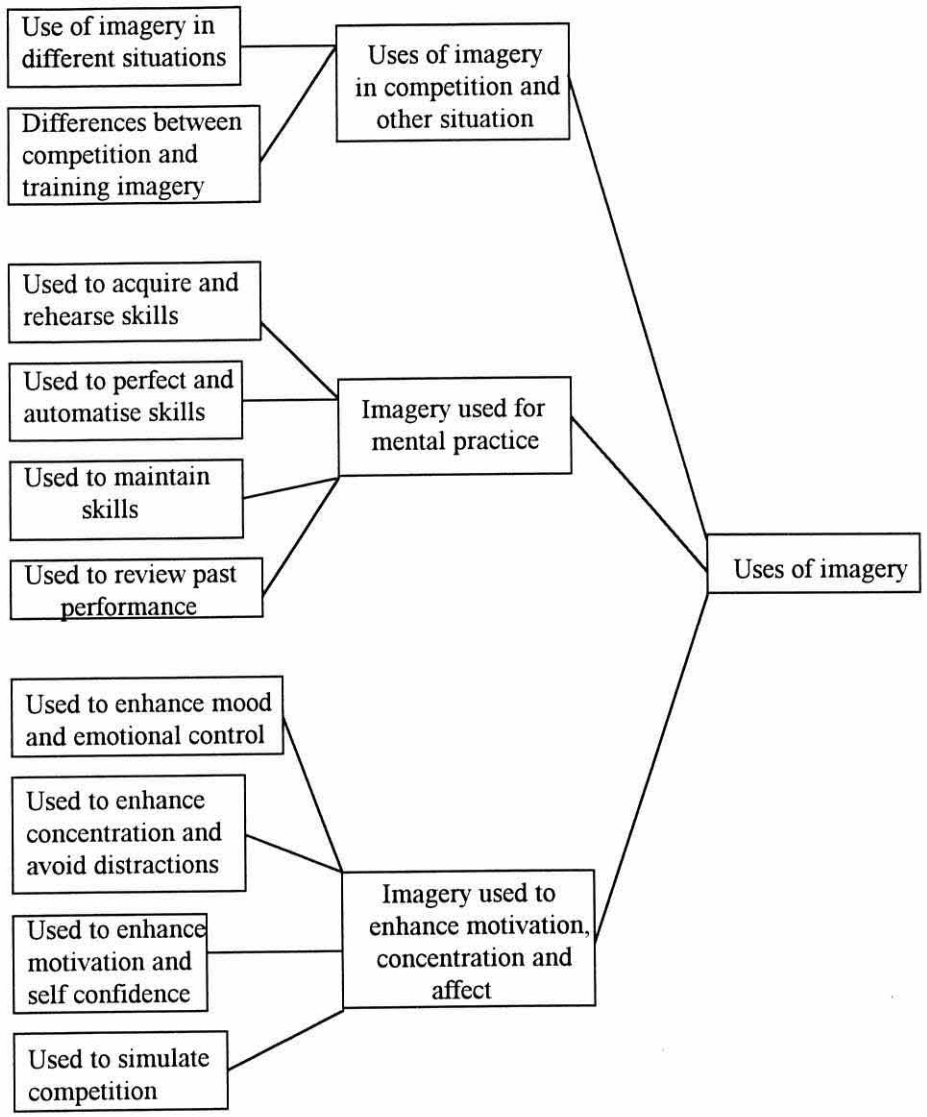

Figure 4.4: Uses of imagery: Hierarchical structure of the third order dimension "Uses of imagery"

4.4 Discussion

The qualitative interviews revealed a wide range of different uses of imagery in training, competition and other environments. Consistent with Paivio (1985), these uses reflected both direct cognitive effects of imagery on performance and learning, and indirect motivational effects. In addition, a comparative dimension emerged from the data which raised several important issues, in terms of imagery use in training and competition.

Also, consistent with previous literature (Hall, Rodgers and Barr, 1990; Salmon, Hall and Haslam, 1994), all of the subjects indicated that they used imagery more in association with competition than in training, and further claimed that they felt that they should spend more time on imagery in training. It was clear throughout the interviews that coaches did encourage their athletes to use imagery for specific purposes. However, they largely left the athletes to prepare in their own way, and concentrated on physical rather than mental training. Coach encouragement played an important role in the use of imagery outside of training, before competitions or when injured. In the present sample of athletes, it was mainly the gymnasts who indicated that they used imagery out of the training environment, and it was clear that the coaches had specifically encouraged this use. There is some evidence therefore, to suggest that coach education programmes might heighten coach awareness of the variety of potential uses of imagery, and encourage them to provide more guidance to the athletes about imagery.

Imagery was reported as being used for it's cognitive function of mental rehearsal by both gymnasts and canoeists, in training and competition. The ways in which it was used were often determined by the particular demands of each sport. In Paivio's (1985) terms, the gymnasts reported that imagery was used most frequently at the specific cognitive level of rehearsing skills and difficult moves in training and competition, with an emphasis being placed on either understanding the technical demands of the move, or on imaging specific details to perfect the performance of skills. In contrast, the demands of slalom canoeists' sport dictated that they used imagery at a specific level to rehearse difficult moves, and at a general level to formulate and rehearse potential movement plans through slalom courses.

The specific task demand differences of slalom canoeing and gymnastics might also explain why the canoeists, but not gymnasts, reported using imagery to review competitive performance. In competition, slalom canoeists attempt several runs down the same course (1 practice and 2 competition runs). As only the fastest and cleanest run counts in the competition, reviewing can be a very useful tool to correct the mistakes made on the first

competition run and therefore improve performance on the second run. In contrast, the gymnasts only get one attempt at each routine, so that imagery has a more important role before a routine, than as a reviewing tool. In addition to this, an imagery review following a performance in gymnastics might serve as a distraction when the gymnast has to prepare for the next routine on a different piece of apparatus, particularly if serious mistakes have been made in the previous routine. However, imagery was used by athletes from both sports in training situations, when there would be several opportunities to rehearse the same skills, routines and courses.

Canoeists noted that they used imagery in order to improve their automaticity of performance in competition and training situations. This was particularly interesting, since it has been suggested that imagery might interfere with the automatisation of performance by requiring the performer to focus conscious attention on aspects of performance at the wrong time (Paivio, 1985). However, one could counter this suggestion by arguing that visual imagery relies primarily on implicit knowledge. The canoeists often talked of using imagery as soon as they knew the course, and long before actual performance, to plan and sequence responses to the course. Further mental practice might refine the image, such that the responses would become implicit and automatic in nature. Thus, imagery in this case was used specifically to improve automaticity. This view was supported by the fact that the canoeists equated imagery with an extra physical practice run down the course, indicating that they believed that mental practice would improve their automaticity in a similar way to physical practice.

Another interesting point was the reported use of verbal instructions (coach's voice) during imagery by one of the gymnasts. She indicated that this served a useful role during training, since it reminded her of key aspects of performance, and also enabled her to instruct herself in the absence of her coach in training and competition. However, it has been suggested that encouraging athletes to focus on explicit knowledge (verbal cues) related to details of performance during training and competition could have a detrimental effect when

performing in competition. Studies investigating the effects of stress on motor skill performance have found that automaticity is more likely to be disrupted under stressful conditions if the skill has been learned with the use of conscious attendance to explicit rules, because (it is thought) performers are more likely to regress to conscious processing when they are anxious (Masters, 1992; Hardy and Martin, 1995; Hardy, Mullen and Jones, in press). Thus, under the stress of competition, the conscious attendance to verbal cues leads to impaired performance because conscious control is less refined than low level automatic control.

The use of imagery to enhance motivation, concentration and affect featured strongly in all of the interviews. Imagery was reported as enhancing motivation in a number of ways, representing both of the dimensions proposed by Paivio (1985). At a general motivational level, it was reported as an energising strategy for moves requiring a lot of energy, and as a means of enhancing general affect by using images of receiving medals and imaging "top class" performance. The use of imagery to improve self-confidence was most frequently reported. It was considered particularly important if there was a degree of uncertainty about successful performance outcome, such as when a move was perceived to be difficult, in the absence of physical training following injury, or under the stressful conditions of competition.

The effect of imagery to enhance self-confidence was indicated as being mediated by the successful nature of the image, thus supporting a self-efficacy account (Bandura, 1977; Feltz, 1984), whereby imagery enables the athlete to gain vicarious experience. If performance during the image is unsuccessful, the vicarious information supplied by the image would be negative, and would therefore decrease self-efficacy (Bandura, 1977; Woolfolk, Parrish and Murphy, 1985). There was also some support for an intrinsic motivation explanation of negative imagery (Deci and Ryan, 1985; Martin and Hall, 1995), as one of the gymnasts reported that she would not want to practice a move if imagery of that move was unsuccessful. In this case, failure at the task during imagery would provide

negative feedback about the athlete's ability to perform the move and would therefore decrease their on-task motivation. Clearly, the controllability of imagery was identified a primary influence on indirect effects of imagery, indicating the importance of imagery practice to enhance imagery control and the potential dangers of using uncontrolled imagery.

Interestingly, imagery was frequently reported as being used to enhance concentration in training, and thereby the quality of training. The role of imagery to enhance training quality, and its identification as a factor discriminating between successful and unsuccessful elite performers has already been reported in the research literature (Orlick and Partington, 1988). In competition, imagery was also reported as a means of blocking out distractions, and therefore reducing anxiety. In this case, imagery may have been used to enable the athlete to focus attention on task relevant cues and block out task irrelevant cues (Wine, 1971). However, in competition, imagery was used more frequently to enhance motivation and mood, as indicated by previous research (Salmon, Hall and Haslam, 1994). The canoeists used imagery to feel more 'aggressive' and 'hyped-up' and therefore to create an appropriate mood state for actual performance. The gymnasts in this sample did not use imagery to enhance mood in this way, suggesting that this mood state would not be appropriate for gymnastics. Both gymnasts and canoeists reported using imagery to control anxiety in competition and when performing difficult moves in training.

Surprisingly, only half of the sample of athletes reported using imagery to simulate competition in training, perhaps due to the relaxed nature of training and the lack of encouragement from coaches to do this. However, those who did report using it in this way, suggested that simulating the competition enabled them to practice skills and movement patterns under the emotional conditions typical of competition. This indicates the potential benefits of using imagery to enhance the quality of training sessions (Jones and Hardy, 1990; Orlick and Partington, 1988).

4.4.1 Methodological Issues

A discussion of the methodological issues related to this study is included in the general discussion (chapter 7).

4.4.2 Summary

The main purpose of this study was to determine the different ways in which imagery is used by gymnasts and slalom canoeists. The interview procedure and the inductive analysis enabled the identification of a wide variety of different uses and details about the content of the images that facilitated these uses. Imagery was not only reported as being used for mental practice effects, but was also used in order to improve motivation, self confidence, affect and concentration. This supports the suggestions that research should not only consider the direct effect of imagery, but should also examine the indirect effects of imagery on learning and performance (Paivio, 1985; Salmon, Hall and Haslam, 1994; Martin and Hall, 1995). In particular, imagery effects on self-confidence should be examined in more detail, since all subjects in the present study identified this use of imagery. To date, only one published experimental study has examined the self-efficacy effects of imagery (Martin and Hall, 1995). This study also indicated the role of imagery controllability on the effects of imagery upon self-efficacy and anxiety control, which has been implied in the research literature (Woolfolk, Parrish and Murphy, 1985; Orlick and Partington, 1988; Start and Richardson, 1964; Bandura, 1977), but not directly tested.

In terms of both the direct and the indirect effects of imagery on performance, there are several indications that differences in the task variables of each sport dictated the way in which imagery was used, thus supporting the view that the influence of task/sport characteristics should be considered (Highlen and Bennett, 1983; Smith, 1987). The role of coach reinforcement was also identified, suggesting that coach education should focus not

only on introducing imagery skills, but also on the variety of ways in which imagery can be used.

Finally, the individual nature of imagery experiences throughout this study support the efficacy of using a qualitative methodology in order to gain detailed information and an in-depth understanding of the way in which athletes use imagery. The results also demonstrate the dynamic nature of imagery, as aspects of the image were shown to be added or emphasised (auditory, visual or kinesthetic), to serve different roles according to the needs of the individual. This has important implications for coaches and sport psychologists, when working with athletes, as it suggests that it is necessary to work within the framework of each individual's imagery experiences (Ahsen, 1984; Murphy, 1990). The present study suggests that further research into imagery uses by athletes from different sports is warranted using qualitative designs. Qualitative research methodologies employing a longitudinal prospective design might also be useful to follow the development of specific imagery strategies in training situations.

CHAPTER 5.

Examination of image content and its influence on the use of imagery by high level artistic gymnasts and slalom canoeists

5.1 The Nature of Imagery

Richardson (1969) defined imagery as "all those quasi-sensory and quasi-perceptual experiences of which we are self-consciously aware and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts". Thus, imagery is a poly-sensory experience, potentially composed of visual, auditory, kinesthetic, olfactory, gustatory and tactile dimensions of sensory information.

Evidence has been found to suggest that there is some functional equivalence between imagery processes and perceptual motor processes (Finke, 1979; Johnson, 1982; Kohl and Roenker, 1989). Consequently, it has been suggested that imagery is internally represented in a similar way to actual experience. Visuo-spatial components of imagery have been studied extensively in the cognitive psychology research literature, where imagery has been proposed to have an analogue-type representation and therefore have pictoral, spatial or auditory qualities (Kosslyn, 1981: Paivio, 1971). However, analogue representations have been criticised on several grounds (Pylyshyn, 1981), as has the lack of consideration of the somatic effects of imagery (Ahsen, 1984). In sport situations, the somatic effects of imagery (such as kinesthetic imagery) are frequently reported by performers (Hall and Erffmeyer, 1983; Hall, Rodgers and Barr, 1990) and have been found to be an important factor in the learning and performance of movement skills (Start and Richardson, 1964). However, kinesthetic imagery appears to be used more frequently and more effectively by experienced performers (Mumford and Hall, 1984; Isaac and Marks, 1992).

Individual differences in imagery experiences have also received attention in the sport psychology research literature. The psychological characteristics of elite performers from a variety of sports (Orlick and Partington, 1988) and differences in the use of psychological skills such as imagery between successful and less successful performers have been studied by a number of researchers (Mahoney and Avener, 1977; Highlen and Bennett, 1979;1983; Meyers, Cooke, Cullen and Liles, 1979; Rotella, Gansneder, Ojala and Billing, 1980). However, this research has been equivocal, indicating no consistent pattern in the uses and experiences of imagery by elite performers from different sports. This suggests that differences in the task requirements and nature of sport may play an important role in the content of images and the way in which imagery is used. In addition, several variables have been identified and studied which might mediate the effect of imagery on performance, such as imagery ability, imagery perspective, control over imagery and the state of arousal prior to imagery (Isaac, Marks and Russell, 1986; Hall, Pongrac and Buckolz, 1985; Mahoney and Avener, 1977; Epstein, 1980; Woolfolk, Parrish and Murphy, 1985; Johnson, 1982; Gray, Haring and Banks, 1984; Hamberger and Lohr, 1980).

5.1.1 Imagery Ability

The ability to form images is usually defined in terms of the terms "vividness" and "controllability", where vividness refers to the ability to form clear and real images (Marks, 1973) and controllability refers to the ability to control the outcome of performance during imagery. A number of studies have found that subjects with higher visual imagery abilities perform better following imagery than subjects with poorer visual imagery abilities (Start and Richardson, 1964; Ryan and Simons, 1981). This effect has also been observed for subjects with higher kinesthetic abilities (Goss, Hall, Buckolz and Fishburne, 1986). However, the use of introspective self-report methods to measure imagery ability has been criticised (Ernest, 1977), as has the adoption of a single measure of imagery ability, instead of multidimensional measures (Kosslyn, 1983; Murphy, 1990).

5.1.2 Imagery Perspective

Mahoney and Avener (1977) were the first researchers to distinguish between internal and external imagery perspectives, in their study of successful and unsuccessful US Olympic team gymnasts. They classified an internal perspective as requiring "an approximation of the real-life phenomenology such that the person actually imagines being inside his/her body and experiencing those sensations which might be experienced in the actual situation". Thus, it was assumed that an internal perspective had a first person visual component, as well as a kinesthetic component. In contrast, external perspective imagery was identified as taking place when "a person views himself from the perspective of an external observer (much like in home movies)", and was therefore a third person perspective image that was purely visual in nature. The study found that US team qualifiers reported using more internal perspective imagery than the non-qualifier.

Research on the issue of imagery perspective has proved rather equivocal, partially due to some confusion over the role of kinesthetic imagery in the different visual perspectives, and also because of the measurement tools used. Consequently, Rotella et al. (1980) found that the use of internal visual perspective imagery distinguished between successful and unsuccessful slalom skiers, yet other studies found no distinguishing effects of imagery perspective for other populations (Highlen and Bennett, 1979; Meyers et al., 1979). Furthermore, studies directly manipulating imagery perspectives, found no differences in skill performance for different imagery perspectives (Epstein, 1980; Mumford and Hall, 1984). There is evidence to suggest that athletes experience more concomitant muscular tension with internal perspective imagery than external perspective imagery (Hale, 1982; Harris and Robinson, 1986). However, both studies included verbal instructions to enhance the experience of kinesthesis during the internal perspective imagery only. To date, research has only addressed the frequency of the use of imagery perspectives by sport performers. However, no studies have examined how, and for what purposes different imagery perspectives are used by sport performers (Murphy, 1994).

5.1.3 Control Over Imagery

There have been several reports of athletes experiencing difficulties with imagery control in the sport psychology literature (Murphy and Jowdy, 1992; Clark, 1960). Orlick and Partington's qualitative study (1988) reported that some elite sport performers had to engage in much imagery practice, in order to experience controllable imagery. Although some studies have found that imagery controllability is positively associated with successful performance (Highlen and Bennett, 1979; Meyers et al, 1979; Start and Richardson, 1964), there are few experimental studies which examine this effect. Woolfolk, Parrish and Murphy (1985) and Powell (1973) have examined the effects of positive and negative outcome imagery on dart throwing performance and found a detrimental effect of negative imagery. In another experiment, which controlled possible motivational effects, Johnson (1982) also found detrimental effects of "negative" imagery on the performance of a linear positioning task. "Negative" imagery has been most frequently proposed to interfere with performance via a direct mechanism of disrupting the subjects' motor programme, although it has also been suggested that this effect might occur via an indirect effect on self-confidence, concentration or motivation (Woolfolk, Parrish and Murphy, 1985; Murphy, 1986).

5.1.4 Imagery, Arousal and Mood

Consistent with the clinical psychology literature, where imagery is often used during systematic desensitisation procedures, it has been recommended that imagery is used following or in association with a relaxation technique (Wolpe, 1958; Suinn, 1976). It has been suggested that the use of relaxation with imagery facilitates the formation of vivid and controllable images (Bernstein and Borkovec, 1973; Suinn, 1985). However, studies examining this effect have found no significant benefits of using relaxation with imagery (Gray, Haring and Banks, 1984; Hamberger and Lohr, 1980).

The actual content of imagery can also influence mood and arousal levels. Clinical theories of imagery recognise the contributions made by further dimensions of imagery, such as the somatic response to imagery and the interpretation of the image, to the therapeutic effect of imagery (Lang, 1979; Ahsen, 1984). These aspects are particularly relevant to the effects of imagery on emotion and motivational variables, and therefore might have indirect effects on performance. Indirect imagery effects are more likely to play an important role in competitive situations, where imagery might be used to enhance self-efficacy, motivation or mood (see previous chapter).

Imagery has been reported to be used by sport performers to facilitate strength performance by increasing levels of arousal (Shelton and Mahoney, 1978; Weinberg, Gould and Jackson, 1980). Studies have also manipulated the content of imagery to enhance mood and alter arousal levels prior to the performance of sport skills (Kavanaugh and Hausfeld, 1986; Murphy, Woolfolk and Budney, 1988; Lee, 1990). These studies have found that emotive imagery is more effective if it is task specific, and therefore focuses attention on the task, rather than purely manipulates mood. However, this research has used laboratory-type tasks rather than complex sport skills performed in real competitive situations.

The vast majority of imagery research studies in the sport psychology research literature have used quantitative methodologies, in order to study imagery effects on skill learning and performance. The only qualitative study that addressed the use of imagery by elite sport performers, indicated that performers used internal, external and kinesthetic imagery, in order to simulate competition in training and to see themselves successfully achieving their goals (Orlick and Partington, 1988). The present study was designed to gain an in-depth understanding of the content of the imagery used by high level female gymnasts and slalom canoeists. A further aim of this study was to gain an understanding of the importance of image content for imagery use, and to identify specific roles adopted by the details of images, to enhance the overall efficacy of imagery. Typically, studies examining imagery and motor skills have been conducted using student populations with little interest in imagery

research. A qualitative methodology was employed for this study, to obtain detailed information from the perspective of high level athletes. As the athletes were asked to recall imagery experience from a recent important competition and a recent training session, it was hoped that these athletes accounts of imagery experiences would be accurate and detailed in nature (c.f. Orlick and Partington, 1988).

5.2 Methodology

The participants in this study were three members of the British Junior Canoe Slalom Team and three members of the British Women's Artistic Gymnastic Team (five female, one male). The athletes were aged between fifteen and eighteen years old. They had, on average, 6 years of competitive experience, and all had experience of international competition.

5.2.1 Procedure

All the athletes volunteered to participate in live interviews which lasted between 39 and 55 minutes, and were conducted in their training environment. Each participant was asked the same series of standardised open ended questions which were outlined in an interview guide (see Appendix 3A and 3B). The interviews were recorded using a Dictaphone, and were later transcribed verbatim into 100 pages of text.

5.2.2 Interview Guide

The interview questions were arranged within the interview guide into the following interrelated sections:- general uses of imagery, imagery instruction, details of competition imagery, imagery in training/at home and imagery effectiveness (see Appendices 3A and 3B). These sections were preceded by an introductory section which explained the purpose of the interview, the procedures being used, and provided orienting instructions in order to elicit the depth of detail required for each section of the interview. This was followed by a

demographics section in order to background information about the subjects (c.f. Gould, Jackson and Finch, 1993a; Scanlan, Ravizza and Stein, 1989). Prior to the first section of the interview on the general uses of imagery, the following definition of imagery was read out to the subjects, in order to check that they were in agreement with this definition.

> Imagery is an experience which mimics real experience. We can be aware of "seeing" an image, feeling movements as an image, or experiencing an image of smell, tastes or sounds without actually experiencing the real thing. Sometimes people find that it helps to close their eyes. It differs from dreams in that we are awake and conscious when we form an image.

The athletes were then asked to identify different situations in which they had used imagery, and their reasons for its use. After explaining how they had used imagery in the past, (and throughout all sections of the interview), subjects were asked general probes, in order to ensure that all situations and reasons had been identified (for example: "Why did you use imagery?"). In addition and where appropriate, subjects were asked specific elaboration probes, in order to encourage them to expand on their answers and to gain a full depth understanding of their responses (example: "Can you describe the types of things you would image?"). These probes were standardised and asked in the same way to control interview bias and to encourage all subjects to respond to the questions with a similar amount of detail.

Subjects were asked how they learnt to image in order to gain further background information about any formal imagery training they might have received, or any imagery exercises they had used in the past. This was followed by questions related to the specific details of competition imagery. In this section, subjects were asked to recall an image used in a recent competition, and to describe the content of this image. Specific probes were asked to facilitate the recall of all visual, kinesthetic and emotional aspects of the image. Subjects then recalled an image used recently in training and were asked to recall the same

visual, kinesthetic and emotional aspects of the image as for the competition image. Next, subjects were asked firstly to identify specific details of their images, which they thought contributed to their imagery effectiveness, and secondly, their reasons for indicating the importance of these details.

Finally, in order to ensure that there were no serious omissions in the interview guide, subjects were asked if there were any other issues that they thought would enable us to understand how they used imagery.

5.2.3 Data Preparation and Analysis

Quotes related to imagery use, details of the content of athletes' imagery, and factors which influenced the effectiveness of imagery were extracted from the transcripts and used as raw data for the analysis. A combination of inductive and deductive procedures was used to analyse the data. Deductive procedures were used to separate the data related to how imagery was used, details of content of athletes' images and aspects of imagery considered to be important by the athletes. The data related to imagery use has already been reported in Chapter 4. Data related to the other two sections was analysed by an inductive procedure, recommended by Patton (1980) and adapted to sport by Scanlan, Ravizza and Stein (1989) and Gould et al. (1992). Following this analysis, deductive procedures were used in order to verify all of the themes and dimensions identified. The analysis of the data followed the hierarchical content analysis recommended by Patton (1980). The data analysis procedure was conducted as follows-

1. Tape recorded interviews were transcribed verbatim into pages of text.

2. Two researchers, of whom one was also the interviewer, read and re-read the transcripts to become familiar with the text, and listened to the tapes where appropriate in order to pick up any additional information from the tapes (other than the words).

3. Individual ideographic profiles on each of the athletes were written by each researcher, in order to gain further familiarity with the scripts. Each profile was then discussed until a consensus was reached, and a joint profile was identified (see Appendix 3C).

4. Each investigator identified an independent set of raw themes to characterise the responses of each athlete within each subsection of the interview. These raw themes were quotes or paraphrased quotes that were self-definable and self-delimiting in the expression of a single recognisable aspect of the subjects' experience (Cloonan, 1971) - in other words they encapsulated a distinct idea or concept that characterised an athlete's response within a subsection of the interview. Together, the researchers then discussed the identified themes and came to a consensus of agreement on each raw theme from all six subjects to be used in the analysis . Each raw theme was written on a card. Agreement had to be obtained on each raw theme. When disagreements occurred the investigators returned to the transcripts and re-discussed all the points of contention.

5. The content analysis organised the raw data themes into categories using a combination of inductive and deductive approaches. Deductive procedures were used in order to organise the raw data themes into two manageable sections. Within each section, inductive procedures were used to analyse the data, where emergent themes were developed by the clustering of themes according to their similarity of meaning. These clusters were labelled as in a factor analysis procedure (first order themes). The inductive procedure proceeded to identify relationships between the first order themes to establish higher order themes (second and third order themes). Thus, a hierarchical structure was developed, with each higher order theme more analytic and abstract in nature (although in some cases raw themes could still be expressed at higher levels). Consensus had to be reached on each higher order theme.

6. An additional researcher carried out a further reliability check (see Scanlan, Ravizza and Stein, 1989), coding randomly selected raw quotes into the raw data themes. The reliability

was 91.8%, or 34 out of 37 quotes correctly coded. All of the first order dimensions were coded into second order dimensions (reliability was 100%).

7. After higher order themes were identified, each descriptor was reread to ensure that they made sense and could be understood. This was done to ensure the overall coherency of the analysis. Both researchers reached a consensus on the overall structure of the analysis.

5.3 Results : Content of Images

The purpose of this investigation was to determine the specific content of the imagery which high level gymnasts and slalom canoeists use in competition and training, and the details of imagery which influence it's use and effectiveness. The data was deductively split into quotes related to details only, and quotes related to influences of these details, thus two separate analyses are presented To simplify the presentation of the results, they are initially described and briefly discussed in terms of the first order dimensions, and are then clarified in terms of the raw data themes and selected quotes from which these dimensions emerged. The emergent second order dimensions are described at the end of each collection of first order dimensions. Situational differences and sport differences are also described where appropriate. Frequency counts or percentages are not included in the analysis due to the small subject numbers and due to problem of misrepresenting the importance of the image details to the individual in a quantitative manner.

Deductive procedures identified 119 quotes and subsequently 69 raw data themes describing the content of subjects' imagery in competition and training. These raw data themes were inductively analysed to identify higher order themes. This analysis revealed 12 first order dimensions and 4 second order dimensions. The results of the analysis are described in the order in which they appeared (first order themes followed by second order themes).

5.3.1 Temporal aspects of image

Five raw data themes emerged to form this first order dimension, which was a collective of quotes about different speeds of images. Three categories of speed were noted throughout the interviews, faster than, slower than, and at the same speed as actual performance. Slower than actual performance speed was only reported by the gymnasts. One of the gymnasts used only slow motion imagery, "They're always in slow motion"; and another gymnast used slow motion imagery for all apparatus except the vault. She also indicated that she had control over image speed, " It's in slow motion.....It's just the speed I want it". For the vault, this gymnast used an image that was faster than actual performance, "that's fast.....that's about the fastest thing I can imagine....I think it's a little bit faster than actual performance".

In general, the canoeists tended to image performance at the same speed as actual performance. Indeed, one of the canoeists timed his image in competition, in order to give a rough indication of how fast he would be able to complete a run, "I can actually time myself down the course (during imagery) and I'm within 5 seconds on the run". However, one canoeist reported using an image that was faster than actual performance in both training and competition, "it's faster definitely in my head, but that's only 'cos I can think dead quick of what strokes I am going to do, quicker than I'm gonna do them".

5.3.2 Visual focal point of image

This first order dimension was associated with 6 raw data themes that were related to which visual aspects of the participants' images were the focal point of attention. Most of these raw data themes were reported by both gymnasts and canoeists, who reported using imagery of specific moves or of full routines/runs in both competition and training situations. They also reported imaging the technical aspects of performance. For the gymnasts, these were about body speed, shape and position; for example, for the vault, "you

have to get the run up right, ...hit the board right, use a good arm swing to push off the vault", whilst for the beam, "I have to spot everything and I have to get my head up at the right time.....you have to put your body in the middle". For the canoeists, images concentrated on technical aspects in order to negotiate the slalom course; for example, "making sure I don't get pulled too far to the left, the main current through the next gate.....take the speed off quite a lot there, make sure that I get the strokes right through there, over the wave, then I need the boat angled to the right, er a right hand stroke at the same time through the stopper". One of the canoeists also noted that in competition, her images focused on sections of the course which were then assembled into a full performance, "what I do is one section and then I do one and two; and then I do one, two, and three; and then say one, two, three, and four; and then I put the whole course together."

5.3.3 Visual dimensions

There were a number of visual dimensions of images reported by the gymnasts and canoeists, resulting in 7 raw data themes. Most of the sample reported using coloured images, but there were some subjects who reported using both colour and monochrome images. In general, subjects stated that their images were visually clear in both training and competition.

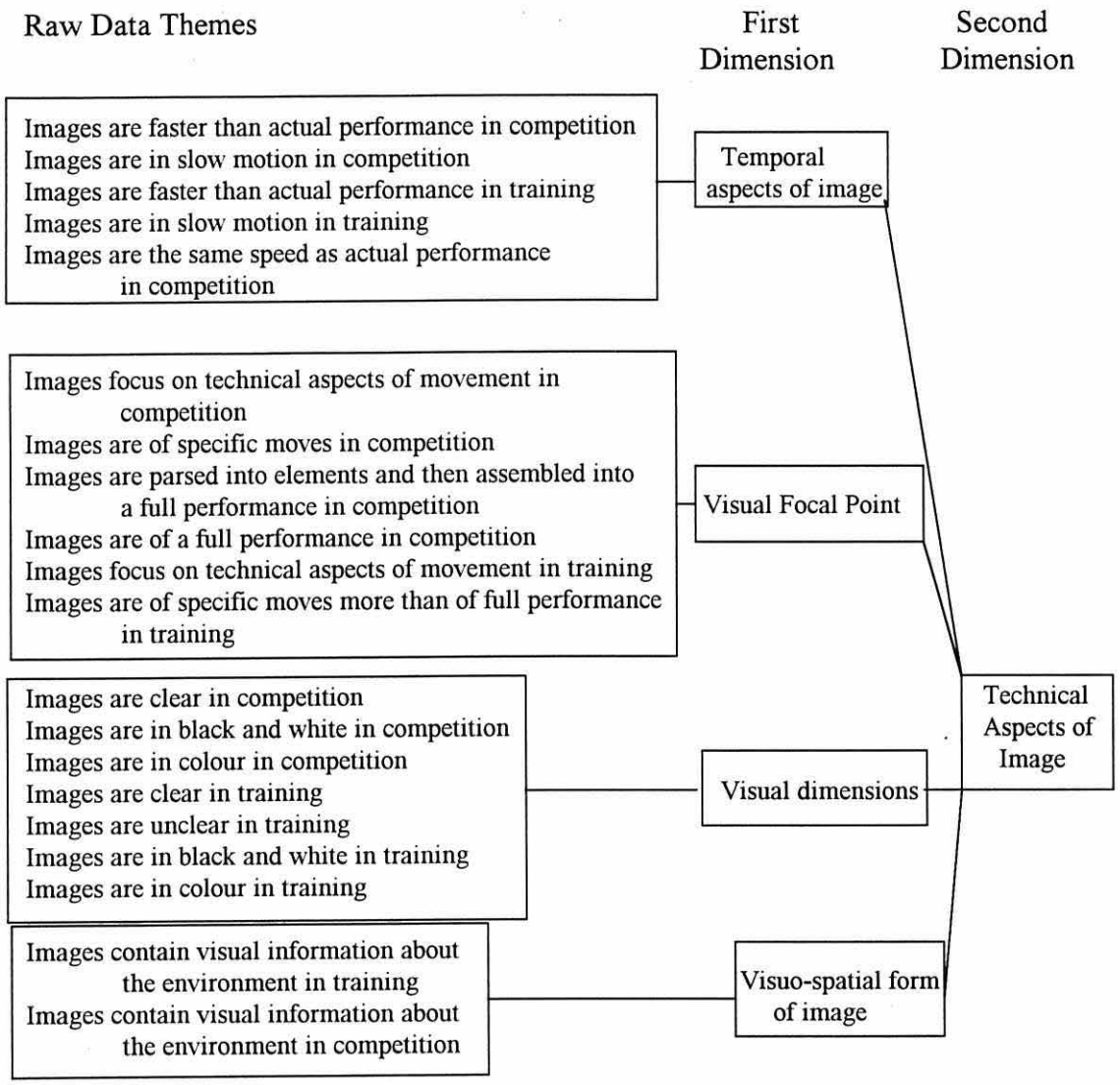

Figure 5.1. Content of images: Hierarchical structure of the second order dimension "Technical aspects of image".

5.3.4 Visuo-spatial form of image

All subjects reported seeing visual information related to the surrounding environment in training and competitions. For the gymnasts, this included information about the apparatus and the arena. For floor, one gymnast reported, "I can see myself. I can just see me in my starting position. I always stare at the floor....and then I can see the lights.....I look at all the surroundings and can sort of see it." However, the gymnasts often reported only seeing features that were directly relevant to their performance, "I could see just me and the floor".

Similar features were observed by the canoeists, who reported seeing aspects of the surrounding environment which were directly relevant to performance, "I'm just at the start line at the moment.... there's a big sleuce in front of me.....I'm just in front of the start gates....and there's a starter", and also visual information which was not immediately relevant to performance, "there's a commentary box, there's loads of British flags, there's hot dogs, chips and all of that on one side".

5.3.5 Technical Aspects of Imagery

The first order dimensions described above were concerned with temporal aspects of the image; visual focal points; the colour and clarity of images; and the visual content of images. These first order dimensions collectively defined one second order dimension labelled "Technical Aspects of Imagery". The hierarchical structure of this dimension is depicted in Figure 5.1

5.3.6 Visual imagery perspective

This dimension was the largest in the analysis in terms of composite raw data themes, of which there were 11. The two visual imagery perspectives, internal visual and external visual were represented by both canoeists and gymnasts. For the canoeists, internal visual imagery was the most commonly used perspective in both competition and training situations: "I actually see a pair of paddles and me looking at it, looking at the course as I go down" and "that's the view I would actually see paddling down, from sitting in the boat". One of the canoeists reported using an internal perspective image of the back of the boat going through the gates, "it's the view I'd see.....from the back of the boat.....I can see the way the tail of the back of my boat is going through the gates". However, this paddler also formed external visual perspective images of the course under some circumstances, such as following a physical attempt at the course, or when training for short courses, "on the long run I go through the back, but on the short course I can imagine myself being there, seeing

myself going through the course.....seeing myself paddling" and "I can change it , so once I've done a run, I can see myself going down....actually paddling it....um....like a video. But before that I can't actually see myself paddling it". In contrast, another canoeist reported sometimes using an external perspective image when inspecting a course and planning responses to the course, "sometimes if I am looking at a course, I can imagine myself doing it, like seeing myself doing it, like externally", but this would always be followed by internal perspective imagery "I walked the course, each section looking at it, watching the water, and then thinking about how I was going to do it, imagining myself do it, and then going through it in my head internally". Only one canoeist reported that perspective switching could occur if she had seen another person successfully performing a difficult move in training, "sometimes, because you see somebody do that move and then you just imagine yourself doing it then. If you haven't seen anyone do that move then no."

The gymnasts reported the use of both internal and external visual perspectives. One gymnast reported using only external perspective imagery for all apparatus, with no switching, "It's just like watching a video of myself, all the way through" and " it's as if I'm on video....it's me I'm actually seeing....I can see myself, I can see me actually doing it, it's like I'm watching myself actually doing it". The other two gymnasts reported using both internal and external perspective imagery with perspective switching for some routines, but not others. However, there appeared to be no consistent pattern to these uses. For example, an internal visual perspective was used for bars and vault by one gymnast, who reported "I think I'm doing it but not like a video", and for vault and beam. The other gymnast reported "all I focus on is the board and the vault....I don't see, as if I was watching, it's me doing it at that time" and "I'm usually in myself then.....it's not like a video then, when I'm on beam.....so sometimes the room spins". Both of these gymnasts reported switching perspectives between tumbling and dance sections: "on the tumbling, like what would happen was that I would be in myself for the start of the run, but like that would switch to like a video, me watching myself during the tumble, and then when I finished and landed the tumble I'd be back in myself again and see the view I'd see if I was actually there"; whilst the

other gymnast said "it's like a video in all of the dance parts but when it comes to the tumbling it's like the view I'd see". In addition, perspective switching was also reported for dismounts from the apparatus, where the perspective of imagery would switch from internal to external for the dismount, for example on bars one gymnast reported that "it wasn't a video image, but it changes just for the dismount". Trends of imagery perspective use were similar in training to in competition.

5.3.7 Kinesthetic Component

This category comprised 4 raw data themes related to the ability to feel movements during imagery. Most of the canoeists and gymnasts reported being able to feel the movements, or at least some of the movements during imagery. For the canoeists, this would typically involve feeling the muscles during performance, "just the muscles....when you pull really hard on the bow rudder or something" or "I can feel myself lifting the paddle up when you know a pole's hard to get or quite easy to hit with the paddle". However, one of the canoeists reported that he was unable to feel the movements unless he had actually run down the course. When asked whether he was able to feel the moves, he replied "I can now, 'cos I've done the course. Before I had done the course I couldn't do it, but now because I've done the course I know exactly what the strokes felt like."

The gymnasts reported that they were able to feel muscular movements on all of the gymnastic apparatus, particularly when imagining the more dynamic moves, such as "a flic on beam.....like in my back' and "on bars when I do a giant (circle), I can feel the kick at the bottom of the swing." One of the gymnasts reported feeling all of the moves during imagery, and experienced concomitant muscular tension, "All of them, yeah. I feel everything, like I'll be tensing my body....that's 'cos I'm feeling it actually when I'm doing my routine". However, another of the gymnasts reported sometimes being unable to feel the harder moves in competition imagery, "when it's a harder move, like I'm not familiar with it, then sometimes I don't actually feel it"; whilst the third gymnast reported being able to only

feel the harder moves in training, "on the not so difficult ones, I don't feel anything. On the hard ones I feel the moves".

5.3.8 Aural component

Surprisingly, an aural component to imagery was only reported by one of the canoeists and one of the gymnasts. The canoeist reported being able to hear the water during imagery in both competition and training situations, "the water that's all.....I sort of bring it into it from outside". The gymnast reported being able to hear the sound of the coach's voice during imagery in training and in competition, " I can only hear my coach's voice, telling me what to do, but that's all."

5.3.9 Image Components

This second order dimension was composed of three first order dimensions, visual imagery perspective, kinesthetic component, and aural component, the first two of which have received considerable attention in the sport psychology research literature. The dimension was named 'Image Components', and represented a total of 19 raw data themes.

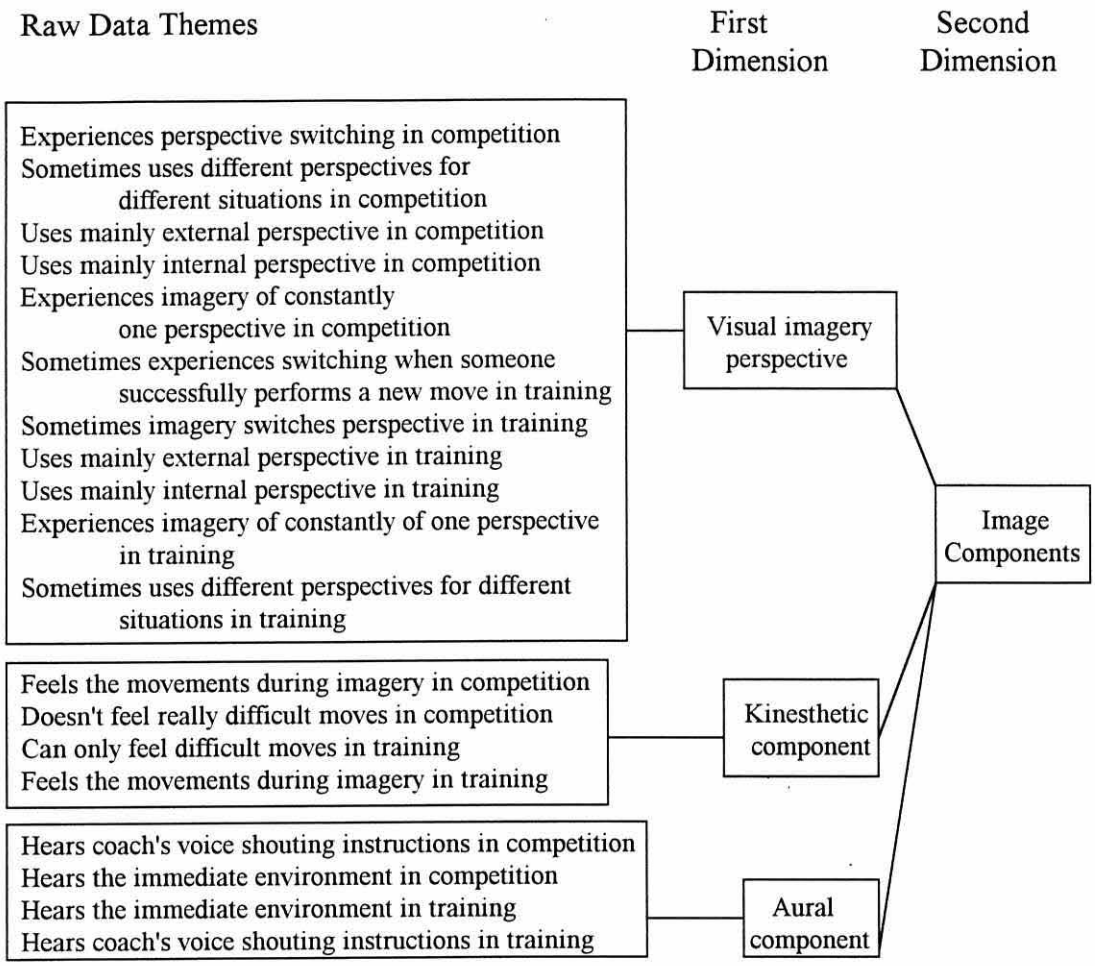

Figure 5.2. Content of images: Hierarchical structure of the second order dimension "Image components".

5.3.10 Psychological state before imagery

Several different types of psychological state were revealed by the canoeists and gymnasts prior to using imagery. Most of the athletes from both sports reported feeling anxious before imagery in competition, "I'd be stressed out a bit", "anxious....I feel like I'm dead nervous and anxious"; and this would often lead to feelings of high physiological arousal, "I had butterflies in my stomach.....I usually get stomach ache before I go on", "everything's a bit tense really.....I was feeling a bit tense" and "I've got a pulse meter and I was walking to the start line.....I get onto the water and my heart rate just goes up". Associated with this, one canoeist indicated that she found it difficult to concentrate, "my mind just wanders

somewhere else. That's not good"; whereas one gymnast found that she felt focused before imagery, " in competition it's more focused, I'm sort of clear in my mind in what I'm doing". One of the canoeists reported that he felt relaxed before imagery, " I try and relax.....I just relax really....just calm myself down if I'm really tensed up"; whereas another reported trying to psyche-up before imagery, "I'd start psyching myself up and keep trying you know, saying it's a big race".

Psychological states before imagery in training were often quite different in nature. Quotes such as "training is more relaxed" and "I'm not as nervous" indicated, quite naturally that the athletes felt more relaxed in the training environment.

5.3.11 Emotive content

Only one of the canoeists reported using imagery with enhanced emotive content, in order to enhance her motivation and mood in both competition and training situations, "when I do angry preps.....I imagine myself you know, really putting a lot of effort in" and " I really sort of concentrate on imagining myself aggressively sprinting, coming out of the gates and imaging myself really pulling hard on the bow rudder"

5.3.12 Psychological state during imagery

Six raw data themes emerged to form this dimension which described the psychological states reported by the athlete's whilst they were using imagery in competition and training. In competition, anxiety was the most commonly cited psychological state during imagery. Examples of quotes related to this included "It's dead anxious", "if it's a big race then nerves really, when you are imagining yourself at the start line" and "nervous.....um frightened". For the gymnasts, these feelings of anxiety were particularly evident when imaging difficult moves in competition, "when I'm imagining a hard move, then I can imagine being scared, 'cos if I've done it, then I know how scary it is". Other psychological states during imagery

in competition included feeling concentration, "I can imagine my concentration" and "perhaps more focused in it", and occasionally feelings of uncertainty "during imagery you don't know what to expect".

In contrast, the more relaxed atmosphere was associated with feeling no particular psychological states during imagery. Several of the athletes reported feeling nothing in particular during imagery in training, "I don't think I feel anything in particular during imagery" and "I don't think I feel anything. I just go quickly through the gates and that's it". Most of the athletes noted feeling concentration during imagery, "I can feel myself concentrating on all the moves" and "concentration if you can feel that.....when you're concentrating very hard, like it feels different to when you're not". The canoeist who reported using emotive imagery, also reported feeling psyched up during imagery, as a consequence of the content of the imagery. However, in general, the canoeists reported that they did not use imagery very often in the relaxed atmosphere of the training environment "in training it's not used very often.....it's not as intense as in competition".

5.3.13 Affective Components

This second order dimension emerged from the 3 first order dimensions described above. It comprised a total of 15 raw data themes related to psychological states before and during imagery, and to emotive aspects of the image. It was labelled "Affective Components"

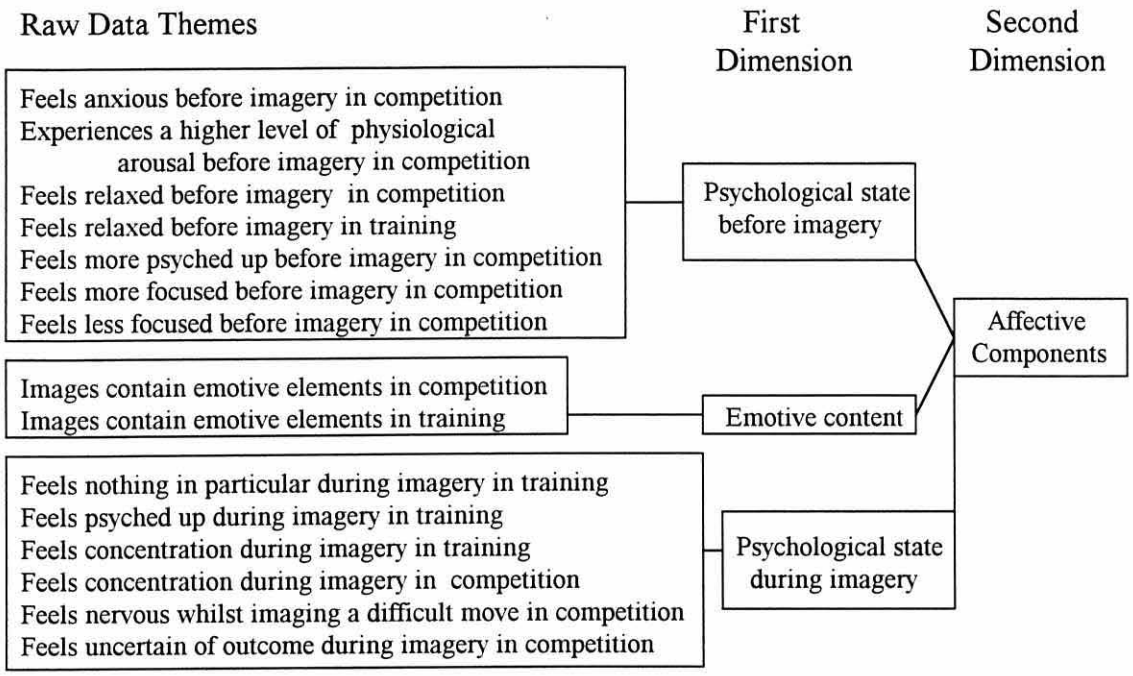

Figure 5.3. Content of images: Hierarchical structure of the second order dimension "Affective components".

5.3.14 Use of music with imagery

The use of music with imagery was reported by only one of the canoeists. This canoeist reported using "inspirational" music in order to enhance her motivation "the music really, with me it gets me motivated". Her use of a Walkman to play the music was also identified as helpful because it kept her away from distractions, "I think my Walkman helps a lot, because you switch off and you know, just basically be alone, you're out of there". The music was also helpful in a technical sense because she use the music to remind her of the strokes she had to use at certain parts of the course, "sometimes when I get to different parts of the course and I can remember the song, I can remember what strokes go with the song".

5.3.15 Use of "in-vivo" movements with imagery

The same canoeist also reported the use of "in-vivo" movements with imagery in both training and competition. "In-vivo" movements during imagery involve some of the movements being imaged actually being performed simultaneous with the imagery, "I normally do the movements of my arms, going through the course using my arms" and "I'm moving my arms around, and you know which way to lean you see, you can feel the way to lean".

5.3.16 Adjuncts to Imagery

The second order dimension, composed of 2 first order dimensions associated with physical features that were added in order to enhance images was labelled "Adjuncts to Imagery".

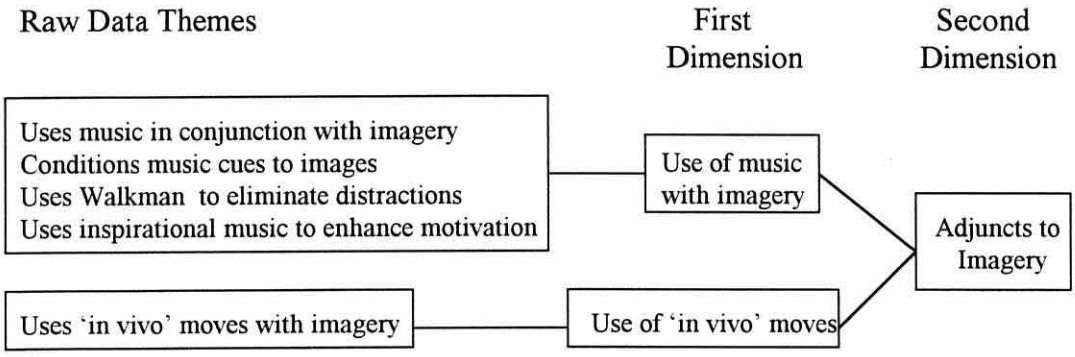

Figure 5.4. Content of images: Hierarchical structure of the second order dimension "Adjuncts to imagery".

5.3.17 Content of Images

Twelve first order and four second order dimensions emerged to form the third order dimension "Content of images". The structure of this dimension is shown in Figure 5.5.

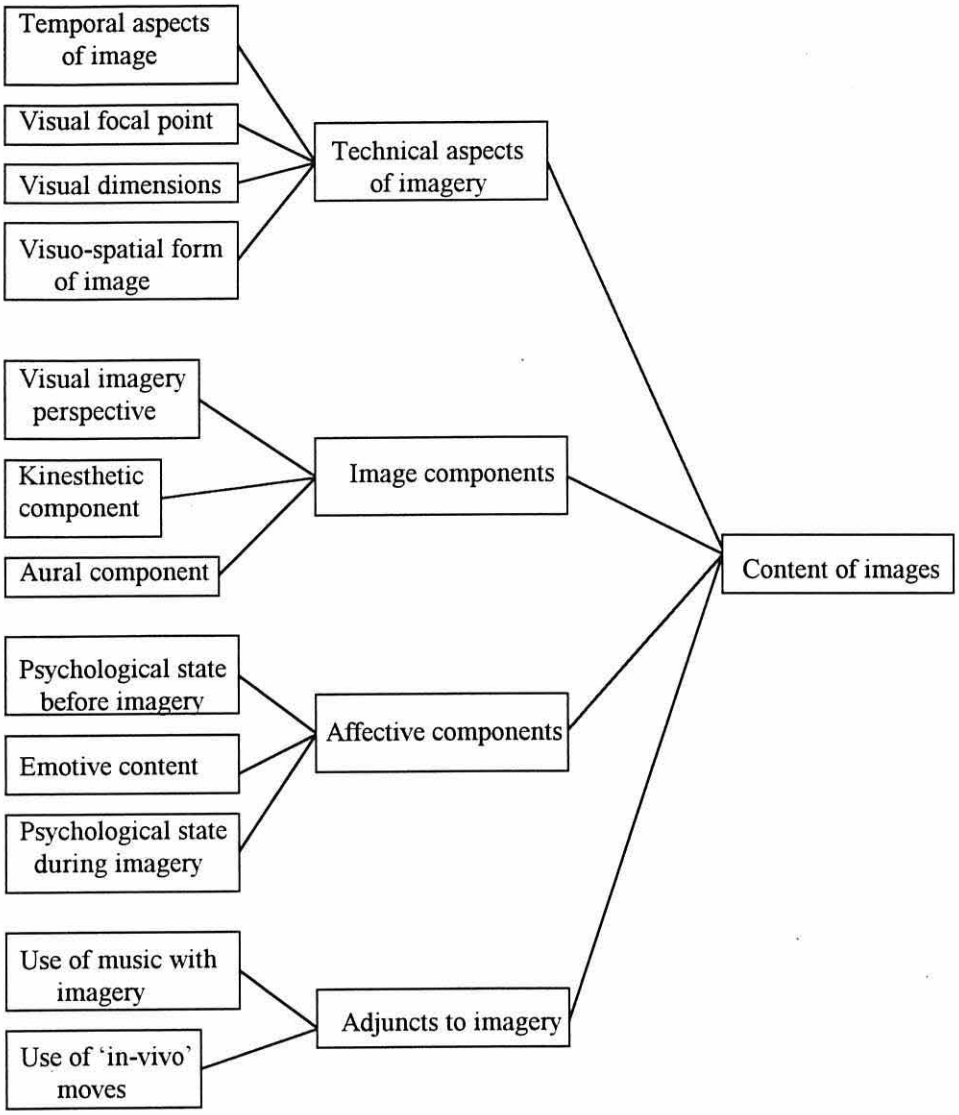

Figure 5.5: Content of images: Hierarchical structure of the third order dimension "Content of images".

5.4 Influences Upon Use of Imagery

The second half of the data was derived from 66 quotes and 30 raw data themes, collectively representing factors that influenced imagery use in competition, training and other situations. The inductive analysis identified 7 first order dimensions and subsequently 2 second order dimensions. The hierarchical structure of the analysis (Figure 5.8) and descriptions of the first and second order dimensions are presented in the section below.

5.4.1 Realism of the image

All of the subjects in the present study indicated that they formed personalised images of themselves performing movements, most of the time if not all of the time, in both training and competition. The personalised nature of images was clear, even for the first person perspective images (internal visual perspective images), where the subjects would be unable to see themselves, as one subject noted "you can sometimes feel the style of the paddling". Only one subject reported that she had used images of someone else. She stated that she might form images of another canoeist if she saw one that was really good: "I used to image this guy called Paul, who is a brilliant paddler, and I used to see him going through the gates". All of the subjects also reported that their images were real in nature. Again, one of the canoeists sometimes formed vague images in training which did not appear real to her, "I think it's 'cos I don't concentrate as hard....and so it's not as um....refined". For all of the other athletes the images appeared as real in training as they did in competition.

5.4.2 Propositional meaning of visuo-spatial form of the image

This dimension was related to ability to interpret the meaning of images, in terms of being able to place whether an image was of a good past performance or of what was going to happen in the future; thus, this was an interpretation of the context of the image. All of the canoeists and gymnasts stated that in the competition situation, their imagery was related to what they expected to happen in that particular competition: "it was how it was going to be" and "what will happen.....what would happen". For the canoeists, this trend to rehearse what was about to happen continued in the training environment, "I image the courses that I'm doing, so it depends on where I am and what the course is" and "you very, very seldom do any imagery before a training session.....because you don't normally know the courses." Thus, imagery of past events would not be relevant to the canoeists in a training environment.

In contrast, all of the gymnasts reported also using images of good past performances, often from past competitions, "sometimes it's of an occasion when I've performed really well, but others it's what I'm gonna do for that, that piece, what I am going to do like now, at this present time". For example, in training when imaging her floor routine, one gymnast said "I can see what I'm doing.....what I'm going to do then". However, for another gymnast, her imagery for her floor routine was of a past performance, "it was of my last competition", and her vault image was "as if I'm doing it in competition. In training I can, when I imagine the vault, I see so that everything was in the past in competition."

5.4.3 Meaning of Image

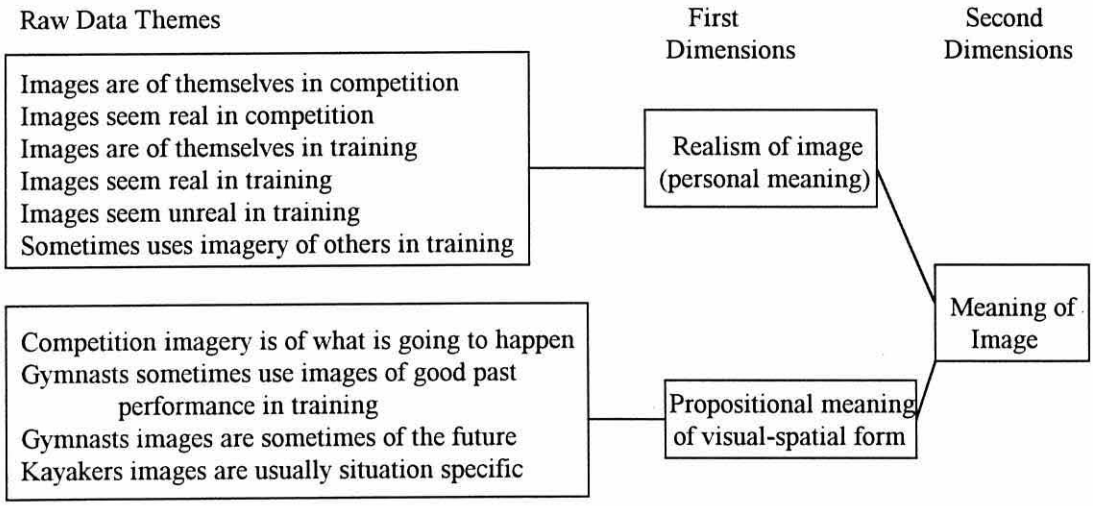

Figure 5.6. Influences upon use of imagery: Hierarchical structure of the second order dimension "Meaning of image".

This second order dimension comprised two first order data themes and 10 raw data themes related to the personal meaning of images to the individual, and the literal or propositional meaning of images (i.e. being able to interpret images at a personal level, and being able to make sense of the visuo-spatial aspects of the image, respectively). This distinction between the meaning of images has been proposed by Barnard and Teasdale (1991). The dimension was labelled "Meaning of Images".

5.4.4 Image controllability

This first order dimension comprised 4 raw data themes. Two of the canoeists who reported that they were always able to form perfect images of performance, "the imagery that I use is of the spot-on run" and "it's all positive. Nothing's gone wrong, nothing's wrong with my run". Indeed, for these subjects, if there was anything wrong with the image, it would not be a case of image controllability, but would be an error of planning judgement which would be confirmed by actual performance, "I know what paddle strokes go where....what I've got to do just before the gates.....I've stuck to my plan....so I just look to see if it goes wrong".

However, one of the canoeists reported experiencing problems with image controllability, "I was um, imaging myself falling in, which means that....you see, I have to go back and start again", then she noted "I can correct it". One of the gymnasts reported that she experienced controllability problems in training, perhaps related to concentration, "it's just because I've got other things on my mind.....a move isn't going right for me and I'm on beam, but that move is not going right on floor. I'll probably go and think about that move on beam, and in my mind like everything's scrambling, like a fall on floor.....I just can't concentrate". Another gymnast reported that sometimes in training and competition she would also be unable to control her images, "when I'm in training, like I sometimes do really stupid things, like I've never done before"; and "sometimes I'll do a wrong tumble or do something that I've never done in my life before". In addition, she felt that her psychological state before imagery, contributed to her control over her images in competition: "you have to be calm. That's why I like have to go through it once or twice, 'cos I'd like be doing mad things in my routine that I'd never done before."

The importance of image controllability was identified by some of the canoeists and gymnasts. One of the canoeists who did not experience problems with image controllability, believed that it was on of the most important variables of the image, "if you weren't in control of it then it could just psyche you out more than anything else. If you were trying to

imagine yourself doing it.....but you just couldn't do it, that would be a real psyche-out". Other emotions experienced after imagery were identified as being dependent of imagery control. On the one hand, "if I've done a good image in my head then I'm happy.....I don't feel so uncertain that it's going to actually stick. I'd feel certain that it's gonna happen, just like I've imaged it" and "if I've done a good image I feel pleased, then I'm happy.....loads more confident". On the other hand, if the image is unsuccessful, "then I start panicking. Then I'm bound to feel even bigger stress than I was before without it"; and "if I imagine myself doing a move that's difficult....I feel worse if I go wrong".

5.4.5 Influences upon the kinesthetic component of the image

This first order dimension was derived from 5 raw data themes associated with details of images that influenced the kinesthetic component of imagery. One of the gymnasts and one of the canoeists suggested that the ability to feel movements improved with familiarity and actual practice of the movements, "if it's a really hard move, then sometimes like if I'm not familiar with it, I don't actually feel. The moves I do every day, I know what they're like, then I can imagine it" and "Before I had done the course, I couldn't do it (feel the moves), but now because I've done the course, I know exactly what the strokes felt like." Other factors reported as facilitating the experience of the kinesthetic component of imagery included the presence of emotive elements in an image. One of the canoeists reported using imagery enhanced with emotive content (angry preps.) in competition and training situations, and noted that when using this type of imagery she would "feel I'm using the muscles a lot more". The canoeist who reported using "in-vivo" movements with imagery, claimed that it helped her feel the kinesthetic elements of moving inside the boat, such as pressure on her feet and body lean: "I think that like to do the strokes with my arms on my back helps, 'cos you can actually feel yourself moving in the boat as well".

The gymnasts who experienced imagery perspective switching indicated that they were able to feel the kinesthetic component more with a particular perspective. One gymnast said "I can feel it better when I see the view, than when I see it like a video", indicating that more kinesthetic sensations were felt in association with an internal perspective. However, the other gymnast reported "I feel them more I think...if it's like a video....'cos I can see what I'm doing more I s'pose, and actually watching all the movements, instead of watching what I'm doing all the time."

5.4.6 Influences upon the simulation value of the image

Five raw data themes emerged to form this first order theme related to the influences of particular image details on the reality of images and therefore their simulation value. Most of these raw themes were derived from quotes given by the canoeists. One of the canoeists indicated that clarity of imagery was important in determining how realistic the image was, "the clearer they are, it's just the more realistic it is, the more it's gonna be like actually what you're gonna do....so when you actually do the run, it comes to you." This canoeist also indicated that the presence of emotive elements in the image, "on your run, you're gonna be doing it like that (psyched up) and so you want to be doing it, imagining it how you're actually going to be doing it". Furthermore, for this canoeist, the use of internal perspective was crucial to enhance it's simulation value, "I like doing them internally, as that's how you're gonna see it when you are in the boat.....It seems a bit silly doing an imagery where you are not actually seeing what you are going to see on the run." Another of the canoeists and one of the gymnasts identified the importance of the image being of themselves to increase it's simulation value, "I think it's good in a way because you're the one who can tell whether or not to do that move.....'cos you know if you're not sure to put it in or not", and "it wouldn't work if it was somebody else.....if you've got to do the move, it's better if you see yourself doing it". One of the canoeists noted the timing of an imaged run down a slalom course enhanced the simulation value of an image, "I can actually time myself down the course and I'm within 5 seconds on the run.....I think it's more like a race run. Just going

down you can....do your strokes really slowly, so that once you've got a time limit, it's more like a race."

5.4.7 Influences upon technical value of the image

This dimension described 5 raw data themes, all related to the influence of different details of images upon the images' technical value. The canoeist who reported experiencing problems with image clarity indicated that practising the image improved image clarity. She claimed that the image "gets stronger each time I try it", and that this depended on her familiarity with the move, "sometimes it's really grainy, sometimes it's not. It depends on how sure I am of the move." One of the gymnasts indicated that her inclusion of a verbal instructions from her coaches as part of her image was important to help her plan and execute her routines "my coach...she can't shout at me when I'm in competition, so I imagine her shouting at me...so I can improve it and just get more marks". This gymnast, plus another gymnast, identified the slow motion imagery as being helpful when perfecting the details of performance: "if you go too fast you don't see everything, but when you go slow, you see everything, every detail, if your toes aren't pointed and just little things"; and "it's in slow motion....It's just the speed I want it, I want it to be (slow) so that I can see that I'm stretched and not floppy". The same two gymnasts also identified the use of external perspective imagery as being useful to work out technical details of performance, "it sorts your mind out, 'cos when you do a new move, it can involve twisting and I'm thinking, "my god, where am I going to tip, I know I'm going to tip this way," but by doing it I can see myself doing it", and "it's like I probably see it from the coach's point of view, so I know that when I'm doing it wrong.....it feels good to me, but I know that it's wrong".

5.4.8 Appropriate details of images increase their effectiveness

This raw data theme was carried through to the second dimension level, and represented a collective of miscellaneous details which contributed to image effectiveness via a variety of

unidentified mechanisms. Examples of these details included the image being of oneself in order to enhance concentration, "being me and giving myself a good kick up the backside to make sure I'm doing it in my head, because if I'm not 100% concentrating on what I'm doing, then I know I'm not going to do it". Another example was the fact that images being of oneself helped the confidence function of imagery, "it helps confidence, they've got to be of myself. It's just that they're of me." One of the canoeists also indicated the clarity of images was important to reduce doubts about performance, "clearness is really helpful, because otherwise you have doubts about what you are going to do...then you lose self belief and your confidence".

5.4.9 Influences Upon Imagery Effectiveness

This second order dimension emanated from four first order dimensions and one raw data theme associated with aspects of images that were identified by the subjects as contributing to or influencing image effectiveness. The four first order dimensions were: a) image controllability; b) influences upon the kinesthetic component of the image; c) influences upon the simulation value of the image; d) influences upon the technical value of the image. The raw data theme which was carried through to the second order dimension was appropriate details of images increase their effectiveness.

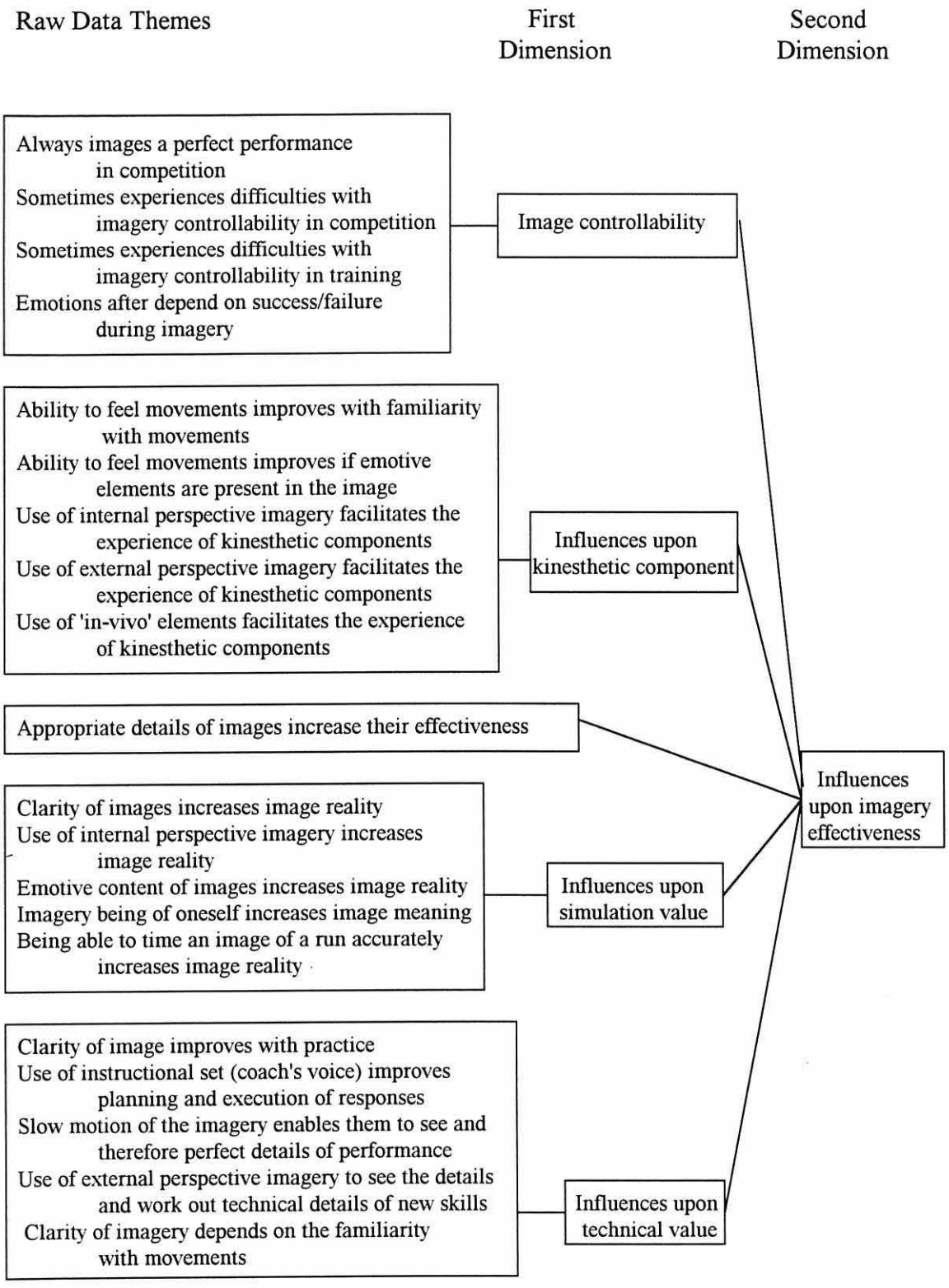

Figure 5.7. Influences upon use of imagery: Hierarchical structure of the second order dimension "influences upon image effectiveness".

5.4.10 Influences upon use of imagery

Seven first order and two second order dimensions emerged to form the third order dimension "Influences upon use of imagery". Figure 5.7 shows the structure of this third order dimension.

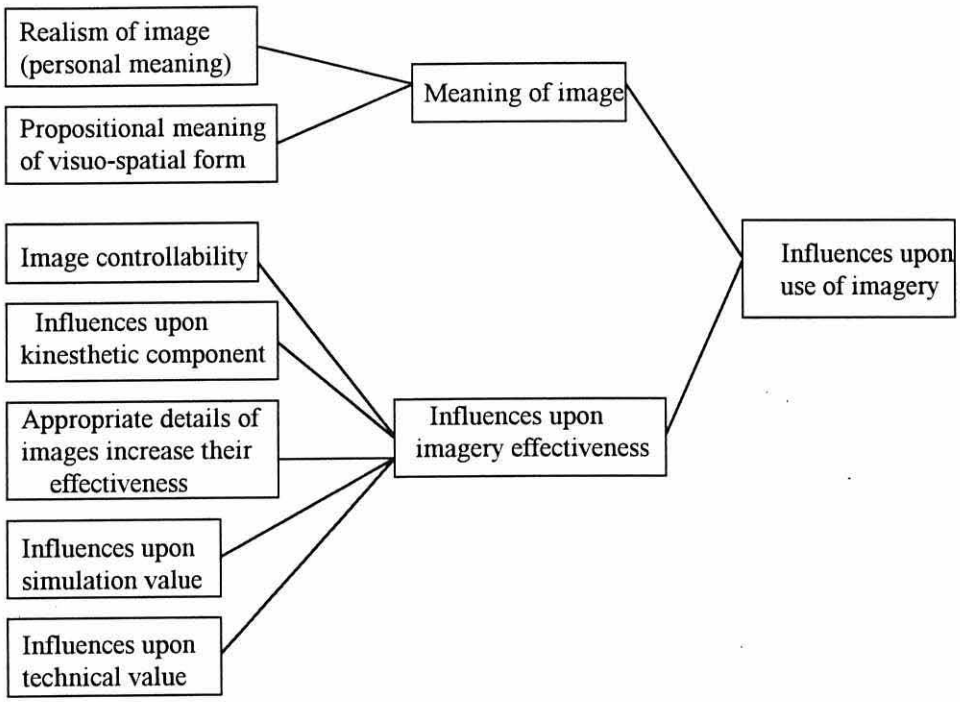

Figure 5.8: Influences upon use of imagery: Hierarchical structure of the third order dimension "Influences upon use of imagery".

5.5 Discussion

The interviews with the gymnasts and slalom canoeists revealed detailed information about image content, which indicated many qualitatively different dimensions of imagery, and also how these details contributed to the athletes' use of imagery. All of the athletes reported using imagery in competition and training, and the rich description of their images, suggests that they generally had good imagery abilities, despite some reports of problems with image control. The athletes also had clear objectives when using imagery, details of which are reported elsewhere (the previous chapter). The first analysis reported in this chapter

indicated that the imagery of the athletes was composed of: elements that were related to technical aspects or physical dimensions; imagery components that were related to perspective or modality; and affective components that were related to emotional and psychological states. A further section identified certain adjuncts to imagery reported by one of the canoeists. The second analysis revealed aspects of imagery which influenced its use. These were primarily details of imagery related to the meaning of images, and details of imagery which contributed to its effectiveness. In some cases, the influence of details on image effectiveness was direct, but there were also some indirect effects, in terms of aspects such as kinesthesis, simulation value or technical value. The results are discussed in content sections, in order to simplify their presentation.

5.5.1 Technical Aspects of Imagery

All of the subjects in this study reported that they formed images with visual details and spatial form and that they focused on technical aspects of performance, single moves or whole routines/runs. The aspects of colour and clarity were also reported, and were considered to contribute to improving the reality of the image and therefore its simulation value.

The use of different speed images was very interesting, as it indicated that the gymnasts had found a use for slow motion imagery. Andre and Means (1986) found that imagery of a Frisbee disc golf game was more effective if performed at the same speed as actual performance, contrary to their hypothesis that the use of slow motion imagery would enhance actual practice and performance by enriching subjects' imaginal experience. However, in their study, the use of real-time imagery did not improve performance significantly more than the attention-control placebo condition, indicating that the task did not significantly benefit from imagery practice. In the present study, the gymnasts indicated that they used slow motion imagery of performance to enable them to see small details and therefore perfect performance. Slow motion imagery may serve an important role in

gymnastics, because gymnastics requires complex movement skills to be performed in a stable environment with all aspects of the movement being judged in terms of form and amplitude, slow motion imagery may allow gymnasts to focus on the details of the movements.

The emphasis on speed of imagery, such that imagery was faster than actual performance, was also indicated by one of the gymnasts for imagery of the vault, and by one of the canoeists for imagery of a slalom course. This might indicate a motivational function of imagery, whereby imagery serves to energise the athlete. However, it is more likely that imagery faster than actual performance would enhance the simulation value of imagery by enabling the athletes to adjust to the requirement of performing these skills at speed. Images were also formed at the same speed as actual performance. One of the canoeists indicated that during competition, he would try to time his images, so that it was the same speed as actually used to complete the course. This strategy was reported to improve the simulation value of imagery, as it also introduced the timing factor to the image that would be present in actual performance. Consequently, there was further support for the influence of task characteristics on the efficacy of different details of imagery (Highlen and Bennett, 1983; Goginsky and Collins, in press).

5.5.2 Image Components

The use of both internal and external visual perspectives was reported by the canoeists and gymnasts in different situations. The canoeists were more likely to use internal perspective imagery without any perspective changes, but did occasionally report using external imagery if they had seen someone successfully complete a difficult manoeuvre, or when planning responses to a new course. In contrast, the gymnasts were more likely to use external perspective imagery, but experience perspective switching for particular movements. The role of imagery perspective was considered to be important for different reasons. Internal imagery was identified as improving the simulation value of imagery by one of the canoeists,

by providing the view of what would be seen during actual performance. Thus, as the purpose of imagery was to simulate actual performance by rehearsing the physical responses that had to be made to visual information in a changing environment, it was considered important to image from an internal visual perspective. The gymnasts indicated that the use of external visual imagery enabled them to see themselves performing, and to see all the details of performance, which improved the technical value of their imagery. Seeing the view from a third person perspective such as a coach or judge was also indicated as important, possibly because in gymnastics, the form of the movement is judged by a third person.

Imagery perspective was indicated as facilitating the production of kinesthetic imagery by two of the gymnasts. One of these gymnasts reported that internal visual imagery facilitated the production of kinesthesis (c.f. Mahoney and Avener, 1977; Hale, 1982). However, the other gymnast indicated that an external perspective image enabled her to concentrate on seeing the details of the movement, rather than on seeing where she was going, and therefore facilitated the production of kinesthesis. The third gymnast indicated that she always used an external perspective image, and reported being able to feel all of the movements in her images, thereby questioning the assumption that internal perspective imagery enables kinesthetic components to be experienced. This also supports evidence in the first experimental chapter which indicated that kinesthetic imagery could be experienced with external visual imagery. However, the reports of perspective switching during tumbling for two of the gymnasts, from external to internal visual perspectives, suggest that an external perspective might enable the performer to see the important aspects of form of the tumble and an internal perspective might help them to see their orientation relative to the environment at critical times during the tumble, such as seeing the ground when upside down and seeing the landing.

All of the athletes in this study reported that they experienced kinesthetic imagery. One of the canoeists stated that he had to have completed a run down the course, in order to feel

his movements during imagery, and that therefore familiarity with the course and movements facilitated kinesthetic imagery. In addition to the imagery perspective issue, one of the canoeists reported feeling the movements more when there were emotive elements present in her imagery. These observations raise an important issue, as they suggest that imagery is not a static phenomenon, and that the performers can emphasise or change the details of their imagery, in order to experience effects that they perceive as important to their performance. Supporting this view, another canoeist reported the use of "in-vivo" movements during imagery in order to enhance the kinesthetic component of imagery. This use of simultaneous movement during imagery has also been reported by Orlick and Partington (1988).

Surprisingly, only two of the subjects in the present study reported an aural component to their imagery. For the gymnasts, one reported the use of verbal instructions during imagery to focus attention on important aspects of performance. Although the use of strategies which focus conscious attention on specific aspects of task performance under stressful conditions has been questioned (Masters, 1992; Paivio, 1985), the inclusion of verbal instructions was indicated as being useful to improve the planning and execution of responses in both training and competition, and therefore improved the technical value of imagery. Interventions which focus attention on process cues have been advocated by a number of researchers (Kingston and Hardy, 1994; Hardy, Jones and Gould, in press). The canoeist reported hearing either the sound of the water during imagery, or hearing music during imagery which she listened to using a Walkman. She considered this adjunct to imagery to be very important for several reasons. Firstly, she would listen to inspirational music which she used as a motivating tool, and as a means of cueing paddle strokes to enable her to remember which strokes to use and when (c.f. Karageorghis and Terry, 1995). The act of listening to the music also enabled her to avoid distractions during her preparation, and therefore was used to improve her concentration prior to competing.

5.5.3 Affective Components

The only clear differences in terms of the pattern of affective states before and during imagery was in terms of the situation in which imagery was conducted. Not surprisingly, subjects reported that they felt more anxiety and higher levels of physiological arousal prior to and during imagery in competition than in training. Other psychological states reported in association with competition included feeling more psyched up and feeling a greater or lesser degree of concentration. One canoeist reported feeling relaxed or at least trying to feel relaxed before imagery in competition.

The gymnasts also reported feeling anxiety during imagery of difficult moves in training, possibly due to the danger of injury if they were performed incorrectly. Only one canoeist indicated that she used imagery with enhanced emotive content. She reported that she would imagine herself feeling the motivational aspects of performance during imagery. Interestingly, the imagery she used in this situation was task specific rather than task irrelevant, thus supporting the view that emotive imagery is more effective if it directs attention to task performance (Murphy et al., 1988; Lee, 1990).

5.5.4 Image Meaning

Consistent with Ahsen (1984), the subjects indicated that their interpretation of imagery was important. They almost always formed images of *themselves* performing moves, full runs and routines, but would sometimes form images of others if they had seen them successfully perform a difficult move. This was usually followed by them trying to form the image of themselves performing. Many of the subjects identified that it was important that the images were personalised and of themselves, as this contributed to the meaning of the image, and improved the simulation value of the image. The realness of the image also influenced its meaning and therefore had a direct influence on its simulation value. At a propositional level (Barnard and Teasdale, 1991), subjects were also able to interpret the meaning of events

during imagery in terms of how applicable they were to their present situation. For example, for the canoeists, an image of good past performance might enhance their motivation via implicational meaning (emotional meaning), but would not provide any information about how they would perform the slalom course in a specific competition (propositional meaning). Thus, they were more likely to form situational specific images of what and how they would perform at the present time, and they would not use imagery prior to actually knowing the layout of a particular course in training or competition. In contrast, the gymnasts used imagery of what would happen in competition, but also used a mixture of successful past performances and of what would happen in the present in training, as images of past performance were meaningful to them in the training environment. The meaningfulness of past performance imagery enabled the gymnasts to use imagery at home and on days off before a competition.

5.5.5 Controllability

Several of the athletes reported experiencing difficulties with the controllability of their images. However, the consequences of poor image control were observed in it's effects on motivational variables, rather than direct effects on performance (Woolfolk, Parrish and Murphy, 1985, Murphy, 1986). The experience of successful imagery was followed by feelings of happiness, confidence and higher motivation; whereas the experience of unsuccessful imagery was followed by feelings of greater anxiety, panic and "psyched-out". It has been suggested that imagery can be used by sport performers as a goal-setting tool (Salmon, Hall and Haslam, 1994; Hall, Buckolz and Fishburne, 1992). Imagery of successful performance has also been shown to increase positive self-evaluative cognitions and perceptions of ability to master skills and situations, which therefore enhances intrinsic motivation and affective outcome (Deci and Ryan, 1985; Martin and Hall, 1995). Imagery of unsuccessful performance is likely to decrease motivation and positive affect, as the outcome of imagery would be interpreted as failure to achieve a goal. Thus, the emotional

effects of imagery are likely to be influenced by the interpretation of information supplied by the image, rather than imagery control per se.

Clearly, the ability to control imagery was related to emotional factors, and was one of the crucial variables when using imagery in competition. In order to increase the probability of controllable images, one subject reported going over imagery several times, whilst another focused on remaining calm. These reports indicated that the subjects had developed strategies to overcome controllability problems, consistent with the findings of Orlick and Partington (1988), that elite performers reported spending a lot of time trying to control their imagery.

5.5.6 Methodological Limitations

The methodological strengths and weaknesses of the present study are discussed in the final chapter of this thesis.

5.5.7 Summary

This study gave clear indications that several key factors influence the specific details of imagery experience. The following tentative conclusions can be drawn from the present study.

1. The present subjects experienced multi-modal imagery, integrating visual, kinesthetic, auditory and emotional experiences.

2. Task demand characteristics appear to influence the way in which imagery is used. In addition, imagery would be adapted by the performers by using or emphasising specific details of their images in order to meet the requirements of the situation. For example, the environmental changes in slalom canoeing seemed to be related to the reported importance

of prospective rather than retrospective images for canoeists, whilst performance assessment in terms of form seemed to be related to the importance of external perspective images for gymnasts. Furthermore, the purpose for which imagery was used seemed to be related to the inclusion of certain details during imagery. For example, the gymnasts appeared to use imagery more for it's technical value and reported using more external perspective imagery, in slow motion, as this enabled them to see the movements and therefore perfect details of performance. The canoeists, on the other hand, reported placing more importance on the simulation value of their imagery, and indicated that aspects such as clarity, internal perspective and the personalisation of the images enhanced the reality of the imagery which therefore made imagery more like an actual performance.

3. The assumption that external perspective imagery is purely visual in nature can seriously be questioned, as kinesthetic imagery was reported to occur concomitantly with external perspective images.

4. The controllability of imagery has been identified as an important variable in the determination of affective outcome and motivation, indicating the importance of imagery practice and the care with which imagery should be used with performers who report being unable to control their imagery.

In summary, this study has identified the content of images and the importance of this content for the use of imagery by high level slalom canoeists and artistic gymnasts. It has also illustrated the depth of detail and knowledge that can be gained from the performers perspective using a qualitative methodology. Although the experience of imagery is very individual in nature it is hoped that the information gained from this study might provide some insight into the importance of image content.

CHAPTER 6.

Effects of Level of Physiological Arousal before Imagery on Mood State and Subsequent Motivation and Efficacy Expectations[2]

6.1 Indirect Effects of Imagery

Theories of imagery from a clinical perspective have indicated the importance of both the psychophysiological involvement of the individual with the image (Lang, 1979), and the meaning of the image to the individual (Ahsen, 1984). However, traditionally imagery researchers in motor learning and performance have adopted a more limited approach to studying imagery effects. This approach has typically compared mental practice to physical practice or no practice at all. Any mental practice effects obtained have then been explained in terms of a neurophysiological effect of imagery upon the activation of appropriate groups of muscles for action (Jacobsen, 1931; Suinn, 1985; Bird, 1984) or by cognitive symbolic rehearsal (Sackett, 1934; Denis, 1985). Recently, alternative mechanisms have been proposed to explain a range of imagery effects. Imagery has been proposed not only to function at a mental rehearsal level, but also to exert an influence upon performance indirectly via changes in motivation (Paivio, 1985; Martin and Hall, 1995), or changes in self-efficacy (Bandura, 1977). Taken together, these theories suggest that imagery may exert it's effect via a number of processes.

It is possible that the ability of imagery to generally enhance mood and motivation, and not the motor content of the image, may be responsible for observed changes in motor performance. For example, based on Bower's (1981) Network Theory of mood and memory, Kavanaugh and Bower (1985) have proposed that emotional states will influence self-efficacy judgements by making mood congruent thoughts more available; such effects might influence physical performance (Kavanaugh and Hausfeld, 1986). Studies examining

[2] This study has been submitted for publication to Cognition and Emotion.

emotive imagery have shown changes in mood state, but no effect upon subsequent performance for strength and endurance tasks (Murphy, Woolfolk and Budney, 1988; Lee, 1990). However, it has also been suggested that these results were due to the use of analogue tasks outside of competitive situations which may illicit lower levels of motivation that are not easily enhanced by imagery (Lee, 1990).

6.1.1 Imagery use in Therapy

Imagery is commonly used by clinical psychologists in systematic desensitisation procedures (Wolpe, 1958). These techniques involve the use of relaxation in conjunction with imagery of a feared stimulus. It is generally accepted that relaxation should take place before imagery, as high sympathetic activity is thought to disrupt the vividness and controllability of images, and therefore therapeutic success (Bernstein and Borkovec, 1973, Lang, 1979, Suinn, 1985, Dyckman and Cowan, 1978). Suinn's (1976) Visuomotor Behavioural Rehearsal (VMBR) technique, combining both relaxation and imagery, has also been used widely in performance and sporting situations. Although several empirical studies have supported the effectiveness of VMBR (Seabourne, Weinberg, Jackson and Suinn, 1985; Kolonay, 1977; Lane, 1980), others have found that relaxation before imagery is not essential in order to obtain beneficial performance effects (Hamberger and Lohr, 1980; Gray, Haring and Banks, 1984).

6.1.2 Interacting Cognitive Subsystems

Interacting Cognitive Subsystems (ICS; Barnard and Teasdale, 1991) was developed to help understand cognitive-affective relationships, particularly in the study of depression and contextual learning. ICS differs from other information processing models of emotion by including qualitatively different types of representational code. The model comprises nine separate subsystems, each handling different types of information. Two of these subsystems are concerned with 'meaning' (the implicational and propositional subsystems), three are

peripheral sensory subsystems (acoustic, visual and body state), two are intermediate structural description subsystems (morphonolexical and object) and two are effector subsystems (articulatory and limb). These subsystems generate multiple representations for any given event. An important feature of the ICS framework is its two levels of meaning. By extracting general schematic patterns from information encoded by other subsystems, intellectual meaning is generated by the propositional subsystem; whilst emotional meaning is generated by the implicational subsystem. ICS is therefore able to account for the importance of the 'emotional meaning' of images (Ahsen, 1984), as well as intellectual meaning (Paivio, 1971).

Using ICS as a framework, it is possible to understand how imagery could operate via all of the potential mechanisms mentioned above, and how the precise nature of the image could influence its effect upon performance. The ICS view of emotion production recognises the contribution of both cognitive and affective elements, and therefore does not assign primacy to either cognition or emotion (Zajonc, 1984; Lazarus, 1984). In contrast, ICS incorporates the importance of sensory components of images into their effects upon emotion (Lang, 1979), as it recognises that proprioceptive and sensory information can be passed directly into the implicational subsystem, by-passing cognitive appraisal by the propositional subsystem; that is to say, ICS predicts that changes in peripheral body state can have a direct effect on the production of emotion (Leventhal, 1984).

ICS is also able to explain the biasing effects of mood states upon judgements (Wright and Mischel, 1982; Kavanaugh and Bower, 1985: Clark, Milberg and Ross, 1983). Theories which propose that mood-congruent effects underlie mood-congruent judgements (Bower, 1981) struggle to explain how changes in emotion can equally influence judgements both related and unrelated to the emotive stimulus (Johnson and Tversky, 1983). Within an ICS approach, evaluative judgements are supported by Implicational schematic models, which receive information from semantic and sensory sources. If the implicational, semantic and sensory elements have co-occurred in the past, a coherent affect-related schematic model

can be generated, which can further influence future affective judgements. For example, Clark, Milberg and Ross (1983) found that following the combination of success feedback and exercise induced high arousal, students gave higher subjective ratings of the quality of university life than following either treatment in isolation. An ICS account suggests that in this case, only the combination of positive propositional information from the success feedback and high exercise induced arousal was able to create an implicational schematic model composed of sufficient co-occuring semantic and sensory elements to positively bias other affective judgements.

ICS has important predictions for the use of imagery to enhance mood state, motivation and confidence, as it suggests that the specific content of the image, the amount of physiological arousal experienced by the individual, and the interpretation of sensory and semantic information might have a crucial influence on mood state and future expectations. More precisely, ICS predicts that the level of physiological arousal experienced during or before imagery might influence the implicational meaning of the images generated and therefore have an influence on the resultant mood state and future expectations of the images.

The present study was designed to examine the effects of physiological arousal prior to imagery of a successful previous performance upon subsequent mood state, competition-related motivation and efficacy expectations in competitive gymnasts. Exercise and relaxation were used to manipulate the level of physiological arousal, whilst imagery was used to provide positive performance related sensory and implicational information. Following the treatments, mood state, motivation to avoid failure, motivation to approach success, and competition related expectations were assessed with regard to an important regional competition which was due to take place one month later. It was hypothesised that imagery of a successful previous performance following relaxation or exercise would facilitate more positive mood states than no-imagery, and that high physiological arousal induced by exercise would amplify any effect that imagery and exercise had on mood state and future competition-related expectations.

6.2 Methodology

Subjects were seventeen regional standard rhythmic gymnasts (mean age=13 years), who had regular experience of competing in rhythmic gymnastics competitions. All of the subjects participated in the experiment four weeks prior to an important regional competition. The design was a 2 (groups) by 2 (treatments) factorial design with repeated measures across treatments. Subjects were randomly allocated to an imagery or a no-imagery group, and then performed both relaxation and exercise treatments prior to the imagery or no-imagery treatment in a counter-balanced order.

6.2.1 Treatments

Imagery: Subjects listened to an audio-cassette containing instructions to help them form an image of a successful previous performance of one of their rhythmic gymnastics routines. The script contained both response and stimulus propositional cues (Lang, 1979) (see appendix), and was constructed to enable subjects to form a vivid image of one of their past performances using the apparatus of their choice. The tape recorded instructions and time allowed for the subjects to image their routine was approximately five-six minutes.

No-Imagery: Subjects spent 5 minutes resting quietly. Subjects were seated on a gymnastics mat for this rest period.

Relaxation: Subjects listened to an audio-cassette containing cognitive relaxation instructions (see appendix) devised as a shortened version of Benson's (1975) meditative relaxation. The taped instructions lasted approximately seven minutes.

Exercise: Using a standard skipping rope, subjects were asked to do 100 skips forward, 100 skips backwards, 20 cross skips and 10 double skips in a seven minute period. The gymnasts were familiar with this exercise as part of their normal physical conditioning programme. Subjects were encouraged to complete these exercises at a steady rate, with brief rest periods between each exercise (up to 10 seconds).

6.2.2 Measures

Shortened Bi-polar POMS: A shortened (36-item) form of the 72-item Bi-polar Profile Of Mood States (Lorr and McNair, 1984) was used to measure subjects' present mood state. This shortened form was developed by Daley and Parfitt (1994) using data from 293 male and female adults who completed the 72-item Bi-Polar POMS. Factor analysis indicated that the factor structure was stable. Six items for each bi-polar subscale were then selected on the basis of high item-total correlations for each subscale of the 72-item version. The shortened subscales had Cronbach's Alphas ranging from 0.75 to 0.84 indicating that the subscales were internally consistent.

Achievement Motivation Inventory: A 10-item achievement motivation inventory was constructed specifically for the present study to measure subjects' judgements of their motivation to approach success (5 items) and motivation to avoid failure (5 items) at the next competition (c.f. Atkinson, 1957). Items were selected from the Sport-specific Achievement Motive Scale, a trait motivational measure developed by Willis (1982), and modified to form state measures of motivation to approach success and motivation to avoid failure. These items measured the motivation to approach success and motivation to avoid failure that subjects' expected they would have when they arrived at the future competition. Each item was rated on a 5-point Likert scale.

Competitive Efficacy Expectation Inventory: Vealey's (1986) State Sport-Confidence Inventory was slightly modified to provide a 5-item competitive efficacy expectation inventory measuring how confident they would feel at the next competition. Items were rated on a 10-point Likert scale measuring the expected intensity of subjects' self efficacy about the competition.

6.2.3 Procedure

Subjects completed the treatments individually. The experiment was conducted as part of a workshop on imagery, so that all of the subjects were familiar with the use of imagery in both training and competition situations when they were tested. The experimenter told the subjects that the experiment was to examine their present feelings and how they felt about the next competition following different types of treatments. The subjects were then randomly assigned to either the imagery or the no-imagery group.

Subjects were fitted with Sport Tester watches in order to measure heart rate as a reflection of physiological arousal. They then performed relaxation or exercise treatments prior to the imagery or no-imagery treatment in a counter-balanced order. Subjects' heart rates were recorded immediately after the imagery and no-imagery treatments. Following the treatments and heart rate measures, subjects were given a questionnaire booklet containing the achievement motivation inventory, followed by the competitive efficacy expectation inventory, and finally the shortened Bi-polar POMS. Subjects completed these questionnaires after each heart rate measure was taken. After completing the first set of questionnaires, subjects were allowed to rest for fifteen minutes before completing their second treatment (exercise or relaxation followed by imagery or no-imagery). A second measure of heart rate was then taken, followed by the completion of the second questionnaire booklet which contained the same three inventories, in the same order. Following the experiment, subjects in the no-imagery group were given the imagery treatment after the experiment to avoid ethical problems and ensure that all subjects did experience the imagery treatment.

6.2.4 Manipulation Checks

At the end of the experiment, subjects completed a post-experimental questionnaire in order to confirm that control over the experimental treatments had been maintained (c.f. Murphy,

1990). Subjects' answers were used to exclude subjects who were unable to comply with the experimental instructions. Subjects were asked if they had understood all of the items on the experimental inventories, if they had experienced any difficulty with either of their treatments, which piece of gymnastic apparatus they were using for their successful previous performance image, and when the performance had occurred. In addition, subjects were also asked to name their preferred treatment.

6.3 Results

The post-experimental questionnaire revealed that one subject in the no-imagery group struggled to understand some of the questions. This subject was removed from the data-set. The following analyses were therefore performed on 9 subjects in the imagery group and 7 subjects in the no-imagery group.

6.3.1 Heart Rate

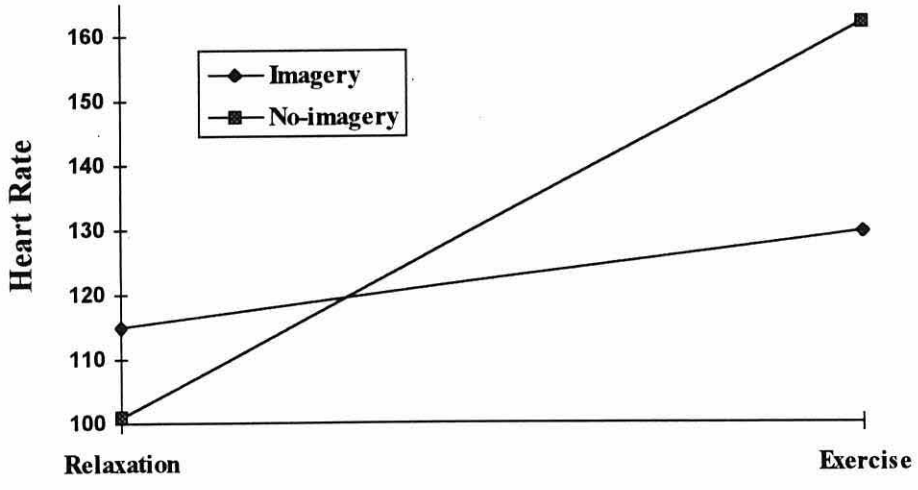

Figure 6.1: Mean heart rate scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

The heart rate data was analysed by means of a group x treatment (2x2) analysis of variance (ANOVA) with repeated measures on the treatment factor. This revealed a significant main effect for treatment, $F(1,14)=21.16$, $p<0.01$, and a significant group by treatment interaction, $F(1, 14)=7.95$, $p<0.05$. Follow-up Tukey's tests on the significant interaction indicated that the heart rates were significantly higher for the no-imagery group following the exercise treatment than following the relaxation treatment. In contrast, there was no significant difference in heart rates between treatments for the imagery group. No other significant differences were present.

6.3.2 Mood State

A group x treatment MANOVA with repeated measures on the treatment factor was conducted using the six bi-polar POMS subscales. This revealed a significant main effect for treatment, $F(11, 154)=4.82$, $p<0.01$, and a significant group x treatment interaction, $F(11, 154)=3.04$, $p<0.01$. Follow-up group x treatment ANOVAs with repeated measures on the treatment factor were conducted independently on all six subscales. Significant main effects are not elaborated upon when they are accompanied by significant interactions because of the potentially confounding effect of interactions upon main effects.

Composed-Anxious Subscale

For the composed-anxious subscale a follow-up group x treatment ANOVA with repeated measures on the treatment factor indicated a significant main effect for group, $F(1,14)=7.20$, $p<0.05$, a significant main effect for treatment, $F(1,14)=6.57$, $p<0.05$, and a significant group x treatment interaction, $F(1,14)=7.78$, $p<0.05$ on the composed-anxious subscale. Tukey's follow up tests indicated that the no-imagery group was more anxious following exercise than relaxation, and that the no-imagery group was more anxious following exercise than the imagery group following either exercise or relaxation. For the imagery group, there were no significant differences between scores following relaxation or exercise.

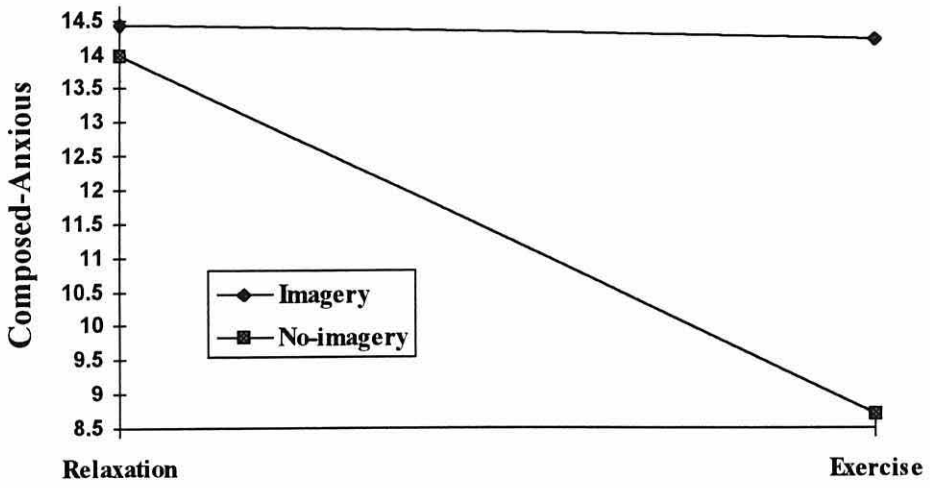

Figure 6.2: POMS results: Mean composed-anxious subscale scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

Agreeable-Hostile Subscale

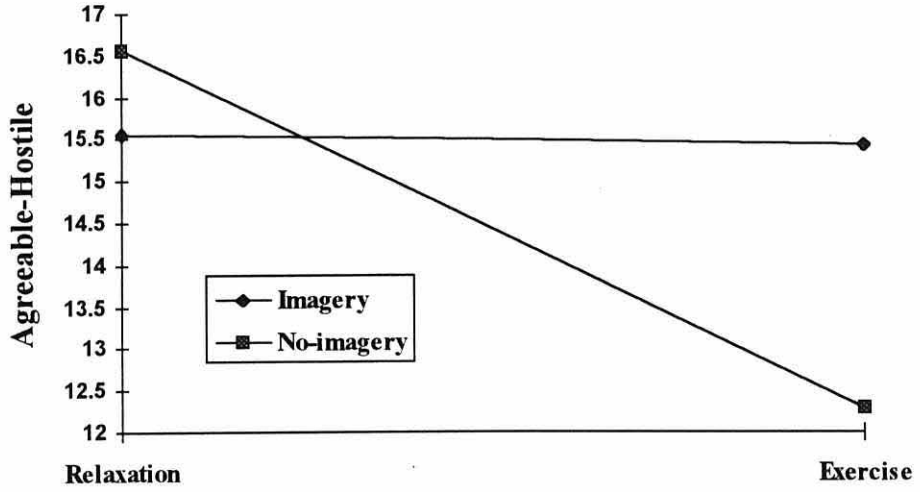

Figure 6.3: POMS results: Mean agreeable-hostile subscale scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

For the agreeable-hostile subscale a follow-up group x treatment ANOVA revealed a significant main effect for treatment $F(1,14)=6.15$, $p<0.05$, and significant group x treatment interaction, $F(1,14)=6.82$, $p<0.05$. Tukey's follow-up tests indicated that the no-

imagery group felt significantly less agreeable and more hostile following exercise than relaxation. No other significant differences were recorded.

Confident-Unsure Subscale

For the confident-unsure subscale a follow-up group x treatment ANOVA revealed a significant group x treatment interaction, $F(1,14)=8.72$, $p<0.01$. Tukey's follow-up tests indicated that following exercise the no-imagery group reported feeling significantly less unsure than the imagery group. No other significant differences were recorded.

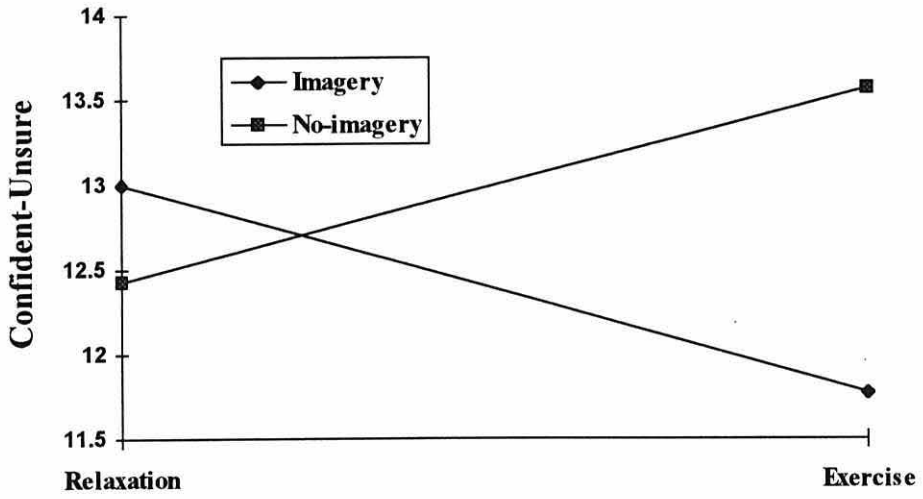

Figure 6.4: POMS results: Mean confident-unsure subscale scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

Clearheaded-Confused Subscale

A follow-up group x treatment ANOVA revealed a group x treatment interaction which approached significance on the clearheaded-confused subscale, $F(1,14)=4.03$, $p<0.07$. Tukey's follow-up tests suggested that the no-imagery group felt marginally more confused following exercise than relaxation. No other significant differences were recorded.

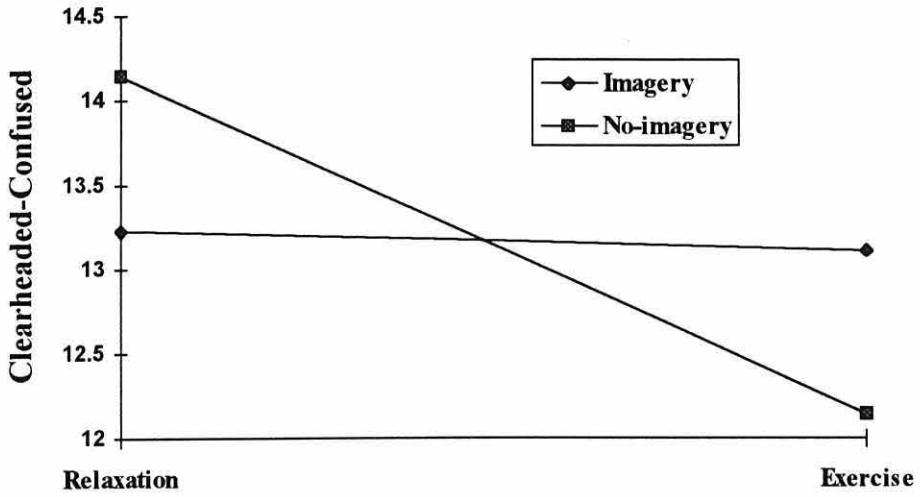

Figure 6.5: POMS results: Mean clearheaded-confused subscale scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

6.3.3 Achievement Motivation Scale

Reliability

The internal consistency of the motivation scale and its two underlying dimensions was assessed using coefficient alpha (Cronbach, 1951). Mean coefficient alpha for the 5 items of the MAF factor across the relaxation and exercise treatments was 0.76 suggesting that this factor was reliably assessed. The other factor MAS, had a mean coefficient alpha of 0.46 for the 5 items across the two treatments and therefore appeared less reliable. Removal of any single item did not rectify this problem, and so no further analyses were performed upon this subscale.

MAF Subscale

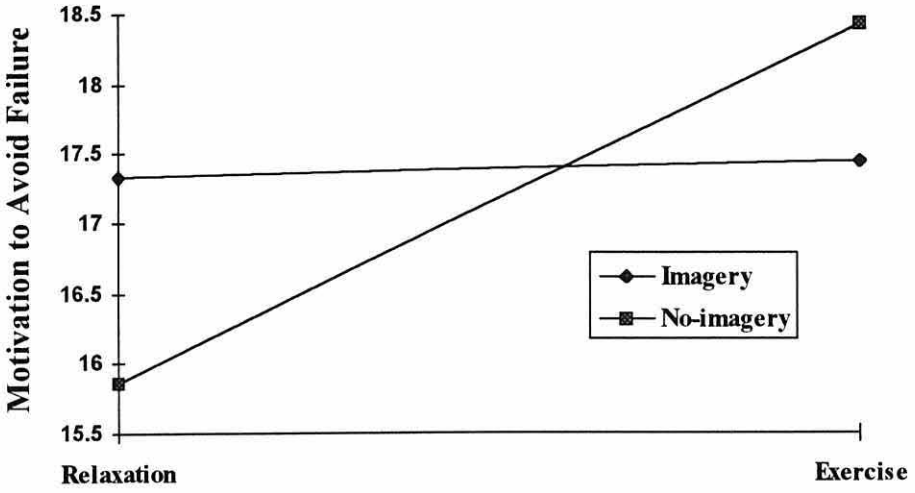

Figure 6.6: Achievement motivation results: Mean motivation to avoid failure scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

A group x treatment (2x2) ANOVA with repeated measures on the treatment factor revealed a significant main effect for treatment, $F(1,14)=5.46$, $p<0.05$ and a significant interaction, $F(1,14)=4.6$, $p<0.05$. Follow-up Tukey's tests suggested that following exercise, the no-imagery group anticipated that they would be more motivated to avoid failure at the next competition than following relaxation. There were no significant differences recorded for the imagery group across treatments and no differences between the two groups in either the relaxation or the exercise treatment.

6.3.4 Competitive Efficacy Expectation Scale

Reliability

Cronbach's alpha for the 5-item efficacy expectation scale across the exercise and relaxation treatments was 0.71, indicating that this measure was reasonably reliable.

Main Analysis

A group x treatment (2x2) ANOVA with repeated measures on the treatment factor revealed no significant main effects ($p>0.05$). However, the group x treatment interaction approached significance, $F(1,14)=4.5$, $p<0.06$. Follow-up Tukey's tests suggested that the no-imagery group expected to have lower efficacy expectations at the next competition following exercise than relaxation. There were no significant differences recorded for the imagery group across the two treatments.

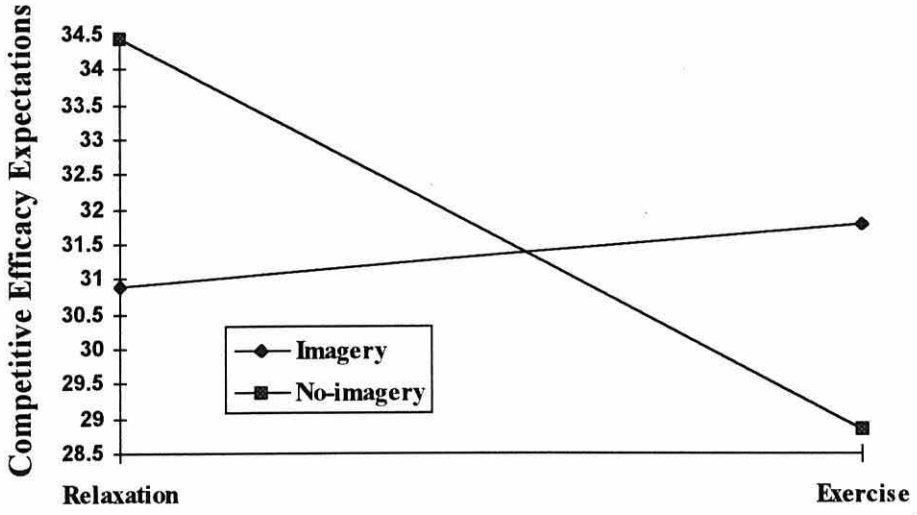

Figure 6.7: Competitive efficacy expectation results: Mean competitive efficacy expectation scores for imagery and no-imagery groups across relaxation and exercise treatment conditions.

6.3.5 Post Experimental Questions

Four of the nine subjects in the imagery group reported finding it more difficult to image a successful previous performance following exercise than relaxation. The subjects in the imagery group imagined routines using different gymnastic apparatus, performed on different occasions in the past. However, they all imagined an occasion within the six months prior to the experiment.

6.4 Discussion

The purpose of the present study was to examine the influence of different levels of physiological arousal prior to imagery upon gymnasts' immediate mood states, and future motivation and efficacy expectations with regard to a competition one month later. The results of this study indicated that only the no-imagery group experienced changes in mood state, motivation and efficacy expectations following relaxation and exercise. In summary, the no-imagery group recorded significantly higher heart rates, felt more anxious, hostile and marginally more confused following exercise than relaxation. Furthermore, in terms of future expectations, the no-imagery group expected to feel more motivated to avoid failure and expected to have lower efficacy expectations at the next competition following exercise than relaxation.

The results from the mood states analyses indicated that the no-imagery group interpreted the exercise induced high arousal negatively. As only the no-imagery group experienced a significant increase in the heart rate scores following exercise compared to following relaxation, the negative mood state measures may have been mediated by changes in heart rate. Alternatively, it may have been the nature of the arousing agent which was responsible for the observed effects, rather than the intensity of the arousal. This would suggest that the content of the exercise treatment was perceived as unenjoyable either because the exercise treatment was set at a relatively high intensity for these subjects (Steptoe and Cox, 1988; Parfitt, Markland and Holmes, 1994) or because skipping was an activity that they would perform as part of their body conditioning programme, which is commonly perceived by gymnasts to be painful and unpleasant.

There was partial support for the hypothesis that exercise induced physiological arousal would amplify any effect that imagery had on mood states, in that significant differences between the imagery and no-imagery groups were observed only in the exercise condition. In contrast to the no-imagery group, the imagery group did not suffer negative motivational

changes following exercise to those reported by the no-imagery group, suggesting that imagery was able to override subjects' apparent negative interpretation of the exercise regimen used. This suggests that the imagery treatment was able to positively manipulate the subjects' current mood states following exercise, despite no positive effect on mood states following relaxation. Furthermore, there were no significant differences for the imagery group scores across treatments, despite several differences in the no-imagery group's scores for mood state measures. Thus, it appears that the imagery of a successful prior performance was at least able to stabilise mood states across both relaxation and exercise treatments.

The results of this study failed to show clear support for the hypothesis that imagery of a successful prior performance would have a positive influence on subjects' current mood states. The absence of a positive effect of imagery relative to no-imagery across both treatments may have been due to extended processing between the propositional and implicational subsystems following imagery of the successful prior performance. The image of a previously successful performance may have encouraged the gymnasts to compare the occasion when they performed successfully with their current levels of performance. A discrepancy between the image and current reality might have led to less positive feelings and mood states, particularly if the gymnasts felt (as yet) insufficiently prepared for their forthcoming competition. Such negative effects could clearly counteract any positive mood effects associated with the previously successful performance. Although this interpretation is speculative, it does suggest that the imagery intervention did not involve only a mental rehearsal effect, but that the meaning of the image was also of crucial importance to the subjects (Ahsen, 1984; Murphy, 1990).

As the imagery group did not experience a significant increase in physiological arousal following exercise, and the time interval between the physiological arousal and the imagery/no-imagery treatment was controlled, the heart rate scores indicated that the imagery treatment enabled subjects to return to a lower physiological arousal condition

more quickly than no-imagery. This suggests that the imagery intervention may have contributed not only propositional information related to good performance, but also to body state information related to the image, thereby reducing physiological arousal to a lower level. Physiological effects due to imagery have been previously suggested (Lang, 1979; Farah, 1988; Marks and Isaac, 1995).

Whilst there was little support for the stated hypotheses, due to the negative interpretation of exercise and the non-significant effects of imagery following relaxation, the results of this study can be explained in terms of the ICS model. Only the no-imagery group experienced significant changes in mood states and competition-related expectations. In this case, exercise could have been interpreted negatively by the implicational subsystem which, in combination with the direct effect of a higher level of physiological arousal, generated a negative implicational schematic model, as indicated by the mood state effects. Consequently, in line with changes in mood state, the no-imagery subjects felt that, at the next competition, they would be significantly more motivated to avoid failure and less confident following exercise than relaxation. In contrast, the imagery subjects experienced mixed implicational code, negative from the exercise treatment and neutral or positive from the imagery treatment. This combination was therefore insufficient to generate either a particularly positive or particularly negative implicational schematic model. Consequently, the imagery group's mood and competition related expectations remained stable across the two treatments.

Interestingly, the no-imagery group reported more confident moods than the imagery group following exercise, yet expected to have lower efficacy expectations at the next competition following exercise than relaxation. The reason for this effect is unclear, however it is possible that either there is no transfer effect of current general confidence to expectations of future competition-related confidence, or that currently positive moods only served to highlight the forthcoming problem that the present subjects were going to have to deal with.

For the present subjects, it seems that relaxation alone was the most beneficial treatment in terms of positive evaluative judgements about a future competition (see Figures 6 and 7). This suggests that mental imagery of a good past performance may have contributed to the development of an implicational schematic model that served to remind subjects of a future event that they perceived as threatening, and that cognitive relaxation alone amounted to a disengagement strategy, resulting in more positive mood states and expectations regarding future competitive self efficacy. The beneficial effects of the meditative relaxation strategy upon motivation and self efficacy suggests that the gymnasts in the present study may have been experiencing high levels of cognitive anxiety (Schwartz, Davidson and Goleman, 1978) and therefore may not have been confident about the forthcoming competition. Different results might be expected for more confident gymnasts, or if the study had been carried out closer to the competition when the gymnasts were more prepared for the competition.

The results of this study confirm that the effects of levels of physiological arousal prior to imagery influence the subsequent mood state and competition related motivation and efficacy expectations of gymnasts. In addition, the ICS framework has proved useful for understanding the function of cognitive affective relationships related to imagery. However, additional factors such as confidence of subjects, nature of the arousing agent, time prior to the competition and image content may all influence the effect that imagery will have on mood states and expectations regarding future motivation and efficacy. As a starting point, future research might concentrate on examining the use of exercise and relaxation prior to imagery either using more confident subjects, or carrying out studies closer to the event when performers are more prepared for the forthcoming competition.

CHAPTER 7.

General Discussion

7.1 Summary

The purpose of this research programme was to examine the variety of effects of different types of imagery on motor skill learning and sport performance. The first section of this thesis examined the direct effects of imagery on the learning and performance of two different types of motor skills and sports. In this section, direct effects of imagery were investigated using imagery from different visual perspectives on the learning and performance of a slalom-type task and a gymnastic-type task. It was found that the use of an external visual perspective enhanced the speed of completion of the slalom-type task in learning and performance, and also enhanced the learning and recall of the gymnastic-type task. In contrast, an internal visual perspective enhanced the accuracy of performance on the slalom-type task. However, the second study found no significant differences between high-level slalom canoeists and high-level artistic gymnasts, in their ability to form visual images from different perspectives. As the athletes had high imagery abilities from both internal and external perspectives, these results were interpreted as indicating that athletes from both sports use both perspectives.

The second section of the thesis employed a qualitative methodology to study the uses of imagery by high level slalom canoeists and artistic gymnasts. Consistent with Paivio (1985), it was found that imagery was used for both cognitive and motivational functions in both competitive and training environments. Imagery was found to be used more in association with competition than training, but was also reported to be used in other situations. The athletes reported using imagery to acquire, rehearse, perfect and automatise skills, and to improve performance indirectly by enhancing self confidence, motivation, affect, and concentration. The nature of the sport was also reported to influence the way in which the

athletes used imagery. The analysis of the content of athletes' images indicated that imagery was multi-modal, and that the content of images would be influenced by task characteristics.

The third section of the thesis examined the use of imagery by gymnasts to enhance emotion and motivation. Interacting Cognitive Subsystems was used as a framework to investigate the effects of the level of arousal prior to imagery on subsequent mood states and motivation. There was no effect of different levels of arousal prior to imagery on mood states, or future motivation and efficacy expectations towards a future competition, but high levels of exercise induced arousal without imagery were found to depress mood, motivation and efficacy expectations. Imagery was able to override these negative effects, suggesting that it stabilised mood states and motivation. These effects were explained in terms of the influence of extraneous variables which might affect the emotional and motivational effects of imagery, such as the gymnasts' levels of confidence, the nature of the arousing agent, and the time prior to competition at which the experiment was carried out.

The specific implications of these studies have already been presented in some detail in earlier chapters. This final chapter collectively discusses the central theoretical and applied issues raised by the studies of this research programme, in an attempt to draw meaningful conclusions. In addition, it addresses methodological issues related to the design and measurement of imagery, which might place limitations on the present research studies. Based on the present research programme, the final section also provides suggestions for future research into the effects of imagery on sport performance.

7.2 Theoretical Implications

A variety of research methodologies have been used in this research programme to examine imagery effects. The first section of this chapter addresses the theoretical implications of the current research programme in terms of the direct and indirect effects of imagery on motor learning and performance. The qualitative studies provided evidence that sport performers

used imagery for both cognitive and motivational functions. There was also evidence of imagery use for the effects described in all four cells of Paivio's (1985) analytic framework (cognitive specific, motivational specific, cognitive general and motivational general). Imagery was used by the slalom canoeists and gymnasts to enhance general motivation levels, by using images to energise themselves or to enhance affect. However, both sets of athletes reported using imagery more to enhance motivation at a specific level, by using imagery of goal oriented responses. At a cognitive specific level, gymnasts reported using imagery to acquire, rehearse and perfect skills, whereas canoeists used imagery to rehearse and automatise skills. In contrast, only the canoeists reported using imagery to enhance performance at cognitive general level, to formulate and rehearse movement plans through slalom courses. Thus, there was evidence of the direct effects of imagery use for both the learning and performance of motor skills, as indicated by the mental practice research literature (Feltz and Landers, 1983; Clark, 1960; Wrisberg and Ragsdale, 1979) and that these effects are influenced by task demands (Wrisberg and Ragsdale, 1979; Minas, 1978; Lutkus, 1975).

7.2.1 Direct Effects : Imagery Perspective

The first section of the thesis examined the direct effects of different visual imagery perspectives using quantitative methodologies. External visual imagery facilitated the recall of the gymnastic-type task in learning and performance, suggesting that there is a similarity between external visual images and visual models, and that this type of imagery might function in a similar way to observational learning (Bandura, 1977; Magill, 1993; Carroll and Bandura, 1985). As the subjects were novices, and the effect was to enhance recall and not form, it was concluded that external visual imagery might facilitate the recall of the gross form rather than the fine form of complex movement patterns in the early stages of learning (c.f. Wrisberg and Ragsdale, 1979; Minas, 1980; Isaac and Marks, 1992). It was also found that external visual imagery enhanced the speed of completion of the slalom-type

task, suggesting that external imagery might also serve a motivational function (Smith, 1987; Murphy and Jowdy, 1992).

Internal visual imagery, on the other hand, was found to facilitate the accuracy of completion of a transfer task, which required subjects to negotiate a new slalom course. This effect of imagery perhaps explains Rotella, Gansneder, Ojala and Billing's (1980) findings that internal visual images were used more frequently by elite slalom skiers than external visual images. The efficacy of internal imagery for slalom type tasks was also supported by the qualitative study (chapter four), which found that the high level slalom canoeists reported using more internal visual perspective imagery for completing slalom courses in training and competition. Furthermore, the slalom canoeists indicated that the use of internal perspective imagery provided information which closely represented actual performance, and was associated with the simulation value of imagery. However, internal visual imagery did not facilitate the learning and performance of the gymnastics-type task. Thus, the proposed superiority of internal imagery for such tasks was not supported (Mahoney and Avener, 1977). Thus, it seems that the efficacy of different imagery perspectives might be determined by the nature of the information supplied by the image, and also by the task requirements (Murphy, 1990; 1994).

There was also evidence of the use of kinesthetic imagery with both internal visual and external visual imagery (chapters two and four). This is consistent with a recent study examining the learning and retention of a gymnastic type task, which found that the use of external kinesthetic imagery enhanced the recall of a gymnastic type task (Callow and Hardy, in preparation). However, it is contrary to Mahoney and Avener's (1977) proposal that internal imagery might be more beneficial for elite gymnastic performers as it involved the experience of concomitant kinesthetic imagery, whereas external imagery was purely visual in nature. Such a confounding of visual and kinesthetic modalities might have explained the reports of more internal imagery by elite gymnasts, as gymnasts have been found to frequently report the experience of kinesthetic imagery (Hall, Rodgers and Barr,

1990; Mumford and Hall, 1985; Isaac and Marks, 1992). The current research programme suggests that if internal perspective imagery exerts an effect on learning and performance of motor skills, the mechanism of its effect is not due to the production of kinesthetic imagery, but instead is due to the nature of the visual information it provides.

The study examining the imagery ability by perspectives of high level athletes, found that high level slalom canoeists and high level artistic gymnasts were able to form images from both perspectives that were highly clear and vivid, and that there were no differences in their abilities to form images from each perspective. As imagery ability is proposed as a function of the amount of use of imagery (Isaac and Marks, 1994), this suggests that both groups of athletes used internal and external perspective images. This view was supported by the qualitative study, which found that both groups of athletes reported using internal and external perspective imagery in different situations.

7.2.3 Indirect Effects : Imagery, Motivation, and Emotion

The present research programme found both qualitative and quantitative evidence indicating that imagery was used to enhance motivation and emotion, consistent with the indirect effects of imagery proposed by Paivio (1985). At a specific level, the high level slalom canoeists and artistic gymnasts reported imaging the activities they were about to perform, in order to enhance their motivation towards the specific goal oriented responses. In addition, they reported that these goal-related images would be accompanied by physiological arousal and emotion which enhanced affect and mood at a general level. There were less reports of the use of more abstract imagery such as collecting medals on the medal podium, or emotional images which were not specifically related to images of the goal oriented responses. This is in contrast to recent research (Moritz, Hall and Martin, in press) which suggests that the imagery of specific skills is insufficient to enhance sport confidence.

The final experimental study found that imagery of a good past performance did have an effect on gymnasts' mood, future motivation and efficacy expectations. In this study, it enhanced the gymnasts' mood following an exercise intervention which they interpreted negatively. However, the way in which it exerted its effect was unclear due to additional variables influencing mood and emotion. One possible explanation for the imagery effects observed in this study was the ability of imagery to reduce levels of arousal following exercise more rapidly than no-imagery. This suggests that the imagery intervention used in this study not only supplied propositional information related to the experience of successful imagery, but also introduced body state information which reduced the exercise-induced physiological arousal. Physiological effects associated with imagery have already been found in the research literature (Jacobsen, 1931; Lang, 1979; Hale, 1982; Harris and Robinson, 1986).

The Interacting Cognitive Subsystems framework proved useful in clarifying possible reasons for the effects observed in this study. In addition, it enhanced awareness of the complexity of emotional effects. ICS predicted that the total pattern of implicational information derived not only from physiological arousal and imagery, but also from subject characteristics such as past experience and confidence levels would influence the effect of imagery on emotion. Thus, different results might be expected for more confident gymnasts, or at a time closer to the competition. The importance of image meaning was also identified as influencing imagery effects on emotion (Ahsen, 1984). ICS suggests that the processing of the central subsystems will determine the elicited mood, consequently the ability of an image to enhance mood might be influenced by the interpretation of the content of the image (see also Chapter 5). This has important implications for studies examining the effects of imagery on emotional variables in sport contexts, as it suggests that goal oriented imagery interventions with contents perceived as unachievable or unrealistic are likely to have detrimental effects on emotion. Thus, ICS makes some important predictions related to the design of imagery interventions. The importance of individual interpretation also

supports calls which have been made for more qualitative and single-subject designs in imagery research (Hollman, 1986; Callery and Morris, 1994).

The qualitative study (chapter five) identified controllability as a variable strongly related to the affective outcome of imagery. Gymnasts and slalom canoeists indicated that if the image contained elements of unsuccessful performance, they would feel less confident, ("psyched-out") and would not want to attempt the skill or routine. In the research literature, the detrimental effects of negative imagery have usually been explained in terms of disruptions to movement production (Woolfolk, Parrish and Murphy, 1985; Powell, 1973), although effects via emotional mechanisms have also been proposed (Murphy and Jowdy, 1992). Traditionally, controllability has been considered as a subcomponent of imagery ability and therefore as a physical quantity (Start and Richardson, 1964; Lane, 1974; Gordon, 1949); however, the subjects' interpretation of uncontrolled images and the affective consequences of such images clearly needs to be specifically addressed (Ahsen, 1984). A self-efficacy explanation would suggest that imagery of unsuccessful performance would decrease self-efficacy and motivation via the perception of failure to achieve goals during imagery (Bandura, 1989; Deci and Ryan, 1985).

7.3 Applied Implications

7.3.1 Nature and Content of Imagery

Consistent with Richardson's (1969) definition of imagery, reports from the high level slalom canoeists and gymnasts supported the view of imagery being a multi-modal experience, comprising visual, kinesthetic, auditory and emotional modalities. The athletes also identified other important aspects of imagery such as the temporal patterning of images, differences in the focal point of the image, and chromatic differences.

The content of imagery was found to be related to the way in which athletes wished to use imagery. Furthermore, the differences in the task demands of each sport seemed to influence the way in which athletes used imagery. The gymnasts indicated that they would use imagery to rehearse and perfect skills, or to understand technical aspects of skills. Thus, the content of imagery would have to support the ability to see the technical aspects of performance. In an attempt to enhance its technical value, the gymnasts therefore often chose to reduce the speed of their imagery and used external perspective imagery to see all of the fine visual details of movement. The canoeists, however, used imagery to rehearse courses and therefore gain extra practice in the absence of actual physical practice. They reported that this improved the automaticity of their responses. As a consequence, they indicated that the content of their images would support the simulation value of imagery. Thus, they used images that were high in clarity, and of themselves from an internal perspective, so that the image was highly compatible with actual experience and appeared "real".

These results support the contention that task demands influence the efficacy of different imagery perspectives, and suggest that other details of imagery might influence imagery efficacy. Coaches and sport psychologists should therefore be aware of the specific content of imagery, the likely influence of the task demands of their sport, and the intended use of imagery when working with sport performers.

7.3.3 Effects of Image Content on Motivation and Affect

The implications of the image content are not only of importance for the use of imagery to directly enhance performance and learning. Image content also had an important effect on the use of imagery to enhance emotion, particularly when imagery was used by the athletes to enhance self confidence and motivation (most commonly reported by all athletes). When using imagery to enhance self confidence and motivation, the canoeists reported that the ability to simulate all aspects of performance in competition during imagery was important,

such as seeing themselves dealing with the stress of competition and feeling themselves paddling aggressively. In such cases, their imagery content would often be enhanced with emotive content, in order to support the motivational effect of the image. This suggests that canoeists are able to use mental rehearsal of their sport skills, and enhance aspects of the image to gain both specific and general motivational effects in both training and competitive environments (Paivio, 1985). Furthermore, the present research (see Chapter 5) suggests that not only images of motivational situations or of successful outcome are used by high level performers to enhance motivation at a general level, as suggested recently by Moritz, Hall and Martin (in press). In contrast, images focusing on important details of performance technique and execution, which are simultaneously enhanced with emotive content are often used to enhance general affect and motivation.

Other details of image content which were reported to influence motivational and affective outcome included the personalisation of images (of themselves) and the controllability of the images. These details were reported to be of particular importance when imagery was used to enhance self confidence. It has been suggested the imagery of one's self performing successfully might convince an athlete that they can execute the task successfully (Martin and Hall, 1995). More specifically, the way in which these details might influence self confidence, motivation and affect might be via the interpretation and therefore the meaning of the image to the individual (Ahsen, 1984; Barnard and Teasdale, 1991). Thus, images of themselves performing successfully would have personal meaning and therefore enhance their motivation and affect. However, this explanation predicts that if the athlete perceived the successful performance of the task to be unrealistic, the imagery of successful performance is less likely to enhance self confidence, motivation or affect. Indeed, it is more likely that imagery in such cases will be uncontrolled or of unsuccessful performance. This suggests that if the athlete is lacking in confidence, using imagery of successful outcomes, or motivating situations might be more appropriate to enhance motivation and affect.

A number of specific details of image content were reported by the athletes to enhance the personal meaning of their images. The canoeists reported using adjuncts to imagery such as music, timing images and 'in-vivo' movements whilst imaging. These elements were reported to increase the personal meaning of their imagery, by enhancing it's simulation, attentional control and motivational value. All of the athletes' reports suggest that the ability to feel the movements enhances the effectiveness of imagery and that factors such as imagery perspective and emotive elements facilitate these feelings. It has been suggested in the research literature that kinesthetic imagery might enhance the meaning of imagery (Lang, 1979; Ahsen, 1984); however, the precise role of kinesthetic imagery remains unclear and is beyond the scope of the present research.

The athletes' reports suggest that the direct and indirect effects of imagery are related to the total pattern of meaning from all of it's constituent elements (Barnard and Teasdale, 1991). They also indicate that at least some high level athletes have a good understanding of how the content of imagery influences it's efficacy. Thus, they are able to manipulate the content of their imagery to enhance its effects. This illustrates the true dynamic and individual nature of imagery, but also indicates that the current theoretical perspectives available lie far behind the sophisticated ways in which high level athletes use imagery, which include it's use to enhance attentional control, self efficacy, and motivation, as well as to reduce anxiety. At an applied level, this suggests that coaches and sport psychologists should try to become more aware of the most meaningful aspects of their athletes' imagery, and should not assume that all athletes use imagery in the same way with the same content (Murphy, 1990; Murphy and Jowdy, 1992).

The athletes indicated that they used imagery to enhance the quality of their training, by enabling them to perfect skills, make corrections to moves, rehearse strategies and simulate competition (Orlick and Partington, 1988; Orlick, 1990; Hall, Rodgers and Barr, 1990). However, they used imagery more in competition situations than in training, and despite the complexity of their uses and content of imagery, felt that they did not use imagery to it's full

potential. It became clear that they felt they should spend more time on imagery in training, to enhance this aspect of their mental training. Quality training involving mental preparation has been identified as being related to successful elite performance (Orlick and Partington, 1988). However, coaches often place the emphasis of training sessions strongly on physical preparation for competition, and leave the athletes to mentally prepare on their own, suggesting the need for coach education to support this important aspect of competition preparation. Coach awareness of imagery issues also reflected the use of imagery by athletes out of training and competition. For example, one gymnastics coach was aware of the benefits of imagery in the rehabilitation process following injury, and therefore encouraged its use by gymnasts in this situation.

7.4 Methodological Issues

7.4.1 Methodological Issues of the Quantitative Studies: Research approaches

Traditionally, research has examined imagery effects using quantitative research methodologies, such as pre-test post-test designs in laboratory or field settings. Such research designs have potentially high internal validity due to the control and manipulation of independent variables, and are therefore effective for inferring causality between dependent and independent variables. However, the control over variables, particularly in laboratory studies, can introduce artificial restrictions on the study of behaviour and hence severely reduce the generalisability of research findings (Martens, 1987; Locke, 1989). Qualitative methodologies have recently gained popularity in the sport psychology research literature, as a means of studying the experiences of elite performers (Orlick and Partington, 1988; Scanlan, Ravizza and Stein, 1989; Gould, Jackson and Finch, 1993). Despite the weaknesses inherent in qualitative procedures such as the problems of maintaining objectivity and the inability to infer causality between variables, the holistic study of behaviour in natural environments can enhance the ecological validity of the research findings (Locke, 1989; Siedentop, 1989).

The use of quantitative paradigms in imagery research is also problematic for studies examining imagery effects, due to the individual nature of imagery experience (Ahsen, 1984). Consequently, imagery effects which might be large for a limited number of subjects, could be masked by the lack of an effect for the majority of subjects (Hollman, 1986). In addition, a large number of extraneous variables appear to mediate the relationship between the imagery and performance (Corbin, 1972; Richardson, 1967a, 1967b). In an attempt to overcome such problems, both quantitative and qualitative methods were used to compliment one another (Patton, 1990; Steckler, McLeroy, Goodman and Bird, 1992). A triangulation of research methodologies was developed such that the qualitative methods might help explain quantitative findings or at least confirm the presence of these findings (methods triangulation), and also to gain an in-depth understanding of imagery experience from the athlete's perspective (perspective triangulation). Combinations of qualitative and quantitative research methodologies have been used in the research literature to examine sources of stress in elite performers (Gould, Jackson and Finch, 1993), and the psychological strategies employed by elite sport performers (Gould, Eklund and Jackson, 1992). As yet, this approach has not been used in the study of imagery and sport performance. In the authors opinion, the variety of research approaches employed to examine imagery effects on motor skill learning and performance was a major strength of the present research programme.

7.4.2 Experimental Control and Statistical Power

An additional strength of the current research was amount of control gained over the treatment conditions in the quantitative studies. The addition of manipulation checks following the experimental procedures of the quantitative studies, in the form of interviews and questions (Hollman, 1986; Murphy, 1990) facilitated this process. These manipulation checks enabled some form of control over the treatment to be established, as the questions specifically asked subjects if they were able to follow the experimental procedures. Data from subjects who were unable to comply with the experimental procedures were eliminated

from the analysis. In addition, the administration of questionnaires measuring subjects' imagery ability prior to these studies, enabled the author to select subjects who had the ability to form clear and vivid images and therefore increased the chances of gaining "clean" data.

However, the use of such measures of control had serious implications in terms of the numbers of subjects included in the analyses. At the start of the first experimental study, forty eight subjects completed the Vividness of Movement Imagery Questionnaire (Isaac, Marks and Russell, 1986) to determine their ability to form images from internal and external visual perspectives. However, only half of the original sample (twenty four) were able to form equally clear and vivid images from both perspectives, and therefore only data from these subjects were included in the analyses. In addition to this, 25% of the subjects from each of the treatment groups were excluded as they were unable to comply with the experimental treatments. Thus, attempts to maintain control over imagery conditions severely reduced the statistical power of the study, and therefore the chances of committing type II errors is increased (Cohen, 1992; Schutz and Gessaroli, 1993). The trade-off between experimental control and Cohen's estimations of subject numbers required to establish good statistical power, is a serious issue for researchers examining imagery effects, which has yet to be addressed. For the present research programme, it was decided that establishing control over the experimental conditions was more important, as the mechanisms of imagery function were the central focus of the research studies. Clearly, studying imagery effects in subjects who could not image would not facilitate this process. In addition to this, Cohen's calculation of statistical power is dependent on predicted effect sizes, which are influenced by the amount of experimental control of a study. Thus, the small sample sizes used in the current research are not considered to be a serious problem, as measures of control which reduce measurement error and group standard deviations will increase the effect size and therefore the statistical power of a study.

Another design issue which needs to be addressed by imagery researchers is the nature of control groups in imagery studies. Studies including a control group in the mental practice research literature have used no-practice control groups (Mendoza and Wichman, 1978; Shick, 1970; Smyth, 1975) and distraction task control groups (Rawlings and Rawlings, 1974; Wrisberg and Ragsdale, 1979; Ryan and Simons, 1981). It has been suggested positive effects of mental practice in studies comparing mental practice groups to control groups, can be explained in terms of differences in motivation levels (Corbin, 1972; Richardson, 1967a; 1967b). However, a recent meta-analytic study examining this effect found that there was no significant difference in the effects of mental practice for studies using distraction control groups than those using traditional no-practice control groups. There are several problems with the use of control groups in imagery experiments. In the case of traditional control groups, it is impossible to ensure that subjects do nothing, and it is also difficult to predict exactly what they will do. Distraction control groups suffer from the problem of comparison with the treatment groups. In short, any effect of the treatment groups relative to the distraction control could be explained in terms of the interference effects of the control group rather than the enhanced performance or learning of the treatment groups. In order to overcome this problem in the first research study, the author initially included a no-practice control group comprising subjects who could not image at all. Initially, the inclusion of a control group of subjects who could not image, was considered to be the strongest control measure that we could include in the study, as it at least ensured that subjects in the control group would not use imagery. However, taking such a measure of control, introduced the another variable "imagery ability" into the analytical procedures, preventing statistical comparisons between treatment and control groups and therefore introducing a fundamental design flaw to the study. Consequently, data from the control group was excluded for the analyses.

7.4.3 Treatment and Measurement Issues

There are several issues related to the treatments and measures used within the quantitative studies which suggest that the results should be treated with caution. Firstly, the attempts to maximise control over the imagery treatments in the first experimental study may have introduced limitations to the way in which subjects were able to form an internal visual perspective image of the experimental tasks. A video of an internal visual perspective of the performance of these tasks was used as a crude example of the type of image we wished subjects to form. However, the use of this video technique excludes the peripheral vision that would be experienced by subjects using internal visual perspective imagery. Certainly, it was hoped that the internal perspective video would not be strictly followed, but would only be used as an example of the type of perspective required.

The results of the quantitative studies should also be treated with caution due to the nature of the measurements used. The first two experimental studies used the Vividness of Movement Imagery Questionnaire (VMIQ) in order to measure imagery ability by visual perspective (outlined in chapter 3). It should be noted that the VMIQ has not been validated specifically for this use. Although differences between elite athletes in terms of their ability to form visual images have already been found (Isaac and Marks, 1994), it is possible that the VMIQ is insufficiently sensitive to measure imagery ability from different perspectives of elite performers, which might explain the lack of differences in the second study. However, differences in imagery abilities by perspectives were found for a student population using the VMIQ, suggesting that the VMIQ might be a useful tool to examine such effects. The present research indicates in line with Murphy's (1990;1994) suggestions that the use of tools to measure subcomponents of imagery will yield a greater understanding of the processes underlying imagery than the use of unitary measures of imagery ability.

For the purpose of the emotional imagery study (chapter 6), sport specific measures of achievement motivation and efficacy expectations had to be developed, to measure these variables with reference to a future competition. Despite the fact that these measures were modified from previously validated measures of trait achievement motivation and state sport confidence (Willis, 1982; Vealey, 1986), the measures used in this study remain unvalidated and therefore the results should be treated with caution. In addition, the shortened version of the Bi-Polar Profile of Mood States (Daley and Parfitt, 1994), has been validated in the research literature with adult populations (Daley and Parfitt, 1995). Thus, the use of this measure with younger subjects can also be questioned. When this research study was carried out there were no validated tools available to measure state measures of emotional variables of teenagers, suggesting that there is a clear need for the development of such tools.

7.4.4 Methodological Issues of the Qualitative Studies

Whilst interpreting the results of the qualitative studies, there were several strengths and weaknesses which needed to be considered. The biggest strength of these studies was the use of a qualitative methodology, to obtain an in-depth understanding of each individual's imagery experience, which enabled comparisons between athletes from the two sports. This approach supplements the extensive quantitative literature which exists on imagery. A further strength of these studies included the use of live (as opposed to telephone) interviews, thereby enabling both verbal and non-verbal behaviours to be observed and noted by the interviewer. Furthermore, the subjects were interviewed in the gymnasium or at the training site during a canoe slalom training session, so subjects were interviewed in their naturalistic environments. Lincoln and Guba (1985) stressed that gaining the trust of the subjects was central to the effectiveness of qualitative studies. The interviewer felt that she had gained the trust of all subjects in the present studies. Although one subject appeared a little uncomfortable at the start of the interview, he relaxed considerably as the interview progressed.

A major limitation of the qualitative studies was the number of subjects who participated in them, which reduces the generalisability of the results to other populations. However, it can be argued that as the experience of imagery itself is so individual in nature, generalisability of imagery research using quantitative methodologies is also reduced (Murphy, 1992; Ahsen, 1984). As a consequence, it has been suggested that single subject and qualitative research designs may be the most effective way of conducting ecologically valid research in imagery (Hollman, 1986). However, research which requires athletes to introspective methods of assessing of implicit experiences has been criticised as being influenced by demand characteristics (Kaufmann, 1981; Berger and Gaunitz, 1977). Despite this, introspective methods of imagery assessment have been shown to provide reliable and valid measures of imagery functioning (Marks, 1983; Isaac, Marks and Russell, 1986). Due to the design of the qualitative studies, and the absence of controlled manipulation of variables, it should be noted that causal relationships between variables cannot be established. Thus, the results of these studies should be treated with caution, as relationships between variables can only be inferred.

The use of retrospective designs is a further limitation of these studies, as the athletes' reports could have been influenced by the outcomes of the actual competitions to which they referred during their interviews. The only way of overcoming this particular problem would be to conduct prospective interviews actually at the competition and training site, in order to gain information about image detail as it was being used. Although, this would increase the "cleanness" of the data, it would undoubtedly also interfere with the subjects' preparation for competition, and would therefore be unethical as an experimental procedure. A further problem of the retrospective design is the possibility of memory decay. This was minimised in the present study, as subjects were able to recall images used in competition or training from the recent past (within a month of the interview for competition, and within a week for training).

7.5.1 Future Directions

The results of this research programme suggest that imagery is used in a variety of different ways by sport performers to directly and indirectly enhance learning and performance. The present research addresses the issue of direct and indirect effects of imagery in the context of slalom canoeing and gymnastics. Future research should examine these effects on the learning and performance of different sport skills and possibly team sports, in order to gain a more complete understanding of it's efficacy in different situations. Qualitative and quantitative evidence has been found to suggest that the efficacy of imagery is dependent on the ability of the image to supply the sport performers with information that is most appropriate for the purpose of the imagery. For imagery to directly exert it's effect on learning or performance, the nature of the task or sport will influence the use of imagery. In addition to imagery perspective, the influence of other components of imagery such as it's temporal, auditory and kinesthetic dimensions also warrant further investigation under controlled conditions. Studies simulating the ways in which sport performers use imagery (for example, competition simulation, skill rehearsal or reviewing) and the examination of the effects of variables such as perspective preference, might also increase the relevance of imagery studies to sport psychologists, coaches and sport performers.

The effects of imagery to enhance motivational and emotional states are clearly complex in nature. Imagery researchers examining such effects of imagery need to be aware of the strong influence of individual interpretation on the generation of emotional meaning of images (Ahsen, 1984). In addition, the influence of emotional states at the time of imagery will also exert an influence on the relationship between imagery and it's emotional effects. Although these issues present difficulties for quantitative studies, the collection of qualitative data in the form of post-experimental questions and physiological data (Lang, 1979) enables researchers to monitor these effects (Murphy, 1990; Hollman, 1986).

This research programme suggests that the study of imagery effects using a variety of different research methodologies, can provide applied support for quantitative studies and therefore enhance the generalisability and ecological validity of research. The use of studies employing single subject designs as a different methodological approach might also enhance our understanding of indirect imagery effects (Hollman, 1986; Callery and Morris, 1993). The present research on indirect imagery effects only examines the relationship between physiological state, imagery, motivation and efficacy expectations. Research also needs to investigate the consequences of imagery induced emotional changes on learning and performance in sport situations (e.g. Hall and Martin, 1995).

Finally, it should be noted that the past research examining imagery effects has been criticised for it's atheoretical nature and the inadequacies of mental practice theories (Murphy, 1990; Mackay, 1981). The present research programme used theoretical perspectives and frameworks such as Interacting Cognitive Subsystems (Barnard and Teasdale, 1991; Paivio, 1985) in the study of imagery effects to generate strict predictions about the effect of imagery on learning and performance. These theoretical perspectives also helped to understand the complexity of the ways in which imagery functions to enhance emotion. Future research using theoretical frameworks such as ICS to generate predictions for imagery research is certainly warranted. Research attention should also be devoted to the development of such theoretical frameworks which support the variety of ways in which imagery is used in sport.

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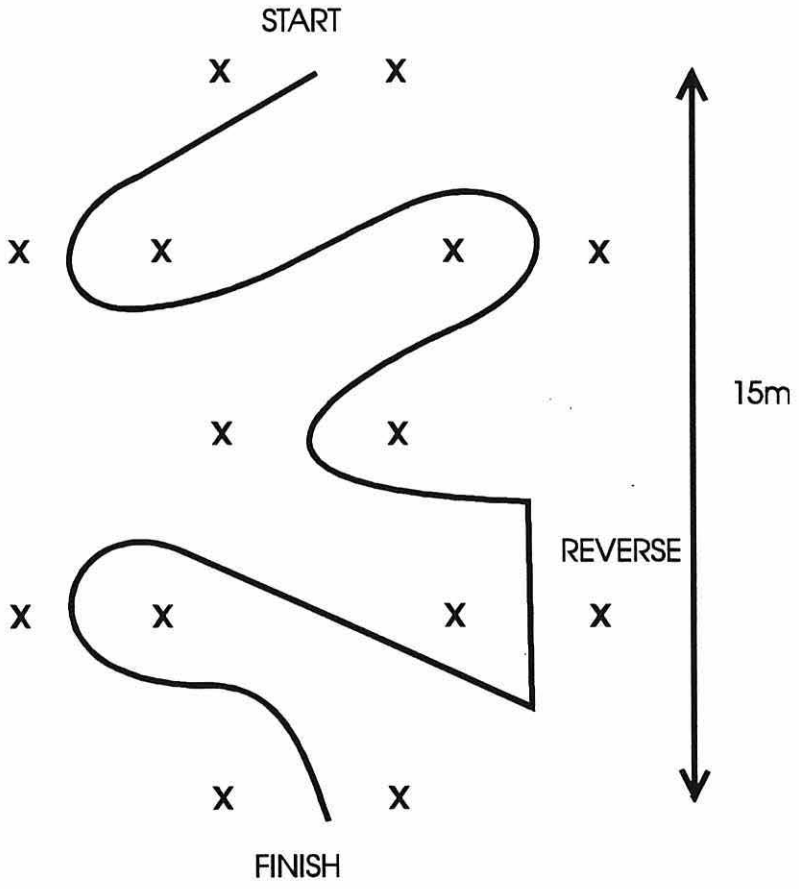
APPENDIX 1A



APPENDIX 1B

Study 1: Post-Experimental Interview Questions

Each group will be asked the following questions after completing each experiment. Their answers will be recorded onto a cassette.

1. Did you use the imagery perspective/ control condition you were asked to use prior to performance of this task?

2. Did you use any other strategy?

3. Did you get any kinesthetic feelings during imagery?

4. How effective did you think the perspective you used was to the performance of this task? (score 1-10)

This question will be asked at the very end of the experimental period to assess the subjects motivation for participating.

5. How did you feel about your participation in the study?

APPENDIX 2

Modified Version of the Vividness of Movement Imagery Questionnaire

Vividness of Movement Imagery Questionnaire

TOTAL SCORES
External =
Internal =
Total =

Movement imagery ability 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 five point scale. After each item, write the appropriate number in the box provided. The first box is for an image obtained when watching somebody else or yourself performing the movement from an external perspective (third person's perspective) and the second box is for an image obtained doing it yourself and seeing the view that you would actually see from an internal perspective (first person's perspective). Try to do each item separately, independently of how you may have done other items. Complete all items obtained from an external perspective and then return to the beginning of the questionnaire and rate the image obtained from an internal perspective. The two ratings for a given item may not in all cases be the same. For all items please have your eyes CLOSED.

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	External Perspective	Internal Perspective
1. Standing		
2. Walking		
3. Running		
4. Jumping		

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	External Perspective	Internal Perspective
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.		

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	External Perspective	Internal Perspective
13. Catching a ball with two hands		
14. Throwing a stone in water		
15. Kicking a ball in the air		
16. Hitting a ball along the ground		

Item	External Perspective	Internal Perspective
17. Running downhill		
18. Climbing over a high wall		
19. Sliding on ice		
20. Riding a bike		

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	External Perspective	Internal Perspective
21. Jumping into water		
22. Swinging on a rope		
23. Balancing on one leg		
24. Jumping off a high wall		

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

APPENDIX 3A

Interview Guide

Use of Imagery By Canoe Slalomists

Participant..... Name..... Age.....

Date..... Time Began..... Time Ended.....

Introduction

Thanks for agreeing to participate in this interview.

The purpose of this study is to gain a better understanding of imagery and how it is generally used in slalom canoeing. It is also hoped that we can gain a better understanding of your use of imagery, as part of your mental preparation for competition. This should help us design appropriate mental training sessions for paddlers in the future, as well as help other sport psychologists understand how canoe slalomists use imagery.

I am using a tape recorder to get complete and accurate information, so that I can ask more questions and so that I can interview you more efficiently. All of the information you give me will remain strictly confidential. You are free to stop the interview or refuse to answer any questions should you wish to do so, at any time. There are no right or wrong answers to the questions asked. What we are hoping to do is to learn from your experience about the way in which you use imagery. If you have any questions now or during the interview or you are confused at any point, please feel free to ask.

The questions I am going to ask are about your experience of using imagery for canoe slalom. During the interview, I will ask you to recall occasions when you have used imagery. When you are doing this, I would like you to keep in mind all of your experiences of imagery related to slalom canoeing. I'll then ask you about how you learned to image. Later, I shall ask you to describe an image that you would use specifically in competition. At this point, I would like you to describe what you would experience in great detail, so that we can gain a clear understanding of the content of your images. Finally, I shall ask about details of the content of your images, so that we can find out what features of your images make them more effective.

At the end of the interview, I would really appreciate it, if you could add anything that you feel is important and has not been covered in the questions asked. However, initially, I would like to ask you a few questions to provide some background information about your participation in canoe slalom.

Demographics

To start with, I would like to ask you a few questions about your experience as a paddler, so that I can relate this to your experiences of mental training.

1. How old were you when you began competitive slalom canoeing?

2. How old are you now?

3. Could you please give me details of your placement in any international competitions?

Year	Comp	Placement

4. Could you please give me details of your ranking in the national divisions?

Year	Division	Ranking

5. How many times do you train per week? And for how long per session?

6. Roughly, how many competitions do you have per year?

7. Do they happen all year round?

Open Ended Questions Section

General Use of Imagery

I would now like you to focus on your use of imagery as part of your mental preparation for training and competition. I am going to ask you questions about your own experience of imagery, but first I shall tray to define what I mean by imagery. Imagery is an experience that mimics real experience. We can be aware of seeing an image, feeling movements as an image, or experiencing an image of smell, taste or sounds without experiencing the real thing. It differs from dreams in that we are awake and conscious when we form an image.

Do you have any questions about what I mean by imagery?

Is this similar to how you would define imagery?

Imagery is used in lots of different situations. Lots of sport performers report using imagery during competition, but it is often used in training or at home.

1. Thinking back over your experiences as a competitive slalom paddler, when (on what occasions) do you recall using imagery?

General Probe: Can you remember any other occasions when you have used imagery?

Elaboration Probe: Can you describe the types of things you would image?

There are several reasons why sport performers use imagery, for example, it can be used to learn new skills, to improve self confidence, to motivate them or to reduce anxiety.

2. What were the reasons for your use of imagery?

General Probe: What was the purpose of your use of imagery?
Why did you use imagery?
Can you think of any other reasons for your use of imagery?

Specific Probes: How did the images make you feel?
Did your images help you physically or mentally?

3. Did imagery help you in any way?

Specific Probes: Does that help any aspects of your performance? In what way?
Does that help your confidence? In what way?
Does that help your motivation? In what way?
Does that help you deal with stress? In what way?
Does that help you relax? In what way?

Imagery Instruction/Training

You seem familiar with imagery.

1. Where or how did you learn to image?

Specific Probes: Has anyone ever taught you to image or how to use imagery?
How did they do that?

2. Have you ever used any exercises to help you improve your ability to image?

Specific Probe: Can you describe them?

3. Has your coach (or any coaches) ever encouraged you to use imagery during training or in competition?

Specific Probe: When was that?
What was the imagery for?
What kinds of things did you image?

4. How much training time do you spend on this aspect of mental training?

Specific Probe: Do you think this is about the right amount?
Do you spend any time practising imagery in your spare time?
Do you think it is an important part of your preparation?

Details of Competition Imagery

Now I would like you to focus more specifically on the use of imagery in competitions. For this section of the interview, I would like you to imagine that you are about to compete in an important competition. I will ask you to describe your competition preparation, and then ask you some detailed questions about a typical image you would use as part of this preparation. Close your eyes and think back to a big competition. Re-run your competition routine through your head....

1. Can you briefly describe your pre-competition routine?

Specific Probe: Does that involve imagery?
Does that involve anything else?

2. What kinds of activities do you do immediately before imaging?

Specific Probes: Can you describe what is going through your head at that point?
Is that a physical or mental activity?
Would you say your heart was beating fast at that point?
How do you feel then? (for example, do you feel relaxed, excited, anxious or something else?)
Does this help you image?
How different is this to how you would feel before imaging in training or at home?

Ok, try to form the image that you used in that big competition. This might be an image of yourself or someone else completing the competition course, or it may be something different.

3. Can you describe your image to me in detail?

Specific Probes: What do you actually see?
Is it of an occasion in the past when you performed well or is it an image of what will happen in the present competition?
Is it like watching a video of yourself, or the view that you would see as if you were actually paddling down the river?
Does it switch from one perspective to the other?
Is the image clear or grainy?
Does the image seem real?
Is the image in colour or black and white?
Is it an image of yourself or of someone else?
Is it of a real bodyform or of a stickman?

4. When you image, can you feel what it is like to perform the movements you are imaging?
Specific Probes: Which movements?
What do you feel?

5. Can you describe any sounds you hear as you image?

6. Are there any smells attached to this image?

7. Can you describe any emotions you feel whilst you are imaging this?

8. Can you describe any emotions you feel after imaging this?
Specific Probes: Do you feel more confident?
Do you feel more motivated to perform?
Do you feel less anxious?
Anything else?

9. Thinking of this image as a whole, what exactly did you use the image for?

Use of Imagery Away from Competitions-(in training/at home)

1. Is the image you described to me earlier (in competition), typical of the type of images you usually form in training?

2. Would the activities you do before imagery differ to those in competition?
Specific Probes: Describe how you would feel before doing imagery in training?

Now close your eyes and think of the last occasion when you used imagery in training?

3. Can you describe your image to me in detail?
Specific Probes: What do you actually see?
Is it of an occasion in the past when you performed well or is it an image of what will happen in the present competition?
Is it like watching a video of yourself, or the view that you would see as if you were actually paddling down the river?
Does it switch from one perspective to the other?
Is the image clear or grainy?
Does the image seem real?
Is the image in colour or black and white?
Is it an image of yourself or of someone else?
Is it of a real bodyform or of a stickman?

4. When you image, can you feel what it is like to perform the movements you are imaging?
Specific Probes: Which movements?
What do you feel?

5. Can you describe any sounds you hear as you image?

6. Are there any smells attached to this image?

7. Can you describe any emotions you feel whilst you are imaging this?

8. Can you describe any emotions you feel after imaging this?
Specific Probes: Do you feel more confident?
Do you feel more motivated to perform?
Do you feel less anxious?
Anything else?

9. Thinking of this image as a whole, what exactly did you use the image for?

10. Do you ever use imagery at home or outside of training and competition?

Specific Probes: If so, how would this image be different?
What features of the image would be different?
What did you use this image for?
Did it help motivate you

11. Do you use imagery for any other purpose such as when injured or out of season?

Specific Probes: What effects do these images have?
What sorts of things do you image?

Imagery Effectiveness

I need to fully understand what it is about the details of the images that make them more effective. Now thinking of all the aspects of the image that we have mentioned (Read through all the aspects we have listed), which do you think make your imagery generally more effective?

1. Which other features do you think are important about the details of your images?

Specific Probe: Can you describe that in more detail?
How does that help?

2. Why do you think these features make your imagery more effective?

Anything Else

Finally before we finish, is there anything important that you would like us to discuss about imagery that you think will help us understand how imagery works for you?

Are there any comments or suggestions you wish to make about this interview?

Thanks for your time and help.

APPENDIX 3B

Interview Guide

Use of Imagery By Artistic Gymnasts

Participant..... Name..... Age.....

Date..... Time Began..... Time Ended.....

Introduction

Thanks for agreeing to participate in this interview.

The purpose of this study is to gain a better understanding of imagery and how it is generally used in artistic gymnastics. It is also hoped that we can gain a better understanding of your use of imagery, as part of your mental preparation for competition. This should help us design appropriate mental training sessions for gymnasts in the future, as well as help other sport psychologists understand how artistic gymnasts use imagery.

I am using a tape recorder to get complete and accurate information, so that I can ask more questions and so that I can interview you more efficiently. All of the information you give me will remain strictly confidential. You are free to stop the interview or refuse to answer any questions should you wish to do so, at any time. There are no right or wrong answers to the questions asked. What we are hoping to do is to learn from your experience about the way in which you use imagery. If you have any questions now or during the interview or you are confused at any point, please feel free to ask.

The questions I am going to ask are about your experience of using imagery for artistic gymnastics. During the interview, I will ask you to recall occasions when you have used imagery. When you are doing this, I would like you to keep in mind all of your experiences of imagery related to gymnastics. I'll then ask you about how you learned to image. Later, I shall ask you to describe an image that you would use specifically in competition. At this point, I would like you to describe what you would experience in great detail, so that we can gain a clear understanding of the content of your images. Finally, I shall ask about details of the content of your images, so that we can find out what features of your images make them more effective.

At the end of the interview, I would really appreciate it, if you could add anything that you feel is important and has not been covered in the questions asked. However, initially, I would like to ask you a few questions to provide some background information about your participation in gymnastics.

Demographics

To start with, I would like to ask you a few questions about your experience as a gymnast, so that I can relate this to your experiences of mental training.

1. How old were you when you began competitive artistic gymnastics?

2. How old are you now?

3. Could you please give me details of your placement in any international competitions?

Year	Comp	Placement

4. Could you please give me details of your ranking in any national competitions?

Year	Comp	Placement

5. How many times do you train per week? And for how long per session?

6. Roughly, how many competitions do you have per year?

7. Do they happen all year round?

Open Ended Questions Section

General Use of Imagery

I would now like you to focus on your use of imagery as part of your mental preparation for training and competition. I am going to ask you questions about your own experience of imagery, but first I shall tray to define what I mean by imagery.

Imagery is an experience that mimics real experience. We can be aware of seeing an image, feeling movements as an image, or experiencing an image of smell, taste or sounds without experiencing the real thing. It differs from dreams in that we are awake and conscious when we form an image.

Do you have any questions about what I mean by imagery?
Is this similar to how you would define imagery?

Imagery is used in lots of different situations. Lots of sport performers report using imagery during competition, but it is often used in training or at home.

1. Thinking back over your experiences as a competitive artistic gymnast, when (on what occasions) do you recall using imagery?

General Probe: Can you remember any other occasions when you have used imagery?

Elaboration Probe: Can you describe the types of things you would image?

There are several reasons why sport performers use imagery, for example, it can be used to learn new skills, to improve self confidence, to motivate them or to reduce anxiety.

2. What were the reasons for your use of imagery?

General Probe: What was the purpose of your use of imagery?
Why did you use imagery?
Can you think of any other reasons for your use of imagery?

Specific Probes: How did the images make you feel?
Did your images help you physically or mentally?

3. Did imagery help you in any way?

Specific Probes: Does that help any aspects of your performance? In what way?
Does that help your confidence? In what way?
Does that help your motivation? In what way?
Does that help you deal with stress? In what way?
Does that help you relax? In what way?

Imagery Instruction/Training

You seem familiar with imagery.

1. Where or how did you learn to image?

Specific Probes: Has anyone ever taught you to image or how to use imagery?
How did they do that?

2. Have you ever used any exercises to help you improve your ability to image?

Specific Probe: Can you describe them?

3. Has your coach (or any coaches) ever encouraged you to use imagery during training or in competition?

Specific Probe: When was that?
What was the imagery for?
What kinds of things did you image?

4. How much training time do you spend on this aspect of mental training?

Specific Probe: Do you think this is about the right amount?
Do you spend any time practising imagery in your spare time?
Do you think it is an important part of your preparation?

Details of Competition Imagery

Now I would like you to focus more specifically on the use of imagery in competitions. For this section of the interview, I would like you to imagine that you are about to compete in an important competition. I will ask you to describe your competition preparation, and then ask you some detailed questions about a typical image you would use as part of this preparation. Close your eyes and think back to a big competition. Re-run your competition routine through your head....

1. Can you briefly describe your pre-competition routine?

Specific Probe: Does that involve imagery?
Does that involve anything else?

2. What kinds of activities do you do immediately before imaging?

Specific Probes: Can you describe what is going through your head at that point?
Is that a physical or mental activity?
Would you say your heart was beating fast at that point?
How do you feel then? (for example, do you feel relaxed, excited, anxious or something else?)
Does this help you image?
How different is this to how you would feel before imaging in training or at home?

Ok, try to form the image that you used for your floor routine in that big competition. This might be an image of yourself or someone else performing a competition routine, or it may be something different.

3. Can you describe your image to me in detail?

Specific Probes: What do you actually see?
Is it of an occasion in the past when you performed well or is it an image of what will happen in the present competition?
Is it like watching a video of yourself, or the view that you would see as if you were actually performing your routine?
Does it switch from one perspective to the other?
Is the image clear or grainy?
Does the image seem real?
Is the image in colour or black and white?
Is it an image of yourself or of someone else?
Is it of a real bodyform or of a stickman?

3a. Try to form the image that you used for your beam routine. Are there any details of this image that are different to the image of your floor routine?

3b. Try to form the image that you used for your bars routine. Are there any details of this image that are different to the image of your floor routine?

3c. Try to form the image that you used for your vault. Are there any details of this image that are different to the image of your floor routine?

4. When you image, can you feel what it is like to perform the movements you are imaging?
Specific Probes: Which movements?
What do you feel?

5. Can you describe any sounds you hear as you image?

6. Are there any smells attached to this image?

7. Can you describe any emotions you feel whilst you are imaging this?

8. Can you describe any emotions you feel after imaging this?
Specific Probes: Do you feel more confident?
Do you feel more motivated to perform?
Do you feel less anxious?
Anything else?

9. Thinking of this image as a whole, what exactly did you use the image for?

Use of Imagery Away from Competitions-(in training/at home)

1. Is the image you described to me earlier (in competition), typical of the type of images you usually form in training?

2. Would the activities you do before imagery differ to those in competition?
Specific Probes: Describe how you would feel before doing imagery in training?

Now close your eyes and think of the last occasion when you used imagery in training for your floor routine?

3. Can you describe your image to me in detail?
Specific Probes: What do you actually see?
Is it of an occasion in the past when you performed well or is it an image of what will happen in the present competition?
Is it like watching a video of yourself, or the view that you would see as if you were actually performing the routine?
Does it switch from one perspective to the other?
Is the image clear or grainy?
Does the image seem real?
Is the image in colour or black and white?
Is it an image of yourself or of someone else?
Is it of a real bodyform or of a stickman?

3a. Do the details of this image in training change for different apparatus?

4. When you image, can you feel what it is like to perform the movements you are imaging?
Specific Probes: Which movements?
What do you feel?

5. Can you describe any sounds you hear as you image?

6. Are there any smells attached to this image?

7. Can you describe any emotions you feel whilst you are imaging this?

8. Can you describe any emotions you feel after imaging this?

Specific Probes: Do you feel more confident?
Do you feel more motivated to perform?
Do you feel less anxious?
Anything else?

9. Thinking of this image as a whole, what exactly did you use the image for?

10. Do you ever use imagery at home or outside of training and competition?

Specific Probes: If so, how would this image be different?
What features of the image would be different?
What did you use this image for?
Did it help motivate you?

11. Do you use imagery for any other purpose such as when injured or out of season?

Specific Probes: What effects do these images have?
What sorts of things do you image?

Imagery Effectiveness

I need to fully understand what it is about the details of the images that make them more effective. Now thinking of all the aspects of the image that we have mentioned (Read through all the aspects we have listed), which do you think make your imagery generally more effective?

1. Which other features do you think are important about the details of your images?

Specific Probe: Can you describe that in more detail?
How does that help?

2. Why do you think these features make your imagery more effective?

Anything Else

Finally before we finish, is there anything important that you would like us to discuss about imagery that you think will help us understand how imagery works for you?

Are there any comments or suggestions you wish to make about this interview?

Thanks for your time and help.

APPENDIX 3C

Ideographic Profiles

Ideographic Profiles for each of the six athletes interviewed are reported below.

Participant 1- Claire - Imagery Profile

Claire had used imagery from an early age, which had been reinforced by lectures from sport psychologists, coaching sessions at regional squads, and by her peers. Most of her imagery was based around mental practice in various forms, although she was aware of more creative and abstract forms of imagery (e.g. she had listened to Unestahl's 'funny voice' and 'dodgy music' relaxation tape!). She mentions using a 'mellow mental prep.' and an 'angry mental prep.' which clearly had different emotional states associated with them. However, she appears to create and use these emotional states to elaborate and supplement her images, rather than the other way round.

Claire clearly thought that mental practice was an important part of race simulation training, which she claimed enhanced her self-confidence, her automaticity and her ability to concentrate. She mentioned automaticity regularly and indicated that not having to focus attention on tactical decisions and strokes allowed her to concentrate on 'aggressively sprinting' and 'pulling hard on the bow rudder'. These latter two points were also features of her 'angry prep.' which seems to indicate a clear motivational component to this particular type of image. In contrast, 'mellow prep.' was able to calm her down in stressful situations.

Although Claire reported using imagery in training, she seemed to use it much more during the day before a competition, once she had knowledge of what a particular course would be (situation specific imagery). Her pre-performance routine for competition was very structured, however it was not clear how much she practised this routine in training. She reported feeling a lot more 'energised/psyched up' after her 'angry prep.' and reported feeling a lot more kinesthetic images with this than with the 'mellow prep.'. The vast majority of Claire's imagery was from an internal perspective, but she did report using external imagery when walking along the river bank. In training, 'mellow preps.' helped her to concentrate, which was mainly visual in nature with a small amount of kinesthetic imagery.

In terms of effective imagery, Claire indicated that it was important that her images were of an internal perspective, were clear and that she had control over her imagery, in order to make the imagery as real and therefore as close to actual physical performance as possible.

Throughout this interview, Claire demonstrated that she had given mental preparation for performance, and imagery in particular, a lot of thought. She was very open in her responses and showed a clear understanding of her use of imagery.

Participant 2 - Neil - Imagery Profile

Neil started competitive canoe slalom only three years before the interview when he was fifteen. He reported using imagery at all competitions and some of the time in training before full runs and during concentration sessions. He said that imagery enabled him to get extra training runs on the course and that in competition it made him feel more confident. He learnt about imagery in a mental training session run by three sport psychologists and reported also using images of previous successful events (standing on the podium) as a motivational image prior to competitions.

When describing the details of his competition imagery, there was considerable ambiguity about the particular perspective he used. He used an unusual image of what the tail of his boat does during the run, when he had not completed a run down a course. Perhaps the back of the boat is important in canoe slalom, as a lot of the boat steering appears to be done from there. When he has run a course, Neil seemed to use an external visual perspective during imagery with some kinesthetic imagery, however, this is somewhat unclear. In training, Neil uses an internal perspective image when he done a run down the course from the seat of the boat.

Neil reported his images as being clear, pretty real, and more likely to be in black and white without a kinesthetic component. Otherwise they would be in colour with a kinesthetic component. He often used imagery whilst in a physiologically aroused state prior to race and reported that he gained confidence from this. He also reported using imagery to review past practice attempts or performances. Overall, Neil claimed that he used imagery in competition to reassure him of what would happen, whereas in training he used imagery more for the rehearsal of specific skills.

Neil noted that he times his imagery in competition and that the accuracy of this time would usually be within 5 seconds of the time it would take him to complete an actual run. He indicated that this function of imagery contributed to it's overall effectiveness.

Neil did not seem very comfortable at the start of the interview, however towards the end of the interview he relaxed and his responses were more open.

Participant 3 - Kath - Imagery Profile

At the time of the interview, Kath had been paddling competitively for nearly five years, since the age of twelve. She had had an excellent competitive season the previous year, and had trained hard over the winter season. She was extremely disappointed with failing to make selection for the British team for the World Championships.

Kath reported using imagery regularly in competitions, but to a lesser extent in training. In competitions, she used imagery to enhance her self confidence and to psyche up for performance. After imaging, she felt switched on and aggressive, and generally formed images from an internal perspective with kinesthetic and sometimes aural components. Whilst imaging Kath often practised the actual stroke movement with her arms, sometimes in a lying position, so that she could also simulate the movement of the boat. In competition, she reported using imagery for simulation training, but not for review purposes, and appeared to practice imagery in training in an unstructured way.

Occasionally (in training), Kath uses imagery which switches to an external perspective, especially if she has watched someone else doing a move. In competition she seemed to put herself under a lot of pressure, and uses imagery to feel that she is doing something about the stress that she experiences. Despite this, the act of imaging seemed very stressful to her, possibly because it reminds her of the forthcoming competition. However, her interpretation of the anxiety she experienced was positive.

When she is away from the water, Kath plays at imagery by doing obstacle courses in the dark, and she indicated that other paddlers joined in with these games. In terms of imagery instruction, Kath was introduced to and encouraged to practice using imagery by her father and her coaches. However, she appeared to have received no formal imagery training.

In competition, Kath often emphasised speed in her imagery. Her images are generally clear, in colour, real and of herself. She can correct image mistakes and often hears the water. Sometimes, at competitions she uses music from a walkman during imagery, which enables her to isolate herself from others. She indicated that this ability of imagery to bring her away from other, and its ability to improve her self confidence, were the reasons for her use of imagery. In training, Kath's images are more vague and less real. She images courses in 'add-on' sections, both from the bank and on the water. She also showed some creativity in her imagery for competitions, but did not maximise it's use in training. In terms of the details of her images, Kath identified image clarity and personalisation (being of herself) as being the important features contributing to imagery effectiveness.

Kath was honest and open in her responses to the questions, and was able to provide lots of details about her use of imagery.

Participant 4 - Janine - Imagery Profile

Janine was fifteen years old at the time of the interview, and had been competing in gymnastics since the age of seven. She is a talented gymnast having placed 21st in the Commonwealth Games (1994). Janine appeared to use imagery a lot, in competitions, in training, at home and at school. She was introduced to imagery by a sport psychologist and has been encouraged to use it by her coach. She uses imagery in different ways on different pieces and from different parts of routines.

Generally, in competition and training, she used an external visual perspective for all dance sequences on floor, but used an internal perspective for all tumbles on floor. On beam in training and vault in competition she used an internal perspective. Her use of internal and external imagery on beam in competition was unclear, however she reported using an internal perspective for her bars routine, which switched to an external perspective for her dismount. For vault in training, she used an external perspective image of a previous competition vault. In general, she experienced much more kinesthetic imagery when imaging tumbles and hard moves, and much more in training than in competition.

Janine was much more nervous and physiologically aroused when she used imagery in competition than in training, and reported experiencing increases in self confidence, motivation and calmness following imagery in both environments. In training she also reported using imagery to 'get familiar with a move'. In terms of the details of her images, they are clear, in colour, of herself and usually accompanied by a kinesthetic component., and she indicated that the fact that they were of herself and the presence of a kinesthetic component contributed to the effectiveness of her imagery. In addition, Janine stated that she could feel a kinesthetic component to her images regardless of their visual perspective, but that an internal visual perspective facilitated kinesthetic imagery better.
Janine's use of imagery was quite sophisticated, though not always consistently structured. She appeared a little less mature than the other participants in the study and tended to provide less elaborate responses to the interview questions.

Participant 5 - Michelle - Imagery Profile

Michelle was a highly ranked female gymnast, who had had an extremely successful career as a junior gymnast. However, her senior career had been marred by several injuries, although at the time of the interview she was regaining her form. She was seventeen years old and had been competing since the age of ten. She reported using imagery much less than when she was younger, apparently due to the loss of control over her images. It was therefore unclear to what extent her interview referred to her current as opposed to her previous use of imagery.

Michelle was introduced to imagery by her coach, who continued to encourage her to use imagery in training and in competition. However, it appeared that Michelle had received no formal imagery training. In competitions, Michelle used imagery of her routines prior to performing them, but did not report using it during or prior to the general warm up, which sounded a bit rushed. She seemed to use it primarily to calm herself down, improve her confidence and motivation, and to keep herself focused. She always imaged from an external visual perspective with a kinesthetic component, and usually imaged in slow motion, so that she could perfect every detail, except on vault where she would image herself performing very fast- as fast as she could. She was usually feeling stressed out when she imaged (even in training), which did not help her controllability of her images.

In terms of the details of her images, they were usually clear, real, in black and white, of a real body form and of herself. The latter point and her ability to control her images were the key factors that she identified as contributing to the effectiveness of her imagery. She reported not usually having anything else in her images other than herself performing her routines.

In general, Michelle was very open about her opinion on imagery. Initially in the interview, she felt negatively about it's use, suggesting that imagery did not work for her. However, her responses indicated that she had recently been able to use imagery effectively. It seemed that Michelle would have benefited from some structured imagery training.

Participant 6 - Siobhan - Imagery Profile

Siobhan was a female gymnast aged fifteen, who started competitive gymnastics when she was seven years old. Siobhan was recently selected for several minor international competitions and was already making an impact in Britain. Siobhan was introduce to imagery by a sport psychologist and was encouraged to use imagery in training and in competition by her coach. She also had had no formal imagery training.

Siobhan reported using imagery a lot in competitions, in training, at home and when injured. She used an external perspective most of the time on floor and bars, but an internal perspective on beam and vault. She was almost always able to feel her images and hears her coach shouting instructions to her during her imagery. Indeed, she identified the instructional function of her imagery as being important, although she also recognised that successful imagery enhanced her self confidence and motivation, whilst making her feel less tense. The emphasis on the word 'successful' is important here, as Siobhan's images are not always controlled and sometimes 'do their own thing'. In training, she reported using imagery to help her concentrate.

Generally, Siobhan's images are clear, real, in colour, of herself, in real body form and in slow motion. She feels that the slow motion is important to enable her to focus on every detail. She uses imagery the day before competitions (a rest day), on the day of competitions and before each piece. She thought that her external perspective made it easier for her to get the feel of the moves because she could see the moves in detail, and also that they provided her with more useful information (c.f. video feedback). She listed the slow motion, external perspective and personalisation of the images as the key features contributing to the effectiveness of her images.

Siobhan was able to give elaborate details about her use of imagery and in addition showed a clear understanding of the way in which she used imagery. During the interview, she was very open and honest in her responses.

APPENDIX 4A

Achievement Motivation and Competitive Efficacy Expectations Inventories

Instructions:
Please read the questions and circle the numbers or words that describe your feelings to answer each question. Please just answer as honestly as you can without spending a long time on each question. If you have any questions at all please ask. The following two sections of questions are related to your feelings about the next competition.

Achievement Motivation Inventory

How do you think you will feel at the next competition? Circle a number from 1 - 5 that describes how you will feel.

strongly agree = 1
agree = 2
not sure = 3
disagree = 4
strongly disagree = 5

At the next competition:-

1. I will be thrilled if I perform really well
   1 2 3 4 5
2. I will feel nervous and fidgety
   1 2 3 4 5
3. I'll find it hard to stay calm
   1 2 3 4 5
4. I will have a strong desire to be successful
   1 2 3 4 5
5. I will have trained very hard to be successful
   1 2 3 4 5
6. If I perform badly, it will bother me for several days
   1 2 3 4 5
7. I will feel butterflies in my stomach
   1 2 3 4 5
8. I will try hard to perform my best
   1 2 3 4 5
9. I will be worried about what will happen in the competition
   1 2 3 4 5
10. I will enjoy the challenge of doing well
    1 2 3 4 5

APPENDIX 4B

Competitive Efficacy Expectation Inventory

How confident do you think you will feel at the next competition? Firstly circle Yes or No to show whether you think you can achieve each of the following statements and then circle a number from 1 to 10 to show how sure you are about achieving them.

1 = definitely won't achieve this
2 = definitely will achieve this

At the next competition:-

1. I will be able to perform each routine with no major mistakes

Yes/No 1 2 3 4 5 6 7 8 9 10

2. I will be able to achieve my competition goals

Yes/No 1 2 3 4 5 6 7 8 9 10

3. I will perform all of the major difficulties well

Yes/No 1 2 3 4 5 6 7 8 9 10

4. I will feel ready and prepared to do well

Yes/No 1 2 3 4 5 6 7 8 9 10

5. I will be able to perform my routines to the best of my ability

Yes/No 1 2 3 4 5 6 7 8 9 10

Shortened Bi-Polar Profile of Mood States

Below are words that describe feelings and moods people have. Please read every word carefully and then circle the number which best describes how you feel now.

1) Energetic	0	1	2	3	0 = Much unlike this
2) Joyful	0	1	2	3	1 = Slightly unlike this
3) Able to concentrate	0	1	2	3	2 = Slightly like this
4) Composed	0	1	2	3	3 = Much like this
5) Kindly	0	1	2	3	
6) Bold	0	1	2	3	
7) Confident	0	1	2	3	
8) Good-natured	0	1	2	3	
9) Untroubled	0	1	2	3	
10) Business-like	0	1	2	3	
11) Jolly	0	1	2	3	
12) Active	0	1	2	3	
13) Ready-to-go	0	1	2	3	
14) Light-hearted	0	1	2	3	
15) Mentally alert	0	1	2	3	
16) Peaceful	0	1	2	3	
17) Friendly	0	1	2	3	
18) Self-assured	0	1	2	3	
19) Unsure	0	1	2	3	
20) Bad tempered	0	1	2	3	
21) Anxious	0	1	2	3	
22) Muddled	0	1	2	3	
23) Discouraged	0	1	2	3	
24) Sluggish	0	1	2	3	
25) Efficient	0	1	2	3	
26) Weary	0	1	2	3	
27) Gloomy	0	1	2	3	
28) Dazed	0	1	2	3	
29) Annoyed	0	1	2	3	
30) Inadequate	0	1	2	3	
31) Powerful	0	1	2	3	
32) Fatigued	0	1	2	3	
33) Downhearted	0	1	2	3	
34) Perplexed	0	1	2	3	
35) Nervous	0	1	2	3	
36) Grouchy	0	1	2	3	

APPENDIX 4D

Post Experimental Questions
Imagery Group

1. Were you able to form the image of yourself performing well?

   Was it easy?

2. Were you able to follow the cues on the tape to help your image?

3. What was the apparatus?

4. Was the image of a competition or training?

5. How long ago was the competition or training session?

6. Did your image change after each different session? If so what changed?

7. Which of the three sessions did you think was best for you?

   Why?

Control Group

1. Did you use an strategy other than exercise or relaxation before answering the questionnaires?

2. Which of the three sessions did you think was best for you?

   Why?

APPENDIX 5A

Imagery Script

Cue: Before starting, ask everyone if they can remember an occasion when they performed really well.

This the script developed to help you form an image of one of your past performances. Once you have imaged this routine, you should open your eyes, and sit quietly and still until everyone has finished.
5secs

I'd like you to try to remember an occasion when you performed one of your routines really well. This might have been in a competition or it might have been in training.
15 secs

Now I'd like you to try to get an image or picture of this occasion in your head.
15secs

Try to picture the leotard or clothing that you were wearing for that routine, and notice what the hall and the floor area look like. Try to recall how you felt before you went onto the floor area. (Your coach may have told you to concentrate on certain points about your routine. Try to remember what she said.) Perhaps you felt relaxed and ready, perhaps you felt nervous or excited. Try to recapture that feeling.
15 secs

Now try to picture yourself walking onto the floor area to your starting position. Become aware of how you felt physically and emotionally in that starting position, waiting for your music. Try to remember the feel of the carpet or floor under your feet and the apparatus in your hands if you have any.
15secs

I will tell you when to let your music start in a minute.
5 secs

When the music starts, I'd like you to picture yourself performing as much of the routine as you can. Concentrate on the feeling of the movements, the leaps having height and amplitude, the turns and balances being strong. If you are using apparatus, focus on the shapes you make and the control of the movements. The apparatus will move fluently and in time with the body movements and music. You should be able to see yourself performing the all of the elements successfully.

When you have finished the routine try to recall how good it felt to perform the routine very well.

You can let your music start now, and start imaging your routine.

3-4mins

APPENDIX 5B

Relaxation Script

Find yourself a comfortable position, and when you are comfortable I'll begin.
5 secs

It doesn't matter whether you keep your eyes open or closed, the choice is yours. Just make yourself comfortable, and focus your attention on your breathing.
10 secs

Listen to your breathing, and as you listen feel your chest rise up ..... and .....down. I'd like you to pay particular attention to your exhalations. Notice how you feel much more comfortable with each breath out .
15 secs

Any sounds that you hear whilst you are doing this will only help you to concentrate even better and make you even more comfortable.
10 secs

You may find that it helps you to feel the exhalations if you place your hands one on top of the other on top of your stomach, just below your rib cage, and feel each exhalation by gently pressing on your stomach as you breathe out.
20 secs

Just continue to relax in this way, so that you gradually get more and more comfortable with each breath out; so comfortable that you are almost asleep yet still hearing my voice at all times.
15 secs

Now, with each breath out, I would like you to concentrate on silently saying the number one. As you do this, let yourself become even more comfortable with each breath out.
40 secs

I'm going to leave you to relax on your own. Remember to keep your attention on silently saying the number one to yourself with each breath out. Let yourself become more and more relaxed, yet still hear my voice at all times.
1 min

In a moment, I'm going to ask you to wake up. When you wake up, you will feel very calm, relaxed and refreshed. To wake yourself up, I would like you to breathe slightly deeper each time you breathe in and count to ten with each breath out; one on the first breath, two on the second breath, three on the third and so on..... Feel the energy spreading through your body with each breath in, right to the tips of your fingers and toes. When you get to ten wake up slowly and in your own time.

You can start counting now.
2 mins