CHAPTER II

REVIEW OF RELATED LITERATURE

A brief account of literature related to the present study is enumerated in this chapter. The chapter is organized in two heads; (i) studies relating to imagery ability, imagery type and imagery use, and (ii) studies relating to imagery and psychological variables and performance.

Studies relating to Imagery Ability, Imagery Type and Imagery Use

Shorti; Tenutez and Feltz (2004) examined the relationships among efficacy in using imagery, imagery use and imagery ability. Consistent with Bandura’s (1986, 1997) theory, it was hypothesized that there would be a positive correlation between efficacy in using imagery and imagery use, and that efficacy in using imagery would mediate the relationship between imagery ability and imagery use. Participants were seventyfour female athletes from various sports. The instruments we used were the Movement Imagery Questionnaire – Revised (Hall & Martin, 1997) for imagery ability, the Sport Imagery Questionnaire (Hall, Mack; Paivio, & Hausenblas, 1998) for imagery use, and a modified version of the latter questionnaire for efficacy in using imagery. Correlations showed that the more athletes were confident in their ability to use a certain image, the more they used it.
Efficacy in using imagery was found to mediate only the relationship between imagery ability and cognitive imagery use.

Short and Short (2005) investigated on the differences between high- and low-confident football players on imagery functions. Recent research has suggested and shown that different athletes use the same image for different functions. These studies question the usefulness of the Sport Imagery Questionnaire (SIQ) as it consists of 30 images that comprise 5 functions. In this study, an original and a modified version of the SIQ were used. The modified SIQ took into account that different athletes could use the same image for different functions as it computed the SIQ function scores according to the athletes’ perceptions. Seventy-nine male collegiate football players participated. It was found that the imagery–confidence relationship differed according to how the SIQ subscale scores were computed.

Mahoney and Avener (2005) conducted an exploratory study on the psychology of the elite athlete; thirteen male gymnasts were given a standard questionnaire and interviewed during the final trials for the U.S. Olympic team. Particular attention was given to psychological factors and cognitive strategies in their training and competition. Using their final competitive grouping as the primary dependent variable, correlations were performed to assess the relationship between these factors and superior athletic performance. Data from this exploratory study suggested that
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varying patterns of cognition may be strongly correlated with successful and superior gymnastic performance. Specifically, dream frequency, self-verbalizations, and certain forms of mental imagery seemed to differentiate the best gymnasts from those who failed to make the Olympic team. These two groups also appeared to show different anxiety patterns and different methods of coping with competitive stress. The implications of these results for sport psychology are briefly discussed.

Recent research suggests that there are at least four aspects to the content of self-talk its valance, overt ness, person, and structure (Hardy 2001). Although Hardy. (2004, Studies 1 & 2) reported that the majority of athletes’ self-talk is positive (e.g., “you can do this”), said covertly (or internally), and is abbreviated (e.g., “head” instead of “remember to keep your head down”) in structure, sex and sport type differences for the content of self-talk have been found (Hardy 2004, Study 1). Specifically, male athletes were found to use more negative, overt (external) and less covert (internal) self-talk compared to female athletes. Moreover, team sport athletes were found to differ from individual sport athletes in almost identical manner. Post hoc analyses revealed that the significant effect of sex was confounded with the effect of sport type.

Hatzigeorgiadis; Theodorakis and Zourbanos (2004) examined the effect of instructional and motivational self-talk on the occurrence of
interfering thoughts and performance on two water-polo tasks with similar characteristics performed in the same environment. Two experiments were conducted in the swimming pool, one involving a precision task (throwing a ball at target) and one involving a power task (throwing a ball for distance). In the first experiment (precision task), both self-talk groups improved their performance in comparison to the baseline measure, with participants using instructional self-talk improving more. In the second experiment (power task), only the motivational self-talk group improved its performance significantly. In both experiments the occurrence of interfering thoughts declined for both groups. The results of the study provide further support for the effectiveness of self-talk and give preliminary evidence regarding likely mechanisms through which self-talk influence performance, that is through indications that self-talk reduces thoughts not related to task execution, thus enhancing concentration to the task.

Hall and Hardy (2004) reports on athlete’s use of self talk. Recent studies focusing on self-talk have increased our understanding of this much promoted mental skill. As a result, self-talk can be thought of as a multidimensional phenomenon focusing on athletes’ self-verbalizations, which can serve both instructional and motivational functions.

Laguna and Ravizza (2003) conducted a study, the purpose of which was to examine athlete’s mental skill use in practice and competition, their
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mental skills training experience, and their perceptions of success. The Test of Performance Strategies (TOPS) and a perception of success questionnaire were administered to 199 collegiate baseball and softball players. An ANOVA revealed a significantly greater use of mental skills in competition than in practice, and significantly higher perceptions of success in practice and competition were found when athletes reported a greater use of mental skills in both environments. The athletes experience with mental skills training, however, did not have a significant influence on their mental skill use during practice or competition. The results demonstrate the importance of mental skill use, and provide numerous applied implications for practitioners as well as opportunities for further research regarding the practice environment of athletes.

Wilson et al (2003) studied to examine the relationship between exercise regulations varying in self-determination and exercise imagery. Female Canadian university exercise participants \((N = 165)\) completed measures of exercise regulations and exercise imagery following an exercise class. Descriptive statistics indicated participants held more self-determined reasons for exercise participation in the form of greater endorsement of both identified and intrinsic exercise regulations, as well as reporting more frequent use of appearance related exercise imagery. Canonical correlation analysis revealed two significant canonical functions \((Rc1 = .47, Rc2 = .30)\).
The first function suggested that more self-determined exercise regulations were associated with both appearance and technique imagery, while the second function revealed that introjected regulation was most strongly associated with appearance-related imagery. Collectively, these data suggest that the content of exercise imagery can be understood within a theoretical framework that clarifies the functional role played by different images in exercise promotion based upon their motivational foundations.

Abma et al (2002) conducted a study; the purpose of this research was to examine how high and low trait sport confident track and field athletes differed in their imagery content and imagery ability. NCAA Division I track and field athletes (M age = 20.5 +/- 1.61 years; M = 7.15 +/- 3.3 years experience; N = 111, 44 males and 67 females) completed the following measures: Trait Sport Confidence Inventory (TSCI), Sport Imagery Questionnaire (SIQ), and Movement Imagery Questionnaire-Revised (MIQ-R). Profile analyses revealed that high trait sport confident athletes utilized each category of imagery (Motivational General-Mastery, Motivational General-Arousal, Motivational Specific, Cognitive General, and Cognitive Specific) significantly more than low trait sport confident athletes. No significant differences emerged between the groups on the two imagery ability scales. The results suggest that the high confident athletes
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used more imagery, but they did not have higher imagery skills than low confident athletes.

Rojerson and Hrycaiko (2002), examined the effectiveness of two mental skills on the performance of ice hockey goaltenders during league games. The mental skills utilized were relaxation, in the form of centering, and self talk. The participants were five male junior A hockey goaltenders. A single–subject multiple baseline across individuals design was employed to evaluate the use of mental skill. The results demonstrated that the mental skill training was effective in producing improvements in the save percentage of the goaltenders. The social validation results indicated that the participants enjoyed using the mental skills and were satisfied with the results obtained. Furthermore, the coaches were very satisfied with the results and felt that the mental skill training was an important ingredient for improving performance, in particular performance consistency.

Callow and Hardy (2001) explored to find out the relationship between imagery type and confidence, and two possible moderating variables, skill level of the athlete and sport type. One hundred and twenty-three female county netball players participated in the study; fifty five from a low standard county and 68 from a high standard county. Participants were administered the Sport Imagery Questionnaire (SIQ). One week later, at a county netball match, the State Sport Confidence Inventory (SSCI) was
administered. Hierarchical multiple regression analyses showed that in the lower standard sample, mastery imagery and imagery related to strategies of the game accounted for a significant proportion of the variance in sport confidence. Additionally, imagery related to the emotions of playing predicted confidence negatively. With the higher standard sample, goal achievement oriented imagery was the only significant predictor of variance in confidence. The results are discussed in relation to the pertinence of, and function that, different imagery types have for performers.

The frequency with which netball players use various types of imagery has been linked with their confidence of performing successfully in a game (Callow and Hardy 2001). In the Callow and Hardy study, two samples of netball players were used: one each from higher-ranked and lower-ranked counties. For the players from the higher-ranked country greater confidence of performing successfully was associated with more frequent use of motivational-specific (i.e. goal-oriented) imagery. For those from the lower-ranked county, greater confidence was related to more frequent use of motivational-general-mastery imagery (i.e. mastering a skill in a competitive situation), cognitive-general imagery (i.e. game strategy), and motivational-general-arousal imagery (i.e. psyching up). More research is needed to determine whether imagery can increase confidence levels and
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whether athletic ability might influence the effectiveness of an imagery treatment.

Studies have shown the speed at which skills are imaged may be different from the speed at which they are physically executed. Clamels and Fournier (2001) found that twelve gymnasts imaged a routine, and each of the six acrobatic and choreographic stages that comprised it, at a faster rate than they actually performed them. Factors that may have contributed to these differences are the time constraints that gymnasts normally have on their pre routine preparation, the intended function of the imagery (i.e. cognitive or motivational), and the perceived task difficulty. The duration of the imagery was longer for the more technically difficult stages.

Cumming and Hall (2001) studied to examine mental imagery within the context of the deliberate practice framework. Altogether, one hundred and fifty nine athletes from one of three different competitive standards (recreational, provincial and national) completed the Deliberate Imagery Practice Questionnaire, which was designed for the present study to assess the athletes’ perceptions of the importance of imagery along the three deliberate practice dimensions of relevancy, concentration and enjoyment. The results indicated that national athletes perceived imagery to be more relevant to performing than recreational athletes. In addition, athletes of a higher standard (i.e. provincial and national) reported using more imagery in
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a recent typical week and they had accumulated significantly more hours of imagery practice across their athletic career than recreational athletes. Finally, the relationships among the dimensions of deliberate practice did not lend conclusive support to either the original conception of deliberate practice or a sports-specific framework of deliberate practice.

Cumming, Hall and Harwood (2001) investigated to establish whether different motivational profiles that result from performing a cluster analysis reflect the use of different functions and amounts of imagery. One hundred and five competitive swimmers were recruited to participate in the study. They were asked to complete both the Task and Ego Orientation in Sport Questionnaire (TEOSQ) and the Sport Imagery Questionnaire. The results of a $K$-means cluster analysis on the TEOSQ scores resulted in a three-cluster solution that maximized between-group differences and minimized within-group differences. A multivariate analysis of variance revealed that the three cluster groups could be distinguished by their use of imagery. Specifically, the results indicated that individuals with a ‘complementary balance’ between task and ego orientations were more motivated to perform the functions of imagery that would help them to maximize their performance.

An additional aspect of self-talk that has recently received attention from researchers (e.g. Gammage; Hardy, & Hall, 2001; Hardy et al., 2001;
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Theodorakis et al., 2000) is the functions that self-talk can serve (i.e. the reasons why athletes use self-talk). It has been found that self talk seems to serve two main functions for athletes (and exercisers), a cognitive (instructional) function and a motivational function. Both main functions can be further sub-divided into more focussed functions. Specifically, the cognitive function can be split into cognitive specific and cognitive general functions, which relate to assisting the athlete, learn and execute individual skills and strategies, respectively. Similarly, the motivational function can be further divided into three separate functions. The motivational arousal function is used by athletes to help “psych” up, relax, and control their arousal levels. The motivational mastery function is concerned with mental toughness, focus, confidence, and mental preparation - all required if the athlete is to successfully master their circumstances. The motivational drive function is slightly more global in nature than the previous two motivational functions. It is concerned with assisting athletes to keep on track in order to achieve their personal goals. Thus, this function is related to maintaining and increasing drive and effort levels. Individual sport athletes have been found to make greater use of the functions of self-talk as compared to their team sport counterparts.

The detrimental effect that incorrect imagery speed may have on performance was illustrated in the Boschker et al. (2000) study. These
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Researchers had participants perform a motor sequence at their preferred speed, and at double and half that speed. Participants were then assigned to one of six treatment groups that practiced or imaged the sequence at a fast or slow pace or did not practice the sequence. The results showed that retroactive interference occurred, with the slow-practicing and slow-imaging participants recording slower performance times in the retention test than in the baseline test, and the fast-practicing and fast-imaging participants recording faster performance times in the retention test than in the baseline test.

Cocude; Mellet and Dennis (1999) reports on establishing the functional and structural similarities between images and perceptual events. Recent studies have focused on the comparison of images that are reconstructions of previous perceptual experience and images constructed from verbal descriptions. This article reports the findings of a research program based on the mental scanning paradigm; they reveal the similarities and differences between the two kinds of mental images. Neuro-imaging studies have also provided evidence that the parieto-occipital cortex is involved in the processing of visual images, whether they are based on perceptual experience or constructed from linguistic inputs. However, the PET studies conducted by our research groups provide no evidence that the primary visual cortex is engaged in the generation of visual images. As there
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is contradictory evidence about this, further research is needed to clarify the role of the early visual areas in mental visual imagery.

The findings of the Orliaguet and Coello (1998) study, in which imagery and actual golf-putting speed were assessed, suggest that the results of other studies using short-duration movement imagery need to be reexamined. In the actual performance of a golf putt, the duration of the skill is consistent (≈ 250 milliseconds) regardless of the targeted distance, whereas the amplitude of the movement increases with greater distance of the target. Orliaguet and Coello found, however, that study participants took longer to image the skill with increasing target distance (the only imaging timed was the skill execution, not imagery of the time the ball took to travel to the hole). This finding means that, with increasing target distance, the imaged skill was progressively out of phase with actual performance.

Collet et al (1998) conducted a study to assess objectively the processes of mental rehearsing (imagery) by measuring variations of the autonomic nervous system (or ANS responses) during an open-ended complex motor skill in two actual experiments (volleyball) and during mental rehearsing taking place between them. Comparison between pre- and post-test (volleyball) scores related to imagining and non-imagining performances revealed significant improvement in case of the later. The ANS parameters (skin potential and resistance, skin temperature and heat
clearance, instantaneous heart rate and respiratory frequency) were quantified by original techniques and indices. Results from a principal component analysis showed a strong correlation between the responses in actual tasks (pre- and post-test volleyball) and during mental imagery, since the same preferential variables appeared on the main axis in 87% of cases. Thus the same autonomic channels seemed to be used during the actual activity and during the mental imagery of this activity. So far as basic results were concerned, the main finding was a differing development of skill between imagining and non-imagining volleyball players. No clear difference was seen between pre- and post-tests in non-imaginers, except an increase in the median of the duration of the response observed in heat clearance. Conversely, for other ANS parameters, a significant decrease was seen in the post-test responses compared to pre-test responses in the imagining group, while no change was observed in non-imaginers, except in the duration of the heat clearance response where an increase was seen. Compared to the non-imagining group, the latter result may also have been associated with a response decrease in the imagining group. Thus mental rehearsing induced a specific pattern of autonomic response: decreased amplitude, shorter duration and negative skin potentials compared to the control group. As this pattern was associated with better performance in the tests it can be suggested that in the case of open-ended motor activity, mental rehearsing may help in the construction of schema which can be
reproduced, without thinking, in actual practice. Thus a neural information process might develop in the central nervous system changing from a parallel into a serial treatment.

Helstrup; Cornoldi and Debimi (1997) explored the relation between visual images classified in terms of the four categories of personal, impersonal, specific, and general images. The result showed that subjects were able to generate all types of images, with personal images being the easiest recall. Personal images, together with general images, were the image types being easiest to integrate with one another. Overall the observations suggested the existence of two imagery dimensions: specific-general, and personal- impersonal. Memory was found to be best for personal images. Personal images turned out to be easier to integrate in memory than specific images. The findings were discussed in terms of different image generation models.
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Studies Relating to effect of Imagery on Psychological Variables and Performances

Nelson et al (2008) studied the effects of video and cognitive imagery on throwing performance of baseball pitchers. The purpose of this study was to examine the effects of a three-week imagery and video imagery intervention program on the throwing accuracy of individual baseball pitchers. A secondary purpose of this study was to investigate whether differences in accuracy response characterize both low- and high-ability imagers. A sample of pitchers (n=30) were asked to take the Movement Imagery Questionnaire–Revised; study participants were randomly selected from the highest and lowest twenty percent of the group. The participants were obtained from high school and college teams within southeastern Georgia (n=6). Following the first week of baseline measurements, two high-ability and two low-ability imagers took part in a three-week video imagery and imagery intervention program. One participant from each group together constituted a control group, which was asked only to try their best when throwing for the study’s accuracy measurements. Results showed that two participants demonstrated an increase in performance, while all participants expressed a desire to continue to use imagery for its various effects. Suggestions for future research and further insight are discussed.

Devonport (2006) explored the views of three high performance kick boxers regarding the contribution of psychology to the development and
maintenance of expert performance within kickboxing. The results provide a useful insight into the experiences of high performance kick boxers, identifying those mental skills and psychological attributes that are perceived to contribute to success. Participants identified seven mental skills that they believed to be linked to success in kickboxing; 1) effective use of self-talk, 2) relaxation, 3) heightened concentration, 4) self-regulation of arousal, 5) goal setting, 6) coping with being hit, and 7) imagery. Three psychological characteristics were identified by all participants as contributing to success, 1) high self-efficacy, 2) highly motivated and 3) mental toughness. Although not specifically identified by participants, it is suggested that a fourth psychological characteristic was also apparent. Participants demonstrated varying degrees of emotional intelligence through their ability to monitor and manipulate their emotional states prior to and during competition. Martial artists used a number of long and short-term psychological strategies in preparing for competition. Furthermore, whilst mental skills were not systematically practiced, all participants endeavored to integrate some form of mental training within physical training. The author concludes that the integration of mental skills training within physical training may help ensure quality practice, and facilitate the effective transfer of mental skills into competition.

Strachan; Munroe-Chandler (2006) conducted a study using imagery to predict self-confidence and anxiety in young elite athletes. Female
participants were recruited from baton twirling competitions in Canada and the USA. Seventy-six athletes were divided into two age cohorts: 7 - 11 and 12 - 15 years. A modified version of the Sport Imagery Questionnaire (SIQ; Hall et al., 1998) and the Competitive State Anxiety Inventory 2 for Children (CSAI - 2C; Stadulis et al., 2002) were given to each participant. Results indicated that developmental differences might exist between the two age cohorts in imagery use, self-confidence, and anxiety.

Ramachandran (2005) examined the effect of various imagery modalities on pre-competitive anxiety, self-confidence and archery performance. Twenty-four male archers, were randomly assigned to one of the following four groups: Group A, the written script group, received a personalized proposition led script; Group B, listened to an audio tape; Group C, watched an internal – perspective video tape of themselves performing; and Group D, the control group received no imagery training, and spent an equivalent amount of time reading archery literature. The subjects had archery practice sessions thrice a week for six weeks period, during which the experimental groups underwent the different modalities of imagery intervention programme. The programme effectiveness was evaluated through the Competitive State Anxiety Inventory - 2 (CSAI - 2) and actual performance points in archery. The pre-test post test data were statistically analysed for comparisons in pre-competitive anxiety, self-confidence and archery performance among the various groups.
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The results indicated an increase in the direction decision of somatic anxiety, cognitive anxiety and self-confidence for the imagery intervention groups as compared to the control groups. The results also revealed that the video and audio groups performed significantly better than the written script group in archery performance.

Vergeer and Roberts (2005) examined the effect of movement and stretching imagery on increases in flexibility. Thirty volunteers took part in a 4 week flexibility training programme. They were randomly assigned to one of three groups: (1) movement imagery, where participants imagined moving the limb they were stretching; (2) stretching imagery, where participants imagined the physiological processes involved in stretching the muscle; and (3) control, where participants did not engage in mental imagery. Active and passive range of motion around the hip was assessed before and after the programme. Participants provided specific ratings of vividness and comfort throughout the programme. Results showed significant increases in flexibility over time, but no differences between the three groups. A significant relationship was found, however, between improved flexibility and vividness ratings in the movement imagery group. Furthermore, both imagery groups scored significantly higher than the control group on levels of comfort, with the movement imagery group also scoring significantly higher than the stretching imagery group. We conclude
that the imagery had stronger psychological than physiological effects, but that there is potential for enhancing physiological effects by maximizing imagery vividness, particularly for movement imagery.

Jordet (2005) studied to determine whether an ecological imagery intervention program would affect perception (i.e. exploratory activity and prospective control of future actions) in three elite soccer players. The imagery was justed to the unique action opportunities typically experienced by each player in games. A single case, multiple baseline across participants design was implemented and close-up video analyses were conducted from a series of league games. Post-intervention questionnaires and interviews were also carried out to support the video analyses. Two of the participants appeared to increase their visual exploratory activity, but only one of the participants marginally improved his performance with the ball. It was concluded that elite players can improve components of perception through ecological imagery training, but it is questionable to what extent this leads to improved prospective control of actions. It is recommended that future imagery and/or perceptual training research addresses specific types of actions more directly.

Munroe-Chandler and Hall (2005) implemented a motivational general-mastery imagery intervention in order to increase a soccer team's collective efficacy. The participants were fourteen female members of a
competitive traveling soccer club (M = 11.47 years, SD = .74). All athletes were placed into one of three groups based on playing position: forwards, midfielders, or defense/goal keeper. A staggered multiple baseline design across groups was employed to evaluate the imagery intervention. Collective efficacy data for training and competition were collected once a week for thirteen weeks. The imagery intervention began at weeks four, seven, and ten for the forwards, midfielders and defense/goal keeper, respectively. Results from visual inspection as well as binomial tests revealed athletes' collective efficacy increased with the implementation of the motivational general - mastery imagery intervention for both training and competition for two of the three groups. In order to investigate the athlete's individualized imagery use, an imagery assessment questionnaire was administered. The results showed that the athletes used imagery on almost a daily basis. As well, the athletes had a very positive reaction to the imagery training.

Cleofas and Kutty (2004) studied the effect of skill training with and without visual imagery on fosbury flop technique in high jump performance of men students. In this study thirty male students aged between 22-25 years of Dr. Sivanthi Aditanar College of Physical Education, Tiruchendur, were selected as subjects at random. They were equally divided into Group A, which underwent the skill training along with visual imagery, Group B, which underwent the skill training only and Group C, acted as the control
The training was given on alternate days for a period of six weeks. Prior to and after the training programme three judges rated the subjects in their performance in the fosbury flop skill. Statistical application of analysis of covariance revealed that the training with visual imagery had a better effect in learning the fosbury technique in high jump.

Mamassis and Doganis (2004) studied the effects of mental training programme on junior’s pre-competitive anxiety, self-confidence and tennis performance. This investigation reports the impact of a season-long Mental Training Program (MTP) on two elite junior tennis players. The two reported cases were part of a study in which MTP players \( n = 5 \) in addition to their tennis practice were exposed to 5 different psychological skills: goal setting, positive thinking and self-talk, concentration and routines, arousal regulation techniques, and imagery. Another group of elite junior tennis players \( n = 4 \) followed the same amount and quality of tennis practice but received no mental training practice. Program effectiveness was evaluated through (a) the Competitive State Anxiety Inventory - 2 (CSAI-2), (b) the athletes’ appraisal on 8 aspects of tennis performance, and (c) tennis-specific statistical data of two selected cases. The results indicated an increase in the direction dimension of the somatic anxiety, cognitive anxiety and self-confidence for the intervention group at the post test. Moreover, the intensity of self-confidence, as well as the overall tennis performance, was greater for
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all the participants of the intervention group after the MTP. Results on two selected cases are reported which clearly demonstrate the effectiveness of the MTP in eliminating specific performance problems.

Tracey and Suzanne (2004) examined the relationship between self-confidence, anxiety, and mood states in collegiate tennis players. The Competitive State Anxiety Inventory--2 (CSAI-2) and the Profile of Mood States (POMS) were utilized based on their ability to assess a number of different psychological states thought to be crucial for proper mental preparation prior to athletic competition as well as for their psychometric properties. These inventories were employed to determine pre-competition levels of anxiety, self-confidence and mood disturbance and their relationship to successful or unsuccessful tennis match outcome. Twenty-four collegiate tennis players completed the POMS and CSAI-2, thirty minutes prior to their tennis match during their participation in the NCAA Regional (VII) Team Tennis Tournament. Results revealed winning tennis players displayed significantly higher self-confidence, lower cognitive and somatic anxiety levels, and lower total mood disturbance scores than loosing players. In addition, winning tennis players exhibited the iceberg profile on the POMS, which is consistent with the findings in similar research conducted with successful athletes in other sports. As such, athletes who displayed high self-confidence and low anxiety levels were potentially able
to remain calm and relaxed under pressure and were not affected by negative events. Furthermore, these results suggest that mental state prior to the start of a tennis match plays a crucial role in overall success or failure.

In a study conducted by Clamels, Berthoumieux, and d’Arripe-Longueville (2004), the authors sought to increase softball performance by enhancing attentional focus. Participants in this study were four French national softball players who participated on the same team. None of the players in the study have had previous mental skill training, however all reported an interest in these skills. During this study, 28 ten-minute imagery sessions were conducted in an attempt to enhance the selective attention of each athlete. The sessions consisted of guiding and teaching the softball players at bat to integrate many external and internal stimuli at one time and to be able to restrict the number of the stimuli as the moment for batting approached by paying attention to stimuli that had been shown to be favored by the experts. The first ten sessions consisted of the batter mentally rehearsing various possibilities they may face. Next were four sessions mentally rehearsing successful performances, then four sessions using both the first and second techniques but also used mental rehearsal of potential runner positions. The next five sessions focused on ball trajectory and desired point of contact, and finally five sessions where the batter imagined all the above with possible distractions involved.
Three different aspects of selective attention were addressed during this study and the results found that the imagery training program proved to be effective in all of the participants. Participant One saw dramatic increases on all three selective attention dimensions that were assessed through visual inspection. Participant Two and Three both saw increases on at least two of the three dimensions. All three intervention participants reported that the imagery sessions were beneficial to their performance. Further illustrating the effectiveness of the imagery training program was found through the evaluation of the control participant who did not participate in any of the imagery sessions. The control participant reported no change in any of the three dimensions of selective attention. Thus, the imagery training program proved to be an effective intervention when attempting to enhance selective attention which is an important aspect of successful performance in sport.

Miller and Donohue (2003) examined the influences of two mental preparation interventions on 1.6 km run performance in 90 (45 male, 45 female) high school long-distance runners in Nevada, U.S.A. After participants completed a 1.6 km baseline run, they were randomly assigned to receive one of these interventions three min prior to a second 1.6 km run (i.e. listening to a personalized script of motivational and running technique statements on headphones, listening to music on headphones, listening to no sound on headphones). Results of running performance indicated that
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participants who were assigned to the motivational and running technique statements and music conditions significantly improved their run performance, whereas participants in the no sound control condition did not. Youth ratings of intervention satisfaction were consistent with performance outcome. Study implications and future directions are discussed in light of these results.

Positive imagery may enhance performance, negative and suppressive images have been found to be detrimental to performance. In a competitive golf situation, Taylor and Shaw (2002) asked skilled and unskilled participants to execute putts under each of three conditions: positive-outcome imagery, negative-outcome imagery, and no imagery. Greater putting error was recorded for the negative-outcome imagery condition than for either of the other two conditions, and there was no difference between the positive-outcome imagery and no-imagery conditions. For skilled golfers, there was a mean difference in golf-putting error of 11.3 cm between the positive- and negative-outcome imagery conditions. Confidence, as assessed by a single item before each putt, was lower following the negative-imagery condition than the two others.

Campos et al (2002) investigated the possible effects of imaging capacity and body image on judo movement skills among intermediate-level judokas aged 21-26 years. Statistical analysis of the results suggest that, of
the various measures of imaging capacity and body image considered, only the Body Competence subscale of the Body Consciousness Questionnaire had a significant effect on judo performance.

Taylor and Shaw, (2002) studied the effects of outcome imagery on golf-putting performance, positive and negative outcome imagery on golf-putting performance. Players of both high and low ability performed a golf-putting task in three imagery conditions: (a) a positive outcome imagery condition, (b) a negative outcome imagery condition and (c) a no-imagery control condition. The task was conducted in a competitive setting, reducing the possibility of demand characteristics. We found that negative outcome imagery was detrimental to putting performance; however, performance in the positive outcome imagery condition was no better than performance in the control condition. There was also evidence to suggest that outcome imagery operated through the mechanism of confidence, as negative outcome imagery was detrimental to both confidence and performance. The results of the present study suggest that golfers should avoid visualizing negative images, as this could damage both confidence and performance.

Carboni et al. (2002) conducted a study that sought to examine the effects of brief (5-minutes or less) imagery training on free throw performance of college athletes. In this single subject, multiple baseline investigation, the authors used the previous season’s free throw percentage
and compared that percentage to the percentage established throughout the intervention for each of the five participants in the study. One athlete was used as the control for this investigation and did not take part in any of the imagery training during the study. The proper use of imagery was taught to each of the five participants in the study and asked to engage in a brief imagery session prior to shooting any set of free throws once the intervention phase began. Results of this study did not show any consistent increases or decreases in free throw shooting percentage. However, there were increases in the ability to concentrate on the task after the imagery intervention was implemented.

Boschker; Bakker and Michaels (2001) studied on the effect of mental imagery on realizing affordances. Using a reaction time experiment, they examined whether imagining a response would lead to an increase in the frequency of its execution. During a pre-test and a post-test, participants had to respond as quickly as possible with either their left or their right hand, as they preferred, to the illumination of one of seventeen target positions arrayed in front of them in a semicircle. Between these two phases, participants performed a practice condition. Each of forty right-handed participants was assigned to one of four groups that differed in their practice condition: One group made only dominant-hand responses to all target locations, two imagery groups imagined dominant hand responses to all
target locations, and the last group received a no-practice, control task. One imagery group received instructions emphasizing that imagery has a strong effect; the second group received instructions suggesting that imagery was not effective. The results showed an increased incidence of the practiced response for both imagery groups during the post-test. No effect was found for the physical performance group and the control group. The change in performance for the imagery groups was not accompanied by a change in reaction time. The results are discussed in terms of imagining the realization of action possibilities and from a neuropsychological point of view.

Boschker; Bakker and Rietberg (2000) in two retroactive interference experiments, assessed the effect of mentally imagined Movement speed on subsequent motor performance. All participants performed a sequential motor action at three speeds during a baseline test and a retention test. During the retention interval of Experiment one, the participants \( n = 50 \) physically performed the action at a slow speed, physically performed it at a fast speed, imagined it at a slow speed, imagined it at a fast speed, or performed a no-practice control task. In Experiment two, the participants \( n = 24 \) imagined the movement, overtly vocalized words, or both, all at a slow speed. The results revealed that the speed of the imagined motor action affected the speed of subsequent performance in the retention test and that
imagery and physical practice were functionally equivalent. The results are consistent with Lang’s bio-informational theory.

Roure et al. (1998) conducted an experimental study on autonomic nervous system responses correlate with mental rehearsal in volleyball training. They found six specific autonomic nervous system (ANS) responses that correlated with mental rehearsal, thereby improving sports performance. The subjects were placed into an imagery group and a control group. The task measured in each group was based on their ability to pass an opponent’s serve to a given teammate, in the sport of volleyball. The experimenters measured the variations of the ANS during the motor skill and during the mental rehearsing sessions. The ANS parameters tested included: skin potential and resistance, skin temperature and heat clearance, instantaneous heart rate, and respiratory frequency. The results of the test revealed a strong correlation between the response in the actual physical tasks (both pre- and post-test volleyball) and during the mental imagery sessions. There existed a difference in the skills between the imagery and the control group, the former being the better. In addition, no clear difference was present between the pre- and post-tests in the control group. This study showed that mental imagery induces a specific pattern of autonomic response. These include: decreased amplitude, shorter duration and negative skin potentials when compared to the control group. As a
consequence of the ANS, the imagery group was associated with better performance. In light of this experiment, Roure suggested that metal imagery may help in the construction of schema which can be reproduced, without thinking, in actual practice.

Using a single-subject, multiple-baseline design, Callery and Morris (1997) conducted twenty-min imagery-rehearsal sessions three times per week with eight elite Australian Rules football players over a competitive season. The players imaged themselves getting to front-and-centre positions during games. For all players, both performance and front-and-centre self-efficacy were higher during the treatment phase than they had been throughout the preceding baseline phase.

In a similar single-case, multiple-baseline study, She and Morris (1997) found that an imagery program for nine male elite baseball players was effective in improving their batting averages, self-efficacy relating to batting, and the state self-confidence in their batting ability. Three players clearly showed an improvement in their batting averages, two had batting averages that tended toward improvement, two had no change, and two had a decline in batting averages. In regard to self-efficacy, five players improved, one had a trend toward improvement, and three showed no change. Similar results were found for state self-confidence, with five players improving their confidence and four showing no change. Only one
player showed no improvement on any of the measures, which may have been due to recurring injuries and an accompanying lack of form.

The success of an imagery intervention to reduce anxiety may depend on the personal characteristics of the athlete. A study by Carter and Kelly (1997) demonstrated that, following paradoxical imagery (i.e. imagery of performing while feeling anxious and doubtful), high-reactant basketball players (i.e. those players with a tendency to offset pressure or restrictions placed on them with the aim of protecting their personal freedom) had lower somatic state anxiety and higher state self-confidence than did low-reactant players. This finding suggests that high-reactant athletes who wish to lower their anxiety levels may benefit more from defiance-based imagery than the commonly used compliance-based imagery. There was little difference in free-throw performance, however.

Glisky; Kihlstrom and Williams (1996), studied on Internal and External Mental Imagery Perspectives and Performance on Two Tasks. It has been well documented that mental practice can improve performance on various cognitive and motor skills. However, the processes involved in mental practice and the theoretical explanations are less clear. The present study examines two variables that contribute to the efficacy of mental practice--imagery perspective and task type. Subjects, who were natural internal or natural external imagers, mentally practiced a cognitive/visual
task (an angles estimation task), and a motor/kinesthetic task (a stabilometer). Only the external imagers showed greater performance than the control on the motor/kinesthetic task, and only internal imagers, showed greater improvement than the control group on the cognitive/visual task. Subjective reports of visual and kinesthetic imagery clarity also differed depending on the type of task being imaged.

Martin and Hall (1995) determined whether subjects who used mental imagery would spend more time practicing a golf putting task and would have higher task specific self efficacy than would controls. Thirty nine beginner golfers were assigned to either an imagery treatment conditions (performance plus outcome imagery or performance imagery) or a no imagery (control) condition. During the first three sessions all subjects were taught how to put a golf ball. Imagery treatment subjects also participated in an imagery program designed for the golf putting task. Subjects in the performance imagery group spend significantly more time practicing the golf putting task than did controls. Subjects who used imagery also set higher goals for themselves, had more realistic self expectations, and adhered more to their training programmes outside of the lab.

Martin and Hall (1995) demonstrated an association between imagery and motivation. These researchers conducted a study of 39 beginner golfers to investigate whether the use of mental imagery would affect intrinsic
motivation to perform a golf-putting task. The participants were divided into three groups: performance plus outcome imagery, performance imagery, and a no-imagery control. In this instance, motivation was inferred from the length of time that participants voluntarily spent practicing putting and a measure of intrinsic motivation: the Task Reaction Questionnaire (TRQ, Mayo 1977). When participants were asked to achieve researcher-set goals, differences were found between groups (performance-plus-outcome imagery, performance imagery, and no imagery) in terms of the time voluntarily spent practicing. The performance-imagery participants, who focused on how they performed the skill, practiced longer than the other two groups; however, the groups showed no differences in terms of their TRQ scores. Although no group achieved the researcher-set goals, the performance-plus-outcome-imagery group, which imaged both their behavior and the result, consistently improved their performances. The other two groups' performances were inconsistent. The improvements in performance of the performance-plus-outcome-imagery group, which were in line with their own established goals of doing as well as or better than they had previously, could explain why this group did not practice longer. The findings encourage further investigation of how imagery can affect motivation.
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Not only does mental imagery seem to enhance athletic performance, but it has been shown to enhance intrinsic motivation and attention as well. Martin & Hall (1995) A study in 1995 tested who would spend more time practicing a golf putting task and who would result in having higher self efficacy. Thirty nine beginner golfers were grouped into an imagery or control group. For three sessions, both groups were taught how to hit golf balls. The imagery group practiced in an imagery training session designed for this specific golf skill. As a result, the imagery group spent significantly more time practicing the golf putting task than the control group. In addition, the subjects in the imagery group had more realistic self-expectation, set higher goals to achieve, and adhered more to their training programs outside the experimental setting.

Bence; Price and Sharps (1992) conducted a research on mental imagery has demonstrated the importance of visual imagery to recall performance. Thirty adult subjects were recruited from introductory psychology classes at the University of Wyoming and at California State University, Fresno. All subjects possessed visual acuity of at least 20/40 and were able to identify sounds played at the volume we used. A tape was made of forty common sounds, such as a trumpet, a crying baby, a helicopter, and a barking dog. A Sony high-fidelity tape recorder was used for the auditory item presentation. High-quality photographs of these items,
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approximately three in. in diameter on average, were placed on standard 11.7 x 16.4 cm stimulus cards. The subjects were seated in groups of three to five within 1.5 m of the tape recorder speakers, and of the experimenter, who displayed the cards. The experimenter was unaware of the purpose of, and our expectations for, the experiment. The subjects were presented with the forty stimulus items sequentially, for five seconds each, with a two seconds inter-stimulus interval. The items were the printed verbal labels of the items, the verbal labels and sounds of the items, or the verbal labels and pictures of the items. Oral labels were spoken at the beginning of the five seconds exposure period in all three conditions and were used in all conditions to avoid difficulties with idiosyncratic responding. After the forty items were presented, the subjects engaged in interpolated arithmetic for two min to control for the idiosyncratic effects of rehearsal. Then the subjects were asked to recall as many items as they could. These results of the study was consistent with the hypothesis that auditory imagery has mnemonic value of a type and magnitude similar to that of visual imagery; auditory imagery produced recall at a level similar to that of visual imagery and substantially above that of purely verbal stimuli.

Isaac (1992) conducted a study which examined the influence of mental practice on sports skills. She tested 78 subjects and classified them as novice or experienced trampolinists. Then she further divided the
two groups into an experimental and control group. She also classified the subjects as either high or low imagers based on initial skill level. Both groups were trained in three skills over a six week period. In order to prevent confounds, the imagery group was unknown to the experimenter until afterwards. The experimental group physically practiced the skill for 2-1/2 minutes, which was then followed by 5 minutes of mental practice. Lastly, an additional 2-1/2 minutes of physical practice followed the mental practice. Meanwhile, the control group physically worked on the skill for 2-1/2 minutes, which was then followed by 5 minutes of a session trying a mental task of an abstract nature, such as math problems, puzzles, and deleting vowels. Then, 2-1/2 more minutes were spent physically working on the skill again. The outcome of the experiment was as follows: there existed a significant difference in the improvement of the high and low imagers. In both novice and experimental groups where the initial skill ability was similar, the high imagery groups showed significantly more improvement than the low imagery group. Furthermore, there was a significant difference between the experimenter and control groups. Not surprisingly, the experimental group had significantly more improvement than the control group. This study posits that despite the level of skill (beginner or experienced) visual imagery proves effective.
Epstein (1980) examined the relationship of internal and external imaginal rehearsal and imaginal style to skilled motor behavior. Dart throwing was used as the dependent measure of physical performance. All subjects were randomly assigned to a control group, an internal mental rehearsal group, or an external mental rehearsal group. After assessing baseline performance, subjects were instructed to mentally rehearse before throwing sets of three darts. Control subjects were given a distracting task prior to throws. The results showed a slight, negative relation between spontaneous external imagery and physical performance. The mental rehearsal factor, however, was not significant. Males significantly outperformed females, and imagery groups had more variability in improvement scores than the control group for women but not for men. It was proposed that females’ lower dart-throwing ability may have caused mental practice to be distracting for some subjects, and thus increased improvement variability in the mental rehearsal group. Conclusions regarding the concept of imaginal style as well as the negative relation between motor performance and the propensity to use external imagery were offered.
Conclusion

Though imagery as a tool for research and performance enhancement is in its early years, a comprehensive analysis of the studies undertaken in this area indicates, that imagery is a powerful and potential tool that has varied application in the field of sports. The reviews cited above reveal that imagery use is getting popular among sportspersons in different sports disciplines. Imagery has also shown to improve the psychological attributes of sportspersons such as in reducing anxiety and arousal; in improving self confidence, attention and concentration abilities. Imagery has shown to improve performances in various closed skilled events such as golf, dart throwing, archery, shooting, and other individual performance events. However, reviews also indicate the possibilities of imagery in improving performance in open skilled events also. Imagery research indicates wide variations in terms of imagery modalities, duration of imagery training, and performance outcomes. This warrants the need and relevance for further research in imagery in sports with variations in the modalities, durations, type of imagery, and the level of subjects so as to establish the effectiveness of imagery as a potential tool for performance enhancement.