

Elite and Novice Athletes' Imagery Use in Open and Closed Sports

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Very little research has investigated differences in imagery use between open- and closed-skill sports. The purpose of this study was to examine the influence of competitive level (elite/novice) and skill-type (open/closed) on athletes' imagery use. A total of 83 British athletes (39 elite, 44 novice) from open- ($n = 40$: 23 rugby; 17 martial arts) and closed-skill ($n = 43$: 28 golf; 15 figure skating) sports completed the Sport Imagery Questionnaire no more than 24 hours prior to competition. MANOVA revealed that main effects due to competitive level and skill-type were significant ($p < .05$). Univariate analyses revealed that elite athletes used more CS and CG imagery than novices ($p < .001$), and contrary to previous research findings, athletes in open-skilled sports used more MG-A imagery than those in closed-skill sports ($p < .001$). Overall, MG-M was the most used imagery type, regardless of competitive level and skill-type. The results are discussed in terms of methodological difficulties, future research, and practical implications.

Mental imagery has been recognized as an important tool in improving athletic performance (Hall, 2001). Many of the world's highest-level athletes report using imagery in the hope of improving their routines and they have attributed at least some of their success to mental imagery (Hardy, Jones, & Gould, 1996). Furthermore, Hardy et al. noted that imagining perfect executions of a particular skill might very well augment the activation of relevant motor programs needed for that particular skill.

Paivio (1985) proposed an analytical framework describing the functions of imagery, through which the problem of *when* and *why* imagery works could be addressed. He suggested that mental imagery might influence behavior on a general or a specific level through both cognitive (e.g., skill and strategy rehearsal) and motivational (e.g., self-confidence, arousal, goal-setting) mechanisms. Drawing from Paivio's work and other existing literature on imagery, Hall, Mack, Paivio, and Hausenblas (1998) conducted a series of investigations and concluded that imagery serves five main functions: (a) cognitive specific (CS; e.g., specific sport skills), (b) cognitive general (CG; e.g., strategies related to a competitive event), (c) motivational specific (MS; e.g., specific goals and goal-oriented behavior), (d) motivational general-arousal

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(MG-A; e.g., feelings of relaxation, stress, anxiety, and arousal), and (e) motivational general-mastery (MG-M; e.g., self-confidence, effective coping, mental toughness, focus, and control). As a result, Hall et al. (1998) developed a general Sport Imagery Questionnaire (SIQ), which can be seen as a useful tool in examining athletes' imagery use.

Since the development of the questionnaire, the majority of existing published studies have used the SIQ to measure athletes' imagery use (e.g., Beauchamp, Bray, & Albinson, 2002; Callow & Hardy, 2001; Cumming & Hall, 2002a; Munroe, Hall, Simms, & Weinberg, 1998). The findings from these studies suggest that numerous factors such as competitive level, type of sport, time of season, and gender affect athletes' imagery use.

Research appears to suggest that elite, high-level, and successful athletes use significantly more imagery than their novice, lower-level, and less successful counterparts (e.g., Callow & Hardy, 2001; Cumming & Hall, 2002a, 2002b). For example, Cumming and Hall (2002a) found that skilled athletes used more imagery than less skilled athletes. Specifically, they revealed that during the off-season, no significant differences in athletes' imagery use were found between provincial and national level athletes, but both provincial and national athletes used all five imagery types more than regional athletes. Vealey and Greenleaf (1998) suggested that elite athletes possess a clearer and more accurate image of what a specific skill should look like, unlike novices who are just beginning to form a mental representation of the skill inside their minds. Other researchers have suggested that the greater use of imagery by elite performers reflects a greater commitment to their sport (Hall, 2001). This seems to provide evidence that elite athletes will use all five imagery subscales significantly more than non-elite athletes. Although research findings seem clear-cut with regard to competitive level, Highlen and Bennett (1979, 1983) suggested that the elite/novice classification might be too simplistic and therefore more research is required to fully understand this phenomenon.

In addition, Hall et al. (1998) suggested that in general, athletes in team sports use more imagery than those in individual sports. Their findings suggested that athletes in team sports reported using more MS and MG-M imagery than athletes in individual sports. In contrast, Hall, Rodgers, and Barr (1990) found that some individual sports (e.g., figure skating and gymnastics) use a lot of imagery. Munroe et al. (1998) failed to find a systematic difference in imagery use between team and individual sports, but did show that some individual sports (e.g., fencing) use very little imagery compared to some team sports such as rugby and field hockey. These inconsistent findings are not unexpected, as it has been recognized that sports can be classified in various ways (e.g., team vs. individual, gross vs. fine, and open vs. closed skilled; Hall, 2001; Munroe et al., 1998).

The focus of the current study concerns whether athletes in open- and closed-skill sports utilize imagery differently. Sports such as rugby and hockey usually involve open-skills because the environment is constantly changing and movements have to be continually adapted. These skills are predominantly perceptual (Knapp, 2002) and externally paced, such as a pass in soccer. On the other hand, closed skills take place in a static environment and athletes' success depends on the consistency of their skill execution. Closed skills tend to be self-paced, requiring concentration in a relatively unchanging environment (Lerner, Ostrow, Yura, & Etzel, 1996), such as a golf-swing and freestyle elements in figure skating. It is important to note that these open- and closed-skills appear on a continuum, with some open skills requiring more interaction than others, and some closed skills requiring more self-pacing than others (Knapp, 2002).

Investigations following this line of research are sparse and the reasons for this lack of contemporary study are unknown. Martin, Moritz, and Hall (1999) provided an applied mental imagery model, which includes a multitude of imagery variables for consideration, such as skill learning and performance, cognitive modification, and arousal regulation. However, the

sport-type (e.g., open vs. closed) variable was excluded from the model due to insufficient evidence to warrant its inclusion. The current study should provide evidence that sport type, in particular the open- vs. closed-skill dichotomy, is worthy of including in a revised version of Martin et al.'s (1999) model of mental imagery.

Highlen and Bennett (1979) claimed that finding a dichotomy between open- and closed-skill sport would be "... more productive than searching for common psychological denominators across all sport, or conversely developing a unique psychology for each sport" (p. 137). They also hypothesized that a closed-skill sport athlete (e.g., gymnastics) would be more likely to use imagery than an open-skill sport athlete (e.g., wrestling). This prediction was based on the belief that closed-skill sport athletes can more easily imagine their set routines, unlike open-skill sport athletes whose style, game plan, and tactics change depending on each move made by their opponents. However, Highlen and Bennett (1983) compared elite wrestlers and divers (representing open- and closed-skill sports, respectively), and failed to find any significant differences in their imagery use. Significant differences in self-talk, measures of anxiety, quality of thoughts, and self-confidence were found between the two groups, suggesting the need for further open- and closed-skill typology research (Highlen & Bennett, 1983).

It is important to consider reasons why Highlen and Bennett (1983) found no significant differences between open- and closed-skill sport groups with regard to imagery use. First and foremost, their study was conducted before any standardized, reliable measure had been developed to independently measure the functions of imagery (e.g., the SIQ). Second, only two small groups of participants (wrestlers and divers) were recruited for their study. (The researchers themselves suggested further research involving a more diverse range of open- and closed-skill sports.) Therefore, to produce more valid data, further research should consider using a reliable measure, a larger range of open- and closed-skill sports, and a larger number of participants.

The lack of research in this specific area of imagery means that it is necessary to extrapolate findings from previous studies that did not directly investigate the dichotomy between open- and closed-skill sports and athletes' imagery use. White and Hardy (1998) collected qualitative data regarding imagery use from slalom canoeists (open-skill) and gymnasts (closed-skill) and found that in both sports, athletes used imagery as part of their training. However, canoeists used imagery to become "psyched-up" (i.e., MG-A imagery), whereas gymnasts used imagery mainly to rehearse skills and difficult moves in training and competition (i.e., CS imagery). However, Vadocz, Hall, and Moritz (1997) found that elite roller skaters (closed-skill) use a great deal of MG-A imagery to help control competitive state anxiety and increase self-confidence. Rodgers, Hall, and Buckolz (1991) conducted a study that investigated the use of imagery by figure skaters (a closed-skill sport). Before an imagery-training program was implemented, it appeared that skaters in each experimental group (imagery, verbal, and control) imagined themselves winning quite often and receiving medals (i.e., MS imagery) as well as imagining the atmosphere of a competition (i.e., MG-A imagery). After a 16-week imagery training intervention, which included the rehearsal of both cognitive and motivational imagery functions, the skaters in the imagery group improved their visual movement imagery ability and demonstrated a number of changes in their use of imagery, such as an improved ability to visualize and sense specific aspects of their skating routine (i.e., cognitive imagery). Rodgers et al. (1991) concluded by claiming that figure skaters seem to use imagery more than that of other athletes, but that the patterns of imagery use (i.e., their functions) remain similar to athletes in other sports. Beauchamp et al. (2002) found that golfers (closed-skill) used both motivational and cognitive imagery fairly similarly. Salmon, Hall, and Haslam (1994) found that soccer players (an open-skill sport) used more imagery for

motivational than cognitive purposes. These findings suggest that athletes in closed-skill sports use more cognitive imagery functions (CS and CG) than athletes in open-skill sports. However, as the above findings are inconclusive, a need for more research investigating the use of different types of imagery within and between open- and closed-skill sports can be seen as appropriate.

Furthermore, few studies have examined the function of imagery in competitive situations. However, especially with regards to CG imagery, Callow and Hardy (2001) believed that sport-type is an important variable to examine. Although they did not specifically study open- vs. closed-skill sport-type, they proposed that netball players (open-skill) would utilize CG imagery to a larger extent than roller skaters (closed-skill). Case study reports have documented the performance benefits of CG imagery for rehearsing pommel-horse routines in gymnastics (Mace, Eastman, & Carroll, 1987), and artistic gymnast routines (White & Hardy, 1998). Due to the nature of these skills the research seems to suggest that athletes in closed-skill sports will use more CG imagery than those in open-skill sports. However, Fenker, and Lambiotte (1987) found that football players (open-skill) are just as likely to use CG imagery to rehearse plays, consequently suggesting that there may not be a significant difference in CG imagery between the two groups.

In summary, not many studies have directly compared the imagery use of athletes in open- and closed-skill sports. By using the SIQ, this study will directly compare the use of five functions of imagery between open- and closed-skill sports. Highlen and Bennett (1983) hypothesized that “imagery strategies would differentiate successful closed-skill athletes from their less-successful counterparts, whereas no such difference would be found in open-skill sports” (p. 391). As this proposition was published over twenty years ago, and very little research into this area has been published since, the current study aims to extend existing imagery literature concerning the difference in imagery use between novice and elite athletes in open- and closed-skill sports. Finally, as only a few studies have assessed athletes’ imagery use in competitive situations, the current study attempts to resolve this flaw by recruiting participants who were willing to complete the SIQ before a competitive event, as opposed to only in training.

Existing literature suggests that elite and successful athletes use more imagery than less successful and lower-level athletes (e.g., Cumming & Hall, 2002a; Hall, 2001). Thus, we predicted that the elite athletes would use significantly more imagery than novices. Considering previous inconsistent findings, we tentatively predicted that the athletes in open-skill sports would use imagery differently than athletes in closed-skill sports. In addition, the findings from previous studies (e.g., Cumming & Hall, 2002a; Hall et al., 1998) suggest that MG-M imagery is the most used imagery type among athletes. Thus, we hypothesized that all of the participants would use significantly more MG-M imagery than other imagery types.

METHOD

Participants

A total of 100 British athletes were approached for this study. For final analysis, a total of 83 (40 male and 43 female, age $M = 11-58$) athletes with complete data from open- ($n = 40$; 23 rugby; 17 martial arts [judo = 1, jujitsu = 3, karate = 1, kickboxing = 10, taekwondo = 2]) and closed-skill ($n = 43$: 28 golf; 15 figure skating) sports were included. Of these, 39 were considered to be elite (county, academy, or above) and 44 were novice (recreational or beginners).

Measure

The Sport Imagery Questionnaire (SIQ; Hall et al., 1998) was used to assess athletes' imagery use. The SIQ is a 30-item self-report measure, using a 7-point Likert-type scale ranging from 1 (*Rarely/Never*) to 7 (*Often*), measuring five different types of imagery. Each subscale consists of six items addressing each imagery type: cognitive specific (CS; e.g., specific sport skills: "I can mentally make corrections to physical skills"), cognitive general (CG; e.g., play strategies and competition routines: "I imagine alternative strategies in case my event/game plan fails), motivational specific (MS; e.g., specific goals and outcomes: "I imagine myself winning a medal"), motivational general-arousal (MG-A; e.g., stress, anxiety, and arousal associated with performance: "I imagine the stress and anxiety associated with competition"), and motivational general-mastery (MG-M; e.g., self-confidence, mental toughness, and focus: "I imagine myself appearing self-confident in front of my opponents"). The SIQ has been recognized as having acceptable internal consistencies for each of the imagery subscales (alpha coefficient of 0.70 and above), and factor analyses have supported the questionnaire's five-factor structure (Hall et al., 1998). In addition, Hall et al. (1998) indicated that the instrument's inter-scale correlations have been shown to be low or moderate, which suggests that the different functions of imagery use are independent but related.

Procedure

The participants were approached in one of two ways. A member of the research team approached participants directly after their regular training session, gave them brief oral instructions and provided them with the research materials (instructions, consent form, questionnaire, and a pre-paid envelope). Other participants (elite golfers) received the materials from their coaches. In such cases, the coaches were instructed on the appropriate administration of the questionnaires. Informed consent for all of the participants was obtained according to university regulations. In case of minors, both the participant and a parent/guardian were asked to give consent. In addition, they were asked to note their age, gender, sport, and level of competition. Participants completed the questionnaire no more than 24 hours prior to competition. The importance of completing the questionnaire prior to competition was highlighted; however, it was acknowledged that administration of a questionnaire before a competition may interfere with an athlete's mental preparation before an event (Beauchamp et al., 2002). As a consequence, participants were advised not to participate in the research if they felt that it would interfere with their mental preparation. The questionnaires were returned to the researchers via post using a pre-paid envelope. As the participants were aware of the purpose of the study, no formal debriefing was conducted. However, participants were given an opportunity for individual debriefing either in person or through E-mail. All of the participants were assured that the data were to be treated with confidentiality. Participants were given an opportunity to withdraw their data at any time within one month of the completion of the study.

RESULTS

The descriptive statistics were calculated for each of the five SIQ subscales. Means and standard deviations for the entire sample by competitive level (elite/novice) and skill-type (open/closed) are presented in Table 1. The significance criterion was set at $p < .05$ and an analysis of variance (ANOVA) revealed that participants used significantly different amounts of the imagery strategies, $F(4, 328) = 16.372$, $p = .0001$. Furthermore, Tukey HSD post hoc tests revealed that athletes reported using MG-M imagery the most ($M = 5.23$, $SD = 1.05$), followed by CS imagery ($M = 4.75$, $SD = 1.23$), MG-A imagery ($M = 4.51$, $SD = 1.12$),

Table 1
Means (SD) for SIQ Subscales by Competitive Level (Elite/Novice) and Skill-type (Open/Closed)

Imagery	Total (<i>N</i> = 83)	Open (<i>n</i> = 40)	Skill-type		Competitive Level	
			Closed (<i>n</i> = 43)		Elite (<i>n</i> = 39)	Novice (<i>n</i> = 44)
CS	4.75 (1.23)	4.58 (1.25)	4.91 (1.21)		5.18 (1.15)	4.37 (1.19)
CG	4.46 (1.21)	4.47 (1.17)	4.46 (1.26)		4.94 (1.02)	4.05 (1.21)
MS	4.29 (1.37)	4.17 (1.32)	4.40 (1.42)		4.51 (1.36)	4.10 (1.36)
MG-A	4.51 (1.12)	4.93 (0.98)	4.11 (1.11)		4.67 (1.09)	4.36 (1.14)
MG-M	5.23 (1.05)	5.30 (1.05)	5.16 (1.06)		5.40 (1.01)	5.08 (1.08)
Total	4.65 (1.18)	4.69 (1.16)	4.61 (1.21)		4.94 (1.13)	4.39 (1.20)

Note: CS = cognitive specific; CG = cognitive general; MS = motivational specific; MG-A = motivational general-arousal; MG-M = motivational general-mastery.

CG imagery ($M = 4.46$, $SD = 1.21$), and finally MS imagery ($M = 4.29$, $SD = 1.37$). As the rating scale was from 1 (*Rarely/Never*) to 7 (*Often*), on average, the majority of the participants scored well above the midpoint in all of the imagery subscales, indicating frequent imagery use.

With the purpose of establishing whether competitive level and skill-type had an effect on athletes' imagery use, a within-participants multivariate analysis of variance (2×2 MANOVA) was conducted, with competitive level (elite $n = 39$ /novice $n = 44$) and skill-type (open $n = 40$ /closed $n = 43$) as the within-participants factors. The five imagery subscales generated from the SIQ were the dependent variables.

Competitive Level

The results revealed that a significant multivariate effect was found for competitive level, Wilks's Lambda = .827, $F(5, 75) = 3.147$, $p = .012$, $\eta^2 = .173$, with an observed power of 85.6%. At the univariate level, significant effects due to competitive level were found for CS imagery, $F(1, 79) = 9.491$, $p = .003$, $\eta^2 = .107$, with an observed power of 86.1%; and CG imagery, $F(1, 79) = 12.564$, $p = .001$, $\eta^2 = .137$, with an observed power of 93.8%. No significant effects were found for MS imagery, $F(1, 79) = 1.771$, $p = .187$, $\eta^2 = .022$, with an observed power of 26.0%; MG-A imagery, $F(1, 79) = 2.379$, $p = .127$, $\eta^2 = .029$, with an observed power of 33.2%; and MG-M imagery, $F(1, 79) = 1.957$, $p = .166$, $\eta^2 = .024$, with an observed power of 28.2%. These findings suggest that elite athletes used significantly more CS and CG imagery than novice athletes; there were no significant differences in the use of MS, MG-A, and MG-M imagery.

Skill-Type

The results revealed that a significant multivariate effect was found for skill-type, Wilks's Lambda = .703, $F(5, 75) = 6.334$, $p = .0001$, $\eta^2 = .297$, with an observed power of 99.5%. At the univariate level, significant effects due to skill-type were found for MG-A imagery, $F(1, 79) = 13.679$, $p = .0001$, $\eta^2 = .148$, with an observed power of 95.5%. No significant effects were found for CS imagery, $F(1, 79) = 1.448$, $p = .232$, $\eta^2 = .018$, with an observed power of 22.1%; CG imagery, $F(1, 79) = .031$, $p = .860$, $\eta^2 = .000$, with an observed power of 5.4%; MS imagery, $F(1, 79) = .584$, $p = .447$, $\eta^2 = .007$, with an observed power of 11.7%;

and MG-M imagery, $F(1, 79) = .462$, $p = .449$, $\eta^2 = .006$, with an observed power of 10.3%. These findings suggest that athletes in open-skill sports used significantly more MG-A imagery than athletes in closed-skill sport; there were no significant differences in the use of CS, CG, MS, and MG-M imagery.

Interactions

No significant multivariate (Wilks's Lambda = .939, $F(5, 75) = .972$, $p = .440$, $\eta^2 = .061$, with an observed power of 32.9%) or univariate ($p > .05$) interactions between competitive level and skill-type were found.

DISCUSSION

The first purpose of this study was to assess imagery use by elite and novice athletes. As predicted, the overall effects of competitive level were statistically significant, indicating greater imagery use by elite athletes than novices. However, univariate analyses revealed that only differences in CS and CG imagery functions were statistically significant. The results from the current study support previous findings (e.g., Callow & Hardy, 2001; Hall et al., 1990), suggesting that competitive level is a factor affecting athletes' imagery use.

The second purpose of this study was to assess the imagery use of athletes in open- and closed-skill sports. As predicted, the overall effect due to skill-type was significant, indicating different patterns to athletes' imagery use in open- and closed-skill sports. It was revealed that athletes in open-skilled sports used more MG-A and MG-M imagery, whereas athletes in closed-skill sports scored higher on CS and MS imagery subscales. However, univariate analyses revealed that the only statistically significant difference was found for MG-A imagery, as athletes in open-skill sports used significantly more MG-A imagery than those in closed-skill sports. These findings are in support of White and Hardy (1998) who found that slalom canoeists (open-skill) used imagery mainly to become psyched-up (i.e., MG-A imagery). No significant differences in CS, CG, MS, and MG-M imagery subscales were found.

The third purpose of this study was to examine the different functions of imagery used by athletes. The results indicated that overall, athletes used all five functions of imagery quite extensively ($M \geq 4.29$ in all SIQ subscales), and as predicted, MG-M was the most used imagery type across the participants. These findings support previous studies (e.g., Cumming & Hall, 2002a; Hall et al., 1998; Salmon et al., 1994), demonstrating that generally athletes use imagery for maintaining or improving mental toughness, confidence, and positive attitude prior to competition.

Considering these findings, as well as previous research, it appears that cognitive imagery may be a useful strategy for elite performers. Specifically, it appears that elite athletes imagine the processes involved in executing specific sport skills (CS imagery), as well as the strategies and technical aspects of their sport (CG imagery), more so than less-elite athletes. Hall et al. (1990) also reported greater imagery use among higher-level athletes than lower-level athletes. They accounted for this by stating that elite athletes probably engage in more systematic imagery training than novices. This may be, as Vealey and Greenleaf (1998) suggested, because elite athletes have a clearer image of what an accurate skill should look like. Other researchers suggested that the greater use of imagery by elite performers reflects a greater commitment to their sport (Hall, 2001).

Martin et al. (1999) hypothesized that high-level athletes probably employ cognitive imagery during phases when their training program involves learning new skills and strategies. The current findings differ from the above as the data were collected no more than 24 hours prior to competition, thus athletes were probably not engaging in learning new skills and strategies.

Munroe et al. (1998) indicated that elite athletes may also use CS imagery to help them to remain focused on a forthcoming competition and to enhance the performance of well-learned skills and strategies. Therefore, it appears that elite athletes may use cognitive imagery during training as well as just prior to competition.

A major difficulty in examining the effects of competitive level is dividing athletes of different standards into two categories, as some athletes may not explicitly “fit” into either elite or novice standard. To amend this problem, future research should consider using more than two competitive level groups, like Cumming and Hall (2002a) and Cumming, Hall, Harwood, and Gammage (2002) did (they collected data from participants who competed at one of three different competitive levels: regional, provincial, and national). Furthermore, athletes placed in the elite group should be of an elite standard to the highest degree possible. Similarly, novices should either be completely unskilled athletes at a particular sport, or simply recreational athletes; either way, the distinction should be made clearer and more specific in future research.

As no significant differences in CS, CG, MS, and MG-M imagery between open- and closed-skill sports were found, the present findings mostly support the results of Highlen and Bennett (1983). The findings of the current study also support other existing studies (e.g., Beauchamp et al., 2002) as all athletes regardless of skill-type used all the cognitive and motivational imagery functions extensively. A trend that athletes in closed-skill sports use predominantly more imagery on the specific level than athletes in open-skilled sports is intriguing. Athletes in closed-skill sports tend to use more imagery to rehearse specific sporting skills such as a golf-putt and elements in figure skating (CS), and to imagine specific goals and goal-oriented behavior such as winning a medal (MS), whereas athletes in closed-skill sports used more imagery to regulate stress and arousal levels (MG-A), and for focus and self-confidence (MG-M).

This trend may be due to several factors. Most closed-skill sports are individual sports (e.g., figure skating), and require discrete, fine (Hall, 2001), and technically more demanding skills (Gammage, Hall, & Rodgers, 2000), thus providing an ideal opportunity (and need) to image before each attempt. In contrast, most open-skilled sports (e.g., rugby) are fast paced, require gross motor skills (Hall, 2001), and are technically less demanding (Gammage et al., 2000), thus providing less opportunity (and need) for imagery use (Hall, 2001). In addition, in closed-skill sports the performance outcome is more in the athletes’ own control whereas in open-skilled sports the performance outcome depends on the team as a whole, thus the use of MS imagery may well be dissimilar. For example, Rodgers et al. (1991) reported that figure skaters (closed-skill) used MS imagery quite extensively, whereas among a wide range of open-skill sports (e.g., badminton, basketball, and rugby), MS was the least used imagery type (Munroe et al., 1998). As sports can be classified in various ways (e.g., open vs. closed, team vs. individual, gross vs. fine skilled), the current study supports the sentiment that the relationship between sport classifications and imagery is worthy of more investigation (Hall, 2001).

On the other hand, some open-skilled sports such as martial arts, also require specific, controlled bodily movements. Jones, Mace, and Stockbridge (1997) defined such sports as kinaesthetic sports and state that these types of sports are characteristically played by athletes that use kinaesthetic imagery (Jones et al., 1997). The existing research suggests that kinaesthetic imagers have been found to use more imagery in general than athletes who use more visually based imagery. In particular, Vadocz et al. (1997) found that kinaesthetic imagers reported using more MG-A imagery than visual imagers. The present research offers support this proclamation, as the current findings are similar. However, it is speculative to assume that the martial artists were using kinaesthetic imagery without administering a questionnaire

to measure this variable. Therefore, as well as administering the SIQ to measure imagery function, future research may wish to distribute the Movement Imagery Questionnaire (Hall & Pongrac, 1983), which measures the type of imagery perspective that an athlete can take (visual or kinaesthetic).

The finding that athletes in open-skill sports use significantly more MG-A imagery than athletes in closed-skill sports is in support of White and Hardy (1998) who found slalom canoeists (an open-skill) to use MG-A imagery to psych themselves up before a race. The current study supports this with the finding that athletes in closed-skill sport use significantly less MG-A imagery than athletes in open-skill sports. However, it is more likely that this finding simply highlights the differences in types of arousal imagery used between certain sports. Slalom canoeists, and other such sports, use MG-A imagery to psych themselves up. Gymnasts and figure skaters, on the other hand, may use arousal imagery to calm themselves before an event, which may not be adequately measured by the SIQ. The finding that MG-A imagery is used significantly more by athletes in open-skill sports than athletes in closed-skill sports must be explained. Open-skill sports have a constantly changing environment, so movements have to be continually adapted (Knapp, 2002). This “environmental unpredictability” causes us to require great concentration on a task and may account for an increase in arousal. Heightened levels of arousal might be transferred (either consciously or unconsciously) to our imagery, thus explaining the higher MG-A imagery in athletes in open-skill sports. This explanation hinges on the assumption that concentration causes heightened arousal, which may be adequate in explaining why athletes in open-skills use more MG-A imagery, but may not be adequate in explaining why closed-skill athletes use less MG-A imagery. This is because closed skills require as much, and often more concentration, which would cause greater arousal if this hypothesis were correct. Consequently, future research should be performed to further understand this and any other differences between and within open- and closed-skills that may occur. For example, in response to suggestions made by Highlen and Bennett (1983), the current study chose to use golf and figure skating as its closed-skill sports. However, there are a few important differences between these two closed-skill sports. For example, a golf swing takes a matter of seconds, whereas a figure skating routine can take up to several minutes to complete. Furthermore, a golf swing is less physically demanding than a figure skating routine. It is because of these differences within closed-sport skills that may constitute for a lack of significant difference in all imagery subscales between open- and closed-skill sports.

The current study has attempted to specifically observe differences in imagery use between open- and closed-skill sports. Therefore, the inclusion of a team sport in the open-skill group may have acted as a confounding variable. Although most team sports predominantly involve open-skills, the inclusion of a team sport suggests the study examines differences in team vs. individual sports as well as open- vs. closed-skill sports, therefore manipulating more than one variable at a time. Thus, future research may wish to avoid using team sports to represent open-skill sports or include team sports to represent closed skills in order to control for these confounding variables. On a similar theme, the current study looked at four sports that include both fine and gross motor skills, which again may confound data in the current study because their effects were not controlled for. In addition, the current study only considered four sports that may not be representative of all open- and closed-skill sports. Thus, using numerous sports that have additional sport-type variables (continuous vs. discrete, fine vs. gross, team vs. individual) may help to investigate the nature of any differences between open- and closed-skill sports, or indeed any other-differences with regard to sport-type and imagery use.

The existing research suggests that prior to competition, athletes report using imagery for a variety of functions, such as regulating arousal and enhancing confidence before an event (e.g.,

Murphy, 1990; Orlick, 1990). It has been suggested that motivational imagery may be more prevalent immediately before a competition, as it may have a greater effect on performance than cognitive imagery functions (e.g., Vealey & Walter, 1993; White & Hardy, 1998). The current findings support this sentiment, as MG-M imagery was the most used imagery type by all athletes prior to competition.

One apparent occurrence during the data collection was that a number of questionnaires (17%) were not fully completed. Some questionnaires missed demographic data, and in some cases a number of questions were left unanswered. In these instances the data were excluded from the study. However, a number of players from a university rugby team failed to divulge their age, but produced complete data from the SIQ. In such cases the data were included in the analysis, and only athletes' age range was reported. This flaw could be rectified in future research. This occurrence of missing data could be due to the competitive state of the athlete, as the lack of questionnaire attention may show focus and even anxiety with respect to the future competition. However, this is only speculative, as anxiety was not measured in the current study. We acknowledge that the administration of the questionnaire immediately prior to competition may have disrupted some athletes' mental preparation. However, one elite golfer reported that the questionnaire helped him to relax and to organize his game plan before the competition. This suggests that administration of the SIQ before a competition may be beneficial, rather than detrimental, to some athletes. Future researchers need to be aware of the impact of questionnaire distribution prior to competition.

The findings of the current study might have important applications to practitioners. The findings that athletes in closed-skill sports use less MG-A imagery than those in open-skill sports, might suggest the need for closed-skill athletes to perform further MG-A imagery training. This would enable them to imagine various types of arousal associated with sport competition. The finding that elite athletes use significantly more CG and CS imagery than non-elite athletes may also suggest the need for motivational imagery training as MS, MG-A, and MG-M imagery was also predicted to be used significantly more by elite athletes than non-elite athletes.

In conclusion, the current study adds to the existing imagery research examining pre-competition imagery in open- and closed-skill sports with athletes at an elite or novice level. The findings from the current study suggest that competitive level and skill-type have an impact on athletes' imagery use. Elite athletes used significantly more CS and CG imagery than novices, athletes in open-skilled sports used significantly more MG-A imagery than those in closed-skill sports, and regardless of competitive level and skill-type, MG-M imagery was the most used imagery function. A number of methodological flaws have been noted and it is therefore suggested that in future research (a) the definitions of elite/novice should be clear and distinct and include a wide continuum, and (b) the skill-type should be defined in various ways (e.g., team/individual, open/closed, discrete/continuous, fine/gross motor skills). In addition, it can be noted that the current study is in no way flawless, but should be seen as a basis upon which future research can be built upon. On doing so, sport-type variables, such as using the open- vs. closed-skill dichotomy, may be worthy of further investigation and per chance inclusion in the revised version of the applied model of mental imagery (Martin et al., 1999).

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