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Imagery and observational learning use and their relationship to sport confidence

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Abstract

The present study investigated 345 athletes' (male = 152, female = 193) use of observational learning and imagery for practice and at competition and how this related to sport confidence. The Functions of Observational Learning Questionnaire (Cumming et al., 2005), the Sport Imagery Questionnaire (Hall et al., 1998), and the Trait Sport Confidence Inventory (Vealey, 1986) were contextualized by asking participants to rate each item twice, once for practice and once for competition. The athletes reported using each of the different functions of observational learning and imagery in these situations, but the pattern of use differed. Whereas nearly all of the imagery functions were more frequently used at competition, the majority of observational learning functions were used more for practice. Cognitive specific and motivational general-mastery imagery were significant predictors of sport confidence in practice and competition, whereas the skill function of observational learning significantly predicted practice confidence only.

Keywords: *Athletics, confidence, imagery, modelling*

Introduction

Mental skills are important building blocks for successful competitive performance. The use of these skills has consistently distinguished between athletes who are more and less accomplished (for a review, see Krane & Williams, 2006). Because mental skills develop in a similar fashion to physical skills (Cumming & Hall, 2002a), it is important for athletes to practise them systematically for best effect. For this reason, it is commonly advocated by sport psychology practitioners that mental skills be incorporated into regular physical practice (Hall, 2001; Weinberg & Gould, 2003; Weinberg & Williams, 2006). However, athletes do not appear to heed this advice. Research has consistently shown that mental skills are more frequently used in conjunction with competition than with practice (Frey, Laguna, & Ravizza, 2003; Lane, Harwood, Terry, & Karageorghis, 2004; Thomas, Murphy, & Hardy, 1999).

Frey and colleagues (2003) suggested several reasons why neglect of mental skills in practice may occur. For instance, athletes may carry a false belief that mental skills can only help them in competition. Similarly, they may lack sufficient motivation to exert the effort required to engage in mental skills when practising. Another possibility not mentioned by Frey et al., but worthy of consideration, is whether mental skills serve different functions in these two settings. It could be that athletes are using mental skills in practice but for different reasons than in competition. A better understanding of these reasons could then direct practitioners towards more effective implementation of mental skills training in practice contexts. Thus, the aims of the present study were to examine athletes' use of two mental skills, observational learning and imagery, in both practice and competition and how the use of these two skills are related to sport confidence.

The framework proposed by Paivio (1985) is a useful starting point for identifying the different functions that mental skills may serve in practice and competition. Although the framework was intended to explain the effects of imagery on sport performance, it has subsequently been applied to

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observational learning (Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005). According to the framework, there are two main functions of mental skills, cognitive and motivational, and each can operate at either a specific or general level. The development of the Sport Imagery Questionnaire (Hall, Mack, Paivio, & Hausenblas, 1998) has led to the identification of five different functions of imagery: (a) cognitive specific (images of specific sport skills); (b) cognitive general (images of strategies, game plans or routines); (c) motivational specific (images related to an individual's goals); (d) motivational general-arousal (images associated with arousal, anxiety, and stress); and (e) motivational general-mastery (images of being mentally tough, in control, and self-confident). Athletes report using all of these functions, but motivational general-mastery and cognitive specific imagery are typically employed the most frequently (Cumming & Hall, 2002b; Hall et al., 1998; Munroe, Hall, Simms, & Weinberg, 1998; Vadocz, Hall, & Moritz, 1997). Because the Sport Imagery Questionnaire measures the frequency of athletes' imagery in general and is not contextualized for a particular setting, it is unclear whether this pattern of use will differ for practice and competition. By comparison, when imagery is considered as a unidimensional construct, the greatest use of this skill appears to surround competition (Barr & Hall, 1992; Hall, Rodgers, & Barr, 1990; Salmon, Hall, & Haslam, 1994; White & Hardy, 1998). What remains to be determined is whether certain functions are emphasized more in one situation than in another and, if so, what the benefits are.

The applied model of imagery (Martin, Moritz, & Hall, 1999) suggests that variations in imagery use might occur due to inherent differences in the intended outcomes of practice and competition. When practising, the emphasis is usually on learning and refining skills and strategies, whereas the focus would shift to confidently performing these skills and strategies under the pressures of competition. According to the model, imagery would be most effective for achieving these outcomes when the appropriate function is used for the given situation. When attempting to learn a new skill during practice, for example, the model suggests cognitive specific imagery to be the most suitable function. Conversely, motivational general-mastery imagery would be the function of choice for athletes trying to maintain their confidence before competition. Of course, it is possible that athletes would employ cognitive specific imagery in competition (e.g. for enhancing performance of specific skills) and motivational general-mastery imagery for practice (e.g. for maintaining confidence when training is not proceeding well). These particular predictions are based on a number of studies that have shown that cognitive specific imagery will improve skill learning and performance (for a review, see Durand, Hall, & Haslam, 1997; Hall, 2001) and motivational general-mastery imagery can build or maintain confidence and self-efficacy (Callow, Hardy, & Hall, 2001; Munroe-Chandler & Hall, 2004; Nordin & Cumming, 2005).

The applied model also predicts how the other three functions of imagery (cognitive general, motivational specific, and motivational general-arousal) could be used in practice and competition for achieving other relevant outcomes. Martin et al. (1999) have encouraged explicit testing of situational-specific hypotheses, but few imagery studies have answered this call. An exception is the work of Beauchamp and colleagues (Beauchamp, Bray, & Albinson, 2002) with competitive golfers. In their study, 51 male golfers competing at a provincial championship were given a modified version of the Sport Imagery Questionnaire immediately after completing their round of golf. The golfers were asked to recall retrospectively the extent to which they used the five different functions of imagery in the hour before the start of their round, and this was compared with self-efficacy ratings completed on the day before the championships were scheduled. In support of Martin and colleagues' (1999) prediction, pre-round motivational general-mastery imagery use was found to be related to both self-efficacy and golf performance. Furthermore, the pattern of pre-round imagery use was found to be slightly different from the typical Sport Imagery Questionnaire study. That is, motivational general-mastery and motivational general-arousal imagery were the two most frequently reported functions, whereas cognitive specific, cognitive general, and motivational specific imagery were less frequently reported. This finding makes intuitive sense because of all of the imagery functions, motivational general mastery and motivational general-arousal imagery most closely relate to the performance demands of competing (Martin et al., 1999).

The applied model has received empirical support and has proved useful as a guide for intervention work; however, the relationships proposed in the model are not always as simple and straightforward as "what you see is what you get". Athletes can use the same image for multiple functions at the same time (Nordin & Cumming, 2005; Short et al., 2002). Furthermore, the outcomes are quite general in nature (e.g. modify cognitions) and so more than one imagery function can be related to the same outcome (Abma, Fry, Li, & Relyea, 2002; Callow & Hardy, 2001; Mills, Munroe, & Hall, 2001; Moritz, Hall, Martin, & Vadocz, 1996; Nordin & Cumming, 2005; Short & Short, 2005). Athletes grouped according to a given characteristic may also use the functions of imagery differently. For example, Abma et al. (2002)

found that high sport confident athletes used all functions of imagery more than their low confident counterparts. Perhaps their finding is not altogether surprising given that imagery, regardless of its function, can provide athletes with a sense of having experienced the situation before. Whether it is perfectly performing a skill or handling the atmosphere of a competition, imagery can provide athletes with information about performance accomplishments, an important source of self-efficacy proposed by Bandura (1986).

Observational learning, or learning by watching demonstrations, is another mental skill used by athletes for both cognitive and motivational functions (Cumming et al., 2005; Wesch, Law, & Hall, 2007). The development of the Functions of Observational Learning Questionnaire (Cumming et al., 2005) helped to determine these as: (a) skill (acquiring information about skills); (b) strategy (acquiring information about strategies); and (c) performance (acquiring information about optimal arousal levels and mental states for performance). Compared with the imagery functions, the skill function of observational learning would be considered analogous to cognitive specific imagery, the strategy function of observational learning is most similar to cognitive general imagery, and the performance function of observational learning would be a combination of motivational general-arousal and motivational general-mastery imagery. No comparable function of observational learning to motivational specific imagery was identified through the development of the questionnaire. Despite the Functions of Observational Learning Questionnaire being a relatively new instrument, the few studies conducted to date have demonstrated a consistent pattern of observational learning use. Both Cumming et al. (2005) and Wesch et al. (2007) found the skill function to be the most frequently reported among athletes, followed respectively by the strategy and performance functions.

Similar to the Sport Imagery Questionnaire, the Functions of Observational Learning Questionnaire also refers to an athlete's general use of the mental skill; it is not yet known whether observational learning use would differ between practice and competition. However, it seems logical that the basic assumptions made by the applied model of imagery could also apply to observational learning. That is, athletes will benefit most from observational learning when the appropriate function is used for the given situation. Following the same examples as provided above, athletes would use the skill function when learning to perform a new skill in practice and the performance function when trying to understand how to be confident in competition. In support of this notion, there is a large body of literature demonstrating the effectiveness of using observational learning to learn skills and strategies (for reviews, see McCullagh & Weiss, 2001, 2002). Less emphasis has been placed on investigating the effect of observational learning for changing psychological responses. Nevertheless, initial studies have been promising, and indicate that observing others can aid individuals to cope with fear and anxiety, as well as to increase their self-efficacy (Starek & McCullagh, 1999; Weiss, McCullagh, Smith, & Berlant, 1998). What remains unknown is which observational learning functions will demonstrate meaningful relationships with such outcomes.

While athletes seem to image more at competition than practice (Barr & Hall, 1992; Hall et al., 1990), the same may not be true for observational learning. Unlike other mental skills, observational learning is predominantly used to achieve outcomes related to learning rather than performance. Bandura (1986) has stated that "most human behaviour is learned by observation through modeling" (p. 47). For this reason, the skill and strategy functions will likely be used more frequently in practice than competition. Observing other athletes performing skills and strategies when competing might prove counterproductive if it causes losses in concentration. Conversely, competition would be an ideal opportunity for athletes to observe how others get psyched up or stay mentally tough. Therefore, a greater use of the performance function is likely to be found at competition. Such findings would then support the idea that the applied model of imagery could also be useful for guiding observational learning research (McCullagh & Weiss, 2002). That is, athletes should employ the function of observational learning that best matches the outcome they are trying to achieve in a particular situation.

Research has generally found that mental skills are more commonly employed in conjunction with competition than practice, despite encouragement from sport psychology practitioners for athletes to treat mental skills in a similar manner to their physical ones. A proposed reason for this disparity is that mental skills can serve various functions for the athlete but these may operate differently according to the circumstances. The main aim of this study was to compare the use of imagery and observational learning in two sport contexts – practice and competition. Imagery and observational learning were selected as the two mental skills since various researchers (Cumming et al., 2005; McCullagh & Weiss, 2001) have argued that these two skills share many of the same cognitive processes, with the main distinction between them being the absence or presence of an external stimulus for the individual. Practice and competition were compared since the applied model of imagery (Martin et al., 1999) and various literature reviews (e.g. Hall, 2001; McCullagh & Weiss, 2001) have suggested imagery and observational learning function differently in practice and competition. With respect to imagery, it has previously been reported that athletes use this skill more in competition than during practice (Barr & Hall, 1992; Hall et al., 1990). However, the different functions were not considered within these studies. Given that competition is about optimal performance while practice is more about learning, we hypothesized in the present study that the motivational functions of imagery would be more predominant at competition than practice, while the reverse pattern would be found for the cognitive ones. Similarly, we expected that the performance function of observational learning would be predominately used at competition, whereas the two cognitive functions would be more frequently reported for practice.

A secondary aim of the study was to examine how the use of these mental skills is related to sport confidence in practice and competition. Sport confidence (Vealey, 1986) refers to the degree of certainty an athlete has about his or her ability to succeed in sport. Confidence is another key ingredient in determining successful performance, with elite athletes frequently citing higher levels of confidence than their non-elite counterparts (Durand-Bush, Salmela, & Green-Demers, 2001; Krane & Williams, 2006; Mahoney, Gabriel, & Perkins, 1987). Moreover, a loss of confidence can have a dramatic negative effect on performance (Vealey, Hayashi, Garner-Holman, & Giacobbi, 1998). Researchers have shown that imagery can increase sport confidence (Callow et al., 2001; Munroe-Chandler & Hall, 2004; Nordin & Cumming, 2005); however, the relationship between observational learning and general sport confidence has yet to be investigated. Furthermore, imagery, observational learning, and sport confidence have not yet been examined within the same study.

Researchers (Bandura, 1986; McCullagh & Weiss, 2001) have proposed that while observational learning and imagery share many of the same cognitive processes, observational learning typically precedes imagery. That is, the observation of a model is used to create a mental image of that experience, especially for motor skills. It follows that when observational learning and imagery are both being employed on an ongoing basis, such as in sport, observational learning may also precede imagery as a source of confidence. Given this reasoning, hierachical regressions were employed to determined whether imagery could account for unique variance in confidence above and beyond that explained by observational learning for both practice and competition. Moreover, this method allowed us to examine which specific functions of observational learning and imagery would emerge as significant predictors of sport confidence. The rationale behind doing so was twofold. First, examination of the beta weights would help us to clarify which observational learning and imagery functions were most imporant in the prediction of sport confidence. Second, carrying out separate analyses for practice and competition allowed us to examine another fundamental premise of the applied model of imagery – that is, the function–outcome relationship may be dependent on the situation.

Methods

Participants

The sample consisted of 345 male ($n = 152$) and female ($n = 193$) athletes who ranged in age from 17 to 34 years (mean = 19.25, $s = 2.08$). The athletes participated in their sport at a recreational ($n = 102$), club ($n = 90$) or competitive ($n = 152$) standard, with the latter category consisting mostly of athletes who were involved in varsity-level competition. They represented 32 different sports (e.g. athletics, basketball, field hockey, ice hockey, rugby, soccer, swimming, volleyball) that were further classified by the participants as being either team ($n = 258$) or individual ($n = 84$) in nature.

Instruments

Sport Imagery Questionnaire. Frequency of imagery use was assessed through the Sport Imagery Questionnaire (Hall et al., 1998). The questionnaire consists of 30 items that are rated on a 7-point scale (1 = *never/rarely* and 7 = *often*). Each item represents one of the five functions of imagery: cognitive specific, cognitive general, motivational specific, motivational general-arousal, and motivational general-mastery. A principal components analysis by Hall et al. (1998) showed that all items loaded on their appropriate factor above the criterion level (0.40) and all subscales had an acceptable internal consistency (alpha coefficients > 0.70).

Functions of Observational Learning Questionnaire. The athletes' frequency of observational learning use was assessed via the Functions of Observational Learning Questionnaire (Cumming et al., 2005). This questionnaire contains 17 items measuring three different functions or types of observational learning: skill, strategy, and performance. Participants rate each item on a 7-point scale (1 = *never/rarely* and 7 = *often*). Both principal component analyses and confirmatory factor analyses have supported the factor structure of the questionnaire, with all three subscales demonstrating acceptable levels of internal reliability (alpha coefficients > 0.70), test–retest reliability (intraclass correlation coefficients > 0.70), and concurrent validity (Cumming et al., 2005; Wesch et al., 2007).

Trait Sport Confidence Inventory. The Trait Sport Confidence Inventory (Vealey, 1986) measures how confident athletes generally feel when they compete in their sport. It consists of 13 items that are summed together to form an indicator of self-confidence. The athletes are instructed to compare their self-confidence with the most self-confident athlete they know and then to rate themselves on a 9-point scale (1 = *low*, 5 = *medium*, 9 = *high*). Validation procedures carried out by Vealey (1986) indicated that the questionnaire is a unidimensional measure with adequate internal consistency ($\alpha = 0.93$), test–retest reliability ($r = 0.86$), content and concurrent validity.

Participants were asked to rate each item of the Trait Sport Confidence Inventory, Sport Imagery Questionnaire, and Functions of Observational Learning Questionnaire twice on their respective rating scales. For the Trait Sport Confidence Inventory, the participants were asked to consider their levels of self-confidence during practice as well as competition. By contextualizing the Trait Sport Confidence Inventory in this manner, the instrument represents a relatively general measure of sport confidence but technically should not be labelled as "trait" sport confidence. Imagery and observational learning use was also contextualized for the sport situation in a similar way by first asking the participants to rate their imagery/observational learning use *for practice*. Then, they were asked to rate their imagery/observational learning use *at competition*. Together with these questionnaires, which assessed the athletes' sport self-confidence, observational learning use, and imagery use for practice and at competition, the participants were asked to report their age, gender, sport, current competitive standard, years of experience, and whether they classified their sport as individual or team.

Procedures

A pilot study was conducted to test the clarity of the instructions and format of the questionnaire. The questionnaire was distributed to students enrolled in an undergraduate sport psychology course and these students were not included in the actual study sample. Students ($n = 35$) were asked to complete the questionnaire and to indicate any instructions or questions that were confusing to help the researchers ensure that the questionnaire was easy to understand. The time required to complete the questionnaire was also measured. Based on the comments from the undergraduate students, minor adjustments were made to the wording of the instructions for the questionnaire and it was determined that it would take participants approximately 25 min to complete the questionnaire package.

The data were collected in one of two ways. Most participants (70%) were first-year undergraduate kinesiology students who were recruited at the start of a lecture. The remaining participants were recruited during team practices. In both cases, a trained research assistant informed the participants of the nature of the study, and those who agreed to take part were given a letter of information, a consent form, and the questionnaire. Participants were asked to complete each item of the questionnaire as honestly as possible. Completed questionnaires were then returned directly to the investigators. The questionnaire took approximately 25 min to complete.

Results

Descriptive statistics and internal reliability

Before conducting the statistical analyses, the data were screened for mistakes in data entry, missing values, and to ensure that they conformed to relevant statistical assumptions. No mistakes in data entry or missing values were identified and all data conformed to statistical assumptions for the tests employed. Alpha coefficients, means, and standard deviations for each subscale of the Sport Imagery Questionnaire and Functions of Observational Learning Questionnaire, as well as the Trait Sport Confidence Inventory, are presented in Table I for practice and at competition. All subscales had adequate internal reliability (> 0.70), with values ranging from 0.74 to 0.86 for the Sport Imagery Questionnaire, 0.86 to 0.92 for the Functions of Observational Learning Questionnaire, and 0.94 to 0.95 for the Trait Sport Confidence Inventory.

Comparisons between practice and competition

To determine whether there were differences in imagery use between practice and competition, a 5 (function: cognitive specific, cognitive general, motivational specific, motivational general-arousal, and motivational general-mastery) × 2 (time: practice, competition) repeated-measures analysis of variance (ANOVA) was employed. For this analysis, significant main effects were found for both imagery function ($F_{4,1376} = 22.61$, $P < 0.001$, $\eta^2 = 0.06$) and time ($F_{1,344} = 11.50$, $P < 0.001$, $\eta^2 = 0.03$). There was also a significant interaction between function and time ($F_{4,1376} = 73.63$, $P < 0.001$, $\eta^2 = 0.18$) [a medium to large effect size based on the guidelines

Table I. Means, standard deviations, and alpha coefficients for each subscale of the Functions of Observational Learning Questionnaire, Sport Imagery Questionnaire, and Trait Sport Confidence Inventory for practice and competition.

Variable	Practice			Competition		
	mean	s	α	mean	s	α
Imagery						
CS	4.84[a]	1.21	0.84	4.75[a]	1.29	0.85
CG	4.50[abc]	1.24	0.81	4.75[1a]	1.23	0.78
MS	4.17[abcd]	1.50	0.86	4.60[1ab]	1.65	0.74
MG-A	4.22[abcd]	1.37	0.83	4.72[1a]	1.31	0.80
MG-M	4.79[a]	1.39	0.87	5.27[1]	1.32	0.86
Observational Learning						
Skill	5.17	1.29	0.91	4.29	1.49	0.92
Strategy	4.58	1.33	0.86	4.44	1.43	0.90
Performance	3.56	1.43	0.89	3.85	1.53	0.90
Sport Confidence	6.75	1.23	0.94	6.64	1.24	0.95

Notes: [1]Significantly greater use of imagery function for competition. [a]Significantly different from MG-M imagery at competition. [b]Significantly different from CS imagery for practice. [c]Significantly different from CS imagery at competition, CG imagery at competition, and MG-M imagery for practice. [d]Significantly different from MG-A imagery at competition, MS imagery at competition, and CG imagery for practice. CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, and MG-M = motivational general-mastery.

of Cohen (1988), where $\eta^2 = 0.01$ is small, $\eta^2 = 0.09$ is medium, and $\eta^2 = 0.25$ is large]. A Tukey HSD *post hoc* test revealed that the athletes reported significantly greater use of cognitive general, motivational specific, motivational general-arousal, and motivational general-mastery imagery in competition than in practice. However, no differences were observed in the use of cognitive specific imagery between practice and competition. The remaining differences found between the means are reported in Table I.

A 3 (function: skill, strategy, performance) × 2 (time: practice, competition) repeated-measures ANOVA was conducted to examine differences in observational learning use for practice and at competition. No significant interaction was found between function and time. A significant main effect was found for observational learning function ($F_{2,688} = 197.69$, $P < 0.001$, $\eta^2 = 0.37$). Tukey HSD *post hoc* tests revealed that athletes used the skill function significantly more than the strategy function, which in turn was reported more frequently than the performance function. A significant main effect was also found for time ($F_{1,344} = 200.33$, $P < 0.001$, $\eta^2 = 0.37$); athletes reported a greater frequency of observational learning for practice than at competition.

A paired-samples *t*-test revealed no differences in the participants' reported self-confidence between practice (mean = 6.75, $s = 1.23$) and competition (mean = 6.64, $s = 1.48$).

Group differences

Given that research has shown differences in athletes' imagery use according to sport type and competitive standard (Hall, 2001), and differences in athletes' use of the functions of observational learning according to sport type and gender (Wesch et al., 2007), we examined differences in all three of these variables. Separate multivariate analyses of variance (MANOVAs) were used to determine whether observational learning and imagery use for practice and competition could be distinguished based on the athlete's gender, sport type or competitive standard. To avoid Type 1 errors when making multiple comparisons with the data, the alpha level was adjusted using a Bonferroni correction ($P = 0.05/3 = 0.017$). With respect to practice imagery, no significant differences were observed according to gender, sport type or competitive standard. A similar pattern was reported for competition imagery except for when examining differences by competitive standard. For this independent variable, a significant multivariate effect was found (Pillai's Trace = 0.07, $F_{10,676} = 2.45$, $P = 0.007$, $\eta^2 = 0.04$). Significant univariate effects were then identified for cognitive general imagery ($F_{2,342} = 6.35$, $P = 0.002$, $\eta^2 = 0.04$), motivational general-arousal imagery ($F_{2,341} = 5.96$, $P = 0.003$, $\eta^2 = 0.03$), and motivational general-mastery imagery ($F_{2,341} = 5.83$, $P = 0.003$, $\eta^2 = 0.03$). *Post hoc* tests revealed that competitive athletes used more cognitive general and motivational general-arousal imagery than both club and recreational athletes, and more motivational general-mastery imagery than recreational athletes. The means and standard deviations of the Sport Imagery Questionnaire subscales are reported in Table II according to competitive standard.

For practice and competition observational learning, no significant differences were observed for gender or competitive standard. When comparing sport type, however, a significant multivariate effect was found for practice observational learning (Pillai's Trace = 0.07, $F_{3,338} = 7.93$, $P < 0.001$, $\eta^2 = 0.07$). A subsequent univariate effect was found for the strategy function of observational learning ($F_{1,340} = 9.08$, $P = 0.003$, $\eta^2 = 0.03$), with a comparison of the means indicating that team sport athletes (mean = 4.69, $s = 1.20$) used more of this function than individual sport athletes (mean = 4.20, $s = 1.62$). Similarly, a significant multivariate effect was found for competition observational learning (Pillai's Trace = 0.05, $F_{3,338} = 5.59$, $P < 0.001$, $\eta^2 = 0.05$), with a significant univariate effect for the strategy function ($F_{1,340} = 10.61$, $P = 0.001$, $\eta^2 = 0.03$). Team sport athletes were found to use more of this function in competition (mean = 4.58,

Table II. Means and standard deviations for the Sport Imagery Questionnaire subscales according to competitive standard.

	Practice						Competition					
	Recreational		Club		Competitive		Recreational		Club		Competitive	
Subscale	mean	*s*	mean	*s*	mean	*s*	mean	*s*	mean	*s*	mean	*s*
CS	4.74	1.30	4.57	1.07	5.07	1.19	4.62	1.37	4.46	1.37	5.02	1.26
CG	4.50	1.07	5.07	1.19	4.84	1.21	4.62[a]	1.35	4.59[a]	1.35	4.93	1.29
MS	4.16	1.19	4.84	1.21	4.50	1.29	4.39	1.58	4.54	1.58	4.80	1.35
MG-A	4.20	1.21	4.50	1.29	4.29	1.16	4.52[a]	1.39	4.49[a]	1.39	4.99	1.09
MG-M	4.75	1.29	4.29	1.16	4.62	1.25	4.98[a]	1.47	5.16	1.47	5.53	1.21

Note: [a]Significantly different from competitive group. CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, and MG-M = motivational general-mastery.

$s = 1.37$) than individual sport athletes (mean = 4.00, $s = 1.55$).

Separate one-way ANOVAs determined that no significant differences existed for practice and competition sport confidence according to gender, sport type or competitive standard when employing an adjusted alpha level ($P = 0.017$).

Correlation analysis

Bivariate correlations were calculated to demonstrate the relationship between self-confidence and current age, years of participation, imagery use, and observational learning use. Current age and years of experience were examined because these variables had previously have been found to be related either to observational learning (Law & Hall, in press) or imagery use (Gregg & Hall, 2006). The results of these correlation analyses, presented in Table III, indicate that years of experience was significantly and positively associated with self-confidence in both practice ($r = 0.13$, $P = 0.01$) and competition ($r = 0.12$, $P = 0.02$). Similarly, age was significantly and positively associated with self-confidence in competition ($r = 0.11$, $P = 0.04$). Furthermore, significant and positive relationships were observed between observational learning use and self-confidence during both practice and competition ($P < 0.01$), with r values ranging from 0.16 to 0.26. Slightly stronger relationships were observed between imagery use and self-confidence during both practice and competition ($P < 0.01$), with r values ranging from 0.28 to 0.44.

The relationship between imagery and observational learning use was also assessed by calculating bivariate correlations. Significant and positive relationships emerged with r values ranging from 0.18 to 0.53 ($P < 0.01$) for practice and from 0.23 to 0.51 ($P < 0.01$) for competition. These small to moderate correlation coefficients are similar to those reported by Cumming et al. (2005) and provide further support that the Sport Imagery Questionnaire and

Table III. Bivariate correlations between self-confidence and current age, years of participation, observational learning use, and imagery use.

	Self-confidence	
	Practice	Competition
Current age	0.09	0.11*
Years of participation	0.13*	0.12*
Skill	0.26**	0.24**
Strategy	0.22**	0.24**
Performance	0.18**	0.16**
CS imagery	0.44**	0.44**
CG imagery	0.39**	0.39**
MS imagery	0.35**	0.28**
MG-A imagery	0.37**	0.33**
MG-M imagery	0.44**	0.41**

Notes: *$P < 0.05$, **$P < 0.001$. CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, MG-M = motivational general-mastery.

Functions of Observational Learning Questionnaire measure similar, but different, constructs.

Hierarchical regressions

Two separate hierarchical multiple regression analyses were used to determine whether imagery and observational learning use accounted for unique variance in practice and competition self-confidence after controlling for individual variables. Based on the results of the above analyses, it was determined that years of participation and current age should all be controlled for in Step 1 of the regression. In the first run of the regression, however, current age did not emerge as a significant predictor. Following recommendations made by Cohen and colleagues (Cohen, Cohen, West, & Aiken, 2003), this variable was deemed to be irrelevant to the prediction of self-confidence, and was subsequently dropped from the regression analyses. Inclusion of this variable may have increased the standard error of the standardized

(β) and unstandardized (B) coefficients, thus in turn reducing statistical power. Therefore, only years of participation were controlled for in Step 1 of the analysis. The order of the following steps of the regression was then guided by both theory and empirical evidence. Given that observational learning may precede imagery as a source of confidence, the three functions of observational learning were then presented as a block in Step 2. This was followed by the five functions of imagery being entered as a block in Step 3. When predicting practice sport confidence, the scores for the practice Sport Imagery Questionnaire and Functions of Observational Learning Questionnaire subscales were entered into the regression. Similarly, the competition Sport Imagery Questionnaire and Functions of Observational Learning Questionnaire subscales predicted sport confidence in competition. The results of the hierarchical regression analyses are reported in Table IV.

Practice sport confidence. Overall, a significant model was found ($F_{9,331} = 12.81$, $P < 0.001$) that accounted for 25.80% of the variance in self-confidence during practice (adjusted $R^2 = 0.24$). At Step 1, years of participation was a significant and positive predictor of self-confidence, but only accounted for a very small amount of the variance ($R^2 = 0.02$). The addition of the practice observational learning subscales at Step 2 represented a significant change to the regression equation ($\Delta R^2 = 0.08$). Only the skill function of observational learning emerged as a significant and positive predictor. The majority of the variance was accounted for by the addition of the practice imagery subscales at Step 3 ($\Delta R^2 = 0.16$). Within this step, both cognitive specific and motivational general-mastery imagery emerged as significant and positive predictors of practice self-confidence.

Table IV. Hierarchical regressions to predict self-confidence from observational learning and imagery when practising and competing.

	ΔR^2	B	95% CI	β	T
Practice self-confidence					
Step 1	0.018*				
Years of participation		0.05	0.01, 0.86	0.13	2.46*
Step 2	0.075***				
Skill		2.29	0.75, 3.82	0.19	2.93***
Strategy		0.90	−0.72, 2.52	0.07	1.09
Performance		0.77	−0.58, 2.12	0.07	1.12
Step 3	0.163***				
CS imagery		3.29	1.30, 5.29	0.25	3.25***
CG imagery		−0.37	−2.70, 1.95	−0.03	−0.32
MS imagery		−0.49	−2.33, 1.34	−0.05	−0.53
MG-A imagery		0.22	−1.92, 2.36	0.02	0.20
MG-M imagery		3.69	1.31, 6.07	0.32	3.05***
Competition self-confidence					
Step 1	0.015*				
Years of participation		0.53	0.07, 1.00	0.12	2.27**
Step 2	0.07***				
Skill		1.69	−0.12, 3.51	0.13	1.84
Strategy		1.96	−0.02, 3.94	0.15	1.95
Performance		0.25	−1.31, 1.82	0.02	0.32
Step 3	0.159***				
CS imagery		4.04	1.70, 6.38	0.27	3.40***
CG imagery		0.06	−2.94, 2.96	0.00	0.04
MS imagery		−1.06	−2.70, 0.58	−0.09	−1.27
MG-A imagery		−0.05	−2.47, 2.37	0.00	−0.04
MG-M imagery		4.32	1.48, 7.15	0.30	2.99***

Notes: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, MG-M = motivational general-mastery.

Competition sport confidence. Overall, a significant model was found ($F_{9,331} = 11.84$, $P < 0.001$) that accounted for 24.40% of the variance in self-confidence during competition (adjusted $R^2 = 0.22$). Years of participation again accounted for only a very small amount of the variance at Step 1 ($R^2 = 0.02$). The addition of the competition observational learning subscales at Step 2 represented a significant change to the regression equation ($\Delta R^2 = 0.07$). However, no functions of observational learning emerged as significant predictors of sport confidence in competition. The competition imagery subscales at Step 3 again accounted for the largest amount of variance ($\Delta R^2 = 0.16$), with cognitive specific and motivational general-mastery imagery again emerging as significant and positive predictors.

Discussion

Two mental skills commonly employed by athletes are imagery and observational learning. Typically, athletes report using mental skills more in conjunction with competition than practice (Frey et al., 2003; Lane et al., 2004; Thomas et al., 1999), but no systematic investigation of the use of imagery and observational learning in these two settings has been conducted to date. Therefore, the main aim of this study was to compare the use of imagery and observational learning in practice and competition. We hypothesized that the motivational functions of imagery would be more predominant in competition than practice, while the reverse pattern would be found for the cognitive functions. This hypothesized pattern of imagery use was not found. Athletes reported employing all functions of imagery more in competition than practice, except for cognitive specific imagery. Furthermore, motivational general-mastery imagery was used most in competition and cognitive specific imagery was used most in practice, with motivational specific and motivational general-arousal imagery the least used in both these settings.

We also expected the performance function of observational learning to be used predominately in competition, with the two cognitive functions of observational learning used more frequently in practice. This pattern of observational learning was not found; rather, athletes employed observational learning more in practice than competition. Similar to Cumming et al. (2005) and Wesch et al. (2007), the skill function of observational learning was the most used and the performance function the least used function, regardless of the setting.

In addition to comparing the use of imagery and observational learning in competition and practice, we examined the influence of gender, sport type, and competitive standard on imagery and observational learning use in each setting. Consistent with most imagery research (Hall, 2001), no differences in imagery use were found for gender. Furthermore, no differences were found for sport type. Munroe et al. (1998) found that type of sport influenced athletes' use of imagery, but they considered a wide variety of sports and did not categorize them into team and individual sports. The present findings suggest that when sports are simply classified as team and individual, no significant differences in the use of the five functions of imagery emerge in either competition or practice.

For competitive standard, the present findings followed the typical pattern found in previous imagery research (Cumming & Hall, 2002b; Hall, 2001). More specifically, competitive athletes (the highest standard in the present sample) reported using more cognitive general imagery and motivational general-arousal imagery than club and recreational athletes, and more motivational general-mastery imagery than recreational athletes. This finding is also consistent with recent research conducted by Gregg and Hall (2006), who investigated the relationship between an objective measure of skill – golf handicap – and the use of imagery. They found that handicap significantly predicted imagery use, whereby players with lower handicaps (i.e. better golfers) employed all the functions of imagery more than golfers with higher handicaps.

The findings for the use of observational learning were consistent with those of Cumming et al. (2005). No differences in observational learning use were found for gender and competitive standard in either practice or competition. There was, however, a significant effect for sport type. Team sport athletes used more of the strategy function than individual sport athletes in both competition and practice. These results in part match those reported by Wesch et al. (2007), who found that team sport athletes used more of the strategy function than individual sport athletes, but also that individual sport athletes used more of the skill function than team sport athletes. It is unclear why this latter finding was not replicated in the present study.

A secondary aim of the present study was to examine how the use of imagery and observational learning was related to sport confidence in practice and competition. Because researchers have argued that observational learning often precedes imagery (e.g. McCullagh & Weiss, 2001), it follows that observational learning may also precede imagery as a source of sport confidence. Following this reasoning, hierachical regressions were employed to determine whether imagery could account for unique variance in sport confidence beyond that explained by observational learning. After controlling for years of participation, practice confidence was significantly predicted by the skill function of observational learning, cognitive specific imagery, and motivational general-mastery imagery. Imagery accounted for the greatest amount of variance in the regression and motivational general-mastery imagery was the strongest predictor of practice confidence. For competition, no function of observational learning emerged as a significant predictor of confidence, but again imagery accounted for a significant amount of variance. Both cognitive specific and motivational general-mastery emerged as significant predictors, with motivational general-mastery again the stronger predictor of the two.

It would appear that both the use of imagery and observational learning can influence sport confidence; however, imagery is more important for competition (i.e. performance) than observational learning. This is probably not surprising given that athletes employ observational learning more for practice than in competition. As alluded to in the Introduction, it is possible that observational learning is viewed as a possible distracter at competition. That is, focusing on others could be seen as an external distracter, especially if the athlete has a more internal orientation. Consequently, future research should examine the relationship between observational learning and competitive anxiety (i.e. concentration disruption). In contrast, focusing on others during practice would not be a distracter and, therefore, observational learning exerts a positive influence on sport confidence. Of course, having said that the use of imagery and observational learning can influence sport confidence, it must be noted that a cause-and-effect relationship cannot be assumed from these analyses. It is possible that individuals with higher sport confidence are most likely to use imagery and observational learning in certain circumstances and this possibility should be examined in future research.

The present findings fit reasonably well with the applied model of imagery proposed by Martin et al. (1999). In support of the model, motivational general-mastery emerged as the strongest positive predictor of sport confidence, regardless of the setting. It would appear that motivational general-mastery imagery should be the function of choice for athletes trying to develop or maintain their confidence (Moritz et al., 1996). It is interesting that cognitive specific imagery as well as the skill function of observational learning were also positive predictors of sport confidence. These results are consistent with recent work showing that skill-based strategies may have a beneficial effect on self-confidence (e.g. Calmels & Fournier, 2001; McKenzie & Howe, 1997; Nordin & Cumming, 2005; Short et al., 2002).

Given that the performance function of observational learning is the function most conceptually related to motivational general-mastery imagery, one might question why this function did not emerge as a significant predictor of sport confidence. Furthermore, Cumming et al. (2005) found that motivational general-mastery imagery was the only function to significantly predict the use of the performance function of observational learning. One possible answer to this question is that the performance function, as assessed by the Functions of Observational Learning Questionnaire, incorporates much more than just using observational learning to understand how to be confident. It also includes using observational learning to understand how to be mentally tough, regulate arousal, and stay focused. The inclusion of these other constructs in the performance function of observational learning may weaken the relationship between this function and measures of confidence.

The present study contributes to the imagery and observational learning literature by providing the first empirical examination of how athletes employ these mental skills differently in practice and competition settings. In addition, we identified the specific functions of imagery and observational learning that may account for athletes' sport confidence levels. As this study was cross-sectional in nature, further research is required to examine how athletes' use of the functions of imagery and observational learning may change over the course of the competitive season in both practice and competition settings, as well as their relationship to specific psychological outcomes.

The findings from the present study support the applied model of imagery use (Martin et al., 1999); however, there is no comparable model for observational learning use. As these two mental skills appear to share some similarities (e.g. use of specific functions in practice versus competition) and both impact outcomes such as sport confidence, perhaps the applied model of imagery can be modified to create an applied model of observational learning use in sport. Similar to imagery use, the sport setting as well as the desired outcome should be considered so that the function of observational learning employed can be matched to the desired outcome. Given the associations found in our data, we suggest that athletes should employ the skill function of observational learning to increase their sport confidence. More research is needed to determine which functions of observational learning are related to other sport outcomes, such as state anxiety and motivation, in specific situations. As previously suggested, perhaps observational learning use is not appropriate for contributing to certain outcomes in every sporting context (e.g. observational learning use may increase anxiety in competition but decrease anxiety in practice). Further research is required to examine these issues. This will aid in the development of an applied model of observational learning use and will help to guide applied practitioners when teaching athletes about the effective use of imagery and observational learning in various sport settings.

The current results do have some applied implications. Practitioners (e.g. coaches, sport psychologists) need to be aware that competitive standard does influence imagery use and lower-level athletes in particular need to be encouraged to use imagery. With respect to employing observational learning to learn strategies of play, this should be promoted in particular with athletes participating in individual sports. In addition, practitioners should encourage athletes to employ both observational learning and imagery for building confidence in practice, while mainly imagery should be promoted for enhancing confidence in competition.

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