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The Imagery Ability, Imagery Use, and Performance Relationship

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Athletes engage in imagery for many different purposes. Their extensive use of imagery may in part be due to its effectiveness in a variety of circumstances and the potential of nearly everyone to learn to use imagery (Hall, 1998). Martin, Moritz, and Hall (1999) have developed an applied model of imagery use in sport. Through a review of the literature, four constructs were identified for the model: (a) the sport situation, (b) the function of imagery used, (c) the outcomes associated with imagery use, and (d) imagery ability. The model indicates that in various sport situations, the function of imagery to be used should match the desired outcome. However, Martin and her colleagues suggest individual differences, specifically imagery ability, may moderate the link between imagery use and outcome. Although previous studies (e.g., Callow, Hardy, & Hall, 2001; Vadocz, Hall, & Moritz, 1997) have assessed the relationships among several of the model's constructs, to date, no known study has examined imagery function, ability, and outcome together.

The Martin et al. (1999) model focuses on the various functions that imagery can serve in sport. Paivio (1985), and later Hall, Mack, Paivio, and Hausenblas (1998) identified five functions of imagery use in sport. Paivio and colleagues proposed that imagery plays both a cognitive and a motivational role in influencing behavior. Each role operates at a general or specific level. Cognitive general (CG) imagery involves mentally rehearsing race plans and strategies of play. Cognitive specific (CS) imagery is the mental rehearsal of skills. Motivational general-arousal (MG-A) imagery involves imaging the arousal and anxiety associated with performing. Motivational general-mastery (MG-M) imagery is used to imagine

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being in control and feeling confident. Motivational specific (MS) imagery entails imaging goal achievement and accomplishment (e.g., winning).

In their meta-analysis of the literature, Driskell, Copper, and Moran (1994) determined that imagery use has a moderate and significant impact on motor skill performance. The frequency of imagery use has been positively linked with athletic performance (Hall et al., 1998). In addition, various researchers (e.g., Cumming & Hall, 2002; Hall et al., 1998) have found that athletes at higher competitive levels (e.g., varsity, national) use all five functions of imagery to a greater extent in both training and competition than do athletes at lower levels (e.g., local, recreational).

Imagery ability refers to the quality of an individual's imagery. In sport, typically visual and kinesthetic imagery ability have been examined. As Hall (1998) suggests, it is logical to suppose that the better imager an athlete is the more effective that imagery will be in aiding his or her performance or skill acquisition. Hall and Martin (1997) further contend that it may be possible to predict athletic performance from variations in imagery ability. Not only do better imagers use imagery more effectively in sport, when athletes increase their use of imagery, their imagery ability improves (Rodgers, Hall, & Buckolz, 1991). A circular relationship between these two variables seems to exist; better imagers are more likely to engage in imagery use, and as a result of using imagery more frequently, imagery ability is enhanced (Vadocz et al., 1997).

The purpose of the present study was to test Martin and colleagues' (1999) applied model of imagery use in sport, and in particular the proposal that imagery ability moderates the imagery use—desired outcome relationship. As Paivio (1985) suggested, it is imperative to determine why imagery techniques are or are not effective. By matching the function of imagery used to the desired outcome, as outlined by Martin et al.'s applied model of imagery use, and identifying potential moderators of the imagery use—desired outcome relationship, it should be possible to develop more effective imagery interventions.

The various imagery functions have been linked to specific desired outcomes in Martin et al.'s (1999) model. The performance benefits of using CG imagery have been reported for rehearsing football plays (Fenker & Lambiotte, 1987), wrestling strategies (Rushall, 1988), and entire canoe slalom races (MacIntyre & Moran, 1996). Researchers have found that MG-A imagery was related to decreased anxiety (Vadocz et al., 1997), and MG-M imagery was related to increased sport-confidence (Callow et al., 2001). Also, Munroe, Giacobbi, Hall, and Weinberg (2000) reported that athletes use MS imagery to image two types of goals, performance and outcome. These various outcomes (i.e., strategies, anxiety, self-confidence, goals), however, were not examined in the present study. Rather, this study focused on sport performance.

Specifically, the desired outcome assessed was track and field performance. Research has consistently demonstrated that CS imagery use is positively related to performance improvements (Driskell et al., 1994; Hall, 2001). Therefore, based on Martin et al.'s model, it was hypothesized that CS imagery use would be related to track and field performance and imagery ability would moderate the CS imagery—performance relationship. It was expected that athletes who were using CS imagery and were more skilled at imaging would demonstrate higher performance levels than those less skilled at imaging. Furthermore, although the use of CG, MG-A, MG-M, and MS imagery were assessed, based on Martin et al.'s model, it was not expected that these functions of imagery would be related to track and field performance.

A secondary purpose of this study was to further examine the relationship between imagery ability and imagery use, as suggested by Moritz, Hall, Martin, and Vadocz (1996) and Vadocz et al. (1997). These two studies provided some initial evidence that visual and kinesthetic imagery ability are related to CS, MG-A, and MG-M imagery use. However, Hall (1998) has cautioned that instruments such as the MIQ-R were designed to measure how good an athlete is at imaging specific movements (i.e., CS imagery), but not how effective they are at imaging other aspects of participating in sport such as arousal (i.e., MG-A imagery) and affect (MG-M imagery). As a result, in the present study, it was hypothesized that imagery ability, as assessed by the MIQ-R, would predict the use of CS imagery. In addition, it was expected that both visual and kinesthetic imagery ability would contribute to the prediction of CS imagery use. Although the relative contributions of visual and kinesthetic imagery ability in predicting CS imagery use is unknown, it was hypothesized visual ability would be a better predictor as most athletes are better at visual than kinesthetic imagery (Hall & Martin, 1997). Finally, imagery ability, as measured by the MIQ-R, was not expected to be related to the other functions of imagery given Hall's (1998) comments.

Method

Participants

Participants were recruited from three successful Canadian university varsity track and field teams, and 53 male and 47 female athletes volunteered to participate. Sixty of the athletes were categorized based on their primary event as track event athletes and the remaining 40 were field event athletes. The athletes ranged in age from 18 to 28.85 years (M = 21.27 years; SD = 1.89) and had participated in track and field for an average of 9.18 years (SD = 3.48).

Measures

Imagery Use. The Sport Imagery Questionnaire (SIQ; Hall et al., 1998) is a questionnaire designed to assess athletes' use of the five cognitive and motivational functions of imagery. The SIQ is composed of 30 questions, six questions per imagery function. Each item is rated on a 7-point Likert-type scale with anchors of 1 = *rarely use that function of imagery* and 7 = *often use that function of imagery*. An average frequency score for the athletes' use of each of the five functions was then calculated. Internal consistency values are satisfactory for the sub-scales of the SIQ and these were also deemed to be adequate in the present study (see Table 1). The SIQ also possesses good validity (Hall et al., 1998).

Imagery Ability. The Movement Imagery Questionnaire – Revised (MIQ-R; Hall & Martin, 1997) assesses imagery ability on the dimensions of kinesthetic and visual imagery. Four items assess each of the two imagery ability dimensions. Each of the eight items requires the participant to first perform a movement, image that movement, then rate on a 7-point Likert-type scale how *difficult* (1) or *easy* (7) they found imaging that action. Average scores for each of the imagery ability subscales were calculated. The MIQ-R has favorable psychometric properties and has acceptable internal consistencies (Hall & Martin, 1997; Vadocz et al., 1997). As

Table 1 Descriptive Statistics for Imagery Sub-Scales and Mercier Table Scores

	Mean	Standard deviation	Chronbach's alpha
Cognitive General	4.55	.99	.67
Cognitive Specific	4.55	1.13	.82
Motivational Specific	3.77	1.48	.87
Motivational General-Mastery	4.88	1.16	.82
Motivational General-Arousal	4.63	1.14	.80
Visual	5.49	1.18	.91
Kinesthetic	5.16	1.28	.90
Mercier Score	687.43	90.17	

indicated in Table 1, acceptable internal consistencies for the visual and kinesthetic subscales were also found in the present study.

Performance. Athletic performance was determined by giving each athlete's best performance at a track and field meet during the indoor season a score based on the Mercier scoring tables (Mureika, Covington, & Mercier, 2000). Mercier scores are standard scores based on the weighted averages of world performances over a four-year period that allow comparisons across events and between genders. The tables were devised, in part, to be used for the purposes of National Team selection and athlete funding by Athletics Canada (Canada's national governing body for track and field). As a point of reference, outdoor world record performances range from 988 to 1079 points, with a mean score of 1031. To date, the psychometric properties of these indoor scoring tables have not been determined.

Procedure

Athletes were contacted early in the indoor track and field season and given a letter of information; if they agreed to participate in the study, they completed both the SIQ and MIQ-R. The questionnaires were administered in a random order. No time limit was imposed on the athletes for completing the questionnaires. Season's best performance scores that occurred after the questionnaires were completed were obtained from official meet results.

Results

Descriptive statistics were calculated for the five sub-scales of the SIQ, the two sub-scales of the MIQ-R, and the performance results (see Table 1). The athletes used MG-M imagery most frequently and used MS imagery least often. The athletes were more adept at visual than kinesthetic imagery; this difference was significant, $t(99) = -3.35$, $p < .001$.

As per Baron and Kenny's (1986) recommendations for testing for moderation, performance data were regressed on imagery use, imagery ability, and the product of imagery use and imagery ability. Performance was regressed, using separate hierarchical regression analyses on all measured combinations of the independent variables. For moderation to be present, there must be a significant effect for the product variable (imagery use x imagery ability). To avoid inflation of Type I error rates, probability levels were set at .01 for all regression analyses. The product variables did not significantly predict performance in any of the analyses. Thus, no significant moderation effects were found. In addition, the functions of imagery and imagery ability also failed to predict performance.

Five hierarchical regression analyses were performed to examine the utility of predicting imagery use through imagery ability (see Table 2). As stated previously, the athletes in the sample were more proficient at visual imagery than kinesthetic, thus visual imagery ability was entered first into the regression equations, followed by kinesthetic ability. Again, to avoid inflation of Type I error rates, probability levels were set at .01 for all regression analyses. Visual imagery ability significantly predicted CS imagery use, and kinesthetic ability significantly added to this prediction. Visual and kinesthetic imagery ability failed to significantly predict the other four imagery functions.

Discussion

The primary purpose of this study was to test Martin et al.'s (1999) applied model of imagery use in sport. Contrary to expectations, CS imagery use failed to predict performance, and CS imagery use and imagery ability did not interact to predict performance (i.e., did not moderate the CS imagery—performance relationship). The most likely explanation focuses on the outcome measure. Imagery use and ability may influence an athlete's technique, and ultimately their quantitative performance. As such, it may be better to employ an alternative outcome measure, such as breaking an event down into composite skills and assessing the performance of these skills, rather than using a more general measure of performance as employed in the present study. Moreover, most research demonstrating that CS imagery use is positively related to performance improvements has employed novice performers who typically demonstrate considerable performance improvements with even small amounts of either physical or imagery practice (Driskell et al., 1994; Hall,

Table 2 Summary of Regression Analyses for Imagery Ability Predicting Imagery Use

Variable		R	R^2	Increment	F	B	*p*
CG	Step 1: Visual	.19	.04	.04	3.65	.19	.06
	Step 2: Kinesthetic	.20	.04	.00	.21	.06	.65
CS	Step 1: Visual	.40	.16	.16	18.51	.40	.00
	Step 2: Kinesthetic	.47	.22	.06	7.56	.34	.01
MG-A	Step 1: Visual	.01	.00	.00	.02	.01	.90
	Step 2: Kinesthetic	.02	.00	.00	.04	.03	.85
MG-M	Step 1: Visual	.24	.06	.06	5.73	.24	.02
	Step 2: Kinesthetic	.26	.07	.01	1.22	.15	.28
MS	Step 1: Visual	.06	.00	.00	.382	.06	.54
	Step 2: Kinesthetic	.15	.02	.02	1.71	.18	.20

2001). It is possible that CS imagery use was influencing the performance of the highly accomplished track and field athletes in the present study but our measure of performance was not sensitive enough to detect this effect. The imagery model proposed by Martin et al. (1999) requires further testing, especially the proposal that imagery ability moderates the imagery use—desired outcome relationship. Only one possible outcome was assessed in the present study and there are various other outcomes (e.g., self-confidence, anxiety) that could be examined.

Previous research (e.g., Vadocz et al., 1997) has shown a relationship between imagery ability and imagery use. Visual imagery ability significantly predicted CS imagery use and kinesthetic imagery ability significantly predicted the use of CS imagery over and above that predicted by visual imagery ability. Individuals are more likely to use techniques they are comfortable with; thus, if an athlete is good at imaging specific movements, then they would be more likely to undertake this activity in appropriate situations (e.g., perfecting a skill).

In general, it appears that visual and kinesthetic imagery ability, as assessed by the MIQ-R, are related to CS imagery use but not the other imagery functions. An explanation for this finding is that the MIQ-R was designed to assess imagery for performing specific moves and not other activities such as winning a competition (MS imagery). Just because athletes can easily imagine themselves performing a skill such as jumping a hurdle does not mean they can just as easily imagine the crowd applauding as they stand on the medal podium. Hall (1998) has argued that if researchers want to fully measure the imagery abilities of athletes, additional instruments need to be developed that consider athletes' abilities to imagine these other situations.

With respect to practical implications, the present study suggests athletes should be taught to become better visual and kinesthetic imagers, encouraged to employ CS imagery, and accordingly, should realize the associated benefits (e.g., enhanced skill learning). When designing imagery interventions, sport psychologists should pay particular attention to the demands of the task and assess which imagery functions would be most effective for the desired outcome. Clearly, Martin et al.'s applied model is a useful starting point for researchers and practitioners and it will undoubtedly continue to be an important tool in guiding imagery interventions.

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