# Types and Functions of Athletes' Imagery: Testing Predictions from the Applied Model of Imagery Use by Examining Effectiveness

SANNA M. NORDIN<sup>1</sup> AND JENNIFER CUMMING<sup>2</sup>

<sup>1</sup>London Sport Institute <sup>2</sup>University of Birmingham

### Abstract

Predictions from the applied model of imagery use (Martin, Moritz, & Hall, 1999) were tested by examining the perceived effectiveness of five imagery types in serving specific functions. Potential moderation effects of this relationship by imagery ability and perspective were also investigated. Participants were 155 athletes from 32 sports, and materials included a chart for rating imagery effectiveness constructed specifically for the study as well as a modified version of the Sport Imagery Questionnaire (SIQ; Hall, Mack, Paivio, & Hausenblas, 1998). Results supported the predictions for cognitive but not motivational imagery types, and MG-M imagery was perceived to be the most effective imagery types regarding frequency and ease of imaging. The relationship between frequency and effectiveness was not moderated by imagery ability or perspective, and athletes who imaged more frequently found imagery more effective and easier to do.

Keywords: imagery type, imagery function, imagery effectiveness, imagery perspective, imagery ability

In sport imagery research, five types of imagery have been the focus of many recent investigations. Initially derived from the framework proposed by Paivio (1985) and later operationalized by Hall, Mack, Paivio, and Hausenblas (1998), these are cognitive specific (CS; imagery of skills), cognitive general (CG; imagery of strategies, routines, and game plans), motivational specific (MS; imagery of goal achievement), motivational general-arousal (MG-A; imagery of stress, anxiety, and arousal), and motivational general-mastery (MG-M; imagery of being self-confident, mentally tough, focused, and positive). Each of these types is also represented by a subscale on the Sport Imagery Questionnaire (Hall et al., 1998). Using this questionnaire, a number of studies have

Corresponding author: Sanna M. Nordin, London Sport Institute, Middlesex University, Archway Campus, 2-10, Highgate Hill, London, N19 5LW, U.K. Tel: +44 (0) 208 411 5023, Email: S.Nordin@mdx.ac.uk

examined how the five imagery types are related to various functions and outcomes (for reviews, see Hall, 2001; Murphy, Nordin, & Cumming, in press). For instance, an imagery type might serve the function of regulating anxiety or lead to the outcome of elevated anxiety levels. The terms *function* and *outcome* are further defined below. The applied model of imagery use (Martin, Moritz, & Hall, 1999) evolved out of these findings and serves as a guide for research and interventions. It encourages athletes to use the type/function of imagery that will be most effective for achieving a specific outcome by following the simple rule of "what you see is what you get." For instance, CS imagery is considered most suitable for achieving skill-related outcomes, MG-A imagery most suitable for achieving arousal-related outcomes, and so forth. Figure 1 illustrates some of the main predictions made by the model.

Martin et al. (1999) have acknowledged the need for continued testing of their model, and several studies have heeded this call. Consequently, there is evidence available to support some of the predictions made. For example, CS imagery has been shown to be beneficial for skill learning and performance whereas MG-M imagery has been linked to increased self-confidence (for reviews, see Hall, 2001; Murphy et al., in press). Contrary to the "what you see is what you get" notion, however, a number of recent studies have found that several types of imagery may be related to one function, and that several functions may be served by one type of imagery (Abma, Fry, Li, & Relyea, 2002; Callow & Hardy, 2001; Calmels, D'Arripe-Longueville, Fournier, & Soulard, 2003; Evans, Jones, & Mullen, 2004; Fish, Hall, & Cumming, 2004; Nordin & Cumming, 2005a, 2005b; Short & Short, 2005; Short et al., 2002; Short, Monsma, & Short, 2004). To continue with the above example, CS imagery can also impact self-efficacy and MG-M imagery can also improve motor skill performance (Nordin & Cumming, 2005a).

The likely explanation for these disparate findings is that imagery content or type (i.e., what athletes image) is seen as synonymous with imagery function (i.e., why athletes image) in the applied model and in the SIQ. Several authors have, conversely, noted that imagery content does not necessarily equate to function (Callow & Hardy, 2001; Hall, 2001; Short & Short, 2005; Short et al., 2004), and that the content of an athlete's image does not necessarily provide an indication of why they are imaging (Hall, 2001). As an example, Callow and Hardy (2001) explained that, "one netballer may image strategies of play [CG] for the cognitive function of improving strategy, whereas another may image strategies of play for the motivational function of psyching themselves up to use the strategy" (p. 15). Short et al. (2002) have further highlighted the problem of confounding imagery type/content with function when designing imagery scripts intended to tap into a certain function by stating:

... can we be absolutely certain that a participant in the CS + facilitative imagery group, for example, considered their imagery to be only cognitive? No, it is possible that the content was motivational to him/her, or even that the content served both functions. (p. 64)



# Figure 1. Relationships between Imagery Types and Functions as Predicted by the Applied Model of Imagery Use in Sport vs. Found in the Present Study.

Note. Dotted arrows indicate relationships predicted by the applied model of imagery use in sport (Martin et al., 1999). Solid arrows indicate the relationships found in the present study. Imagery ability is predicted to moderate the relationships between imagery types and functions, but no such moderation effects were found in this study. Also note that all imagery types were seen as to some extent effective for serving each function, but only the most effective types for each function are illustrated here.

What function(s) an image is serving is therefore dependent on the meaning applied to the image by the athlete (Ahsen, 1984; Martin et al., 1999; Murphy et al., in press). In an attempt to get away from this conceptual quagmire, Murphy et al. proposed the following definitions: *imagery type* is the content of an image (e.g., the visual image of oneself executing a skill), *function* is the reason or purpose why an athlete images (e.g., for skill improvement), and *outcome* is the actual result of the imagery (e.g., enhanced skill performance). When defined in this manner, the items of the SIQ are seen as representing different imagery types. The imagery types could serve one or more functions, but this would be dependent on the meaning applied to the image by the athlete.

In a similar vein, Short et al. (2004) modified the SIQ to allow athletes to indicate not only how frequently they engage in a particular imagery type (the traditional response format for the SIQ), but also to indicate why they did so (function). Athletes chose from five functions that are proposed to be served by the SIQ subscales: to assist the learning and performance of new skills (CS function) or strategies (CG function), or to effect motivation (MS function), confidence (MG-M function), or arousal/anxiety (MG-A function). In accordance with the applied model (Martin et al., 1999), it was found that the imagery types on the whole served their designated functions. But, five items (of 30) were seen as chiefly serving a function other than the one intended and all items were perceived as to some extent serving several functions. In fact, and despite explicit instructions to the contrary, between 14 and 37 participants (5-13% of the sample) circled more than one function for any given SIQ item. Thus, the study indicated that individual differences exist in the imagery type-imagery function relationship, and that athletes may engage in one image for several reasons as well as engaging in several images for a singular reason. As such, these findings contest the applied model's simple rule that "what you see is what you get" and suggest that the SIQ subscales are likely best viewed as imagery types rather than functions. As such, the work by Short et al. (2004) has brought to the imagery literature several important findings regarding imagery conceptualization and measurement. Furthermore, the authors have pointed out several ways that future research may build on their work. For instance, participants should be asked to indicate not only whether they perceive an image to serve a certain function but also the degree to which it does so. Moreover, given that some results emerged based on participant non-compliance with instructions, it was suggested that participants should be able to select more than one function for each image.

Another way of testing the predictions made by the applied model (Martin et al., 1999) would be to examine the degree to which each imagery type is perceived as being *effective* in serving its proposed functions. As far as we are aware, only one published study has examined athletes' perceptions of imagery effectiveness with the SIQ. In that study, Weinberg, Butt, Knight, Burke, and Jackson (2003) added an "effectiveness companion scale" to the SIQ, so that athletes rated each item for both frequency and perceived effectiveness. It was found that athletes who engaged in a certain type of imagery more frequently also found it to be more effective. An examination of the means suggests that the athletes found MG-M imagery to be the most effective type of imagery, but unfortunately, the effectiveness means were not compared statistically. Thus, it remains unknown whether athletes perceive the five types of imagery to differ significantly in effectiveness. Another aspect of Weinberg et al.'s study was the generality of their effectiveness scale. That is, athletes were asked to rate how effective they found each image for enhancing their physical and mental skills *in general*. While this rating of effectiveness provides more information than that provided by the traditional frequency ratings alone, it does not specify what the athletes perceive the imagery to be effective for. If various functions were included, researchers would be able to determine whether differences exist in the effectiveness of different imagery types for serving various specific functions. Notably, Weinberg et al. (2003) did acknowledge that "different aspects of the motivational and cognitive functions of imagery could be attached" (p. 36) to their modified SIQ, in order to yield more detailed findings. As examples, Weinberg et al. suggested asking how effective imagery was in enhancing confidence or in preparing the athlete for competition. Doing so would provide another avenue to evaluate the "what you see is what you get" premise of the applied model (Martin et al., 1999).

Altogether, the primary aim of the present study was to extend the findings of Weinberg et al. (2003) and those of Short et al. (2004) described above. To do so, we investigated the extent to which athletes perceived five frequently researched types of imagery to be effective in serving 10 different commonly described imagery functions. Using 10 functions allowed for a finer level of discrimination than was possible in the previous studies. For example, MG-M imagery has sometimes been described as affecting both self-confidence and focus (e.g., Hall et al., 1998; Martin et al., 1999). These are fairly distinct aims, and we therefore chose to keep them separate. In all, our 10 functions included skill learning and development, skill execution and performance enhancement, strategy learning and development, strategy execution, enhancing motivation, regulating stress and arousal, getting psyched up, calming down, gaining or maintaining confidence, and staying focused. These were derived from the imagery literature with particular emphasis on the qualitative work by Munroe, Giacobbi, Hall, and Weinberg (2000) that contains a thorough description of why and what athletes' image. To avoid attaching 10 functions to each of the 30 items of the SIQ (i.e., resulting in 300 ratings, which would likely lead to participant fatigue), we chose to summarize each of the five imagery types into simple statements such that "CS-type" imagery was described as "imagery of specific sport skills," and so on (see Table 1 for details). Note, therefore, that we are using a slightly different method for examining the relationship between imagery type and function than used previously by Short et al.

Several variables have been proposed as capable of influencing the effectiveness of athletes' imagery, including their ability to generate images and the visual perspective adopted (for a review see Murphy et al., in press). In fact, another tenet of the applied model is that imagery ability may moderate the relationship between imagery usage and its associated outcomes (Martin et al., 1999). To date, only two studies have examined whether this is indeed the case (Cumming, in press; Gregg, Nederhof, & Hall, 2005). Gregg et al. investigated whether imagery ability moderated the association between imagery frequency and track and field performance. Neither imagery frequency nor imagery ability was found to predict performance, and consequently,

#### S. M. Nordin, J. Cumming

no moderation effects could be found. However, track and field performance across a season is a complex variable to measure, which may have impacted the result. By comparison, Cumming (in press) found that regular exercisers' abilities to create appearance-health images moderated the relationship between imagery frequency and leisure-time exercise, coping efficacy, and scheduling efficacy. Given the limited and somewhat equivocal research done to date, therefore, we investigated whether athletes' imagery abilities may moderate the relationship between the frequency of a particular imagery type and the effectiveness of that imagery type in serving a specific function as measured by the SIQ. As noted above, Weinberg et al. (2003) found positive and significant correlations between imagery frequency and effectiveness when calculated by imagery type, suggesting that the effectiveness of a particular imagery type can be predicted by its frequency. By designing our study to measure how effective each imagery type was perceived to be for a range of specific functions, it afforded us the possibility to investigate the proposal that imagery ability is a moderator variable in a much more specific manner. Commonly used measures of imagery ability are limited to images of specific movements and do not capture the full range of images being assessed in the present study (Hall, 2001). Consequently, we followed similar procedures to Cumming (in press) and added two companion rating scales to the SIQ to measure the ease with which athletes visually and kinesthetically imaged each item. This procedure allowed us to then explore whether the ability to image, for example, CS images moderated the relationship between CS frequency and the effectiveness of CS, and so on for each imagery type and function.

A similar idea underpinned our fourth and final purpose, which related to imagery perspective. Given the lack of evidence at the time, imagery perspective was "conspicuously absent from our model" (Martin et al., 1999, p. 260). However, this variable may also be a potential moderator of imagery and its associated functions and outcomes (Hall, 1997). As yet, the only study to examine imagery perspective in relation to the different imagery types is the one carried out by Cumming and Ste-Marie (2001). Following an imagery training program, synchronized skaters were found to increase their CS and CG imagery frequencies to a similar extent, regardless of the perspective taken while imaging. However, no functions or outcomes of imagery were measured in that study, and so it remains unknown whether imagery perspective should be included within the applied model. Therefore, to extend the knowledge in this area, we examined whether perspective could moderate the relationship between imagery frequency and effectiveness.

In sum, the aim of our investigation was to test two predictions of the applied model of imagery use (Martin et al., 1999). First, whether "what you see is what you get" so that CS imagery is seen as most effective for skill-related functions, MG-M imagery as most effective for mastery-related functions, and so on. We did so by exploring imagery effectiveness (see Weinberg et al., 2003) and the imagery type—imagery function relationship (see Short et al., 2004; Short & Short, 2005). Second, we examined whether the relationship between the frequency of a particular type of imagery and the effectiveness with which that imagery type serves a particular function was moderated by either imagery ability (see Gregg et al., 2005) or imagery perspective (Hall, 1997). By including this set of variables into our study design, we were able to explore the relationships between imagery types, functions, effectiveness, and perspective in a more extensive way than has previously been done.

# Method

#### PARTICIPANTS

One hundred and fifty-five athletes (86 females, 69 males) with an average age of 20.69 years (SD = 2.95) participated in the study. The athletes had commenced participation in their sport at 11.80 years of age (SD = 4.97), had accumulated 8.31 years (SD = 5.18) of experience, and spent 3.35 years (SD = 2.81) at their current competitive level (recreational = 30, regional/club = 97, national/international = 25, unreported = 3). They represented 32 different sports with the majority being recruited from soccer (n = 24), trampolining (n = 17), athletics and artistic gymnastics (n = 15 each), and basketball (n = 12). Equal numbers of participants (n = 77 each) were recruited from individual (e.g., gymnastics, swimming) and interactive sports (e.g., soccer, rugby).

#### MATERIALS

Participants were asked to complete a multi-section questionnaire compiled for the purposes of the study. It consisted of five sections, each concerned with either background information, effectiveness ratings, frequency and ease of imaging, or imagery perspective.

Background information. First, participants provided information about their gender, sport type, age when they first began their current sport, number of years participating in current sport, and current age. They also reported their level (recreational, regional/ club, or national/international) and the length of time they had been at that level.

Effectiveness ratings. The second section comprised a chart designed to examine the perceived effectiveness of different imagery types for serving specific functions. Based on the conceptualizations behind the SIQ, the imagery types were specific sport skills (CS type), routines, sections, game plans (CG type), performance outcomes (MS type), mental toughness, focus, confidence, positivism (MG-M type), and emotions and feelings associated with the athletes' sport (MG-A type). Each of the five images was contrasted against 10 functions of imagery that are typically discussed in the literature, and these are listed in Table 1. Participants were asked to rate how effective they perceived each image to be in serving each function, using a Likert scale ranging from 1 (totally ineffective) to 7 (very effective). By doing so, we could identify which function they felt it served most effectively. The internal reliabilities (calculated for each of the five types across 10 functions) ranged from .78-.87.

Frequency and ease of imaging. For section three, participants completed the SIQ (Hall et al., 1998), a 30-item questionnaire that is averaged to form five sub-scales. The typical response format involves participants rating the frequency with which they

			l fir	id is effective fo	r (please put	a number in ei	ach box)			
The image of	Skill learning & development	Skill execution & performance enhancement	Strategy learning & development	Strategy execution	Enhancing motivation	Regulating stress and arousal	Getting psyched up	Calming down	Gaining or maintaining confidence	Staying focused
Specific sport skills (CS)	5.27	5.37	4.34	4.43	4.61	4.45	4.60	4.03	4.97	5.23
	(1.20)	(1.07)	(1.31)	(1.35)	(1.41)	(1.39)	(1.58)	(1.51)	(1.23)	(1.30)
Routines, sections, game plans (CG)	4.51	4.86	5.01	5.01	4.49	4.37	4.39	3.91	4.76	5.05
	(1.33)	(1.20)	(1.32)	(1.30)	(1.41)	(1.44)	(1.59)	(1.56)	(1.51)	(1.48)
Performance outcomes (MS)	4.27	4.79	4.33	4.48	5.33	4.53	5.21	3.77	5.21	4.99
	(1.59)	(1.41)	(1.37)	(1.50)	(1.39)	(1.31)	(1.36)	(1.40)	(1.38)	(1.52)
Mental toughness, focus,	4.42	4. <i>57</i>	4.34	4.48	5.30	5.17	5.53	4.47	5.53	5.58
confidence, positivism (MG-M)	(1.50)	(1.54)	(1.46)	(1.46)	(1.31)	(1.32)	(1.31)	(1.55)	(1.34)	(1.35)
Emotions and feelings associated with my sport (MG-A)	3.95	4.09	3.99	4.18	5.23	4.83	5.35	4.40	5.01	4.93
	(1.51)	(1.48)	(1.45)	(1.50)	(1.34)	(1.42)	(1.30)	(1.55)	(1.36)	(1.37)

 Table 1. The Effectiveness Chart: Imagery Types, Functions, and their Associated Effectiveness Ratings (Means and Standard Deviations)

Note. Responses were made by athletes on a Likert scale that ranged from 1 (totally ineffective) to 7 (very effective)

engage in different images on a Likert-type scale from 1 (rarely) to 7 (often). The SIQ has previously been shown to have adequate psychometric properties (Hall et al., 1998), and internal reliabilities for frequency in the present study ranged from .78-.85. In a similar manner to Cumming (in press), two companion rating scales were added to assess the relative ease or difficulty with which participants felt able to engage in the images described in the SIQ. Visual and kinesthetic imagery abilities were assessed separately, with participants rating each SIQ item from 1 (very hard to see) to 7 (very easy to see) and from 1 (very hard to feel) to 7 (very easy to feel). Internal reliabilities for visual imagery ability ranged from .82.-.88 and from .80-.86 for kinesthetic imagery ability.

Imagery perspective. Finally, participants were asked about their imagery perspective via a single question. An external perspective was described as "seeing yourself from an outside view (i.e., as if watching yourself on video)" while an internal perspective was described as "seeing yourself from an inside view (i.e., as if you are actually inside yourself)." Ratings were given on a 10-point Likert scale, ranging from 1 (completely inside) to 10 (completely outside), as was first done by Cumming and Ste-Marie (2001).

#### PROCEDURE

The study first received approval from the appropriate ethics review board, and thereafter participants were recruited via sports clubs, personal contacts, and leisure center classes. When first approached by the researcher, they were given a brief verbal introduction to the study and an information letter. It was explained that participation was voluntary, and all volunteers then provided informed consent. Questionnaire completion required approximately 20-25 minutes.

# RESULTS

#### EFFECTIVENESS - IS "WHAT YOU SEE WHAT YOU GET?"

Means and standard deviations were first calculated for each imagery type and for each function from the effectiveness rating chart (see Table 1). To examine which type(s) of imagery were considered most effective for any particular function, we calculated a series of 10 two-way repeated measures ANOVAs. Basic tests for normality were performed and found to be acceptable. A separate analysis was performed for each of the 10 functions, with effectiveness scores for the five imagery types (CS, CG, MS, MG-M, and MG-A) entered as the independent variable with repeated measures. To avoid Type I error, the alpha level was adjusted (p < .005). Note that these analyses are not traditional repeated measures analyses, but they are simply a way of concurrently comparing several means while avoiding inflating Type I error and allowing for the inclusion of between-participant variables. Indeed, because Weinberg et al. (2003) found some differences in effectiveness ratings by gender and sport type, we included these as independent, between-participant variables. Where a significant multivariate effect was found, tests of main effects specified the means that differed significantly from each other. Unfortunately, the analyses were underpowered (< 80%) to detect any interactions between imagery type and either gender or sport type. For this reason, the descriptive results presented in Table 1 are for the sample as a whole, where the observed power was high (99% to 100%). Main findings are further illustrated and compared to the predictions from the applied model (Martin et al., 1999) in Figure 1.

A significant multivariate effect was found for the purpose of skill learning and development, Pillai's trace = .42, F(4, 141) = 25.17, p < .005,  $\eta^2 = .42$ . Tests of main effects indicated that CS imagery was deemed most effective for skill learning and development. CG and MG-M were also found to be more effective than MG-A. A similar result emerged for skill execution and performance enhancement, Pillai's trace = .41, F(4, 142) = 24.64, p < .005,  $\eta^2 = .41$ , with CS imagery being judged as most effective. Additionally, CG, MS, and MG-M imagery were seen as more effective for enhancing skill execution and performance than MG-A.

For strategy learning and development, a multivariate effect was found, Pillai's trace = .28, F(4, 142) = 13.82, p < .005,  $\eta^2 = .28$ , with CG imagery being identified as the most effective. CS, MS, and MG-M imagery were also seen as more effective than MG-A imagery for this function. This result mirrored that for strategy execution, Pillai's trace = .21, F(4, 142) = 9.56, p < .005,  $\eta^2 = .21$ , for which CG imagery was again deemed superior to the other types. No other types differed from one another concerning strategy execution effectiveness.

Another multivariate effect was found for the function of enhancing motivation, Pillai's trace = .26, F (4, 142) = 12.55, p < .005,  $\eta^2 = .26$ . To this end, MS, MG-M, and MG-A were all seen as superior to CS and CG but did not differ from each other. For regulating stress and arousal, MG-M was superior to CS, CG, and MS: Pillai's trace = .23, F (4, 141) = 10.54, p < .005,  $\eta^2 = .23$ . MG-A was seen as more effective than CG.

For getting psyched up, Pillai's trace = .33, F(4, 142) = 17.20, p < .005,  $\eta^2 = .33$ , the athletes perceived MS, MG-M, and MG-A imagery to be more effective than CS and CG. By comparison, for the function of calming down, Pillai's trace = .20, F(4, 142) = 9.04, p < .005,  $\eta^2 = .20$ , MG-M was perceived as more effective than CS, CG, and MS, while MG-A was superior to MS only.

For gaining or maintaining confidence, Pillai's trace = .22, F (4, 142) = 9.79, p < .005,  $\eta^2 = .22$ , MG-M was rated as more effective than all other types. Moreover, MS was seen as superior to CG imagery. Finally, for staying focused, Pillai's trace = .23, F (4, 142) = 10.32, p < .005,  $\eta^2 = .23$ , MG-M was again perceived to be more effective than other imagery types. No other findings reached significance with regards to staying focused.

#### CHARACTERISTICS OF IMAGERY TYPES

Frequency. Means and standard deviations for the five subscales of the SIQ were calculated along the dimension of frequency. Thereafter, a repeated measures two-way ANOVA examined whether the five imagery types differed in frequency ratings. Gender and sport type (individual versus team sport) were again included as independent, between-participant variables. Similar to the above analyses, however, the observed power was only sufficient when examining the sample as a whole. For imagery frequency, a multivariate effect was found for imagery type, Pillai's trace = .46, F (4, 147) = 31.57, p < .025,  $\eta^2$  = .46. The associated tests of main effects indicated that MG-M imagery was the most frequent (M = 4.73, SD = 1.25), while MS was the least frequent (M =3.83, SD = 1.28). Moreover, the athletes reported engaging in CS images (M = 4.53, SD = 1.19) more frequently than CG (M = 4.29, SD = 1.19) and MG-A (M = 4.24, SD = 1.17) with these latter two means not differing from one another.

Ease of seeing and feeling. To explore the role of imagery ability, another set of analyses were conducted. A paired-samples t-test revealed that when imagery types were collapsed together, athletes had slightly higher visual (M = 4.66, SD = .95) than kinesthetic (M = 4.46, SD = .93) imagery abilities, t(154) = 4.26, p < .001. Thereafter, two repeated measures ANOVAs were conducted. The aim of these ANOVAs was to see whether athletes perceived the imagery types to differ in how easy or difficult they were to image, both visually and kinesthetically. To reduce the risk for Type I error, we adopted a Bonferroni correction (p < .025). No theoretical rationale existed for including gender or sport type in these analyses, and the ANOVAs were consequently performed without between-participant factors. A significant multivariate effect was found for ease of seeing, Pillai's trace = .25, F(4, 151) = 12.27, p < .025,  $\eta^2 = .25$ . MG-M (M = 4.91, SD = 1.14) and CS (M = 4.78, SD = 1.19) were perceived to be more easily visualized than MG-A (M = 4.58, SD = 1.12), CG (M = 4.55, SD = 1.19), and MS (M = 4.49, SD = 1.24). In a similar fashion, a main effect was found for ease of feeling, Pillai's trace = .45, F (4, 151) = 30.78, p < .025,  $\eta^2$  = .45. Athletes perceived MG-A (M = 4.86, SD = 1.09) and MG-M (M = 4.71, SD = 1.17) images to be easier to feel than CS (M = 4.34, SD = 1.15), MS (M = 4.22, SD = 1.22), or CG (M = 4.16, SD = 1.13). Also, CS was rated easier to feel than CG.

Perspective. For imagery perspective, the average rating was 4.79 (SD = 2.53) and the range of scores spanned the full Likert scale from 1 to 10. Six participants did not provide this information, and were not included in the subsequent analyses.

#### **MODERATION EFFECTS**

Our second aim was to examine possible moderators of the imagery frequency effectiveness relationship. To do so, we first computed a correlation matrix to explore the associations between the various variables. For simplicity, average scores were computed for the various imagery characteristics collapsed across the subscales of the SIQ for frequency and ease of imaging and collapsed across imagery type and function as measured in the chart for effectiveness. As may be seen in Table 2, correlations between imagery effectiveness, frequency, and ease of seeing and feeling were generally positive, significant, and moderate-to-large in size.

We next examined whether imagery ability (visual or kinesthetic) could act as a moderator variable between imagery frequency and effectiveness. Like Gregg et al. (2005), we followed Baron and Kenny's (1986) recommendations and regressed

	Effectiveness	Frequency	Ease of seeing	Ease of feeling
Frequency	.524*			
Ease of seeing	.455*	.775*		
Ease of feeling	.473*	.728*	.799*	
Perspective	.077	.083	.133	.002

**Table 2.** Correlations among Perceived Effectiveness, Frequency, Ease of Seeing,Ease of Feeling, and Perspective

Note. \* = correlation significant at the 0.01 level.

effectiveness data on imagery frequency, ability, and the product of imagery frequency and ability. The data were first centered (i.e., each score was subtracted from its subscale mean) in accordance with the guidelines advocated by Aiken and West (1991). Also similar to Gregg et al. (2005), however, the product variables did not significantly predict effectiveness in any of the analyses, indicating that no moderation effects were found. As noted in the introduction, it is conceivable that this could be due to using the grand mean of these variables. Thus, we also conducted more specific calculations by imagery type to illuminate any moderation of the frequency-effectiveness relationship. Each imagery type (CS, CG, MS, MG-M, and MG-A) was considered separately for each of its main functions as listed in Table 1. Consequently, regressions for CS were performed with skill learning and skill execution, regressions for CG were performed with strategy learning and strategy execution, and so forth. Separate regressions were conducted for visual and kinesthetic imagery abilities as potential moderators. Given the large number of analyses, probability levels were set at .01 to avoid inflating the risk for Type I error. No significant effects were identified for any of the product variables (i.e., frequency x ability interaction terms) in any of the analyses. Again, then, no moderation effects were found, suggesting that imagery ability does not moderate the impact of imagery frequency on imagery effectiveness, at least when the variables are measured in this manner.

As indicated in Table 2, no correlation existed between imagery perspective and effectiveness, nor between perspective and frequency. Thus, our intention to examine whether perspective could act as a moderating variable between imagery frequency and effectiveness was not acted upon.

#### DISCUSSION

The primary purpose of this study was to examine athletes' perceptions of imagery effectiveness, ability, and perspective as well as the more commonly assessed imagery characteristic of frequency. In the process, we examined two predictions arising from Martin et al.'s (1999) applied model of imagery use in sport: whether imagery types and functions can be straightforwardly matched so that "what you see is what you get," and whether imagery ability and perspective moderate the relationship between

imagery frequency and effectiveness. When asking athletes about the degree to which they perceived the five imagery types to be effective in serving a range of 10 functions, the predictions from the applied model were accurate with regards to the coanitive types of imagery (CS and CG). Specifically, CS was rated as the most effective type for skill learning and development and for skill execution and performance enhancement. CG was deemed most effective for strategy learning and development and for strategy execution. Thus, it appears that as far as CS and CG are concerned, "what you see really is what you get." For the motivational imagery types (MS, MG-M, and MG-A), the results were less concordant with the applied models' predictions. In the model, MS is proposed to be the imagery type most useful for enhancing motivation. By contrast, our results suggested that MS, MG-M, and MG-A were all perceived to be equally effective for this function. The model further predicts that MG-A should be most useful for regulating stress and arousal, psyching up and calming down, while our results found MG-A and MG-M to be statistically indistinguishable (although MG-M yielded the highest mean score in both instances). MG-M continued to yield the highest mean scores for the functions of gaining or maintaining confidence and for staying focused, which is in agreement with the models' predictions. Thus, it appeared that our athletes perceived MG-M to be the most effective imagery type in general and across specific functions, at least with regards to what the applied model labels 'motivational functions' (Martin et al., 1999). This result is similar to those of Weinberg et al. (2003), although their findings were inferred simply by inspecting mean ratings and not compared statistically.

Our findings also extend those of Short et al. (2004). A limitation of their study was that their participants were instructed to indicate only one function for each imagery type. By instructing our participants to rate each imagery type according to its effectiveness in serving 10 different functions, we were able to demonstrate more conclusively that athletes indeed engage in one type of imagery for a variety of purposes (functions), as well as in several imagery types for a single purpose. Based on these findings as well as previous literature (Abma et al., 2002; Callow & Hardy, 2001; Calmels et al., 2003; Evans et al., 2004; Fish et al., 2004; Nordin & Cumming, 2005a, 2005b; Short & Short, 2005; Short et al., 2002; Short et al., 2004), we therefore disagree with the claim that "what you see is what you get," at least with regards to the motivational types of imagery. Accordingly, we would like to echo the recommendation from Short et al. (2004) that "image function should be verified with the participants to ensure that imagery interventions are consistent with one's research or intervention goals," (p. 348). It is also encouraging to note that imaging oneself being mentally tough, focused, confident, and positive (MG-M) appears to be effective for a multitude of reasons. Thus, from an applied perspective it seems worthwhile to build such content into any imagery intervention.

As well as being perceived to be the most effective for many functions (on the chart), MG-M was also the most frequent (according to SIQ data). Correspondingly, the correlation between frequency and effectiveness was high and positive, suggesting that athletes who image more often also find it more effective. Again, this replicates the results of Weinberg et al. (2003). It is worth pointing out that while our frequency —effectiveness correlation was a moderate .52, those obtained by Weinberg et al. (2003) range from .78-.84. It is likely that this discrepancy is a consequence of the measurement tools used; we employed different measures for frequency and effectiveness (i.e., chart and SIQ) while Weinberg et al. used the SIQ to capture both. Given the above mentioned finding that MG-M can effectively serve a range of functions, it is encouraging to note that athletes have reported MG-M as the most frequent imagery type not only in our study but in a large number of imagery investigations before us (for a review see Murphy et al., in press).

On the opposite side of the spectrum, our participants reported the lowest frequency scores for MS imagery. Again this resembles several previous investigations (Abma et al., 2002; Fish et al., 2004; Gregg et al., 2005; Short et al., 2004; Short & Short, 2005; Weinberg et al., 2003). It also complements Nordin, Cumming, Vincent, and McGrory's (2006) finding that athletes find MS (and MG-A) to be less relevant to performance improvement than CS, CG, or MG-M. It is possible that the specific wording of the items on the MS subscale of the SIQ contribute to such results rather than imaging goals and goal-oriented responses necessarily being unimportant. Nevertheless, it does suggest that sport psychologists should be careful when encouraging athletes to image themselves being interviewed or congratulated as champions (i.e., encourage the use of MS-type images from the SIQ) because these images may not be viewed as serving a useful purpose. Future research is required to establish whether imaging less outcome-oriented goals, which are not captured by the SIQ, is deemed more relevant and useful by athletes.

With regards to imagery ability, our study was the first to consider whether athletes perceived the five types of imagery to differ in the ease with which they could be imaged either visually or kinesthetically. MG-M and CS images were seen as easier to visually image than CG, MS, and MG-A, and MG-A and MG-M images were easier to kinesthetically image than CS, CG, or MS. Given that imagery ability is likely related to imagery frequency in a circular fashion (e.g., Cumming & Ste-Marie, 2001; Greag et al., 2005; Vadocz, Hall, & Moritz, 1997), it is possible that variations in the perceived ease of 'seeing' and 'feeling' different types of imagery result in part from their relative frequencies. Indeed, the high correlations between frequency and ability support such an interpretation (see Table 2). But the correlations are not perfect, and particularly the ease with which MG-A was imaged kinesthetically does not mirror its relatively lower frequency rating. So if MG-A images are not very frequently engaged in, what could explain their relative ease to image kinesthetically? The results of Nordin et al. (2006) provide some ideas on this point. Specifically, that study suggests that MG-A imagery, alongside MS, is engaged in less deliberately than other imagery types. As noted above, these particular types were also seen as less relevant to performance enhancement than other types. When these results are considered in combination with the present findings, it seems that images described on the MG-A subscale are perhaps not the kind we want to encourage athletes to use because they are not perceived as being particularly effective or relevant. Instead, these images might be intrusive and even debilitative (see Nordin et al., 2006). For instance, imaging the stress and anxiety associated with one's sport might well not be deliberate or facilitative. Although the MG-A subscale has not produced consistent correlates across investigations, some studies have found that it is positively associated with competitive anxiety (Monsma & Overby, 2004; Vadocz et al., 1997). Of course, anxiety is not always debilitative to the athlete and further work is required to verify this point, but we suggest that caution is warranted with regards to recommending athletes to engage in the images on the MG-A subscale. Similar to our discussion for MS, this is not to suggest that images of arousal are always worthless or bad, but simply that the specific wording of MG-A items on the SIQ seem to have less than ideal connotations for many athletes. Future researchers may also wish to examine a wider range of imagery types (e.g., imagery of goals) and functions (e.g., imagery for mental toughness) than was done here, which would enable better recommendations to be made for which imagery types are most useful for a given purpose.

We also examined whether visual or kinesthetic imagery ability could act as a moderator between imagery frequency and effectiveness. Like Cumming (in press), we investigated moderation effects for five imagery types and each of 10 functions. Despite this level of specificity, no significant moderation effects were found. Instead, our results were more similar to those of Gregg et al. (2005), who also reported no interaction between ability and frequency when predicting performance of track and field athletes. Consequently, our data suggests that imagery ability does not moderate the impact of frequency on perceptions of effectiveness. In other words, an increased frequency of imaging will likely lead to increased perceptions of effectiveness, regardless of how proficient athletes are at "seeing" or "feeling" images in their minds. Alternatively, increased perceptions of effectiveness may lead to increased imagery frequency, again regardless of imagery ability.

Imagery perspective was also not found to moderate the relationship between frequency and effectiveness. Indeed, no correlation existed between perspective and any of the other imagery characteristics, including frequency, effectiveness, or ability. Of course, we only measured perceptions of effectiveness, and so the possibility that objective outcomes (e.g., jump length, running speed) of imagery are moderated by imagery ability or perspective still remains. Yet, our results do concur with those of Cumming and Ste-Marie (2001), who found that imagery perspective did not impact the degree to which athletes increased their cognitive imagery frequencies. Altogether, it seems that the search for moderators of the imagery type-function/outcome relationship continues. Our null findings, however, do contribute to the literature by suggesting that more frequent imagery might lead to more effective imaging, regardless of the level of imagery ability or the imagery perspective taken.

Imagery ability and perspective aside, two other characteristics that have been suggested to impact the imagery type-function relationship or imagery effectiveness are gender and sport type (Martin et al., 1999; Short et al., 2004; Weinberg et al., 2003). Unfortunately, problems with observed power precluded us from examining whether these variables impacted athlete perceptions of various imagery characteristics. The inability to do so is a limitation of our work. Similarly, the applied model (Martin et al., 1999) asserts that imagery might differ between training and competition, but comparing situations was beyond the scope of our study. Additionally, it should be recognized that the chart used to examine effectiveness does not have established psychometric properties. However, this is also the case for our comparison studies (Short et al., 2004; Weinberg et al., 2003), who also created study-specific instruments. While the fact that others have used a particular methodology in the past does not in and of itself make it justified, it is clear that these studies have contributed intriguing and important findings to the literature. It is our hope that we, too, have been able to make some contribution to the debate. Future research is required to establish whether the various amendments that we and our colleagues have done to the SIQ represent a valuable enough contribution to the literature to warrant better psychometric assessment.

A more conceptual shortcoming of our study concerns our measurement of imagery ability. It was intended that by asking participants to rate each SIQ item according to how easy or difficult they found it to 'see' and 'feel,' we would obtain visual and kinesthetic imagery abilities for five imagery types (and not just for movement imagery, as is typically done in studies of this kind). However, by asking about 'feel,' we may have confounded kinesthetic imagery abilities with the ease of imaging emotions and arousal. This is pertinent to MG-M and MG-A items, which describe emotive situations and feelings but is unlikely to present a problem as regards CS, CG, and MS imagery. Additionally, the recent work of Cumming (in press) demonstrated the value in measuring imagery ability in such a specific way; not least by establishing that exercisers who image their health and appearance more frequently and find such images easier to see and feel also typically exercise more. Our study is the first to find that athletes, too, report their imagery abilities for different imagery types to vary. More generally, the strength of the present investigation was to examine a wider range of characteristics than is typically done in quantitative imagery investigations. In doing so, we also tested the replicability of several previous findings (Gregg et al., 2005; Short et al., 2004; Weinberg et al., 2003) and the validity of two predictions from the applied model of imagery use (Martin et al., 1999). The study further contributes to the literature by highlighting some potential shortcomings of the SIQ, which could not have been demonstrated by simply using the questionnaire in its intended format.

Altogether, the present investigation has demonstrated that vast individual differences exist in athletes' perceptions of various imagery characteristics. Our results should therefore not be taken as 'truths' but only as an indication that a particular imagery type is not always best for a given function. When generalizing is required, however, it can be made in line with the applied model for cognitive imagery types. By contrast, it appears that caution is required before recommending athletes to use MG-A imagery, while MG-M might be usefully employed for a range of motivational purposes and could thus be recommended more widely. In all cases, individual differences should be taken into account as far as is feasible. As such, we do believe that Martin et al. (1999) were right in stating that the meaning of an image to an athlete is crucial. Therefore, it is regrettable that meaning found no explicit home in their model. It is possible that the new model proposed by Murphy et al. (in press), where meaning is included, will be helpful in aiding future research that could better account for this seemingly so important yet frequently ignored concept.

#### References

- Abma, C. L., Fry, M. D., Li, Y., & Relyea, G. (2002). Differences in imagery content and imagery ability between high and low confident track and field athletes. *Journal of Applied Sport Psychology*, 14, 67-75.
- Ahsen, A. (1984). ISM: The triple code model for imagery and psychophysiology. Journal of Mental Imagery, 8, 15-42.
- Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Thousand Oaks, CA: Sage Publications.
- Baron, R., & Kenny D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Callow, N., & Hardy, L. (2001). Types of imagery associated with sport confidence in netball players of varying skill levels. *Journal of Applied Sport Psychology*, 13, 1-17.
- Calmels, C., D'Arripe-Longueville, F., Fournier, J. F., & Soulard, A. (2003). Competitive strategies among elite female gymnasts: An exploration of the relative influence of psychological skills training and natural learning experiences. International *Journal of Sport and Exercise Psychol*ogy, 1, 327-352.
- Cumming, J. (in press). Investigating the relationship between exercise imagery, leisure-time exercise behavior, and self-efficacy. *Journal of Applied Sport Psychology*.
- Cumming, J. L., & Ste-Marie, D. M. (2001). The cognitive and motivational effects of imagery training: A matter of perspective. *The Sport Psychologist*, 15, 276-288.
- Evans, L., Jones, L., & Mullen, R. (2004). An imagery intervention during the competitive season with an elite rugby union player. *The Sport Psychologist*, *18*, 252-271.
- Fish, L., Hall, C., & Cumming, J. (2004). Investigating the use of imagery by elite ballet dancers. AVANTE, 10(3), 26-39.
- Gregg, M., Nederhof, E., & Hall, C. (2005). The imagery ability, imagery use and performance relationship. The Sport Psychologist, 19, 93-99.
- Hall, C. R. (1997). Lew Hardy's third myth: A matter of perspective. *Journal of Applied Sport Psychology*, 9, 310-313.
- Hall, C. R. (2001). Imagery in sport and exercise. In R. Singer, H. Hausenblas, & C. Janelle (Eds.), Handbook of research in sport psychology (2nd ed., pp. 529-549). New York: John Wiley & Sons.
- Hall, C. R., Mack, D. E., Paivio., A., & Hausenblas, H. A. (1998). Imagery use by athletes: Development of the Sport Imagery Questionnaire. *International Journal of Sport Psychology, 29*, 73-89.
- Martin, K. A., Moritz, S. E., & Hall, C. R. (1999). Imagery use in sport: A literature review and applied model. *The Sport Psychologist, 13,* 245-268.
- Monsma, E. V., & Overby, L. Y. (2004). The relationship between imagery and competitive anxiety in ballet auditions. *Journal of Dance Medicine and Science*, 8(1), 11-18.
- Munroe, K. J., Giacobbi, P. R. Jr., Hall, C., & Weinberg, R. (2000). The four Ws of imagery use: Where, when, why, and what. *The Sport Psychologist, 14,* 119-137.
- Murphy, S. M., Nordin, S. M., & Cumming, J. (in press). Imagery in sport, exercise, and dance. In T. Horn (Ed.), Advances in sport psychology (3rd ed). Champaign, IL: Human Kinetics.
- Nordin, S. M., & Cumming, J. (2005a). More than meets the eye: Investigating imagery type, direction, and outcome. The Sport Psychologist, 19, 1-17.
- Nordin, S. M., & Cumming, J. (2005b). Professional dancers describe their imagery: Where, when, what, why, and how. *The Sport Psychologist, 19,* 395-416.
- Nordin, S. M., Cumming, J., Vincent, J., & McGrory, S. (2006). Mental practice or spontaneous play? Examining which types of imagery constitute deliberate practice in sport. *Journal of Applied Sport Psychology*, 18, 345-362.
- Paivio, A. (1985). Cognitive and motivational functions of imagery in human performance. Canadian Journal of Applied Sport Sciences, 10, 22s-28s.

- Short, S. E., Bruggeman, J. M., Engel, S. G., Marback, T. L., Wang, L. J., Willadsen, A. et al. (2002). The effect of imagery function and imagery direction on self-efficacy and performance on a golf-putting task. *The Sport Psychologist*, 16, 48-67.
- Short, S. E., Monsma, E. V., & Short, M. (2004). Is what you see really what you get? Athletes' perceptions of imagery's functions. The Sport Psychologist, 18, 341-349.
- Short, S. E., & Short, M. W. (2005). Differences between high- and low-confident football players on imagery functions: A consideration of the athletes' perceptions. *Journal of Applied Sport Psychology*, 17, 197-208.
- Vadocz, E. A., Hall, C. R., & Moritz, S. E. (1997). The relationship between competitive anxiety and imagery use. *Journal of Applied Sport Psychology*, 9, 241-253.
- Weinberg, R., Butt, J., Knight, B., Burke, K. L., & Jackson, A. (2003). The relationship between the use and effectiveness of imagery: An exploratory investigation. *Journal of Applied Sport Psychology*, 15, 26-40.

Copyright of International Journal of Sport & Exercise Psychology is the property of Fitness Information Technology, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.