Self-Reported Psychological States and Physiological Responses to Different Types of Motivational General Imagery

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The aim of the present study was to examine self-reported psychological states and physiological responses (heart rate) experienced during different motivational general imagery scenarios. Forty competitive athletes wore a standard heart rate monitor and imaged five scripts (mastery, coping, anxiety, psyching up, and relaxation). Following each script, they reported their state anxiety and self-confidence. A significant increase in heart rate from baseline to imagery was found for the anxiety, psyching-up, and coping imagery scripts. Furthermore, the intensity of cognitive and somatic anxiety was greater and perceived as being more debilitating following the anxiety imagery script. The findings support Lang’s (1977, 1979) proposal that images containing response propositions will produce a physiological response (i.e., increase heart rate). Moreover, coping imagery enabled the athletes to simultaneously experience elevated levels of anxiety intensity and thoughts and feelings they perceived as helpful.

Key Words: motivation, psychology, sport psychology

Advancements in the measurement of competitive anxiety over the last decade have reinforced the importance of considering the interpretations that athletes have of their competitive anxiety symptoms (e.g., Jones, 1995). Elite athletes have been shown to interpret symptoms associated with precompetition anxiety as more facilitative than lower level or less successful athletes despite no difference found in the intensity of symptoms experienced (e.g., Hanton, Thomas, & Maynard, 2004; Jones, Hanton, & Swain, 1994; Jones & Swain, 1995). Because elevated levels of anxiety are not necessarily debilitating to an athlete’s performance, traditional anxiety reduction strategies (e.g., deep breathing) may inadvertently diminish activation levels below optimal levels for the performer (Hanton & Jones, 1999a; Hardy, Jones, & Gould, 1996). Consequently, research has shifted focus from investigating methods of lowering anxiety to identifying strategies that can be used by athletes to develop facilitative interpretations of symptoms associated with their precompetition anxiety.

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Considerable qualitative research has identified imagery as one such strategy that aids athletes to overcome negative symptoms and reappraise them as controllable and facilitative to performance (e.g., Hanton & Jones, 1999a; Hanton, Mellalieu, & Hall, 2004). For example, elite performers interviewed by Hanton et al. described how imagery enabled them to maintain a positive outlook and interpret symptoms experienced in a positive manner. Quantitative studies have also begun to explore the extent to which imagery is useful in this regard (e.g., Hale & Whitehouse, 1998; Hanton & Jones, 1999b; Jones & Uphill, 2004). For example, Hale and Whitehouse asked soccer players to imagine taking a potentially game-winning penalty kick with either a “pressure” or “challenge” appraisal emphasis. Those participants in the challenge situation reported their anxiety symptoms to be more facilitative than participants in the pressure situation. Furthermore, Hanton and Jones (1999b) included imagery as one component in a mental skills intervention that enabled competitive swimmers to view their anxiety symptoms as more facilitative and demonstrate improvements to performance.

Additional rationale for using imagery to modify directional perceptions of competitive anxiety symptoms can be found in Lang’s (1977, 1979) bioinformational theory. This theory describes imagery as a cognitive schema made up from different units of information (also called propositions). Each emotional image contains stimulus propositions, response propositions, and meaning propositions. Stimulus propositions are information concerning external stimuli and the context in which they occur (e.g., details about the competitive venue). Response propositions describe the physiological responses of an individual to the stimuli in that scene (e.g., increased heart rate) and represent how they would react in the real-life situation. Finally, meaning propositions elaborate on the relationships between the stimuli and response propositions, and describe the perceived importance of the imagined scene to the individual. For example, imaging the atmosphere of a competition might be considered anxiety producing for one athlete and energizing for another. Previous studies have demonstrated that different interpretations of the same imagery content can occur, and these interpretations will have a subsequent effect on athletes’ perceptions of the symptoms associated with competitive anxiety (Hale & Whitehouse, 1998; Jones & Uphill, 2004).

Of the three sources of imagery information, response propositions have been of particular interest to researchers because they are coded in the brain as motor output (Lang, 1977). When these propositions are activated in memory, an actual physiological response is produced that is measurable through concurrent physiological recordings. Lang believes that this phenomenon, termed efferent leakage, provides a vehicle for modifying behavior. That is, imagery allows individuals to develop a new response to stimuli that previously evoked the behavior designated to be changed. It is therefore possible for athletes to change their maladaptive responses to the competitive environment (e.g., debilitating competitive anxiety) by provoking the stimulus situation in a vivid, emotional image. The athlete would then replace their typical reaction with a more adaptive response, and consequently begin to view symptoms associated with competitive anxiety as being more facilitative toward their performance.

The tenets of bioinformational theory have been well supported in the clinical psychological literature, with studies examining the use of imagery for aiding
individuals to handle their fears and phobias (e.g., Cuthbert et al., 2003). In sport, it has gained recent attention as a theoretical perspective that may help explain the effects that imagery might have on regulating anxiety and arousal (Martin, Moritz, & Hall, 1999). Activating response information during imagery of emotional sport scenes, for example, has resulted in measurable physiological changes (Gallego, Denot-Ledunois, Vardon, & Perruchet, 1996; Hecker & Kaczor, 1988). Furthermore, athletes who image the arousal associated with competing are more likely to report higher levels of state anxiety intensity (Monsma & Overby, 2004; Murphy, Woolfolk, & Budney, 1988; Vadocz, Hall, & Moritz, 1997). By contrast, images designed to help individuals experience performance in a relaxed and calm state have been associated with decreased levels of state anxiety intensity (Murphy & Woolfolk, 1987). Together, this range of images relating to arousal and anxiety are classed as serving a motivational general arousal (MGA) functional role for athletes (Hall, Mack, Paivio, & Hausenblas, 1998). Within their applied model of imagery use, Martin et al. suggested that MGA imagery would enable athletes to modify undesirable arousal levels in stressful situations by activating response propositions. For example, an athlete who is feeling sluggish and lethargic before the start of a competition might psych themselves up by imaging how their body should ideally respond.

Motivational general arousal imagery is not necessarily suitable, however, for athletes whose anxiety symptoms have already placed them within the ideal activation pattern for optimal performance (Hardy et al., 1996). A more appropriate strategy might then be to raise levels of self-confidence through motivational general mastery imagery (MGM; Hall et al., 1998), which is the imagery function used by athletes to be confident, focused, positive, and mentally tough (Munroe, Giacobbi, Hall, & Weinberg, 2000). It has been consistently found that athletes who use MGM imagery report higher levels of both self-confidence and self-efficacy (for a review, see Martin et al., 1999; Murphy, Nordin, & Cumming, in press). These mastery cognitions will in turn enable athletes to better cope with the demands of the situation (Jones, 1995). Indeed, a robust finding is that athletes who report facilitative interpretations of the symptoms associated with their precompetition anxiety also report higher levels of confidence than counterparts who report more debilitating interpretations (e.g., Jones et al., 1994; Jones & Swain, 1995).

Hanton, Mellalieu, et al. (2004) explained that high levels of self-confidence may “protect against or overrides negative interpretations of anxiety responses by facilitating coping resources (e.g., rationalization of thoughts and feelings) and enabling performers to perceive that they can remain in control in the pressure environment of competition” (pp. 479-480). In support of this proposed mechanism, they found that elite athletes employed imagery to enhance confidence and thereby feel comfortable when experiencing symptoms associated with competitive anxiety. Similarly, Neil, Mellalieu, and Hanton (2006) found that elite athletes report more facilitative interpretations, higher levels of self-confidence, and a greater use of imagery and self-talk than their nonelite counterparts. Finally, Monsma and Overby (2004) found higher levels of pre-audition anxiety and lower levels of confidence in ballet students who used less MGM imagery. Altogether, these results suggest that MGM imagery would protect against debilitating interpretations of symptoms by raising or maintaining high levels of self-confidence. However, this possibility has not yet been directly tested with a quantitative study.
Therefore, the aim of the present study was to compare self-reported psychological states (i.e., state anxiety and self-confidence) and physiological responses (i.e., heart rate) following five types of MGA and MGM imagery: (1) MGA anxiety imagery, (2) MGA psyching-up imagery, (3) MGA relaxing imagery, (4) MGM imagery, and (5) MGA and MGM imagery. Similar to Hecker and Kaczor (1988), the activation of response propositions during imagery was indicated by significant increases in heart rate above baseline levels. The different versions of MGA and MGM imagery were included to help clarify the mechanism through which imagery protects athletes against debilitating interpretations of the symptoms associated with their precompetition anxiety. The MGA anxiety script was intended to examine the effect of imaging anxiety symptoms on actual and self-reported responses, and MGM imagery determined the effect of imaging mastery cognitions on self-confidence and interpretations of anxiety symptoms. The MGA relaxing script was included as a control condition to verify that simply the act of engaging in imagery was not raising heart rate over baseline, and MGA psyching-up imagery helped to replicate previous findings that imagery designed to increase activation levels could be interpreted in different manners depending on the appraisal emphasis (Hale & Whitehouse, 1998; Jones & Uphill, 2004). Finally, the combined MGA and MGM imagery script (i.e., coping imagery) was included to demonstrate whether athletes could experience a psychological state termed confident coping by Jones and Hanton (2001). That is, the athletes would simultaneously experience elevated levels of anxiety intensity and mastery cognitions, which would be interpreted as being facilitative toward performance.

In line with bioinformational theory, it was predicted that increased levels of anxiety symptoms and heart rate would occur for imagery scripts that contained response propositions (MGA anxiety imagery, MGA psyching-up imagery, and coping imagery) compared with those that did not (MGA relaxing imagery and MGM imagery). Consistent with the confidence protective mechanism, athletes were expected to report higher levels of self-confidence and appraise their symptoms as more facilitative following imagery containing mastery cognitions (MGM imagery and coping imagery).

Method

Participants

The 40 participants (21 males, 19 females) were individual sport athletes who competed at the university level and had a mean age of 20.1 years \( (SD = 1.22) \). They averaged 7.91 years \( (SD = 4.40) \) of involvement in their sport (dance, equestrian, golf, judo, rowing, squash = 1 each; tennis = 2; gymnastics = 3; swimming = 4; badminton = 5; athletics = 6; fencing = 14).

Measures

Demographic Information. The participants were requested to provide information regarding their age, gender, sport, and years of experience.
Imagery Ability. The Movement Imagery Questionnaire–Revised (MIQ-R; Hall & Martin, 1997) was employed as a measure of visual and kinesthetic imagery ability. Participants are asked to first physically perform and then visually or kinesthetically image four simple movements. The ease with which they are able to either see or feel the movements is rated on a 7-point Likert scale anchored at 1 (very hard to see or feel) and 7 (very easy to see or feel). The resulting eight items are then averaged to form visual and kinesthetic subscales. The original MIQ (Hall & Pongrac, 1983) has been shown to be a valid and reliable instrument (for a review, see Hall, 1998). The revised version contains fewer items, but correlates highly with the corresponding subscales on the MIQ. In the present study, adequate internal reliabilities were found for both visual (.70) and kinesthetic (.72) imagery ability.

Competitive State Anxiety and Confidence. The Immediate Anxiety Measures Scale (IAMS; Thomas, Hanton, & Jones, 2002) is a three-item self-report questionnaire that asks athletes to indicate the intensity and direction of their cognitive anxiety, somatic anxiety and self-confidence. An important aspect of the IAMS is the written instruction provided to the participants to help them understand and recognize their precompetitive anxiety symptoms. Included in these instructions are “athlete-friendly” definitions and examples of cognitive anxiety (e.g., thoughts and worries), somatic anxiety (e.g., butterflies in the stomach, tense muscles), and self-confidence. Participants are then asked to rate the intensity (1 = not at all, 7 = extensively) and the direction of their symptoms (−3 = very negative, 0 = unimportant, +3 = very positive) on a 7-point Likert scale. Thomas et al. provided evidence that the IAMS accurately measures symptoms associated with precompetition anxiety by reporting strong, positive correlations with corresponding scales on the CSAI-2.

Postimagery Manipulation Check. A nine-item manipulation check was devised for the purposes of the present study to assess participants’ perceptions about their imagery experience. It was based on recommendations made by Murphy and Martin (2002) as well as previously reported manipulation checks (e.g., Cumming, Nordin, Horton, & Reynolds, 2006). Two items assessed the degree to which the imagery script was either arousal producing or confidence building (1 = not at all, 7 = extremely). One item measured the level of emotion produced by the script (1 = no emotion, 7 = strong emotion). One item asked participants to predict how well they would perform in the hypothetical competition (1 = poor, 7 = outstanding). One item asked participants to rate how helpful or hurtful they perceived the imagery to be with regards to their performance in the hypothetical competition. Using the same response format as the MIQ-R, two items assessed the ease with which participants were able to visually and kinesthetically image the script (1 = very hard to see or feel, 7 = very easy to see or feel). Finally, one item measured the vividness and clarity of the imagery (1 = no image at all, 7 = perfectly clear; as good as normal vision).

Heart Rate. A Polar F1 heart rate monitor measured heart rate throughout the study.
**Procedure**

*Development and Pilot Testing of Imagery Scripts.* Seven imagery scripts were developed for the purposes of the present study and initially pilot-tested with four individual sport athletes (see the appendix to this article for a script example). The scripts were initially written based on recommendations made by bioinformational theory and examples available from the literature (e.g., Hanton & Jones, 1999b; Hecker & Kaczor, 1988; Porter, 2003). Slight revisions were then made following recommendations provided by the pilot participants. Two scripts were used for training purposes only and gave participants practice in experiencing differing physiological and emotional responses during their imagery. To ensure that participants were able to image different aspects of MGA imagery, one script described the participants energetically running on a treadmill whereas the other described the participants calmly walking by a gently flowing stream.

Five imagery scripts were used for the main part of the study, and described the immediate moment prior to competing in a hypothetical competition (i.e., the athlete’s warm-up is completed and it is just a couple of minutes before the start of the competition). To make the imagery more meaningful and individualized for each participant, they were next asked to recall a previous competitive experience and to use this event as the basis of each subsequent imagery scene. The memory of this previous competition experience then served as the stimulus information for imaging a relaxation scene (MGA relaxing imagery), a psyching-up scene (MGA psyching-up imagery), a competitive anxiety scene (MGA anxiety imagery), a mastery scene (MGM imagery), and a coping scene (MGA and MGM imagery). All of the scripts contained response information. However, the MGA scripts contained particular reference to somatic response cues whereas the MGM script did not. The MGA relaxation script described participants experiencing low levels of somatic arousal (e.g., breathing deeply, heart rate slowing down). The MGA psyching-up script described participants feeling energetic and revved up for the performance (e.g., heart beating fast, blood pumping through the veins), whereas the MGA anxiety script described participants experiencing common symptoms of competitive anxiety (e.g., heart racing, tight muscles, butterflies in the stomach). The MGM mastery script described the participant being confident, focused, and in control of the situation. Finally, the MGA and MGM coping scripts contained key elements of both the MGA anxiety and MGM mastery scripts. For instance, the scene described the participant feeling confident and in control while experiencing a racing heart rate and other common symptoms of anxiety.

*Recruitment.* The majority of the participants were recruited via ads placed on student notice boards or through personal contacts, and received course credit for their participation. They were requested to attend two 1-hr laboratory sessions with a 24- to 72-hr time lapse between sessions. All participants were tested individually.

*Session 1.* Upon arrival at the laboratory, participants were asked to complete a consent form and demographic information sheet. They were then fitted with a
heart rate monitor to wear for the remainder of the session. Next, the following
definition of imagery was provided to the participants:

Imagery is an experience that mimics real experience. We can be aware of
“seeing” an image, feeling movements as an image, or experiencing an image of
smell, tastes or sounds without experiencing the real thing. Sometimes people
find that it helps to close their eyes. It differs from dreams in that we are awake
and conscious when we form an image. (White & Hardy, 1998, p. 389)

Participants subsequently completed the MIQ-R and CTAI-2. The participants
next completed a series of exercises to make them more aware of stimulus and
response propositions during their imagery. As described by Lang, Kozak, Miller,
Levin, and McLean (1980), this procedure involved drawing the participants’ atten-
tion towards specific stimulus details of the scene as well as encouraging them to
experience relevant physiological and emotional responses during their imagery.

To provide the participants with further practice, they were next presented with
two MGA imagery scripts (energetic running on a treadmill, calmly walking by a
gently flowing stream) that were each 3 min in length. The scripts were preceded
by 2 min in which the participants were requested to breathe deeply and relax
themselves. These instructions helped to establish stable baseline heart rates and
allowed heart rate changes during imagery to be more clearly observed (Lang et al.,
1980). Baseline heart rate was obtained after 90 s. At the end of the baseline phase,
the prerecorded imagery scripts were then played to the participant via headphones
and a CD player. The participants were instructed to image the scripts as vividly
as possible, and to use their preferred imagery perspective (Hall, 1997). Because
response propositions were incorporated throughout the relevant scripts and given
approximately every 10 to 15 s, the heart rate measurements were recorded every
10 s throughout the imagery. At the end of the script, the participants were given
1 min to recover and then a final heart rate was obtained. At the end of this 6-min
period, the participants completed the IAMS and the postimagery manipulation
check. The heart rate and self-reported data collected during Session 1 was purely
for the purpose of acclimatizing the participant to the study methods, and these
data were not included in the analysis.

**Session 2.** The participants were first fitted with a heart rate monitor to wear for
the remainder of the session. They were reminded of the imagery exercises done in
the previous session and were particularly encouraged to focus on physiological and
emotional responses in the upcoming session. The participants were then presented
with five different imagery scripts delivered in a counterbalanced order, and were
instructed to image them as vividly as possible and from their preferred imagery
perspective. In a format identical to that used in the first session, the scripts were pre-
ceded by 2 min of relaxation and deep breathing, and followed by 1 min for recovery.
Each script was 3 min in length and heart rate was recorded every 10 s throughout.
Heart rate was also obtained 90 s into the baseline period and after 60 s of the
recovery. Participants then completed the IAMS and postimagery manipulation
check before proceeding with the next script. After the five scripts were completed, the participants were debriefed about the study and thanked for their participation.

Results

Preliminary Analyses

Data Screening. Following procedures advocated by Tabachnick and Fidell (2001), the data was first inspected for accuracy of data entry, missing values, and outliers. The data file did not contain any missing values, mistakes in data entry, or univariate outliers. A Mahalanobis distance statistic evaluated at \( p < .001 \) also revealed no multivariate outliers. Next, fit with the assumptions associated with multivariate analyses were tested (e.g., normality, linearity, homogeneity of the variance–covariance matrices, and multicollinearity) and was found to be mostly satisfactory. In some cases, however, Mauchly’s test of sphericity revealed violations to the homogeneity of the variance–covariance matrices (\( p > .001 \)). When this violation occurred, the Greenhouse–Geisser correction is reported to reduce the degrees of freedom (Greenhouse & Geisser, 1959).

General Imagery Ability. Participants were screened for their visual (\( M = 5.82, SD = .75 \)) and kinesthetic imagery ability (\( M = 5.62, SD = .81 \)). All participants scored an average of at least 4 on both scales (i.e., the image was neither easy nor difficult). Therefore, no one was eliminated from the data analysis owing to a lack of imagery ability.

Gender. Males and females have previously been found to react differently to competition situations (Martens, Burton, Vealey, Bump, & Smith, 1990; Perry & Williams, 1998). For example, Perry and Williams found that males reported a more facilitative interpretation of symptoms associated with competitive anxiety. Consequently, gender was considered as a possible confounding variable for the effects of different types of imagery on heart rate response, state anxiety, and state self-confidence. To this end, separate repeated measures MANOVAs were carried out with gender as the between-subject factor and employing an adjusted alpha level of \( p = .01 \). When heart rate was the dependent variable, there was no significant effect for gender (\( p > .01, \eta^2 = .11 \)) and no Gender \times Time interaction (\( p > .01, \eta^2 = .09 \)). Similarly, no significant main effect for gender and no significant Gender \times Imagery Script interaction were found for state anxiety (all \( p > .01, \eta^2 = .001 \) to .11) and self-confidence (both \( p > .01, \eta^2 = .04 \) to .05).

Postimagery Manipulation Check. Analyses were carried out on the data resulting from the postimagery manipulation checks. For each item, a repeated measures ANOVA was calculated to examine differences across the five imagery scripts with follow-up Tukey HSD post hoc tests when appropriate. The means and standard deviations for these items are reported in Table 1.

Two items tapped the perceived function of the imagery scripts as being arousal producing or confidence building. A significant effect for arousal, \( F(2.89, 112.67) = 31.00, p < .001, \eta^2 = .44 \), indicated that MGA relaxing imagery was perceived as significantly less arousal producing than the other four imagery scripts. Additionally, a significant effect for confidence, \( F(3.05, 118.89) = 70.99, p < .001, \eta^2 = .65 \),
revealed that mastery, coping, and MGA psyching-up imagery were perceived as significantly more confidence building than MGA relaxing or MGA anxiety imagery. Furthermore, MGA relaxing imagery was perceived as more confidence building than MGA anxiety imagery.

Four items indicated the participants’ ability to image the scripts: level of emotion produced, ease of seeing, ease of feeling, and degree of vividness and clarity. A significant effect, $F(3,30, 125.21) = 22.70, p < .001, \eta^2 = .37$, determined that MGA relaxing imagery produced less emotions than the other four imagery scripts. No other significant effects were found, indicating that participants were able to image all imagery scripts with the same relative ease and vividness.

Finally, two items tapped into the athletes’ perceptions of the effect that the different imagery scripts might have on subsequent performance: predicted performance in a hypothetical competition and perceived helpfulness of the imagery scripts in aiding the performance. Significant effects were found for both predicted performance, $F(2.91, 113.50) = 62.26, p < .001, \eta^2 = .62$, and perceived helpfulness, $F(3.00, 116.91) = 75.59, p < .001, \eta^2 = .66$. Significantly better performance was predicted following mastery, coping, and MGA psyching-up imagery than for MGA relaxing or MGA anxiety imagery. Furthermore, a significantly higher mean was found for MGA relaxing imagery when compared with MGA anxiety imagery.

### Table 1 Means and Standard Deviations for Postimagery Manipulation Check Items

<table>
<thead>
<tr>
<th>Item</th>
<th>MGA psyching up</th>
<th>MGA anxiety</th>
<th>MGA relaxing</th>
<th>MGM</th>
<th>Coping</th>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
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<tr>
<td>Arousal producing</td>
<td>4.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.28</td>
<td>5.25</td>
<td>1.33</td>
<td>2.75&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Confidence building</td>
<td>5.18&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.36</td>
<td>2.33</td>
<td>0.89</td>
<td>3.78&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Predicted performance</td>
<td>5.20&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.79</td>
<td>2.75</td>
<td>0.90</td>
<td>4.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Level of emotion</td>
<td>4.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.37</td>
<td>4.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.06</td>
<td>3.13</td>
</tr>
<tr>
<td>Ease of seeing</td>
<td>5.05</td>
<td>1.32</td>
<td>4.88</td>
<td>1.16</td>
<td>4.80</td>
</tr>
<tr>
<td>Ease of feeling</td>
<td>5.23</td>
<td>1.14</td>
<td>5.20</td>
<td>1.20</td>
<td>5.00</td>
</tr>
<tr>
<td>Vividness and clarity</td>
<td>5.00</td>
<td>1.24</td>
<td>4.90</td>
<td>1.13</td>
<td>4.73</td>
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<tr>
<td>Perceived helpfulness*</td>
<td>1.28&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.85</td>
<td>−1.55</td>
<td>1.01</td>
<td>0.30</td>
</tr>
</tbody>
</table>

<sup>Note.</sup> MGA = motivational general arousal imagery and MGM = motivational general mastery imagery.

<sup>a</sup>Significantly different mean from MGA anxiety imagery.

<sup>b</sup>Significantly different mean from MGA relaxing imagery.

<sup>*</sup>Perceived helpfulness was rated on a 7-point Likert scale anchored at −3 (very hurtful) and +3 (very helpful).
Following an identical pattern of results, mastery, coping, and MGA psyching-up imagery were perceived as significantly more helpful than MGA relaxing or MGA anxiety imagery. Finally, MGA relaxing imagery was perceived as being significantly more helpful than MGA anxiety imagery.

**Main Analyses**

**Heart Rate Response.** Heart-rate measurements obtained every 10 s during the imagery script were averaged together, and this was referred to as the *imagery heart rate* for the analysis. To examine whether changes in heart rate occurred during imagery, a 5 (Imagery Script) × 3 (Time) MANOVA with repeated measures on the second factor was carried out. A significant multivariate effect was found for time, Pillai’s trace = 0.45, \(F(10,150) = 4.40, p < .001, \eta^2 = .23\), observed power = 98.8%, followed by significant univariate effects for three scripts: MGA psyching-up imagery, \(F(1.60, 62.34) = 11.30, p < .001, \eta^2 = .23\); MGA competitive anxiety imagery, \(F(1.39, 54.38) = 14.15, p < .001, \eta^2 = .27\); and coping imagery, \(F(2, 78) = 7.30, p < .001, \eta^2 = .16\). A Tukey HSD post hoc analysis revealed significant differences between baseline heart rate and imagery heart rate, and between imagery heart rate and recovery heart rate for these dependent variables. But no significant differences were found between baseline heart rate and recovery heart rate.

**Cognitive State Anxiety.** A 2 (Cognitive Anxiety Dimension) × 5 (Imagery Script) repeated measures MANOVA was conducted to determine the impact of each imagery script upon cognitive state anxiety. A significant multivariate effect was found, Pillai’s trace = 0.64, \(F(8, 312) = 18.13, p < .001, \eta^2 = .32\), observed power = 100%. Further significant univariate effects were found for both intensity, \(F(3.36, 131.10) = 36.50, p < .001, \eta^2 = .40\), and direction, \(F(3.26, 126.95) = 28.16, p < .001, \eta^2 = .38\). Tukey HSD post hoc comparisons for intensity revealed significantly higher scores following MGA anxiety imagery than all other imagery scripts. Furthermore, intensity scores following coping imagery and MGA psyching-up imagery were significantly higher than after MGA relaxing imagery. For direction, anxiety symptoms experienced after MGA anxiety imagery were perceived as significantly more debilitating than all other scripts.

**Somatic State Anxiety.** Another 2 (Somatic Anxiety Dimension) × 5 (Imagery Script) repeated measures MANOVA was conducted, but this time to determine the impact of each imagery script upon somatic state anxiety. A significant multivariate effect was again found, Pillai’s trace = 0.86, \(F(8, 312) = 29.12, p < .001, \eta^2 = .51\), observed power = 100%, with subsequent univariate significant differences for both intensity, \(F(4, 156) = 40.22, p < .001, \eta^2 = .51\), and direction, \(F(2.69, 104.89) = 32.01, p < .001, \eta^2 = .45\). Similar to cognitive anxiety, Tukey HSD post hoc comparisons revealed significantly higher intensity means after MGA anxiety imagery than for all other imagery scripts. Furthermore, significantly higher intensity scores were found after MGA psyching-up than MGM and MGA relaxing imagery. Finally, significantly higher intensity scores were found after coping imagery than MGA relaxing imagery. For direction, anxiety symptoms experienced after MGA anxiety imagery were perceived as significantly more debilitating than MGA psyching-up, MGM, and coping imagery.
**State Self-Confidence.** A repeated measures ANOVA determined the influence of the five imagery scripts on state levels of self-confidence, and a significant effect was found, $F(3.16, 123.35) = 90.87, p < .001, \eta^2 = .70$, observed power = 100%. A Tukey HSD post hoc test indicated higher means for self-confidence following MGM, coping, and MGA psyching-up imagery as compared to MGA anxiety and MGA relaxing imagery. The means and standard deviations for state anxiety (intensity and direction) and self-confidence are reported in Table 2.

**Discussion**

The aim of the present study was to compare heart rate response and self-reported psychological states (i.e., state anxiety and self-confidence) following different types of MGA and MGM imagery. It was predicted that increased levels of anxiety symptoms and heart rate would occur for imagery scripts that contained response propositions (MGA anxiety imagery, MGA psyching-up imagery, and coping imagery) compared with those that did not (MGA relaxing imagery and MGM imagery). Moreover, athletes were expected to report higher levels of self-confidence and appraise their symptoms as more facilitative following imagery containing mastery cognitions (MGM imagery and coping imagery).

Consistent with these predictions, a significant increase in heart rate and anxiety intensity was found for the imagery scripts that contained somatic response propositions: MGA anxiety, MGA psyching-up, and coping. Crucially, changes in heart rate were not found for MGA relaxing and MGM imagery, indicating that imagery alone was not causing increased activation levels. Rather, only those

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<tr>
<th>Table 2 Means and Standard Deviations for Cognitive State Anxiety, Somatic State Anxiety, and State Self-confidence</th>
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<tr>
<td>MGA psyching up</td>
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<tr>
<td>M</td>
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<tr>
<td>Cognitive state anxiety</td>
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<td>Somatic state anxiety</td>
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<td>Intensity</td>
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<td>Direction</td>
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<tr>
<td>State self-confidence</td>
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<td>Intensity</td>
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</tbody>
</table>

*Note. MGA = motivational general arousal imagery and MGM = motivational general mastery imagery.*

<sup>a</sup>Significantly different mean from MGA anxiety imagery.

<sup>b</sup>Significantly different mean from MGA relaxing imagery.

<sup>c</sup>Significantly different from MGM imagery.
scenes that included information about increased heart rate resulted in significant changes compared with the baseline and recovery periods. Consequently, these findings lend further support to a basic proposition of Lang’s (1977, 1979) bioinformational theory that stimulating response information during imagery will result in measurable physiological changes. From an applied perspective, these findings also reinforce the recommendation made by Martin et al. (1999) for athletes to use MGA imagery as an arousal-regulation strategy.

In line with the notion that imagery designed to increase activation levels can be differently interpreted by athletes depending on the appraisal emphasis (Hale & Whitehouse, 1998; Jones & Uphill, 2004), MGA anxiety imagery was perceived as more debilitative than MGA psyching-up imagery. Moreover, and as expected, MGM and coping imagery resulted in significantly higher ratings of self-confidence when compared with MGA anxiety and MGA relaxing imagery, and more facilitative interpretations of symptoms associated with precompetition anxiety than MGA anxiety imagery. These findings support the role that imagery is purported to play in protecting athletes against debilitative interpretations by maintaining high levels of self-confidence (Hanton, Mellieu, et al., 2004; Neil et al., 2006). That is, MGM and coping imagery would enable athletes to be confident and view anxiety symptoms as being under their control and facilitative in nature. It is important to point out, however, that coping imagery also led to increased activation levels in the athletes. Therefore, only this type of imagery achieved the psychological state of “confident coping” as proposed by Jones and Hanton (2001). By combining elements of both MGA and MGM imagery, the athletes simultaneously experienced elevated levels of anxiety intensity and thoughts and feelings they perceived as helpful. Consequently, coping imagery would likely benefit athletes involved in sports where high levels of activation are necessary for successful performance (e.g., body-checking an opponent in ice hockey). Finally, the results of the postimagery manipulation check revealed that athletes’ perceptions about the imagery were generally concordant with the intended experience. For example, MGA relaxing imagery was perceived as producing less arousal and emotion than the other four scripts. Furthermore, MGA psyching-up, MGM, and coping imagery were all perceived as more confidence building and helpful than MGA anxiety and MGA relaxing.

We did not expect to find the pattern of results for psyching-up imagery to be identical to coping imagery and very similar to MGM imagery. Without any direct reference to mastery experiences, the psyching-up script not only led to increased arousal, but also to greater self-confidence and was perceived as more confidence building and helpful than MGA anxiety and MGA relaxing imagery. Consequently, psyching-up imagery is likely fulfilling a source of self-efficacy referred to as physiological and affective states (Bandura, 1997). According to Bandura, individuals feel more efficacious when their activation levels are optimal and perceived as helpful. Hence, even though the psyching-up script was intended to serve a MGA function, it was also interpreted by the athlete as providing a MGM function (i.e., increase self-confidence). Short, Monsma, and Short (2004) similarly reported that athletes perceived the items on the Sport Imagery Questionnaire (SIQ: Hall et al., 1998) to serve more functions than the ones intended. For example, images representing MGA imagery (i.e., items on the SIQ) were also believed by athletes to affect their confidence to at least some extent. Such findings reinforce the importance of ascertaining the perceived meaning of the imagery for the athlete (Martin et al., 1999; Murphy & Martin, 2002; Murphy et al., in press; Short & Short, 2005).
Various theorists (Ahsen, 1984; Lang, 1977, 1979) have explained that imagery is a highly personalized experience whereby similar imagery content can be interpreted in a different manner by different individuals. Within applied situations, imagery will likely be most effective when its perceived function matches the outcome intended (Short & Short, 2005). Short and Short have advocated that interventions are planned by first considering the function to be served by the imagery. Practitioners can then determine the imagery content based on the results of studies such as the present one. Just as important would also be to include some manner of establishing the perceived meaning of the imagery to the athlete. If, for example, an athlete did not perceive a psyching-up scene to be confidence building, the imagery intervention might not lead to the desired outcome. Whether the perceived imagery function does indeed influence the effectiveness of an intervention, however, has yet to be examined and would be a suggested avenue for future research.

Surprisingly, no difference was found in the athletes’ ability to image each of the scenes, with the exception that MGA relaxing imagery was perceived as producing less emotion than the other scripts. These findings are contrary to Lang et al. (1980), who found that more emotionally charged imagery was rated as being more vivid by the participants. However, this may be due to participants in the present study having been screened for their general imagery ability as well as having received extensive training during Session 1. Alternatively, the rating scales employed in the postimagery manipulation check may not have been sensitive enough to detect differences between the imagery scripts. To clarify this uncertainty, future research might determine whether the present findings would hold for individuals with lower imagery abilities. Lang (1977) believed that individuals who produce more vivid images would be able to generate a more intensive affective response. For instance, Lang et al. found that a good therapy prognosis was consistent with the individuals’ ability to generate a more complete imagery response set. According to bioinformational theory, therefore, it is likely that individuals with weaker imagery abilities would be unable to produce the physiological changes found during the response-oriented imagery employed in the present study. Consequently, they would be less likely to benefit from an imagery training program for modifying their perceptions of debilitative anxiety symptoms.

There are some important applied implications that can be drawn from the present study. First, a cautionary note should be assigned to the use of MGA imagery. It has been broadly defined as a function of imagery used by athletes to relax, psych up, and control their arousal levels (Munroe et al., 2000). Within the context of competition, the athlete should be careful to use the aspect of MGA imagery that would be appropriate for achieving the desired level of activation. Furthermore, there are potentially detrimental consequences to having an athlete image themselves being anxious in competition without corresponding feelings of mastery. If an athlete is debilitated by anxiety symptoms, imaging the atmosphere of a competition (i.e., the stimulus) will cause their body to somatically react in a fashion similar to what would be expected in real life. By continuing to pair this stimulus with a debilitating response (at least in the eyes of the athlete), the athlete’s imagery will only serve to reinforce anxiety symptoms as being problematic.

Although the study was strengthened by its inclusion of physiological recordings during imagery and extensive manipulation checks, there are several limitations that should also be pointed out. First, we were unable to measure the athletes’ performance in an actual competition, but instead had to rely on their predicted
performance based on a hypothetical scenario. Given the potentially debilitative nature of the MGA anxiety script, we felt very strongly that it would be unethical to ask athletes to engage in this form of imagery prior to competing. The results support this decision, with athletes believing that their performance would have been hampered after imaging the MGA anxiety script. Second, the sample size might be considered small, but this did not seem to adversely affect the results. More specifically, the observed power was generally high and the effect sizes were interpreted as large for most analyses. Finally, the within-participant design of the study meant that participants were not randomized to different conditions, but were instead exposed to all imagery scripts. Consequently, there are certain threats to internal (i.e., familiarity with testing session from repeated exposure) and external validity (i.e., findings might not generalize to other settings) that could not be accounted for in the study. However, the imagery scripts were delivered in a counterbalanced order and certain imagery scripts served as control conditions to minimize these problems.

In conclusion, our findings show that MGA imagery will increase activation levels when the appropriate response propositions are activated and MGM imagery operates by modifying self-confidence. Moreover, our study is the first to distinguish among subtypes of MGA imagery (i.e., relaxing, anxiety, and psyching-up imagery) when examining outcomes related to arousal and anxiety, and demonstrate that these subtypes can be interpreted differently by the athletes. That is, whereas the changes in arousal produced by MGA anxiety imagery were perceived as hurtful to the athletes, MGA psyching-up imagery was appraised more positively. Finally, pairing confidence-based cognitions (MGM imagery) with somatic response proposition (MGA anxiety imagery) promoted feelings of confidence while experiencing elevated levels of anxiety intensity.

References


Appendix

A copy of the stimulus–response training exercises and all imagery scripts are available from the lead author upon request. An example of an imagery script (coping imagery) is as follows:

You have just finished your warm-up and you are now just a couple of minutes away from the start of your competition…. You are mentally and physically ready…. Your body is signaling that it is prepared…. You have butterflies in your stomach and slight feelings of nausea… telling you that adrenaline is pumping round your body… confirming that you are prepared to begin… your body is in its optimal state… you are supremely confident that you can dominate the situation…. Your muscles feel tight… they will react to your every command…. You are totally in control of your body and this focuses you on the task ahead…. Your heart is racing faster… and faster… and your breathing is rapid…. You know that oxygen is coursing through your body…. You recognize these as feelings that you always experience prior to your best performances…. This makes you even more confident in your own ability…. Any thoughts of the competition that you experience just prove to underline your level of readiness…. All the other competitors can see that you are a well prepared, supent athlete who will succeed…. 

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