Exmaining the Direction of Imagery and Self-Talk on Dart-Throwing Performance and Self Efficacy

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The study investigated the impact of varying combinations of facilitative and debilitative imagery and self-talk (ST) on self-efficacy and performance of a dart-throwing task. Participants (N = 95) were allocated to 1 of 5 groups: (a) facilitative imagery/facilitative ST, (b) facilitative imagery/debilitative ST, (c) debilitative imagery/facilitative ST, (d) debilitative imagery/debilitative ST, or (e) control. Mixed-design ANOVAs revealed that performance, but not self-efficacy, changed over time as a function of the assigned experimental condition. Participants in the debilitative imagery/debilitative ST condition worsened their performance, and participants in the facilitative imagery/facilitative ST condition achieved better scores. These findings demonstrate that a combination of facilitative imagery and ST can enhance performance whereas debilitative imagery and ST can hamper it.

Positively framed imagery is generally considered to be an intervention strategy that results in desirable outcomes, such as improved self-confidence and performance (for reviews see Hall, 2001; Murphy & Martin, 2002). Imagery with negative associations, on the other hand, appears to have harmful consequences. For instance, elite swimmers have reported associations between negative images and debilitative interpretations of competitive anxiety symptoms, lower levels of self-confidence, decreased focus, and poorer performance (Hanton, Mellalieu, & Hall, 2004). Moreover, Janssen and Sheikh (1994) suggested that the damaging effects of negative imagery appear greater than the value of positive ones. However, research comparing the impact of positive and negative images on motor skill performance has produced equivocal results (e.g., Nordin & Cumming, 2005; Short et al., 2002; Taylor & Shaw, 2002; Woolfolk, Murphy, Gottesfeld, & Aitken, 1985; Woolfolk, Parrish, & Murphy, 1985). Short and colleagues (2002) proposed that such inconsistencies may exist due to imagery direction (i.e., positive and negative imagery) being operationalized by performance outcome. They noted that negative imagery has become synonymous with negative outcomes, whereas positive imagery has
been equated to positive ones. The problem with this approach is that a seemingly negative outcome, such as missing the bull’s eye on a dart board, may not always be considered to be negative. Depending on the performance level and self-efficacy for the task, narrowly missing the bull’s eye might actually be positive, particularly for beginners who have not developed much confidence in their abilities (Nordin & Cumming, 2005). Hence, Short et al. (2002) recommended that imagery direction be conceptualized along the same lines as competitive anxiety, by defining imagery as either debilitating (hurtful) or facilitative (helpful). Consequently, facilitative imagery was defined as imagery designed to have a positive effect on one’s ability to learn and perform, modify important cognitions such as self-efficacy, and regulate arousal and anxiety. By comparison, debilitating imagery was defined as imagery designed to hamper an individual’s ability to achieve these same results. When imagery direction was conceptualized in this way, Nordin and Cumming (2005) found that debilitating imagery had a stronger and/or more immediate effect on self-efficacy and dart throwing performance than facilitative imagery.

Research has also examined the effects of positive and negative self-talk (ST) on performance, and again, this line of inquiry has produced mixed findings (e.g., Dagrou, Gauvin, & Halliwell, 1992; Van Raalte et al., 1995; Van Raalte, Brewer, Rivera, & Petitpas, 1994). These discrepancies might relate to the different meanings that positive and negative statements hold. Similar to imagery, positively worded ST has become tantamount to positive outcomes, whereas negative ST is thought to result in negative ones. However, this is not necessarily the case. For example, positive ST and motivational ST are both defined as “encouragement or talk that one can be successful” (Hardy, Gammage, & Hall, 2001, p. 312) and these terms are often used interchangeably. Certain athletes, however, report negatively worded ST as motivational (e.g., Hardy, Gammage et al., 2001; Hardy, Hall, & Alexander, 2001; Van Raalte et al., 1994, 1995), suggesting that negative ST also has the potential to produce a positive result. Instructional ST is a positively worded statement that is typically associated with successful outcomes such as enhanced skill performance (Hardy, Gammage et al., 2001). There are certain circumstances, however, when athletes may view such statements as harmful. For instance, instructional ST that is overly detailed might disrupt the automatic performance of a skill (Landin, 1994).

In light of these possibilities, we suggest that ST direction can also be conceptualized as facilitative or debilitating. By modifying the definitions previously employed to distinguish positive and negative ST, facilitative ST is defined as ST designed to aid an athlete’s ability to perform, modify important cognitions, stay focused, regulate arousal and anxiety, and cope with difficulties. Debilitative ST, on the other hand, is defined as ST designed to impair an athlete’s ability to achieve these same outcomes. Similar to imagery, a key factor distinguishing whether ST will be considered as facilitative or debilitating would then be dependent on the meaning that the ST content holds for the athlete (Murphy & Martin, 2002).

Of primary interest to the present study was to examine the directional components of both imagery and ST together. Noting the similarities between the two strategies, Hardy, Gammage et al. (2001) suggested that additive effects will likely occur when imagery and ST are used in combination. Applied practitioners have long acknowledged the importance of combining mental skills when designing
psychological skills training programs, and there is a growing body of research to support the use of two or more psychological strategies for enhancing performance (e.g., Thomas & Fogarty, 1997). Theoretical justification for combining imagery and ST is also provided by the dual coding theory (Paivio, 1986) and the action-language-imagination (ALI) model (Annett, 1996). Both theories assume that information is acquired through two independent channels, with one system specialized for nonverbal information (e.g., observing demonstrations, imagery) and the other system dealing with verbal information. With more specific reference to motor skills, the ALI model predicts that individuals will use imagery as a rehearsal strategy to help develop an internal representation of the movement. ST is employed to generate an image of the movement, which in turn activates the internal representation and enhances subsequent learning. Examining the combined effectiveness of the two strategies within this model, Hall, Moore, Annett, and Rodgers (1997) found that participants remembered movement patterns better when they used both imagery and ST as compared to using imagery alone.

In sum, imagery and ST can be facilitative or debilitative toward an athlete’s performance. Furthermore, additive effects seem to occur when imagery and ST strategies are combined relative to using each one independently. The aim of this study was to examine the effects of combining these strategies on the self-efficacy and performance of a dart throwing task when the direction of the imagery and ST content was considered. Despite being a reliable predictor of performance, Feltz and Lirgg (2001) have pointed out that “it is surprising that so few intervention studies have been conducted with self-efficacy as the dependent variable” (p. 350). Thus, self-efficacy was included in the present study to further our understanding of how psychological strategies may influence this variable. According to Bandura’s (1986, 1997) social cognitive theory, both imagery and ST are sources of self-efficacy, with imagery most commonly classified as a vicarious experience, whereas ST is categorized as a form of verbal persuasion (Feltz & Lirgg, 2001). Research has shown that imaging oneself successfully performing a skill (i.e., facilitative skill-based imagery) can enhance self-efficacy expectations (e.g., Calmels & Fournier, 2001; McKenzie & Howe, 1997; Short et al., 2002). Few studies have examined the effect of ST on self-efficacy, but several authors have suggested that ST can help build self-confidence (e.g., Hardy, Gammage et al., 2001; Landin & Hebert, 1999). When considering the direction of these strategies, Bandura (1997) has indicated that the debilitating effects of certain strategies can be as powerful as their enabling effects. To date, no study has considered the directional component of ST, but research has found that imaging oneself unsuccessfully performing a skill (i.e., debilitative skill-based imagery) or being unconfident (i.e., debilitative confidence-based imagery) will lower self-efficacy (Nordin & Cumming, 2005; Taylor & Shaw, 2002).

To help fill this gap in the literature, we investigated whether a combination of facilitative imagery and ST would enhance the self-efficacy and performance of a dart throwing task and whether a combination of debilitative imagery and ST would worsen self-efficacy and performance. In both these conditions, the imaged and verbal information were compatible. We also examined treatment conditions consisting of incompatible or conflicting information. That is, we included one condition that combined debilitative imagery with facilitative ST and another that
combined facilitative imagery with debilitative ST. By doing so, we could examine whether participants could overcome any effects of debilitative imagery by engaging in facilitative ST, and whether debilitative ST would hamper the effects of facilitative imagery. Qualitative research by Hanton et al. (2004) indicates that athletes can use positively framed ST to persuade themselves to stay confident and avoid negative thoughts and images. Empirical testing of whether facilitative ST can counteract the effects of debilitative imagery could further aid the development of accurate and useful information regarding how to reduce any deleterious effects of debilitative imagery for athletes. We accomplished this by delivering the imagery script prior to the ST portion of the intervention.

For the incompatible conditions, we predicted that one of two results would emerge. One possibility was that conflicting imagery and ST would “rule each other out” and self-efficacy and performance scores remain unchanged. This would be similar to what was expected to occur for the no-intervention control group. Given that the ST was performed immediately prior to each dart throw, a second possibility was that the ST would create the mental representation that most closely effected performance. Regardless of the imagery script, therefore, facilitative ST would lead to better performance and increased self-efficacy and debilitative ST would worsen performance and decrease self-efficacy.

**Method**

**Participants**

The 95 participants recruited for the present study consisted of both males ($n = 53$) and females ($n = 42$) with an age range of 19-29 and a mean age of 21.03 years ($SD = 1.65$). The majority of participants were undergraduate students who responded to an advertisement and received course credit for their participation. Eight participants reported having no previous dart throwing experience, 78 participants reported having very little experience, and 9 participants reported being somewhat experienced.

**Equipment**

The equipment consisted of a Harrows Official Competition dartboard, three Harrows Combat Precision Steeltip darts, and a wooden oche. The dartboard was 44.45 cm in diameter and divided into 8 concentric circles using the following radii: .75 cm (Bull’s eye: 8 pts); 1 cm (7 pts); 4.5 cm (6 pts); 3.5 cm (5 pts); 1 cm (4 pts); 5.5 cm (3 pts); 1 cm (2 pts); 5.5 cm (1 pt). The oche, which was placed on the floor, could be moved to three distances from the dartboard, namely five feet (1.52m), six feet (1.83m), and seven feet (2.13m). Consistent with previous research (Nordin & Cumming, 2005) and further pilot testing, a distance of six feet was selected for the practice trial. In order to avoid floor and ceiling effects, performance in the practice trial determined what distance participants would subsequently throw from for the rest of the trials (i.e., five feet, six feet, or seven feet). Other studies have employed similar procedures in attempts to reduce these problems (Nordin & Cumming, 2005; Short et al., 2002; Woolfolk, Murphy et al., 1985; Woolfolk, Parrish et al., 1985).
**Measures**

**Imagery Ability.** Scores on the Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997) were examined to ascertain whether the imagery intervention was influenced by the participants’ general ability to image. To complete the MIQ-R, participants were asked to first physically perform a simple movement and then visually or kinesthetically image the movement they just performed. Next, the participants rated the ease or difficulty with which they were able to image. Ratings were made on a 7-point Likert scale, ranging from 1 (very hard to see/feel) to 7 (very easy to see/feel). Four movements were rated both visually and kinesthetically, corresponding to eight items in total. Items were then averaged to produce visual and kinesthetic subscale scores. Both the kinesthetic (.81) and the visual (.89) subscales had good internal reliabilities.

**Performance.** Performance scores were based on where individual darts landed on the dartboard. Darts landing in the smallest circle in the centre of the board (bull’s eye) were awarded 8 points, and points decreased the further away darts were from the board’s centre. Darts landing outside the board were awarded 0 points.

**Self-Efficacy.** Participants’ self-efficacy was determined by assessing both the strength and direction of participants’ expectations about their subsequent performance on the dart-throwing task. All statements followed the format “I believe I can score 7 or above on x of the next 24 throws,” with 8 being the maximum score. In total, the questionnaire consisted of 12 progressively harder statements, with “I believe I can score 7 or above on 2 of the next 24 throws” being the first and easiest statement, and “I believe I can score 7 or above on 24 of the next 24 throws” being the twelfth and hardest statement. Participants indicated their self-efficacy beliefs by rating their confidence levels in response to the statements in percent, with 0% corresponding to “I am very sure I cannot,” 50% corresponding to “I am unsure—it could go either way,” and 100% corresponding to “I am very sure I can.”

**Procedure**

**Introduction.** Upon entering the laboratory, participants were instructed that they were taking part in a study to investigate the effects of imagery and ST on self-efficacy and performance in a dart-throwing task. Thereafter, all participants read an information letter describing the experiment and gave informed consent. The White and Hardy (1998) definition of imagery was then given to the participants. Next, participants completed the Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997) and were randomly allocated to one of the five evenly sized experimental conditions (n = 19/condition), namely (a) facilitative imagery and facilitative ST, (b) facilitative imagery and debilitative ST, (c) debilitative imagery and facilitative ST, (d) debilitative imagery and debilitative ST, or (d) control group. Consequently, we had five experimental groups, four of which received a combined imagery and ST intervention. All participants were given identical brief instructions of the correct dart-throwing technique that they should attempt to use when completing the experiment. They were also informed about the scoring system and were instructed to aim for the centre of the board (the bull’s eye).
at all times. Each subsequent trial was then performed by the participant alone in the presence of the researcher.

**Distance Assignment Trial.** Following the introductory procedures, participants performed a practice trial of 15 darts from a distance of 6 feet (1.83m) from the board. This number of practice throws was chosen following recommendations by Van Raalte et al. (1995), who claimed this to be the optimum number of throws to prevent boredom while allowing participants to gain experience of the task. The score that a participant obtained on the practice trial determined the distance from the board that he or she stood for the rest of the experiment. The maximum possible score an individual could obtain on the practice trial was 120, and following extensive pilot work, scores between 80-120 were assigned to a distance of 7 feet (2.13m) from the dart board, 40-79 points a distance of 6 feet (1.83m), and 0-39 points a distance of 5 feet (1.52m). As a result, 48 participants performed the rest of the trials from 7 feet (2.13m), 46 participants from 6 feet (1.83m), and 1 participant from 5 feet (1.52m). Because distance assignment was to be used as an independent variable in our preliminary analyses, we chose not to include the data from the participant who threw from 5 feet. The final sample size was therefore 94.

**Baseline.** Once the distance assignment was completed, baseline self-efficacy was measured (self-efficacy rating #1). This was followed by a baseline trial of 24 dart throws.

**Trial 1** Following the baseline, the imagery intervention was introduced to participants in the intervention groups. Participants were read a script and instructed to image as clearly and vividly as possible. The imagery scripts were the same as the skill-based imagery scripts used by Nordin and Cumming (2005), which in turn were modified versions of scripts used by Short et al. (2002). Also similar to Nordin and Cumming (2005), control group participants were asked to count backwards out loud in steps of three, starting with a large four-digit number for three minutes. They were informed that they were not assessed on this arithmetic task, that it was a simple concentration task, and that they would receive help if needed. This task served the dual purpose of ensuring that the control group did not employ their own imagery while receiving the same rest periods as those in the intervention groups.

Following the imagery intervention or mental arithmetic task, all participants completed another self-efficacy questionnaire for the upcoming set of throws (self-efficacy rating #2). Thereafter, intervention group participants were provided with a brief definition of ST (Hackfort & Schwenkmezger, 1993), and the ST intervention (facilitative or debilitative) was introduced. ST statements were either “I will hit the bull’s eye” (facilitative) or “I will miss the bull’s eye” (debilitative). Each statement was designed with the intention of being either facilitative or debilitative toward the participant achieving the intended outcome of the task. To confirm that these statements followed Landin’s (1994) suggestion to keep ST brief and phonetically simple, the length and wording of each one was subjected to pilot testing. Pilot participants (n = 4) reported that the wording was simple and that saying these statements did not interfere with the timing of their dart throwing performance.
Before throwing commenced, all participants were reminded that their aim was to hit the bull’s eye with every throw regardless of the interventions they received. This was strongly emphasized to minimize the effect of demand characteristics on results. In addition, intervention group participants were reminded to say their ST statement either silently or out loud before each throw, according to personal preference. Once the 24 throws of Trial 1 were completed, participants in the intervention groups were instructed to complete a post-trial manipulation check to assess their perceptions of the nature and helpfulness of the imagery/ST interventions and establish whether participants used their interventions as instructed. These checks were adapted from those used by Nordin and Cumming (2005). Two questions assessed the participants’ specific ability to visually and kinesthetically image the imagery script using the same Likert scale employed by the MIQ-R (Hall & Martin, 1997). Perceived imagery and ST direction were rated separately from 1 (entirely debilitating) to 5 (entirely facilitative). The extent to which participants used the ST statements as instructed prior to each throw was rated from 1 (not at all) to 5 (throughout). Finally, participants reported the extent to which they had been aiming to hit the bulls-eye as instructed, ranging from 1 (not at all) to 5 (throughout).

**Trial 2.** The second trial followed just the same format as the first. Participants received exactly the same imagery intervention or a similar distracter task (control group), with the only difference being that the four-digit starting number was changed. Another self-efficacy questionnaire (self-efficacy rating #3) was completed immediately after the imagery intervention. Next, intervention groups were given the same ST statement as in Trial 1. Thereafter, 24 darts were thrown, and participants in the intervention groups were instructed to complete a second post-trial manipulation check.

**Closing.** After the completion of the experimental trials, all participants completed a post-experimental manipulation check to verify whether they had employed any strategies other than those given to them by the experimenter. Those who reported “yes” then indicated whether this was their own imagery, their own ST, goal setting, or some other strategy not listed. In the latter case, they were asked to report the strategy employed. The participants were also asked to complete 13 items from the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960) to measure their general need for approval. The items describe either (a) desirable but uncommon behaviors (e.g., admitting mistakes) or (b) undesirable but common behaviors (e.g., gossiping), and participants responded whether each statement was true or false for them. Each item is scored as 1 or 0, and scores on the undesirable but common behaviors were reverse coded. The resulting range of possible scores is 1–13, with higher scores representing a higher need for approval. Finally, participants were asked to guess, from a list of five possibilities, what experimental condition they thought they were in.

After completing the post-experimental manipulation check, the participants received a debriefing form explaining the purpose of the experiment, what condition they were in, and the expected outcomes of the study. Lastly, they were given the opportunity to ask questions.
Results

Preliminary Analyses

A series of preliminary analyses were conducted to examine whether other variables aside from the interventions had influenced performance and self-efficacy ratings. First, three one-way between groups ANOVAs were performed with a corrected alpha level to protect against Type 1 error ($p = .0167$). These ANOVAs examined whether baseline differences in self-efficacy and performance existed according to previous dart throwing experience, distance assignment, and gender. In the case of a significant result, repeated measures ANOVAs were calculated to ascertain whether such differences were consistent across trials (i.e., main effect for trial) or whether the groups had responded differently to the various interventions (i.e., interaction between trial and group). Following these procedures, it was determined that performance and self-efficacy were not influenced by previous dart throwing experience, assigned throwing distance, or gender. Furthermore, a MANOVA revealed no differences between the groups in their general visual and kinesthetic imagery ability (as measured by the MIQ-R). Therefore, the data was collapsed across these variables for the main analyses.

Post-Trial Manipulation Check. The scores for both post trial manipulation checks were averaged and one-way between group ANOVAs with a corrected alpha level ($p = .0083$) followed by Tukey HSD post hoc tests were examined for differences among the four intervention groups. These results are presented in Table 1 along with the relevant means and standard deviations. A significant difference between the four intervention groups was found for the degree to which they aimed for the centre of the dartboard on each throw, $F(3, 72) = 5.60, p = .002, \eta^2 = .19$, revealing that participants in the facilitative imagery/debilitative ST condition did not try as hard as participants in the other three conditions to reach the centre of the dartboard. However, given that the possible range of scores were between 1 (not at all) and 5 (throughout), the overall mean ($M = 4.91, SD = .27$) suggests that participants did generally aim for the centre of the dartboard regardless of their condition. Group differences were also found in the participants’ perceptions of imagery direction, $F(3, 72) = 31.83, p < .001, \eta^2 = .57$ and ST direction, $F(3, 72) = 30.67, p < .001, \eta^2 = .56$. As intended, participants in both facilitative imagery groups perceived the imagery to be more helpful than participants in both debilitative imagery conditions. Similarly, participants in both facilitative ST conditions perceived the ST to be more helpful than participants in both debilitative ST conditions. No group differences were found in the participants’ ability to visually or kinesthetically image the scripts (i.e., specific imagery ability), nor were there any differences found in the participants’ use of their assigned ST strategy throughout the performance trials. Again, the overall mean of 4.79 ($SD = .39$) indicates that participates adhered to their assigned ST strategy throughout the performance trials.

Post-Experimental Manipulation Check. All but one participant accurately guessed their experimental condition. Thirty-five participants (36.8%) reported using at least one strategy other than those given to them by the experimenter. Own imagery was used by 8 participants (8.4%); 11 participants (11.6%) used their own ST; 23 participants (24.2%) reported setting goals; and 5 participants (5.3%) used...
<table>
<thead>
<tr>
<th></th>
<th>Facil Imagery &amp; Facil ST</th>
<th>Facil Imagery &amp; Debil ST</th>
<th>Debil Imagery &amp; Debil ST</th>
<th>Debil Imagery &amp; Facil ST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>Aiming for centre of dartboard (1 = not at all, 5 = throughout)</td>
<td>4.00</td>
<td>0.00</td>
<td>3.71</td>
<td>0.45</td>
</tr>
<tr>
<td>Specific visual imagery ability (1 = very hard to see, 7 = very easy to see)</td>
<td>5.08</td>
<td>1.22</td>
<td>5.34</td>
<td>1.03</td>
</tr>
<tr>
<td>Specific kinesthetic imagery ability (1 = very hard to feel, 7 = very easy to feel)</td>
<td>4.29</td>
<td>1.54</td>
<td>4.13</td>
<td>1.08</td>
</tr>
<tr>
<td>Direction of imagery (1 = entirely debilitative, 5 = entirely facilitative)</td>
<td>3.87</td>
<td>0.70</td>
<td>3.97</td>
<td>0.63</td>
</tr>
<tr>
<td>Direction of ST (1 = entirely debilitative, 5 = entirely facilitative)</td>
<td>3.71</td>
<td>0.95</td>
<td>2.24</td>
<td>0.77</td>
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<tr>
<td>Use of ST in performance trials (1 = not at all, 5 = throughout)</td>
<td>3.76</td>
<td>0.39</td>
<td>3.82</td>
<td>0.38</td>
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</table>
some strategy other than those mentioned on the post-experimental manipulation check form (e.g., pre-performance routine). Chi-square analyses explored whether any differences existed between groups in their use of these strategies. Two significant results were found: a higher proportion of participants in the debilitative imagery/facilitative ST condition (n = 5) used their own imagery, $\chi^2(4) = 10.37, p = .04$, as well as other strategies (n = 4), $\chi^2(4) = 12.67, p = .01$. With respect to social desirability, the average score for the sample on the Marlowe-Crowne Scale was fairly low ($M = 4.91, SD = 2.47$), suggesting that the participants generally did not show a tendency toward responding in a socially desirable fashion. An ANOVA indicated that no group differences existed between the four intervention groups in their ratings of social desirability.

**Main Analyses**

The main analyses determined whether the five experimental groups differed in their self-efficacy ratings and dart throwing performance. First, one-way ANOVAs established whether any differences existed at baseline ($p = .025$). Thereafter, repeated measures ANOVAs and Tukey post-hoc tests revealed whether the groups differed in their self-efficacy and dart throwing performance across trials, following the imagery and ST interventions.

**Performance.** An ANOVA confirmed that no differences existed in baseline measures of performance (dependent variable) among the five experimental groups (independent variable). Next, a 5 (group) $\times$ 3 (trial) mixed-design ANOVA was employed with experimental group serving as the between-groups independent variable and trial as the within-groups independent variable. Means and standard deviations are presented in Table 2. No main effects were found for either group or trial, but a significant interaction was found between group and trial, $F(8, 178) = 2.78, p = .006$, $\eta^2 = .11$. Thus, performance changed over time as a function of experimental condition (see Figure 1). Tukey HSD post hoc tests then compared performance means across the trials. No differences were found for the control group and the facilitative imagery/debilitative ST group indicating that these groups maintained stable levels of performance. By contrast, significant differences were found for the other three experimental groups. In comparison to baseline, participants in the facilitative imagery/facilitative ST condition performed significantly better in trials 1 and 2, with no differences being found between these two final trials. Participants in the debilitative imagery/facilitative ST condition demonstrated no difference in performance between baseline and Trial 1, but a significant improvement between Trial 1 and Trial 2. Finally, participants in the debilitative imagery/debilitative ST condition performed significantly worse in both Trial 1 and Trial 2 in comparison to baseline. Additionally, a significant difference was found between Trials 1 and 2: participants’ level of performance initially decreased from baseline to Trial 1, after which it significantly increased again in Trial 2.

**Self-Efficacy.** An ANOVA confirmed that no differences existed in baseline measures of self-efficacy (dependent variable) among the five experimental groups (independent variable). Next, a 5 (group) $\times$ 3 (trial) mixed-design ANOVA was employed with experimental group serving as the between-groups independent variable and trial as the within-groups independent variable. Means and standard
### Table 2  Means and Standard Deviations of Self-Efficacy Ratings and Performance Scores for Each Group Over Time

<table>
<thead>
<tr>
<th>Group</th>
<th>Self-efficacy</th>
<th>Performance</th>
<th>Self-efficacy</th>
<th>Performance</th>
<th>Self-efficacy</th>
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<tbody>
<tr>
<td>Baseline</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Facil Imagery &amp; Facil ST</td>
<td>14.92</td>
<td>9.83</td>
<td>5.16</td>
<td>0.74</td>
<td>13.32</td>
<td>9.50</td>
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<td>Facil Imagery &amp; Debil ST</td>
<td>20.00</td>
<td>11.32</td>
<td>5.33</td>
<td>0.41</td>
<td>17.96</td>
<td>8.04</td>
</tr>
<tr>
<td>Debil Imagery &amp; Debil ST</td>
<td>20.52</td>
<td>16.22</td>
<td>5.44</td>
<td>0.61</td>
<td>15.17</td>
<td>12.56</td>
</tr>
<tr>
<td>Debil Imagery &amp; Facil ST</td>
<td>20.56</td>
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<td>5.25</td>
<td>0.58</td>
<td>11.77</td>
<td>10.18</td>
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<tr>
<td>Control</td>
<td>23.14</td>
<td>11.99</td>
<td>5.51</td>
<td>0.39</td>
<td>20.10</td>
<td>12.56</td>
</tr>
</tbody>
</table>

Note. <sup>a</sup> = significantly higher than the same group at baseline, <sup>b</sup> = significantly lower than the same group at baseline, <sup>c</sup> = significantly higher than the same group in Trial 1.
deviations are presented in Table 2. No main effect was found for group and no
significant interaction between trial and group was found. A significant main effect,
however, was found for Trial, $F(2, 178) = 17.56, p < .001, \eta^2 = .17$. Tukey HSD
post hoc tests revealed that all participants significantly decreased their self-efficacy ratings from baseline to Trial 1 whereas no difference was found between self-efficacy ratings in Trials 1 and 2.

Because self-efficacy was assessed prior to each trial, but before the ST intervention,
only imagery would have had an influence on the second self-efficacy measure. ST was introduced during Trial 1 and would only have influenced the third self-efficacy measure. This design provided an opportunity to determine whether the addition of ST had any effects over and above that of the imagery. To this end, a 4 (intervention group) × 2 (trial) mixed-design ANOVA was calculated with self-efficacy again as the dependent variable. No main effect was found for trial or for group, and no significant interaction was found between trial and group. Thus, imagery had no effect on self-efficacy beliefs measured prior to Trial 1 and the addition of ST had no effect on the self-efficacy beliefs measured prior to Trial 2.

To better understand why self-efficacy decreased for the participants, correlations were calculated between self-efficacy beliefs and performance at baseline, Trial 1, and Trial 2. Significant and positive but not high correlations existed between each measure of self-efficacy and performance (practice trial: $r = .31, p < .01$; Trial 1: $r = .41, p < .01$; Trial 2: $r = .40, p < .01$). Similar correlations between participants’ self-efficacy and their actual performance prompted Murphy and Woolfolk (1987) to suggest that participants were predicting their future performance on a golf putting task based on baseline performance levels. To ascertain whether this occurred in the present study, correlations were calculated between self-efficacy ratings and performance in Trial 1 with the influence of baseline measures of
performance partialled out ($r = .08, p = .46$). The same partial correlation was then calculated between self-efficacy ratings and performance in Trial 2 with the influence of either baseline measures ($r = .08, p = .46$) or Trial 1 ($r = -.04, p = .72$) partialled out. Because the correlations were no longer significant, once the effect of previous performance was removed from the relationship, Murphy and Woolfolk’s (1987) suggestion seems to apply to the findings of the present study. That is, the participants rated their self-efficacy for upcoming dart throws based on their previous performance.

**Discussion**

The aim of this study was to investigate the impact of imagery and ST direction on self-efficacy and performance. To do so, we compared a no-intervention control group and four different imagery and ST psychological strategy intervention groups. Instead of receiving an intervention, the control group engaged in a backward counting filler task. Therefore, we predicted that participants in this group would show no changes in performance or self-efficacy relative to baseline. Two intervention groups received compatible imagery and ST interventions (both facilitative or both debilitative) and two groups received incompatible interventions (facilitative imagery combined with debilitative ST or vice versa). For the compatible intervention groups, it was hypothesized that a combination of facilitative imagery and ST would enhance self-efficacy and performance of a dart throwing task, whereas a combination of debilitative imagery and ST would worsen self-efficacy and performance. By contrast, we hypothesized that either one of two results would occur for the incompatible intervention groups. The first possibility was that any effects of the imagery and ST interventions would cancel each other out, resulting in no effects on either performance or self-efficacy. Alternatively, it was predicted that the ST would affect performance and self-efficacy more strongly than the imagery, given that it was closer in time to the performance.

As predicted, the control group performed equally well in all trials. Although the main interest of the study was to examine within-group changes across trials, it was curious to note that the control group appeared to perform better overall. While no differences were found between the groups at baseline, there was a trend for control group participants to perform better at this time. Despite being randomly allocated into groups, therefore, the control group was slightly biased toward those participants who initially performed the task better. With regard to the compatible intervention groups, performance results were also largely consistent with our predictions. That is, participants who received facilitative imagery and ST performed better in Trials 1 and 2 than at baseline, while participants who received debilitative imagery and ST performed worse in Trials 1 and 2 than at baseline. It is also noteworthy, however, that participants in the debilitative imagery/debilitative ST group experienced their performance decrement entirely in Trial 1. Consistent with Nordin and Cumming (2005), therefore, the debilitative condition had an immediate effect on performance. Participants then began to improve their performance in Trial 2, although this increased score was still significantly lower than baseline levels. One possible explanation for this reversed result is that the harmful effects of combining debilitative imagery and ST began to wear off after Trial 1. Additional trials would be necessary to establish whether this is indeed the case. To the best
of our knowledge, however, studies examining the effects of debilitative imagery have typically involved either one (Taylor & Shaw, 2003) or two performance trials (Nordin & Cumming, 2005; Short et al., 2002). Thus, it would be beneficial for researchers to include multiple trials in future studies of a similar nature.

The incompatible intervention groups showed a different pattern of performance results, and were to some extent in line with both the anticipated possibilities. Specifically, the group performing facilitative imagery and debilitative ST did not change its performance over time. Consistent with the first possibility, therefore, the opposing types of imagery and ST may have cancelled each other out with regard to performance effects. On the other hand, participants who performed debilitative imagery and facilitative ST, while keeping a stable performance between baseline and Trial 1, performed better in Trial 2 than in Trial 1. It therefore seems that facilitative ST protected participants from the potentially harmful performance effects of debilitative imagery in Trial 1. Moreover, participants were able to improve their performance by Trial 2, which is consistent with our alternative prediction for the incompatible groups. That is, facilitative ST performed immediately prior to throwing a dart might have enabled participants to create a mental representation of a successful outcome. As suggested by the ALI model (Annett, 1996), it may have been this mental representation that affected subsequent performance. Given that only limited research has tested the predictions made by the model thus far, we recognize that additional work would be necessary to replicate our findings. However, results are in line with Hanton et al.’s (2004) qualitative finding that athletes use positively framed ST to avoid negative images. Consequently, ST may be used as an “imagery-stopping” technique to prevent debilitative images from impairing an athlete’s performance. A possibility that deserves further research attention is whether ST might be a simple and easy strategy to implement for athletes who have difficulties controlling intrusive debilitative images.

As for self-efficacy, the results obtained did not conform to our expectations. Instead of finding a significant interaction between trial and group, we instead found a main effect for trial. Therefore, participants’ self-efficacy was not influenced by the interventions. Indeed, none of the groups differed from each other in their self-efficacy ratings for the various trials. Rather, participants demonstrated a significant decrease in their self-efficacy from baseline to Trial 1, and then remained equally efficacious for Trials 1 and 2. Similar results prompted Nordin and Cumming (2005) to suggest that the practice trial may have been too short (i.e., nine throws) and the self-efficacy measure not sensitive enough. Despite increasing the practice trial from nine to 15 throws and making the efficacy measure more sensitive in the present study, the results were again similar. Feltz and Lirgg (2001) have pointed out that measurement problems are typically why interventions have not been successful at changing self-efficacy beliefs. Thus, it is possible that further improvements to the wording of our measure may lead to results more in line with the hypotheses.

The order of our procedures helped us to determine that imagery had no effect on self-efficacy beliefs measured prior to Trial 1 and that there were no additive effects of introducing ST to self-efficacy beliefs measured before Trial 2. In other words, engaging in imagery and ST, regardless of whether these strategies were debilitative or facilitative, did not cause the decline in self-efficacy. While the effect of ST on self-efficacy had not been previously investigated, a number of studies have shown that imaging oneself performing a skill successfully enhanced
self-efficacy (facilitative skill-based imagery, e.g., Calmels & Fournier, 2001; McKenzie & Howe, 1997; Short et al., 2002). Imaging oneself being confident is another type of imagery previously shown to enhance self-efficacy (facilitative confidence-based imagery, e.g., Callow, Hardy, & Hall, 2001). Perhaps if our imagery script had included this imagery type, we may have seen an effect on self-efficacy; however, Nordin and Cumming (2005) directly compared the influence of these two imagery types on self-efficacy and found no difference.

While the psychological strategies were ruled out as the cause of the self-efficacy decline, the moderately-sized correlations between self-efficacy and performance pointed to an alternative explanation. Following procedures outlined by Murphy and Woolfolk (1987), a series of partial correlations established that participants were basing their self-efficacy ratings for upcoming dart throws based on previous performances. This is not surprising since performance accomplishments are considered to be the strongest source of self-efficacy information (Bandura, 1997). Nevertheless, it was interesting to note that while self-efficacy decreased for all groups, certain groups maintained or even improved their performance. As suggested by Nordin and Cumming (2005), the participants may have experienced an inflated level of self-efficacy following the initial throws completed during the practice trial, and these expectations became more realistic as additional performance feedback was obtained across trials. The correlation between baseline self-efficacy and baseline performance provides some support for this argument. While this correlation revealed a significant and positive relationship, it was the lowest of the self-efficacy—performance correlations obtained. This suggests that novice dart throwers probably have an inaccurate perception of how well they can perform at the outset of such a study, an argument that concurs with Bandura’s theory (1997). Future research may examine this issue further by including both novices and more experienced performers.

In any study examining the effects of psychological strategies such as imagery and ST, a large number of confounding factors could potentially affect the results. It is a strength of the present study, therefore, that preliminary analyses were carried out to establish that previous dart throwing experience, distance assignment, baseline self-efficacy and performance levels, gender, and general imagery ability did not influence our main analyses. We could then be confident that any conclusions drawn about the effect of different combinations of imagery and ST was not caused by these other variables. A frequent recommendation in the imagery literature is that studies should establish that the meaning of the image for the participant is the same as intended by the researcher (e.g., Murphy & Martin, 2002). Accordingly, we established the perceived direction of both the imagery and ST interventions. These checks not only confirmed that our attempts at manipulating imagery and ST direction were successful, but also established that our results were not influenced by the participant’s specific imagery ability or their adherence to using ST prior to each throw.

Social desirability is another potential problem for studies of this nature. That is, participants guess the aims of the study and try to be “good” by acting in accordance with these aims. We have several pieces of evidence to suggest that this was not a problem for the present study. First, if participants had tried to be “good” and conform to what they thought was expected by the experimenter, those performing in the debilitative imagery/ST group would have tried the least to aim for the
center of the dart board. However, this was not the case, with manipulation checks confirming that participants aimed for the center of the dart board despite having guessed their assigned experimental condition. Second, a questionnaire indicated that participants did not tend to respond in a socially desirable manner. Third, it should be noted that the fact that all but one participant accurately guessed their condition is perhaps unsurprising, given that both the imagery and the ST were designed to be pervasively facilitative or debilitative.

A final potential limitation to our study is that nearly 37% of participants used at least one strategy other than that given to them by the experimenter. Nordin and Cumming (2005) also found that nearly 63% of participants used supplementary psychological skills in addition to those prescribed by the investigator. Similarly, Hall et al. (1997) found that all participants assigned to a verbal description condition used imagery, and that participants assigned to an imagery condition used verbal descriptors about 20% of the time. That some participants used additional psychological strategies in the present study, therefore, is likely to be more of a rule than an exception. A higher proportion of participants in the debilitative imagery/facilitative ST group reported using their own imagery as well as other strategies (e.g., pre-performance routines). It is possible that the use of supplementary psychological strategies may have impacted self-efficacy and performance for this group, but these effects are likely to be minimal given that such a small number of participants were involved (4-5).

In conclusion, the present study has demonstrated that a combination of facilitative imagery and ST can enhance dart throwing performance whereas debilitative imagery and ST can impair it. Thus, athletes should try to use facilitative imagery and ST in combination when attempting to improve performance. Future research is necessary, however, to clarify the additive effects of combining these two strategies. It was also found that using facilitative ST immediately before performance may thwart the normally harmful effects of debilitative imagery. Thus, combining imagery and ST in different manners has shed some light on the potential counteractive effects these strategies may serve, suggesting that ST may be used as a possible intervention strategy to help athletes eliminate or avoid debilitating images.

References


**End Note**

"We would like to thank an anonymous reviewer for pointing this out to us.

*Manuscript submitted: July 13, 2005*

*Revision received: November 8, 2005*