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MENTAL IMAGERY INFLATES PERFORMANCE EXPECTATIONS BUT NOT ACTUAL PERFORMANCE OF A NOVEL AND CHALLENGING MOTOR TASK

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ABSTRACT

The current study re-examined the "estimation inflation" effect previously found with performance estimates of motor skills. After viewing a demonstration of a balancing task, 54 participants performed either physical practice, imagery practice, or no practice ($n = 18$ per group). Self-efficacy ratings were obtained regarding perceived ability to perform the task before and after a test phase where actual performance was measured. Prior to the test phase, the imagery group reported significantly higher levels of self-efficacy compared to the physical practice group. However, imagery practice did not benefit performance as only the physical practice group performed better on the balance task compared to control. Thus, imagery practice and physical practice produced dissociable effects on performance estimates and actual performance. Furthermore, inflated performance expectations elicited through imagery disappeared following the test phase. These results provide further evidence that short bouts of imagery can inflate expectations, but not actual performance of a novel motor task. Once individuals gained authentic experience of the task, the initial misjudgement about performance

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was replaced with more realistic expectations. Therefore, creating overly optimistic expectations of ability did not hamper future expectations once authentic experience was gained.

INTRODUCTION

Within sporting situations, imagery is commonly used by athletes to review past actions and preview upcoming ones. As such, imagery is a useful strategy for enhancing the performance of previously learned skills and strategies (for reviews, see Cumming & Ramsey, 2008; Hall, 2001; Murphy, Nordin, & Cumming, 2008). Of some debate, however, is the degree to which imagery can benefit the acquisition of a new skill when athletes have little or no experience with the task. One viewpoint is that imagery would be most beneficial at an early, primarily cognitive stage of learning when the focus is on understanding how the task should be performed (e.g., Fitts & Posner, 1967). It is believed that imagery can help individuals to organize and plan for performance (Murphy & Martin, 2002). Research, however, has generally not supported this opinion. Instead, the effects of imagery appear stronger for those individuals who are at a later stage of learning (Feltz & Landers, 1983). An alternative explanation is based on the idea that one's actions are driven by a centrally stored movement representation (Jeannerod, 1995). Individuals can access and strengthen these mental representations through imagery. Without prior experience with the task, however, no mental representation would be available and imagery would not be expected to exert a beneficial effect. In support of this prediction, Mulder, Zijlstra, Zijlstra, and Hochstenbach (2004) found that only those participants who had some prior experience with a toe abduction task showed improvements following imagery. By comparison, complete novices were unable to improve through imagery practice alone.

While no direct benefits appear evident from using imagery to learn completely novel tasks, there may still be indirect effects operating through other psychological mechanisms such as self-efficacy. Indeed, Bandura (1997) has proposed that imagery is a source of self-efficacy by providing information about how to best perform skills and strengthening beliefs in one's capabilities. In novel situations, Landau, Libkuman, and Wildman (2002) have further suggested that imagery can be used by individuals to gauge whether they possess sufficient ability to carry out the task. Occasionally, however, mentally stimulating a task can lead to overly optimistic judgments of self-efficacy. This disparity between beliefs in one's abilities and what actually occurs in reality is referred to as the *imagination inflation effect* (Garry, Manning, Loftus, & Sherman, 1996; Hyman & Pentland, 1996; Libby, 2003). Most commonly researched in reference to autobiographical memory, imaging counterfactual events has previously been found to change memories of childhood experiences (Garry et al., 1996; Heaps & Nash, 1999; Hyman & Pentland, 1996). For example, Garry et al. found that mentally stimulating an event that had not actually occurred (e.g., getting stuck in a tree) led participants to later become more confident that the event really happened. Similarly, Goff and Roediger (1998) determined that repeatedly imagining performance of an action (e.g., breaking a toothpick) caused participants to later remember that they had performed the action when in fact they had not. In both of the studies, participants confused the content of their images with reality. As an explanation, Garry et al. proposed that imagery made these events and actions more readily available in memory, but the source of this information was either forgotten or mis-remembered. During the recall test, the availability of the memory would make the event more plausible in the mind of the individual, and this would explain why they would report being confident that the fictitious event or action had actually taken place.

Following a similar line of reasoning, Landau et al. (2002) designed a series of experiments to determine whether short bouts of imagery could inflate participant's estimates of their physical abilities, which they termed "*estimation inflation*." They consistently found that participants who imagined themselves lifting a heavy object estimated that they could lift more weight than participants who did not engage in the imagery exercise. Furthermore, increasing the frequency of images resulted in higher estimates suggesting that imagery helped participants to remember details of the imagery content more easily when making their performance estimates. Manipulating the amount of weight lifted also helped to determine whether participants were using the weight as a reference point upon which to base their estimates or were assessing the plausibility of the imagery content when making judgments about their abilities. To this end, participants in the imagery conditions were asked to image themselves lifting either 200 pounds or 400 pounds. If participants were using the imaged weight as an anchor, Landau et al. hypothesized that those who image lifting a higher weight should always have higher estimates. No differences were found between the 200 and 400 pounds imagery groups, but these groups reported higher performance estimates than a no-imagery control group. Thus, participants were likely assessing the plausibility of the imagery content rather than using the amount of weight as a reference point. Generalizing these findings beyond lifting objects, Landau et al. also asked participants to rate their ability to perform 10 different motor tasks (e.g., shooting a free-throw, throwing a football, putting a golf ball, making a vertical leap). Participants returned a week later and image themselves performing five of the tasks. They then rated their abilities again for all 10 tasks). It was found that ratings of physical ability increased for only those tasks that had previously been imaged.

The estimation inflation effect found by Landau et al. (2002) seems to support the idea that imaging motor tasks makes these actions more available in memory. When individuals are asked to rate their abilities, the ease to which these stimulated actions comes to mind is likely what convinces them that they are able to perform the task despite having little or no previous experience. Another possible explanation investigated by Landau, Leynes, and Libkuman (2001) is whether these brief imagery exercises led to real improvements in the individual's ability to carry out the task. In both of their experiments, imagery had an effect on the performance predictions made by the participants, but not on actual performance. More specifically, participants who imaged a free throw shooting task tended to overestimate their abilities when compared to a control group. But, no differences between the groups were found in the number of successful free throw shots achieved. As explained above, imagery may not have influenced actual performance due to the participant's limited experience with the task. Even if participants had a mental representation for throwing objects at a target, the imagery exercises were probably too brief (i.e., usually lasting between 15 seconds and 1 minute) to cause a facilitative effect.

Building on the previous work of Landau and colleagues, the main aim of the present study was to re-examine the estimation inflation effect with a novel motor task (i.e., balancing on a stabilometer). Adjustments were made to the previous design in several ways. First, performance estimates and actual performance of the imagery group were not only compared to a control condition, but also to a physical practice group. By doing so, the present design separates the influence of imagery practice and physical practice on estimates of performance and on actual performance, which was not possible in previous experiments (Landau et al., 2001, 2002).

Second, the present study explored a further issue related to the estimation inflation effect, which has not been addressed previously (Landau et al., 2001, 2002). By taking a second estimate of future performance, we were able to test whether overestimating one's abilities had a negative or positive effect on subsequent self-efficacy. According to Bandura (1997), "acting on a sound appraisal of personal capabilities increases prospects of success, whereas acting in gross misjudgements of what one can do may be costly to one's psyche" (p. 61). He further explains that individuals do not generally tend to hold unrealistic efficacy beliefs. Indeed, self-efficacy is usually related to performance. However, the strength of this relationship can be influenced by a number of different factors. For example, a discrepancy between efficacy beliefs and action is found when the demands of the task are ambiguous or underestimated by the individual. Therefore, the estimation inflation effect might occur from a lack of knowledge about the task to be performed. This error of over assurance, according to Bandura, does not go unnoticed by the individual and is usually corrected. What is unknown is whether the individual is subsequently able to bring their self-efficacy beliefs more in line with reality. Alternatively, this information might shake the individual's beliefs in a more negative direction. The novelty of the task being employed in the present study afforded us the opportunity to investigate this issue further. Consequently, a second aim of the study was to examine what impact misjudging efficacy beliefs in an overly optimistic direction would have on subsequent self-efficacy after the individual gained more experience with the task.

Third, adjustments to the procedures were made in order to enrich the imagery experience of the participants thereby making it more possible for performance improvements to be found. Similar to Caliari (2008), participants were provided with an opportunity to view several demonstrations of the task before and midway through their practice condition. The demonstrations were primarily intended to support the images being formed by the imagery group (Holmes & Collins, 2001) based on the robust finding that observing an action can activate common neural pathways used for carrying out the action (e.g., Clark, Tremblay, & Ste-Marie, 2003; Mulder, de Vries, & Zijlstra, 2005). Watching a model perform the task would consequently enable the imagery group to form a mental representation of the task to be imaged. Providing all participants with this information eliminated viewing the demonstrations as a possible confounding variable. If only the imagery group had received the demonstration, for example, we would not be able to conclude that imagery was causing the estimation inflation effect.

In addition, the imagery exercise was done in an individualized manner and included response training (Lang, Kozak, Miller, Levin, & McLean, 1980). This training procedure is based in bioinformational theory (Lang, 1977, 1979), and involves drawing attention toward the physiological responses being experienced during imagery (e.g., contraction of the leg muscles). Smith and Collins (2004) previously explained that response-oriented imagery will enable individuals to better access and optimally strengthen mental representations. These adjustments to the procedures were intended to enrich the imagery experience of the participants thereby making it more possible for performance improvements to be found. If estimation inflation occurred because individuals had improved their performance of the task through mental practice, it was predicted that participants in the imagery group would not only provide higher performance estimates, but higher actual performance than the control group who received no such practice. That is, the imagery group would not have an inflated view of their performance; their performance estimates would be in line with reality. Conversely, if higher estimates were found without corresponding higher levels of performance for the imagery group, this result would further support the memory explanation of the estimation inflation effect and demonstrate that participants had a distorted view about their abilities to perform the task.

METHODS

Participants

The participants were 54 university students, most of whom received course credit for their participation. Both males ($n = 29$) and females ($n = 25$) participated in the study with ages ranging between 19 and 30 years, and a mean age of 20.35 ($SD = 1.77$).

Measures

Demographic Information

Participants were asked to provide demographic information concerning their gender and age.

General Balancing Ability

Prior to the start of the study, participants were asked to rate their general ability to balance on a 5-point Likert scale, ranging from 1 (*very poor*) to 5 (*very good*). On average, the participants scored a 3.39 (*SD* = .71) indicating that most perceived their balance ability as being moderate to moderate-good.

General Imagery Ability

The Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997) was employed as a measure of general imagery ability to ensure that all participants were capable of imaging. The MIQ-R is an 8-item questionnaire asking participants to first physically perform and then visually or kinesthetically image four simple movements. The participants were then asked to rate their ability to visually or kinesthetically image the movement on a 7-point Likert scale ranging from 1 (*very hard to see/feel*) to 7 (*very easy to see/feel*). The items were then averaged to form visual ($M = 5.19$, $SD = 1.04$) and kinesthetic ($M = 5.06$, $SD = .89$) subscales. Both subscales had acceptable levels of internal reliability (Nunnally & Bernstein, 1994) with Cronbach alpha coefficients of .78 (kinesthetic subscale) and .86 (visual subscale).

Self-Efficacy

A self-efficacy measure was designed for the present study following Bandura's (1997) recommendations. The measure assessed both the level and the strength of participant's beliefs about their abilities to perform the balancing task in comparison to the observed model. Items were based on the question "I believe I can replicate the model's standard of balancing on at least x of the attempts." The question was repeated a total of four times, with each question representing a progressively harder goal. Participants indicated the strength of their belief in each statement ranging from 0% "*I am very sure I cannot do this*," to 50% "*I am unsure—it could go either way*," and 100% "*I am very sure I can do this*."

Balance Performance

The balancing apparatus was a custom-built stabilometer consisting of a 100cm × 67cm wooden platform mounted freely on a horizontal axis (center of board) in the participants' frontal plane. From this horizontal axis, the maximum deviation possible was 14 degrees to either side. Data was collected using a potentiometer mounted on the horizontal axis and sampled at 200Hz by a PC-compatible computer with a C.E.D. 1401+ data acquisition board. Potentiometer data were transformed into degrees of variance from the horizontal equilibrium. Participants' proficiency in performing the balancing task was then measured by the standard deviation (*SD*) away from horizontal axis, with a lower *SD* score indicating a better balancing performance (i.e., less deviation from the horizontal axis).

Post-Experimental Manipulation Check

Using a similar method employed in previous studies (e.g., Nordin & Cumming, 2005; Ramsey, Cumming, & Edwards, 2008), the participants were asked to report whether they had employed any additional psychological strategies during the study. Some common mental strategies were listed (e.g., self-talk, their own imagery, goal-setting) and multiple responses were allowed. Thirty of the 54 participants (55.6%) reported using their own psychological skill, with self-talk ($n = 8$) and own imagery ($n = 5$) being the most common. 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 were asked to respond whether each statement is true or false of them. Each item is then scored as a 1 or 0 respectively, and scores on the desirable but uncommon behaviors were reverse coded. The resulting range of possible scores is 1 to 13, with higher scores presenting a higher need for approval. The average score for the sample was fairly low ($M = 5.37$, $SD = 2.50$), indicating that the participants generally did not show a tendency toward responding in a socially desirable fashion. Participants in the imagery group were also asked to rate how easy or difficult it was for them to visually and kinesthetically image the balancing task. Their responses were rated on the same 7-point Likert scale used in the MIQ-R, with scores therefore ranging from 1 (*very hard to see/feel*) to 7 (*very easy to see/feel*). Scores were in a similar range to general imagery ability, with the average being 5.35 ($SD = 1.23$) for specific visual ability and 5.00 ($SD = 1.30$) for specific kinesthetic ability, suggesting that the imagery group participants were able to both visually and kinesthetically image the balance task.

Procedures

Introductory Phase

Participants were first given an information letter and completed a consent form. They were then asked to provide demographic information and rate their perceived balancing ability. A short definition of imagery was provided (White & Hardy, 1998) and participants were asked to complete the MIQ-R (Hall & Martin, 1997). A digital recording of a model performing the balancing task was then shown to the participants. The demonstration was digitally recorded using a handheld video camera, and the recording was played to the participants using a PC and Windows Media Player. The model was a 22-year-old male who was unknown to the participants. The participants viewed this model performing the balancing task for 30 seconds, followed by a blank screen for 30 seconds. This 1-minute video clip was repeated an additional two times for a total of 3 minutes of viewing time.

The participants were told that performance would be measured by the degree of stability achieved around the horizontal equilibrium point. If they were able to keep the balance board perfectly stable and horizontal for the entire 30 seconds, they would then achieve a better score. Participants were also told that the model they had just observed performing the task showed very little deviation from the center of the board, and therefore attained an excellent balancing score. Thereafter, participants were randomly assigned to one of three conditions for the practice phase: a physical practice group ($n = 18$); an imagery group ($n = 18$); and a control group ($n = 18$).

Practice Phase

Those assigned to the physical practice group practiced the balancing task by alternating between 30 seconds of balancing with 30 seconds of rest for a total of four sets. During the rest phases, participants were instructed to work on a word search puzzle, which is a mental activity that was employed to try and prevent them from engaging in spontaneous mental practice. Following the first four physical practice sets, participants were again shown the video demonstration of the model performing the task, thereby providing them with a 3-minute rest break. Participants then performed an additional four sets of practice, again alternating balancing performance with work on a word search puzzle every 30 seconds.

Participants in the imagery practice group followed nearly an identical procedure, with the exception being that they were asked to practice the task by engaging in mental imagery. They were instructed to image themselves performing the task as clearly and as vividly as possible for 30 seconds and then rest for 30 seconds for a total of four sets. During the rest phases, participants were asked questions to ensure that they were experiencing physiological responses during imagery, a procedure known as response training (Lang et al., 1980). After completing the first four sets, imagery group participants were also shown the video of the model performing the task and then performed another four sets of imagery practice alternating with response training every 30 seconds.

Finally, participants in the control group worked on a word search puzzle for 4 minutes, and this matched the length of time that the practice groups spent completing their first four sets of practice. Similar to these other groups, the control group was again shown the video demonstration for a second time. They then worked on the word search puzzle for a further 4 minutes.

Test Phase

Following the 12-minute practice phase, the participants were asked to rate their beliefs about their ability to perform the balance task (self-efficacy measure #1). Participants were then told that their performance would be measured on the balancing task. To prevent problems with demand characteristics, they were told that they should try to do their best on the task. The actual performance test consisted of 30 seconds of physically balancing followed by 30 seconds of rest for a total of 3 minutes. Participants then rated their beliefs about their ability to perform the balancing task for a second time (self-efficacy measure #2), and were asked to complete a post experimental manipulation check. They were then debriefed on the nature of the experiment and thanked for their participation.

RESULTS

Preliminary Analyses

Before proceeding with the main analyses, preliminary analyses were first conducted to establish that no variables other than those manipulated for the study purposes were influencing the results. Possible confounding variables considered were gender, perceived balancing ability, general imagery ability, use of additional psychological skills, and general need for approval (i.e., social desirability). Four separate one-way between-group ANOVAs, with a Bonferroni corrected alpha level ($p = .0125$) to control for Type I error when making multiple comparisons, determined that no differences existed between the three experimental groups on perceived balancing ability, visual imagery ability, kinesthetic imagery ability, or in their general need for approval. Further, two separate one-way between-group ANOVAs with a corrected alpha level ($p = .025$) revealed no differences in performance according to gender or use of own psychological skills. Finally, two separate mixed-designs ANOVA with a corrected alpha level ($p = .025$) revealed no difference in the self-efficacy measures according to these same two independent variables. Given the lack of significant findings, the data was collapsed across these variables for the main analyses.

Main Analysis

Balance Performance

A one-way between-groups ANOVA revealed a significant difference in balancing performance (dependent variable) according to group assignment (independent variable), $F(2, 51) = 15.06, p < .001, \eta^2 = .37$. A Tukey HSD post hoc test indicated that the physical practice group (M = 5.78, SD = 1.80) performed significantly better, as reflected by their lower mean, than the imagery group ($M = 8.00, SD = 1.74$) and the control group ($M = 8.55, SD = 1.18$) (both $p < .001$). No significant differences between the imagery and control groups were found ($p = .94$) (Figure 1).

Self-Efficacy

Group differences in self-efficacy were examined by calculating a 3 (group) × 2 (self-efficacy) ANOVA with repeated measures on the last factor. No main effect was found for group, but a significant main effect was found for time, $F(1, 51) = 19.49, p < .001, \eta^2 = .28$, and a significant interaction between group and time, $F(2, 51) = 7.04, p = .002, \eta^2 = .22$. Given the equal group sizes and the assumption of homogeneity of variance not being violated (Maxwell, 1980), a Tukey's HSD

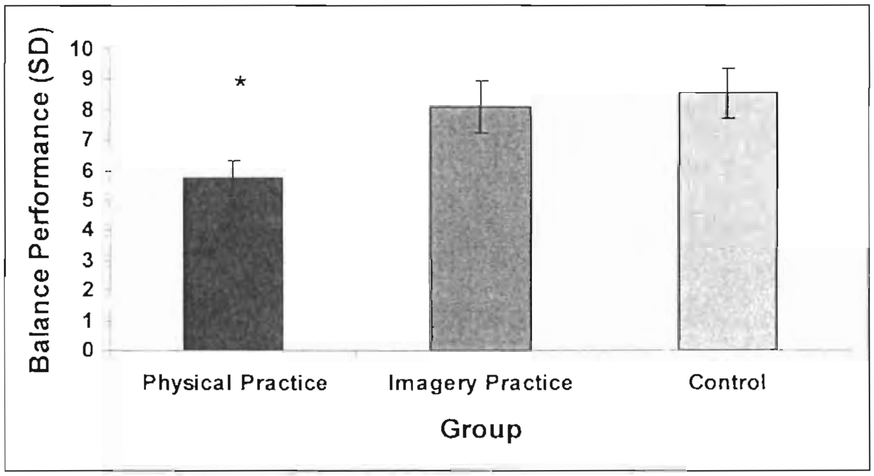

Figure 1. Performance scores during the test phase for thethree experimental groups. **Note:** A lower value reflects superior performance.
* = significantly lower than the imagery practice and control groups ($p < 0.001$)

single-step procedure controls for Type I error for the collection of all posterior pairwise contrasts (Kirk, 1995). From this follow up test, three notable findings were revealed. First, compared to the physical practice group, the imagery group had significantly higher levels of self-efficacy prior to the test phase ($qT = 4.31$, $p < .05$), thus demonstrating a between-subject effect for self-efficacy measure #1 (physical practice: M = 46.90, SD = 20.07; imagery practice: M = 63.00, SD = 17.59; control: M = 48.68, SD = 23.88). Second, both the control group ($qT = 5.12$, $p < .01$) and the imagery practice group ($qT = 6.36$, $p < .01$) significantly lowered their self-efficacy after the performance test, thus demonstrating a within-subject effect across time. Further, no differences (all $p > .05$) existed between the three groups for self-efficacy measure #2 (physical practice: M = 49.24, SD = 24.10; imagery practice: M = 41.00, SD = 27.32; control: M = 38.55, SD = 25.63) (Figure 2).

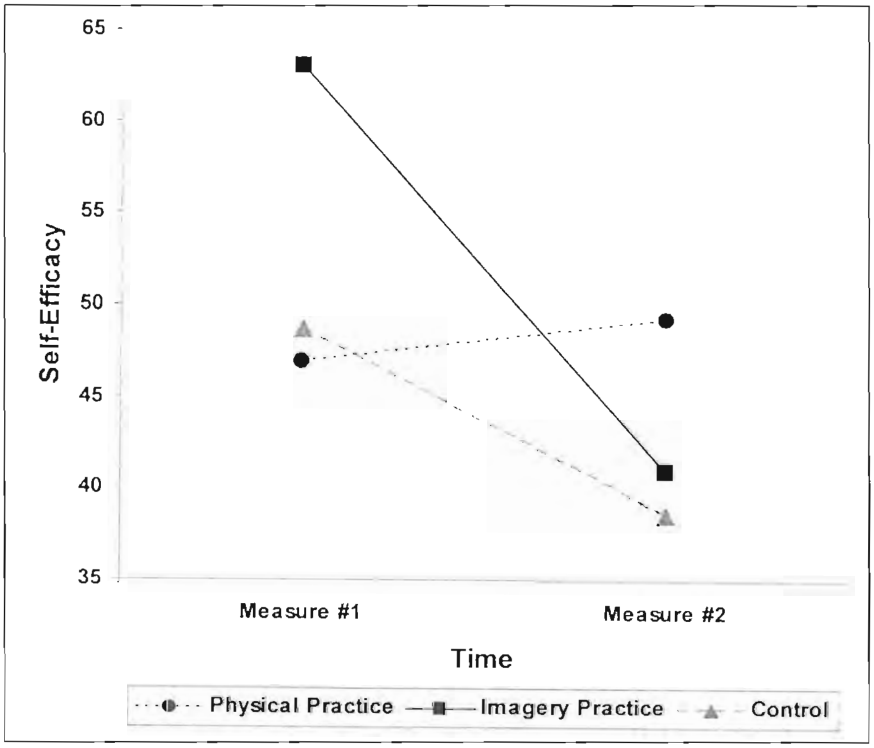

Figure 2. Interaction between time and group on self-efficacy scores for the three experimental groups.

Bivariate Correlations

The relationship between self-efficacy and balancing performance was investigated using bivariate correlations. Balancing performance was unrelated to self-efficacy beliefs held prior to the test phase ($r = -0.19, p > .05$), but was significantly and positively associated with post-test self-efficacy ($r = .70, p < .001$). In other words, superior balancing performance (as indicated by a lower value) was associated with higher levels of self-efficacy only after experience with the task was obtained.

DISCUSSION

The present study re-examined the estimation inflation effect with a novel motor task (i.e., balancing on a stabilometer). All participants first watched a video demonstration of a model perfectly performing the task (i.e., a mastery model). Two types of practice (physical and imagery practice) were then compared to a no practice control condition (who worked on a word search puzzle). Subsequent to this practice phase, self-efficacy ratings for future task performance were measured before and after actually performing the balancing task (test phase). Based on the findings of Landau and colleagues (2001, 2002), we predicted that imagery practice would result in higher levels of self-efficacy prior to the test phase. In addition, the present design extended Landau et al. (2001, 2002) in two main ways. First, through the inclusion of a physical practice group, we were able to separate the influence of imagery practice and physical practice on estimates of performance and on actual performance. Second, by taking a second estimate of future performance, we were able to test whether overestimating one's abilities had a negative or positive effect on subsequent self-efficacy.

As expected, self-efficacy beliefs were significantly greater following imagery practice compared to physical practice, which is consistent with the estimation inflation effect (landau et al., 2001, 2002). But, actual performance of the task following imagery practice was no different to the control group's performance. Thus, imagery practice did not benefit actual performance compared to working on a word search puzzle. By contrast, physical practice did result in greater test phase performance compared to both imagery practice and control. In other words, imagery practice resulted in higher beliefs in one's ability to perform the task, but not actual performance of the task, whereas physical practice did not influence performance estimates but did improve actual performance. This finding further demonstrates that imagery practice is capable of inflating estimates of physical abilities (Landau et al., 2001, 2002). In addition, the disparity between performance expectation and actual performance suggests that simulating a novel task through imagery can provide misleading information to the individual, whereas physical practice does not. In doing so, our findings demonstrate that imagery practice and physical practice produce dissociable effects on performance estimates and actual performance.

The disparity in performance estimation observed following imagery practice and physical practice disappeared following the test phase. That is, there were no group differences in self-efficacy after all participants physically performed the task. Additionally, the imagery practice group's expectations of future performance decreased significantly from pre- to post-test. These data suggest that the initial inflation in future performance expectation following imagery practice was removed when genuine experience of the task was gained. This authentic experience acquired from physically performing the task seems to have produced more "realistic" predictions of future performance. Therefore, actually performing the task provided more accurate knowledge of task difficulty compared to mentally simulating task performance through imagery. In doing so, task ambiguity was reduced which may have permitted a more informed basis for future performance estimations. Testament to this idea, a significant and positive relationship was found between task performance and post-test self-efficacy: individuals who performed better on the task reported higher ratings of efficacy. This evidence suggests that the estimation inflation effect may be explained, at least in part, by a lack of knowledge about the task to be performed. Additionally, the findings suggest that misjudging efficacy beliefs in an overly optimistic direction will not negatively impact on future predictions of performance. Therefore, individuals seem capable of returning to realistic levels of self-efficacy following artificially inflated performance expectations.

The control group also significantly lowered their self-efficacy beliefs after the test phase. One interpretation of this finding is that the vicarious experience of having viewed a "mastery" model was sufficient for the control group to have artificially high pre-test self-efficacy beliefs. Without having any experience with the task, the control group would be expected to report lower self-efficacy beliefs than both the physical practice and imagery practice groups. Instead, the means of the control and physical practice groups were not significantly different from each other. Therefore, it is possible that viewing perfect performance of a task may have impacted the observers' beliefs about their ability. Further investigation may seek to explore this proposal by comparing a mastery model (as used in the current study) to a "coping" model (i.e., a model that gradually improves, see Schunk & Hanson, 1989; Schunk, Hanson, & Cox, 1987). An alternative explanation of the data, which the present design cannot discount, is that individuals overestimate their ability with no experience of the task. Future work that clarifies this possibility would be valuable.

Despite the elevation of performance expectations through imagery practice, actual performance of the task following such a practice was no different to the control group's performance. The current findings, therefore, do not support a mental practice explanation of estimation inflation. That is, imagery did not increase performance expectations of novel tasks by actually improving an individual's ability to perform such tasks. If this was the case, performance estimations would more closely correspond to actual performance levels. These findings show stronger support for a memory explanation of estimation inflation. In other words, simulating performance of novel tasks through imagery can make task performance seem more readily available in memory (Garry et al., 1996; Heaps & Nash, 1999; Hyman & Pentland, 1996; Libby, 2003). It should be noted that the present design did not completely separate memory and mental practice effects as the imagery performed was based, in part, on remembering a previously viewed model. Further work that directly tests the predictions made by memory and mental practice explanations of estimation inflation would be worthwhile.

Taken together, our data suggests that inflated levels of self-efficacy, when elicited through imagery, may not have the capacity to influence subsequent motor performance of novel tasks (Landau et al., 2001). Even though steps were taken to enrich the imagery experience in the current study, only performance expectations and not actual performance were influenced. These findings, therefore, provide support for the notion that imagery is ineffective for learning novel tasks (Mulder et al., 2004). Consequently, our data does not encourage the use of imagery as a complete substitute for physical practice at an early stage of learning. Instead, we support recommendations made by Hall (2001) for imagery to be used as a complement to physical practice that might enable learners to refine and enhance their mental representation of the skill.

There are a few limitations to the present study that are worth mentioning. Due to the nature of the research questions being asked, which required a navel task, no baseline measure of performance was obtained in the present study. Therefore, it is not certain whether group differences in balancing ability existed at the onset of the study. However, participants were randomly assigned to their groups so any pre-existing differences would have been purely by chance. Furthermore, participants' perceptions about their general ability to balance were similar among the three groups. Developing a self-efficacy measure for balancing performance according to Bandura's (1997) also proved difficult. Unlike tasks with an obvious outcome (e.g., number of balls putted), it was not easy to establish what level of performance the participants were trying to achieve. To get around this problem, we asked participants to compare their abilities to the performance demonstrated by the mastery model. Similar to other previous studies employing manipulation checks, we found that participants tended to spontaneously engage in psychological skills such as goal-setting and self-talk (Nordin & Cumming, 2005; Ramsey et al., 2008). Importantly, the use of these other psychological skills did not appear to influence performance (see Results, *Preliminary Analyses*).

In conclusion, even with an enriched imagery experience, the findings from this study affirm the notion of estimation inflation with respect to learning novel tasks. That is, imagery practice (of novel tasks) that is based on a mastery model is able to inflate an individual's expectation of ability but not their actual ability to perform that task; only physical practice improved actual performance. Therefore, mentally practicing novel tasks can provide a distortion between the belief and reality in one's ability level, whereas physical practice does not. In doing so, our findings demonstrate that imagery practice and physical practice produce dissociable effects on performance estimates and actual performance. Furthermore, once individuals gained authentic experience of the task, the initial misjudgment in belief was abolished with more realistic expectations prevailing. Thus, creating overly optimistic expectations of ability does not hamper future expectations once authentic experience is gained. This advancement in knowledge is noteworthy for coaches and athletes who design mental practice interventions, as it suggests the current stage of learning of the individual should be considered for optimal performance benefit.

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