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Winter, S., and Collins, D.

Journal of Sport & Exercise Psychology, 2013, 35, 299-307

JOURNAL OF
SPORT & EXERCISE
PSYCHOLOGY
Official Journal of NASPSPA
www.JSEP-Journal.com
ORIGINAL RESEARCH

Does Priming Really Put the Gloss on Performance?

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Priming has recently emerged in the literature as offering advantages in the preparation for skilled performance. Accordingly, the current study tested the efficacy of imagery against a priming paradigm as a means of enhancing motor performance: in essence, contrasting a preparation technique primarily under the conscious control of the performer to an unconscious technique promoting automaticity. The imagery intervention was guided by the PETTLEP model, while the priming intervention took the form of a scrambled sentence task. Eighteen skilled field-hockey players performed a dribbling task under imagery, priming, skill-focus, and control conditions. Results revealed a significant improvement in speed and technical accuracy for the imagery condition as opposed to the skill-focus, control, and priming conditions. In addition, there were no significant differences in performance times or technical accuracy between the priming and control conditions. The study provides further support for the efficacy of imagery to elicit enhanced motor skill performance but questions the emerging emphasis on priming as an effective tool in preparation for physical tasks.

Keywords: preparation, skilled execution, imagery, PETTLEP, priming

Cognitive psychology has seen a resurgence of interest around the concept of consciousness (Velmans, 2000), which has subsequently transferred into the sport psychology literature. The emergence of cognitive science led to the idea of a cognitive unconscious (Reber, 1993) in the form of complex information processing that is conducted without conscious awareness. One such premise is automaticity, which is associated with the execution of skilled movement and is considered to be fast, effortless, and without the need for technical attention (Bargh & Chartrand, 1999). This is opposed to the defining features of conscious processing, which are mental acts of which individuals are aware that are intentioned, require effort, and are also controllable (Logan & Cowan, 1984).

Automatic mental processes free one's limited conscious attentional capacity (Kahneman, 1973), allow rapid processing, and are manifested in the behavior of skilled performers as appearing not to have to think about what they are doing (Singer, Lidor, & Cauraugh, 1993). Within the realm of performance sport, appropriate self-direction of thought processes before and during task execution has been shown to make a significant difference in the level of performance attained (Abernethy, Maxwell, Jackson, & Masters, 2007; Beilock, Bertenthal, McCoy, & Carr, 2004; Moran, 2009; Singer, 2000; Singer et al., 1993). Reflecting these stances, a debate is emerging about the comparative efficacy of strategies to develop conscious thoughts that are conducive for physical performance, as contrasted to the promotion of unconscious processing through automaticity approaches.

Traditionally, the approach from the sport psychology literature has advocated the provision of mental skills training (MST; e.g., Frey, Laguna, & Ravizza, 2003; Wrisberg, Simpson, Loberg, Withycombe, & Reed, 2009) focused on the immediate preparation for performance. Implementing this approach to psychological preparation requires the allocation of appropriate cognitive-behavioral techniques to allow the performer to transform maladaptive cognitions to those that are readily adaptable (Burton & Raedeke, 2008). Thereby, the focus being on promoting techniques, for example imagery, that can aid the right thoughts tailored to preparation and optimal performance (Weinberg, 2008). Imagery can be considered as primarily under the conscious control of the imager (Holmes & Calmels, 2008) and the extensive imagery literature base has always supported the inclusion of some form of imagery process in sport's practice and pre-performance regimes (Connaughton, Wadey, Hanton, & Jones, 2008; MacNamara, Button, & Collins, 2010; Smith & Wright, 2008).

Contrasting Pre-Performance Preparation Strategies: Theoretical Perspectives

As a comparatively opposing development, there has been an increasing emphasis in the literature on unconscious processing through the promotion of automaticity (Kinrade, Jackson, & Ashford, 2010; Lam, Maxwell, & Mas-

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ters, 2010; Liao & Masters, 2001). This notion has been promoted in the literature through techniques imported from cognitive psychology, for example, priming. The social cognition literature has demonstrated priming effects on cognitive and motor performance (Bargh, Chen, & Burrows, 1996; Bry, Follenfant, & Meyer, 2008; Dijksterhuis & Van Knippenberg, 1998; Kay, Wheeler, Bargh, & Ross, 2004; Schubert & Häfner, 2003). Priming refers to "the influence a stimulus has on subsequent performance of the processing system" (Baddeley, 1997, p. 352). It has been suggested that primes developed to manipulate focus toward global aspects of performance would be advantageous, as they would encourage automaticity (Bargh et al., 1996; Bruce, Carson, Burton, & Ellis, 2000; Hull, Slone, Meteyer, & Matthews, 2002).

To prime an individual's performance, a commonly used method from cognitive psychology is for participants to be presented with a series of five-word items in which they are required to use four of the words to form a grammatically correct sentence (Bargh et al., 1996; Kay & Ross, 2003; Srull & Wyer, 1979). The scrambled sentence paradigm has been used to determine how a cognitive representation primed in one situation affects behavior in a seemingly unrelated situation (Bargh & Chartrand, 2000). Recent and innovative applications to physical performance (Ashford & Jackson, 2010; Banting, Dimmock, & Grove, 2011; Bry, Meyer, Oberlé, & Gherson, 2009) have employed this scrambled sentences method before completion of a hockey-dribbling task, cycling task, and a relay race respectively.

Offering further support for the promotion of automaticity, explicit monitoring or skill-focus theories suggest that pressure increases self-consciousness concerning performing correctly, which in turn leads performers to focus their attention on skill execution to ensure an optimal outcome (Beilock & Carr, 2001). Explicit attention to step-by-step processes is thought to disrupt the execution of proceduralized processes that normally run outside of conscious awareness (Baumeister, 1984; Beilock et al., 2004; Beilock & Carr, 2001). The studies by Beilock and her colleagues contain results consistent with current theories of practice-based automaticity in that extended practice leads to proceduralized control that does not require constant attention (Beilock, Wierenga, & Carr, 2002).

Interestingly, and in contrast to these theoretical assumptions, Ericsson and colleagues have asserted that automaticity theories are limited for explanations of the mediation of skilled performance (Ericsson, 2002; Ericsson & Kintsch, 1995; Ericsson, Krampe, & Tesch-Romer, 1993). They propose that experts maintain high levels of conscious monitoring and control that are essential for further improvements in performance. A recent example in sport (McRobert, Ward, Eccles, & Williams, 2011) showed that the number of thoughts (the majority of which were task related) reported by skilled versus less-skilled athletes during performance was higher. The finding that experts' incidental memory for task-relevant information was superior to that of novices also implies that forms of expert performance remain mediated by attention-demanding cognitive processes (Ericsson & Lehmann, 1996). These theoretical propositions represent the two sides of the debate identified earlier: specifically, whether the direction of thoughts should be task related to performance, or promoting automaticity through unconscious processing.

Addressing the Debate: Effectively Contrasting Between the Two Approaches

In an application of the priming approach to physical performance, Ashford and Jackson (2010) employed the scrambled sentences method before completion of a hockey-dribbling task. The priming intervention generated superior performance on the hockey-dribbling task, with respect to both outcome (time) and process (technical accuracy) parameters.

However, there were two problems with the otherwise carefully conducted study by Ashford and Jackson (2010). Firstly, the *pre*-performance priming condition was contrasted with an *in*-performance, explicit focus condition—a technique seemingly designed to obstruct performance by promoting thinking about the task through explicit instructions (Baumeister, 1984). The difficulty of a task within the constraints of the experimental protocol, operationally delineate its nominal level of difficulty (Guadagnoli & Lee, 2004). This skill-focus condition involved a secondary task and thereby posed an additional cognitive challenge. Cognitive load theory (Paas, Renkl, & Sweller, 2003) stresses that mental load, which originates from the interaction between task characteristics (e.g., task format, task complexity) and learner characteristics (e.g., experience, prior knowledge), yields an a priori estimate, which refers to the cognitive capacity that is actually allocated to accommodate the demands imposed by the task (van Merriënboer & Sweller, 2005). Therefore a difference in both task difficulty and cognitive load were apparent, which is not directly comparable to any of the other conditions employed within the Ashford and Jackson study.

Secondly, and attempting to address this erroneous pre-performance to in-performance contrast, the new priming approach was not compared with another, more well-established pre-performance strategy, namely, imagery. Not only would this represent a fairer comparison (between two *pre*-performance strategies), it would also enable an evaluation of the comparative efficacy of priming against another empirically supported preparation technique. Furthermore, such a comparison holds implications for applied practitioners and hence provides a valuable addition in a sport psychology journal.

Reflecting these parameters, the aim of the current study was to see if priming could also potentially enhance performance against imagery. Thereby, comparing the conscious technique of imagery (Holmes & Calmels, 2008) through directing thoughts that are task related to performance, to the unconscious priming paradigm promoting automaticity (Bargh et al., 1996; Bruce et al.,

2000) employed by Ashford and Jackson (2010). We hypothesized that imagery would be more effective than priming due to the following reasons: Firstly, the majority of priming studies from the social cognition literature have used priming to activate mental or perceptual representations leading to behavior corresponding with specific attributes (e.g., Bry et al., 2008; Dijksterhuis & Van Knippenberg, 1998; Hull et al., 2002). Secondly, apart from the Ashford and Jackson study, research in the sport and exercise psychology domain (Bry et al., 2009; Banting et al., 2011) have adopted priming for cooperation and motivational behaviors, rather than simple motoric effect, and notably use novice performers in both circumstances.

Thirdly, through providing evidence on explicit monitoring, the authors have adopted Ericsson and colleagues' proposition that these are limited for explanations of the mediation of skilled performance. If experts maintain high levels of conscious monitoring and control, we feel priming is unlikely to have an effect on expert performers. Furthermore, imagery is well established in the sport psychology literature as having performance-enhancing effects (e.g., Connaughton et al., 2008; MacNamara et al., 2010; Smith & Wright, 2008). We therefore hypothesized that imagery would enhance performance relative to control, skill-focused, and priming conditions. In addition, we hypothesized that the "explicit focus" manipulation (Baumeister, 1984; Beilock et al., 2004; Beilock & Carr, 2001) would have a detrimental effect when compared with the control condition.

Method

Participants

Following institutional ethical approval and informed consent, 18 field hockey players were recruited. The sample comprised 9 males (age: M = 31.78 years, SD = 9.62 years) and 9 females (age: M = 27.44 years, SD = 5.53 years). Collectively, participants reported having a mean of 16.5 years' experience (SD = 7.49 years) ranging from county to international standard.

Task

Ashford and Jackson's (2010) hockey-dribbling task was adopted for the study. Participants were required to use an Indian dribble to maneuver a field-hockey ball around a 12-m slalom course, marked out by cones at 1-m intervals. All participants were instructed to use their own equipment for familiarity purposes when completing trials in all of the attention conditions outlined here. To enable comparison with Ashford and Jackson's original study, we employed the high-pressure condition they used as this was shown to yield the largest effect. Accordingly, each trial was recorded using a Sony DCR-HC51 digital video camera.

Performance Times. The time taken to complete each trial was recorded to the nearest 0.02 s directly from video footage using Quintic software.

Lateral Displacement. The mean maximal lateral displacement was calculated for each cone in each attention condition, through the use of a reference grid. This consisted of zones 5 cm wide measured adjacent to the cones, enabling the maximum displacement of the ball corresponding to each cone of the task to be recorded. An independent rater was used to randomly assess 10% of trials in each condition. No differences between raters were apparent.

Pressure Manipulation. The high-pressure manipulation was replicated from Ashford and Jackson's (2010) study through the presence of a video camera and a cover story. Participants were informed that footage from the hockey-dribbling task would be used in a film about the basic skills of field hockey that the researcher was to present to the national governing body. Reflecting the focused purposes of the present investigation, however, pressure was not considered as a factor and no contrasting low-pressure condition was included.

Attention Conditions

Priming. A scrambled sentence task (Srull & Wyer, 1979) was adopted for the priming manipulation. Words associated with autonomous performance were selected for the content of the prime: for example, "controlled," "fluent," and "graceful." Before completing trials, participants were given unlimited time to complete the grammatical task, comprising 30 five-word items presented in a random order: for example, "slalom balanced was the where." Participants were instructed to use four of the five words presented to form a grammatically correct sentence, for example, "the slalom was balanced."

Imagery. Each participant informed the researcher which slalom from their three control trials they had performed to the best of their ability. This individualized video footage was shown to each participant as a prime for mental rehearsal concerning the upcoming execution of the hockey-dribbling task. The footage lasted approximately 7 s, dependent on individual skill differences. To ensure the actual movements and their imagined counterparts were proximally and functionally equivalent, the PETTLEP approach of Holmes and Collins (2001) was used to guide participants' motor imagery. This evidence-based, 7-point checklist of imagery delivery emphasizes the minimum requirement areas in which practitioners should monitor the equivalence to the physical task to enhance the efficacy of their practice. Participants were able to mentally practice their actual hockey-dribbling task, adopting a characteristic posture, wearing their typical hockey attire, all within the environment the task was taking place. Participants were thus provided with an external imagery guide that resonated with the represented movement pattern in real time.

Skill Focus. Participants were asked to "be aware of what you are doing," and "focus on the movement of your hands throughout the trial" (Baumeister, 1984). When each participant pronated or supinated their dominant hand, they verbalized the words "down" and "up," in response to a tone that sounded on a 6-s variable-interval schedule.

Control. All attention conditions took place after the control condition, in which individuals were given the instructions to "complete the dribbling task as quickly and accurately as possible" (Ashford & Jackson, 2010).

Procedure

A standardized procedure was followed by all participants, and it consisted of a warm-up and five trials of the dribbling task for familiarization purposes, with the last three serving as the control condition. Participants were informed they would receive a specific set of instructions before the three-trial completion of each experimental condition. Following this, a Latin square design was adopted to allow attentional conditions to be assigned quasi randomly, permitting the researchers to control for variation in presentation order (Hinkelmann & Kempthorne, 2008). Participant numbers were deliberately selected to enable order of presentation to be completely crossed. Participants were further informed that, if any significant errors occurred, for example, losing control of the ball beyond the reference grid, the trial would be repeated. This procedure ensured accuracy was maintained throughout the trials (cf. Ashford & Jackson, 2010; Beilock, Carr, MacMahon, & Starkes, 2002).

After each testing stage, a modified version of the funneled debrief adopted in the Bargh et al. (1996) study was used, whereby participants were questioned on their experiences with the condition, their adherence to it, and how easy/useful they had found it. On completion of the whole experimental procedure, participants were fully debriefed about the nature and purpose of the study and thanked for their participation.

Data Analysis

Two one-way repeated-measures ANOVAs were conducted on the attentional focus conditions. Mean trial completion time and mean lateral displacement served as the dependent variables. Post hoc analyses were used to identify the differences between the attentional focus conditions when significant effects were identified, with a Bonferroni adjustment being applied. Partial eta-squared (η_p^2) were reported as the effect size (Tabachnick & Fidell, 2007), with Cohen's *d* used for all simple effect comparisons. Values of .02, .05, and .08 indicated small, medium, and large effect sizes, respectively (Cohen, 1992).

Results

Initial testing showed no significant effects due to the Latin square design on either variable (time: $F(2, 34) = .342$, $p = .713$; lateral displacement: $F(2, 34) = .118$, $p = .889$; cf. Myers, 1979). Furthermore, although participants were varied (reflecting perhaps their status as county, national, or international performers), no outliers were apparent. Accordingly, data were collapsed across conditions for simpler analysis.

Performance Times

ANOVA revealed that the mean performance time was significantly different among the four attentional conditions, $F(3, 51) = 46.39$, $p < .001$, $\eta_p^2 = .73$. Post hoc analyses indicated that performance was significantly faster in the imagery condition, than in the priming ($p < .001$, $d = .36$), skill-focus ($p < .001$, $d = .72$), and control conditions ($p < .001$, $d = .38$). In addition, post hoc analyses revealed that performance was significantly slower in the skill-focus condition than in both the control ($p < .001$, $d = .39$) and the priming conditions ($p < .001$, $d = .38$). Finally, there was no significant difference between performance times in the priming condition compared with the control condition (see Figure 1).

Interrater Reliability

To establish objectivity, two individuals assessed the lateral displacement of the hockey ball in a random selection of trials (10%) from each condition (Ashford

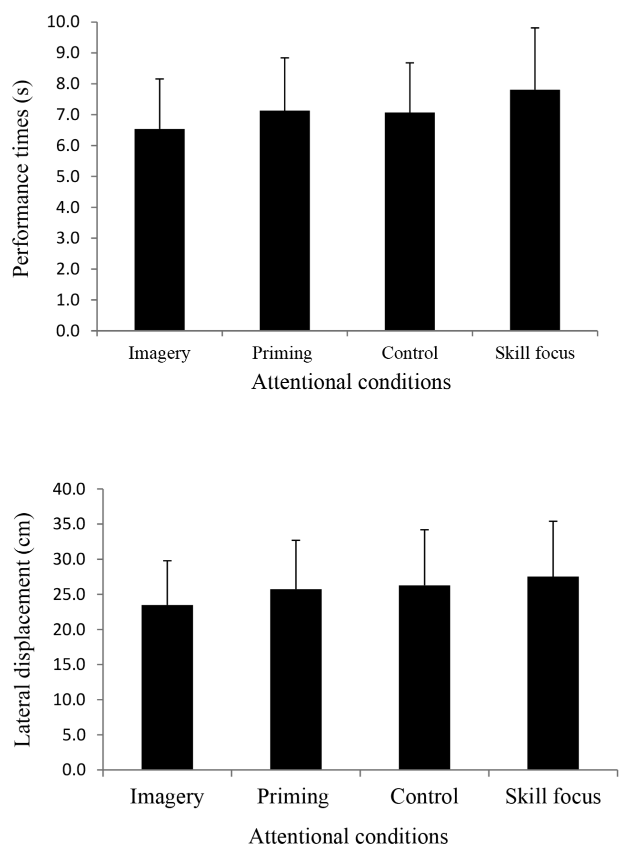

Figure 1 — Mean (± *SE)* performance times and lateral displacement in the control, priming, imagery, and skill-focus conditions.

& Jackson, 2010). Calculation of Pearson's correlation coefficient indicated the scores of the judges were highly correlated, $r = .81$, $p < .001$ (Judge A: $M = 25.89$ cm, $SD = 5.28$ cm; Judge B: $M = 26.08$ cm, $SD = 5.55$ cm), a similar finding to Ashford and Jackson's (2010) study ($r = .83$, $p < .001$).

Lateral Displacement

ANOVA revealed a significant difference between the mean lateral displacement measurements among the four attentional conditions, $F(3, 51) = 14.98$, $p < .001$, $\eta_p^2 = .47$. Post hoc analyses indicated that lateral displacement was significantly lower in the imagery condition than in the control ($p < .001$, $d = .39$), skill-focus ($p < .001$, $d = .56$), and priming conditions ($p < .001$, $d = .33$). No significant differences were observed between the control and skill-focus conditions, between the control and priming conditions, or between the skill-focus and priming conditions (see Figure 1).

Participant Debrief

There was a general consensus from participants that imagery was facilitative to the motor task. The opposite was expressed for the skill-focus condition, which participants found disruptive to performance. In terms of priming, some participants reported the task "calming" *but* adverse to how they optimally want to feel before performing the motor task. In other cases, participants reported the priming task as so "banal" that they failed to complete it properly, necessitating the recruitment and testing of five replacements.

Discussion

The primary aim of the current study was to examine the efficacy of imagery against priming as a means of enhancing motor performance—in essence, contrasting a technique, which is considered primarily under the conscious control of the performer (Holmes & Calmels, 2008) with an unconscious technique promoting automaticity (Bargh et al., 1996; Bruce et al., 2000; Hull et al., 2002). Previous research from the sporting domain has supported the use of imagery as a performance-enhancing technique that can aid the direction of task-related thoughts tailored to preparation and optimal performance (Connaughton et al., 2008; MacNamara et al., 2010; Smith & Wright, 2008). Notably, the social cognition literature has supported priming effects on cognitive and motor performance (Bry et al., 2008; Dijksterhuis & Van Knippenberg, 1998; Kay et al., 2004; Schubert & Häfner, 2003). In the sporting literature, however, priming has not yet been studied extensively.

Examination of performance times across the four attention conditions revealed performance to be significantly faster in the imagery condition than in all the other three conditions. Ericsson and colleagues propose that experts maintain high levels of conscious monitoring and control, which are essential for further improvements in performance (Ericsson, 2002; Ericsson et al., 1993; Ericsson & Lehmann, 1996). The skilled athlete's primary desire with respect to his or her task is to continually enhance performance on that task. Consequently, she or he does not relinquish cognitive control of the task but, instead, retains and even enhances it in the form of the constant monitoring and evaluation of performance (Ericsson & Kintsch, 1995; McRobert et al., 2011). Supporting this theoretical proposition, imagery can be considered as primarily under the conscious control of the imager (Holmes & Calmels, 2008) and thus can be used as a strategy to mediate the direction of thoughts as task related to performance. Imagery is one of the most widely researched of all psychological interventions in sport and is very well established as a performance enhancement technique (e.g., Smith, Wright, Allsopp & Westhead, 2007; Wakefield & Smith, 2011; Weinberg, 2008). This was further supported in the current study with hockey players performing significantly better following this technique.

The most noteworthy finding from Ashford and Jackson's (2010) study was that performance was significantly faster in the priming condition than in the control condition, which they supported by the theoretical premise that the motor processing system resulted in an attentional focus and behavioral response that was consistent with the content of the prime (Bargh et al., 1996; Bruce et al., 2000; Hull et al., 2002). This is in stark contrast to the current study, where there was no significant difference in the performance times between the priming and control conditions. This is also apparent in the absence of significant difference in the technical accuracy of the task between these two conditions. Participants found priming to have no additional performance benefits than the control instruction of "complete the dribbling task as quickly and accurately as possible." Notably, the majority of studies in the social cognition literature have used priming to activate a mental representation of a social group (e.g., older people, professors, dumb blondes) leading to behavior corresponding with specific attributes of the stereotype (Bry et al., 2008; Dijksterhuis & Van Knippenberg, 1998). These authors suggest that several behaviors may be evoked leading to improved performance; for example, participants may allocate their effort differently and hence the prime may automatically and subconsciously induce participants to concentrate on the task and to think harder about possible answers. In contrast, the purpose of priming in the current physical context was to avoid thinking about the task. However, in any priming task the assumption could be made that the translation of words to stimuli, and then to existing motor programs, involves working memory (Baddeley, 1997), which opposes the theoretical premise of the technique and may offer an explanation as to why priming elicited no difference to the control condition in this study.

As opposed to the imagery condition and as expected, significant performance decrements were evident in the skill-focused condition compared with the imagery, priming, and control conditions. Explicit monitoring or skill-focus theories suggest that pressure increases self-consciousness concerning performing correctly, which in turn leads performers to focus their attention on skill execution to ensure an optimal outcome (Beilock & Carr, 2001). This study lends support to the contention that the skill-focused condition caused participants to focus their attention internally toward aspects of performance (e.g., Baumeister, 1984). In particular, the results highlight the negative impact of attending to proceduralized components of a skill and allocation of attention playing a mediating role in performance degradation (cf. Guadagnoli & Lee, 2004) and additional cognitive load (Paas et al., 2003; van Merriënboer & Sweller, 2005).

The purpose of analyzing the displacement of the hockey ball was to examine whether variations in performance could be attributed to a general decrease in the speed of motor performance and/or a decrease in technical accuracy. Previous studies also utilizing a dribbling task with their participants (e.g., Beilock, Carr, et al., 2002; Jackson, Ashford, & Norsworthy, 2006) only used time as the performance measure and hence obtained no evaluation of accuracy. In relation to this, Gray (2004) conducted a study assessing the impact of attentional allocation on hitting kinematics in baseball batters. Specifically, he observed that under the control and external focus conditions, swing execution remained unaffected; however, the skill-focus condition caused a significant degradation of performance. Interestingly, in the current study lateral displacement for the skill-focus condition was not significantly higher than the control or priming attention conditions. Ashford and Jackson (2010) observed no significant difference between their control and skill-focused lateral displacement, which our current study supports. Hence, although both studies demonstrated faster times in the control over the skill-focus condition, the accuracy/error was not significantly detrimental to performance. In fact, the skill-focus condition caused the hockey players to perform the task slower but without significantly less accuracy on the task, a finding which does not fully support Gray's (2004) study. The significant differences for lateral displacement in this study occurred between imagery and each of the other three attention conditions. Imagery displayed the least ball displacement over the slalom course and subsequently the highest technical accuracy for the motor performance (see Figure 1), providing further support for the technique.

Further Considerations on Priming

The main moderator of priming effects is applicability (Bry et al., 2009; DeCoster & Claypool, 2004), defined as the congruence between the features of a prime and the features of the behavior to be performed. The more congruent they are, the more likely the concept will be activated to perform the behavior (Higgins, 1996). Outside of the laboratory setting, sporting tasks vary considerably in the different behaviors and tasks that are necessary for successful performance. Clearly, the applicability constraint would not hold when there are multiple subtasks to which the prime is differentially applicable. Hence, Higgins and Brendl's (1995) applicability rule should be tested in sports that require highly complex technical aspects of performance (e.g., gymnastics) or different physical, technical, and tactical aspects (e.g., rugby). Furthermore, as priming is promoting automaticity of movement, this unconscious processing is irrelevant for performers who need to think both before and during performance (e.g., boxing). Therefore, the range of sports and specific tasks that priming is applicable to warrants further investigation.

There are also further concerns with the practicality of priming for sports performers, if practitioners in the field are considering this technique as a preparation tool. The commonly used method, to prime an individual's performance, is for participants to be presented with a series of five-word items in which they are required to use four of the words to form a grammatically correct sentence (Bargh et al., 1996; Kay & Ross, 2003; Srull & Wyer, 1979). The scrambled sentence paradigm has been used to determine how a cognitive representation primed in one situation affects behavior in a seemingly unrelated situation (Bargh & Chartrand, 2000). Expecting athletes to complete sentence-scrambling tasks before performing could be viewed as unrealistic. Alternative methods of presenting the primes (e.g., a video containing subliminal primes or flashcards) are therefore necessary (Bruce et al., 2000) if practitioners working in the real world are to adopt. This is further supported from the current study, in which five replacements had to be recruited, because participants reported the priming task as so "banal" that they failed to complete it properly.

Another issue relates to the nature of awareness with the prime. When participants' complete priming tasks in research settings it is a novel activity (Ashford & Jackson, 2010; Bargh et al., 1996; Hull et al., 2002). The priming paradigms are proposed to be implicit in nature as participants are not aware of the prime or its intended effect. However, if practitioners in the sporting world were asking athletes to perform the priming technique on a regular basis as part of their psychological preparation, this premise would certainly be compromised. Moreover, from an applied standpoint there are important practical considerations to be resolved if priming only works if the performer is unaware as to the purpose of the technique. This is certainly implied by the "mere exposure" construct (Zajonc, 1980), where explicit as opposed to implicit priming reduces the effect (Bornstein, 1989). Furthermore, applied practitioners are guided by code of conducts published by their governing bodies, such as the American Psychological Association (APA), British Psychological Society (BPS), and British Association of Sport and Exercise Sciences (BASES). An interesting ethical question is posed if applied practitioners use a technique with their performers on a regular basis, the purpose of which they cannot disclose (Biddle, Bull, & Seheult, 1992; Petitpas, Brewer, Rivera, & Van Raalte, 1994).

As evidence-based practitioners seek to understand the most effective allocation of thought processes for the sport performers they are working with, they require specific empirical literature to guide and inform professional practice. While the results of the current study illustrate the efficacy of imagery in motor performance, the dribbling skill was taken out of the sporting context. However, it was necessary for the current study to replicate the experimental protocol adopted by Ashford and Jackson (2010) if priming was to be fairly evaluated. Laboratory-based investigations are useful because they enable the rigorous control of variables. However if empirical research is to be translated successfully into the applied world, the techniques of interest need to be ecologically valid (Bennett, 2000). Opportunely, support for imagery has already been established from ecologically valid settings (e.g., Calmels, Holmes, Berthoumieux, & Singer, 2004; Evans, Jones, & Mullen, 2004), testing its robustness in true situations of heightened pressure. Hence the field is already in a position to provide practitioners and athletes with beneficial information regarding the facilitating effects of imagery (e.g., Holmes & Collins, 2001; Smith et al., 2007; Weinberg, 2008).

In conclusion, the current study provides further support for the efficacy of imagery to elicit enhanced motor performance. Results revealed that the imagery condition was effective in enhancing performance, based on both time and accuracy measurements, when compared with a control, priming, and self-focus attentional conditions. Owing to higher cognitive processes often being essential within the realm of performance sport, the present findings reinforce the proposition that attentional allocation also has a significant impact on performance in this more complex arena. Consequently, we would advocate that sport psychology practitioners promote strategies to develop athlete's conscious thoughts that are conducive for performance. In light of the present findings, the PETTLEP model should be considered to be a critical component of effective preparation for physical and mental performance. If this area of empirical research is to be translated successfully then the imagery developed for sport performers needs to be functionally effective in facilitating execution of the performance, especially under pressure.

Finally, from a philosophical standpoint, we would have to question the examination of techniques in an applied field (sport psychology) that have doubtful application. Of course, research must take place on a fundamental-to-applied continuum. In such cases, however, it seems disingenuous to not initially check the field for more appropriate (and perhaps more effective) points of comparison. We would clearly encourage further research into priming but perhaps with a better and more face-valid contrast.

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Manuscript submitted: August 16, 2012

Revision accepted: February 12, 2013