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SPECIAL ISSUE

Enclothed Cognition and Controlled Attention During Insight Problem-Solving

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Individual differences in working memory capacity (WMC) increase the ability and tendency to devote greater attentional control to a task—improving performance on a wide range of skills. In addition, recent research on enclothed cognition demonstrates that the situational influence of wearing a white lab coat increases controlled attention, due to the symbolic meaning and physical experience of wearing the coat. We examined whether these positive influences on attentional control lead to negative performance outcomes on insight problem-solving, a task thought to rely on associative processes that operate largely outside of explicit attentional control. Participants completed matchstick arithmetic problems while either wearing a white lab coat or in a no-coat control condition. Higher WMC was associated with lower insight problem-solving accuracy in the no-coat condition. In the coat condition, the insight problem-solving accuracy of lower WMC individuals dropped to the level of those higher in WMC. These results indicate that wearing a white lab coat led individuals to increase attentional control towards problem solving, hindering even lower WMC individuals from engaging in more diffuse, associative problem-solving processes, at which they otherwise excel. Trait and state factors known to increase controlled attention and improve performance on more attention-demanding tasks interact to hinder insight problem-solving.

Working memory enables individuals to select, maintain, and update information relevant to current goals or contexts, in the presence of internal and external distraction, and across diverse and ongoing cognitions (Engle, 2002; McCabe, Roediger, McDaniel, Balota, & Hambrick, 2010; Shipstead, Lindsey, Marshall, Engle, 2014; Unsworth & Engle, 2007). Because of the importance of these attention- and memory-related abilities to a wide variety of higher-order cognitive tasks, individuals with higher working memory capacity (WMC) generally exhibit a performance advantage over those with lower WMC (see Barrett, Tugade, & Engle, 2004, for a review). However, the advantage of higher WMC can be disrupted by situational factors that temporarily reduce one's attentional resources, such as sleep deprivation (Ilkowska & Engle, 2010), performance pressure (Beilock & Carr, 2005), and performing two tasks at once (e.g., Rosen & Engle, 1997). Given its importance to professional and academic achievement (Alloway & Alloway, 2010; Hambrick & Meinz, 2011; Unsworth, McMillan, Brewer, & Spillers, 2012), and close relationship with fluid intelligence (Conway, Kane, & Engle, 2003; Kane, Hambrick, & Conway, 2005; Shipstead et al., 2014; Unsworth, Fukuda, Awh, & Vogel, 2014), it is not surprising that researchers are interested in finding ways to increase WMC (Harrison et al., 2014; Klingberg, 2010; Melby-Lervåg & Hulm, 2013; Morrison & Chein, 2011; Shipstead, Redick, & Engle, 2012). This goal is the basis for adaptive computerized training (Jaeggi, Buschkuehl, Jonides, & Shah, 2012; Shipstead, Hicks, & Engle, 2012), and other activities targeting trait abilities (e.g., Diamond & Lee, 2011; Moreau & Conway, 2014), as well as state-based interventions, such as mindfulness meditation (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Mrazek, Franklin, Phillips, Baird, & Schooler, 2013) and journaling (Klein & Boals, 2001; Ramirez & Beilock, 2011).

However, recent evidence suggests that higher levels of attentional control can harm performance on tasks that benefit from a more diffuse focus of attention, such as insight problem-solving (DeCaro, Van Stockum, & Wieth, under review; Wiley & Jarosz, 2012a). In the current study, we examine the interaction between trait and state factors known to increase attentional control. We hypothesize that higher levels of attentional control may hinder insight problem-solving, whether produced by individual differences in WMC or a situational factor shown to increase controlled attention by eliciting deliberative thinking—wearing a white lab coat (Adam & Galinsky, 2012). Although greater attentional control is generally thought to be good for performance, it is possible that interventions designed to enhance controlled attention may restrict the ability to notice useful information that is important for some tasks, especially those that rely on creative or associative processes.

EXECUTIVE ATTENTION AND INSIGHT

Insight is the experience of suddenly realizing the solution to a problem that, just prior to this realization, appeared

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insurmountable. *Insight problems* are problems that tend to evoke this experience, and share characteristics that differentiate them from other kinds of problems (Bowden, Jung-Beeman, Fleck, & Kounios, 2005; Chu & MacGregor, 2011; Gilhooly & Murphy, 2005). The ability to attain insight often requires an individual to abandon prior ways of thinking and represent a problem in a new or unexpected way.

According to *special-process theory*, insight solutions emerge from a set of cognitive processes that are not typically required for non-insight problem-solving (Bowden et al., 2005; Chein & Weisberg, 2014; Schooler & Melcher, 1995). Specifically, it is believed that when individuals encounter a problem, they first create a mental representation of the problem and its parameters (Novick & Bassock, 2005). Afterward, they select a solution approach in keeping with their representation of the problem (Mayer & Hegarty, 1996). However, with insight problem-solving, the initial representation is typically incorrect, and individuals often find themselves at an impasse (Ash, Jee, & Wiley, 2012; Ohlsson, 1992). To overcome impasse, individuals must generate a new representation of the problem (i.e., restructure), in order to identify a viable solution approach (Ash, Cushen, & Wiley, 2009; Knoblich, Ohlsson, Haider, & Rhenius, 1999). Importantly, the ability to restructure is thought to depend on associative processes (e.g., spreading activation) that operate largely outside of conscious attentional control (Bowden & Jung-Beeman, 1998; Bowden et al., 2005; Bowers, Regehr, Balthazard, & Parker, 1990; Durso, Rea, & Dayton, 1994; Ohlsson, 1992; Schooler, Ohlsson, & Brooks, 1993; Seifert, Meyer, Davidson, Patalano, & Yaniv, 1995; Siegler, 2000). Insight is attained when individuals restructure their representation of the problem in a way that the solution path becomes suddenly apparent, leading to the characteristic "aha!" moment commonly associated with insight problem-solving (Kounios, & Beeman, 2009; Smith & Kounios, 1996).

Evidence that insight problem-solving relies on associative processes comes from research demonstrating that factors that interfere with controlled attention actually improve insight problem-solving. For example, insight problem-solving is improved for individuals known to have lower trait levels of inhibitory control, such as individuals with frontal lobe damage (Reverberi, Toraldo, D'Agostini, & Skrap, 2005), Attention-Deficit Hyperactivity Disorder (ADHD; White & Shah, 2011), or lower WMC (DeCaro et al., under review). Moreover, situational factors that reduce state levels of inhibition, such as moderate alcohol intoxication (Jarosz, Colflesh, & Wiley, 2012) and solving problems during one's non-optimal time of day (Wieth & Zacks, 2011), improve insight accuracy.

If a more diffuse focus of attention benefits insight, then insight problem-solving may be hindered by factors that increase attention to the problem-solving process. Controlled attention may reduce insight problem-solving accuracy for two reasons. First, attentional control supports the ability to inhibit distractions and focus on goal-relevant information (Engle, 2002; Engle & Kane, 2003; Unsworth & Engle, 2007), narrowing one's search through the problem space (Wiley & Jarosz, 2012a), and constraining search sets in secondary or long-term memory (Unsworth & Engle, 2007). Although generally useful for solving non-insight problems, such focused attention may lead individuals to overlook more distantly-related information held outside the perceived problem space (Wiley & Jarosz, 2012a). Second, attentional control supports one's ability to execute complex problem-solving approaches (Hambrick & Engle, 2003; Wiley & Jarosz, 2012b). However, if individuals persist in using such approaches, then they may be slower to recognize that their initial representation of the problem has created an impasse that can only be overcome by developing a new representation of the problem (Schooler, Fallshore, & Fiore, 1995). In support of these ideas, studies demonstrate that priming a more narrow focus of attention alters how individuals approach problems, resulting in less-creative solutions (Friedman, Fishbach, Förster, & Werth, 2003), and fewer reports of insight (Wegbreit, Suzuki, Grabowecky, Kounios, & Beeman, 2012).

WMC is one individual-difference factor that supports the ability to allocate controlled attention toward task performance. Indeed, it is thought that the ability to keep memory and attention organized around relevant information drives the positive relationship between WMC and performance on a wide range of skills (Shipstead et al., 2014; Unsworth et al., 2014). Research demonstrates that individuals initially prefer, or are biased towards, using these complex strategies when they have the attentional resources to do so (DeCaro & Beilock, 2010; Schelble, Therriault, & Miller, 2012). For example, higher WMC individuals tend to look for patterns in random sequences (Wolford, Newman, Miller, & Wig, 2004), and continue to use complex, time-consuming algorithmic problem-solving approaches when simpler, more efficient strategies are available (Beilock & DeCaro, 2007; DeCaro, Thomas, & Beilock, 2008). Thus, attentional control not only enables but may also promote a tendency to implement complex problem-solving approaches—even if a controlled task approach is unnecessary or suboptimal (e.g., Gaissmaier, Schooler, & Rieskamp, 2006).

If higher WMC supports the ability and tendency to focus attention during problem solving, then this trait factor may lead to poorer performance on insight problems. In support of this idea, DeCaro, Van Stockum, and Wieth (under review) found that higher WMC individuals performed less accurately than lower WMC individuals on insight matchstick arithmetic problems. As discussed in greater detail below, insight matchstick arithmetic problems require individuals to relax constraints that are typically associated with mathematical problem-solving (e.g., that there should be only one equal sign in an equation) in order to transform an incorrect arithmetical statement into a correct one (Knoblich et al., 1999; Knoblich, Ohlsson, & Raney, 2001; Öllinger, Jones, & Knoblich, 2008). When they encounter an insight problem, higher WMC may encourage individuals to persist within a conventional, yet faulty, problem representation suited to an attention-demanding approach, in line with their exceptional attentional control abilities (Gilhooly & Fioratou, 2009).

State factors may also lead individuals to allocate controlled attention towards problem solving, thereby impeding insight. As discussed above, several studies have demonstrated that insight problem-solving can be improved by temporarily reducing state levels of attentional control (Jarosz et al., 2012; Wieth & Zacks, 2011). In line with such findings, other studies suggest that the converse may also be true—insight problem-solving can be harmed by temporarily increasing state levels of attentional control (Friedman et al., 2003; Wegbreit et al., 2012).

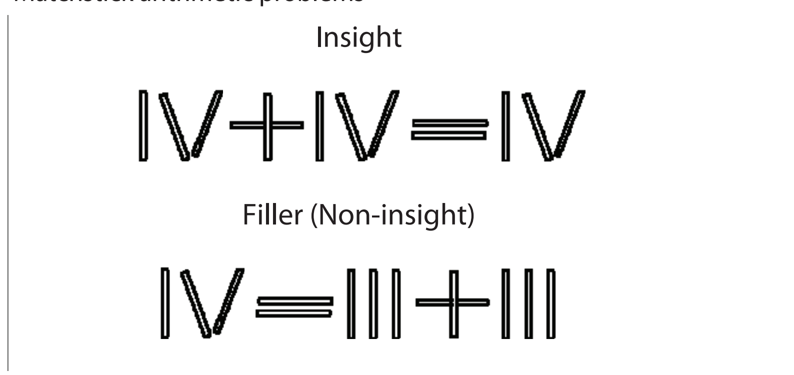
One means by which state attentional control may be increased is through the influence of an article of clothing worn by the individual—a phenomenon known as *enclothed cognition* (Adam & Galinsky, 2012). Enclothed cognition represents a specific case of embodied cognition, which recognizes that individuals' psychological processes are influenced by their physical experiences (Niedenthal, 2007; Wilson, 2002). Specifically, the theory of enclothed cognition posits that the clothes people wear influence their psychological processes by leading the wearer to behave in ways that are consistent with the clothes' popular symbolic meaning. For example, Adam and Galinsky (2012) demonstrated that wearing a white lab coat, prototypical of scientists and doctors, is commonly associated with carefulness, attentiveness, and responsibility (i.e., deliberative thinking). In line with these symbolic associations, Adam and Galinsky found that performance on measures of selective attention (i.e., a Stroop task) and sustained attention (i.e., a comparative visual search task) improved when individuals were randomly assigned to wear a white lab coat. However, performance did not improve when the lab coat was identified as an "artistic painter's coat" as opposed to a "medical doctor's coat." Performance also did not improve when participants merely saw the lab coat displayed on the desk in front of them throughout the experiment, but did not wear the coat. These results suggest that wearing a lab coat leads individuals to embody the associated symbolic meaning, influencing the extent to which they devote attentional control to the task (Adam & Galinsky, 2012). In particular, a white lab coat appears to trigger heightened controlled processing that is likely to benefit performance on a variety of attention-demanding tasks.

CURRENT STUDY

The current study examined the independent and joint effects of WMC and wearing a white lab coat during insight problem-solving, in order to investigate how trait and state influences on attention interact to impact performance on tasks thought to benefit from less attentional control. The problems that participants completed are thought to depend on insight, to the extent that participants must inhibit their tendency to approach the problems using typical mathematical steps and algorithms, while also flexibly restructuring their initial problem representation to overcome impasse (Knoblich et al., 1999; Öllinger et al., 2008; see also Jones, 2003; Ohlsson, 1992, 2011). Specifically, participants completed matchstick arithmetic problems, which are composed of false arithmetic statements using matchsticks representing Roman numerals, arithmetic operators (addition and subtraction symbols), and equal signs (see Figure 1). Participants were asked to transform these false equations into true equations by moving a single matchstick to a different location or orientation.

Participants completed both non-insight and insight matchstick arithmetic problems. *Non-insight* matchstick problems (standard type problems; Knoblich et al., 1999; Öllinger et al., 2008) are solved by moving a matchstick representing the number 1 ("I") from one position to another. These problems rely on simple rule-based approaches consistent with prior experience reordering values in an equation, and thus are unlikely to induce impasse or demand representational change (Knoblich et al., 2001; Knoblich, Öllinger, & Spivey, 2005; Öllinger et al., 2008). In the current study, non-insight problems were used as filler items to reduce transfer across insight matchstick problems. In contrast, *insight* matchstick problems (constraint relaxation problems; Knoblich et al., 1999; Öllinger et al., 2008; see also Ohlsson, 2002) require relaxing certain preconceptions about equations (e.g., that equations have only one equal sign), and are likely to induce impasse and demand representational change (Knoblich et al., 2005; Öllinger et al., 2008). These problems are solved by changing the addition symbol to an equal sign (see Figure 1), and are thought to rely on more

Figure 1.
Matchstick arithmetic problems



associative-based approaches to reach solution (Knoblich et al., 1999, 2001, 2005; Reverberi et al., 2005).

During the problem-solving task, one group of participants was asked to wear a white lab coat (coat condition), as a state manipulation of their attentional control; the others did not wear a lab coat (no-coat control condition). After the problem-solving portion of the experiment, participants completed an assessment of WMC, providing a measure of their trait ability to focus attention in a controlled manner (Kane, Bleckley, Conway, & Engle, 2001). We were particularly interested in observing how greater attentional control—whether generated by higher trait WMC or a state manipulation of clothing—impacts insight problem-solving accuracy. Lower WMC individuals have been shown to outperform higher WMC individuals on insight problems, possibly because they use more flexible and diffuse attention to approach the problems (DeCaro et al., under review). However, with the addition of a white lab coat to elicit attentiveness, we expected lower WMC individuals to perform as poorly as higher WMC individuals. Such a finding would illustrate the interaction of trait and state factors on insight problem-solving. Moreover, such findings would represent a caveat to the traditional emphasis on improving attentional control: Manipulations intended to improve attentional control may hinder insight, particularly for those individuals who are typically best able to perform these tasks.

METHODS

PARTICIPANTS

Participants were 96 undergraduate students enrolled in psychology classes (73 female; age M = 20.89, SD = 4.02; range 18–43 years). An additional six participants were excluded from the study: three for prior exposure to matchstick arithmetic problems, two for committing more than 20 percent errors on the sentence portion of the working memory task (aRspan; Conway et al., 2005), and one for failing to comply with instructions (i.e., put coat on backwards). An additional two participants were identified as univariate outliers (scored below 2.5 SD from the mean on the WMC measure). Participants received course credit for participation.

COAT MANIPULATION

Participants were randomly assigned to one of two conditions: coat (n = 55), or no-coat control (n = 41). Participants in the coat condition were additionally randomly assigned to either a "doctor's coat" (n = 30) or "painter's coat" (n = 25) condition, and provided a cover story adapted from Adam and Galinsky (2012, Experiment 1). Participants in the coat condition were told that construction had taken place in the lab earlier in the semester, and to protect clothing during construction, everyone wore coats ("doctor's coats" or "painter's coats," depending on condition). Even though the construction was completed, participants were asked to wear the coat, so that all participants would be in the same situation. However, we did not fully replicate the methodology used by Adam and Galinsky (2012), who called each coat either a "medical doctor's coat" or an "artistic painter's coat" and did not include a distinction between coats in the experiment in which they used the construction cover story. Given the pervasive association between creativity and art in lay conceptions of creativity (Glăveanu, 2014), including the word "artistic" potentially triggered implicit theories of creativity (Hass, 2014), which deviate from trait profiles typically attributed to doctors and scientists (Feist, 1998). However, in the context of the construction cover story, a "painter's coat" is unlikely to be associated with creativity, and more with qualities attributed to everyday professionals (i.e., a conventional painter in a construction setting; Glăveanu, 2014). Due to the minor contribution of this manipulation to the overall methodology (i.e., the word "doctor's" or "painter's" coat was only mentioned two times), and the finding of Adam and Galinsky (2012, Experiment 1) that simply wearing a lab coat with no explicit label increased attention, we therefore ultimately expected to find no differences between the two coat conditions.

MATERIALS

Problem-Solving Task

Matchstick Arithmetic (Knoblich et al., 1999) was used as the problem-solving measure. Matchstick arithmetic problems are false arithmetic statements written with Roman numerals (I, II, III, etc.), arithmetic operators (+, −), and equal signs depicted as matchsticks. Each matchstick problem is composed of three roman numerals separated by an operator and an equal sign, and has a unique solution consisting of a single move. For each problem, participants were instructed to transform the false arithmetic statement into a true arithmetic statement while adhering to the following rules: (a) only one matchstick can be moved, (b) matchsticks cannot be discarded or added, and (c) the answer must be a correct arithmetic statement. Participants completed three insight problems and three non-insight problems used as filler problems (Figure 1), presented in random order on the computer. Participants recorded their answers on paper. Each problem was displayed for a maximum of two minutes before automatically advancing to the next problem.

Working Memory Measure

The Automated Reading Span task (aRspan) was used to measure WMC (Redick et al., 2012). The aRspan is a complex memory span task, which interleaves a secondary attention-demanding processing task between items presented for serial recall. In the aRspan, participants are shown a sentence and asked to determine whether it makes sense or not; then they are shown a letter. After a sequence of 3–7 sentence-letter strings, participants are asked to recall the letters in order. A total of 15 sequences of sentence-letter strings, including three of each length, are presented in random order. ARspan scores consist of the total number of memory items (i.e., letters) recalled correctly, regardless of serial position (Conway et al., 2005; Redick et al., 2012). Scores range from 0–75, with higher scores denoting greater levels of attentional control (i.e., WMC; Kane et al., 2001; Unsworth, Heitz, Schrock, & Engle, 2005). The task takes 15–20 minutes to complete.

PROCEDURE

After providing informed consent, participants were seated in private testing rooms. Participants randomly assigned to the *coat condition* were then given the cover story described above. Participants in the *no-coat control condition* were not asked to wear a coat and were not given any additional instructions. All participants then completed the matchstick arithmetic problems. Following the problem-solving task, participants in the coat condition were told that the remaining activities were new to the experiment, and coats were collected. Then, all participants completed the aRspan. Finally, participants completed a questionnaire with items about previous experience with matchstick arithmetic problems and demographics, and were debriefed.

RESULTS

We hypothesized that trait and state factors that increase attentional control would interact to reduce insight problem-solving accuracy. Specifically, we predicted that higher WMC would be associated with less accurate insight problem-solving in the no-coat (control) condition. Additionally, we predicted that wearing a white lab coat would reduce insight problem-solving accuracy. Because of methodological differences between our study and that of Adam and Galinsky (2012), we did not expect to find differences between the "doctor's coat" and "painter's coat" conditions. We expected that wearing a white lab coat would primarily impact lower WMC individuals, by reducing their insight problem-solving accuracy relative to the performance of lower WMC individuals in the no-coat condition.

We first examined WMC scores as a function of condition, to verify random assignment and rule out the potential for any carryover effects from the coat manipulation. No significant differences were found (no-coat condition: M = 58.41, SD = 8.30; coat condition: M = 59.35, SD = 8.54; F < 1). Non-insight (filler) problems were submitted to the same analyses as insight problems (described below). No significant differences in non-insight problem-solving accuracy were found, either as a function of condition, WMC, or their interaction (M = 38.19%, SD = 33.50, *all ps* > .3).

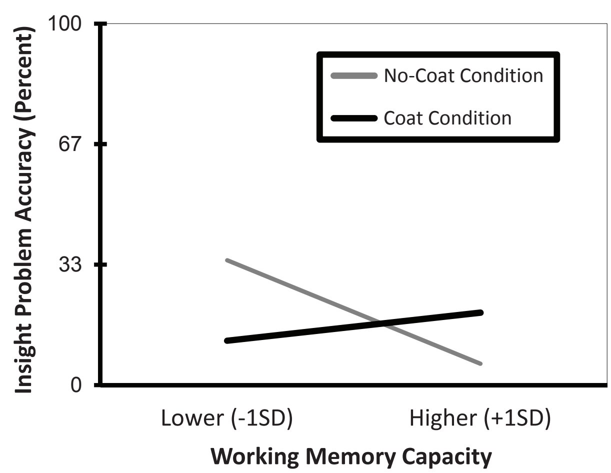
We examined the impact of WMC and condition on insight problem-solving accuracy using ordinary least squares regression. Helmert contrast-coded variables were employed to test planned comparisons between conditions. The first contrast allowed us to test for differences between the two coat conditions (doctor's coat versus painter's coat), and the second contrast allowed us to examine differences between the no-coat condition and the two coat conditions combined (see West, Aiken, & Krull, 1996). The model included WMC scores (mean centered), the two contrast-coded condition variables, and a WMC by condition interaction term for each contrast.

There was no main effect of WMC (B = -.01, SE = .01, p = .525). There was also no main effect of condition for either contrast-coded variable (doctor's coat versus painter's coat: B = -.30, SE = .30, p = .298; no-coat versus coat conditions combined: B = -.13, SE = .22, p = .555). As expected, there was no interaction between WMC and the doctor's coat versus painter's coat contrast (B = .06, SE = .02, p = .773), suggesting that the relationship between WMC and insight problem-solving accuracy was similar across the two coat conditions. However, as predicted, a significant WMC by condition interaction was found when the two coat conditions were combined (i.e., no-coat condition versus combined coat condition; B = .06, SE = .03, p = .021, sr^2 = .05). Taken together, these findings suggest that the act of wearing a white lab coat led individuals to perform the insight problems differently, depending on differences in WMC.

In addition, the data were examined by estimating a Bayes factor using Bayesian Information Criteria (Jarosz & Wiley, 2014). This analysis compares the fit of the data under the

Figure 2.

Insight problem accuracy as a function of working memory capacity and condition.



Note: Lower and higher working memory points are plotted at ±1SD from the mean.

null hypothesis to that under the alternative hypothesis. An estimated Bayes factor (null/alternative) suggested that the data were .505:1 in favor of the alternative hypothesis, or rather, 1.98 times more likely to occur under a model including an interaction between WMC and condition (no-coat, coat) than a model without it.

Subsequent regression analyses were conducted to examine the nature of this interaction. As shown in Figure 2, WMC was significantly negatively associated with insight problem-solving accuracy in the no-coat condition ($B = -.05$, $SE = .02$, $p = .015$, $sr^2 = .06$). No relationship between WMC and insight problem-solving accuracy was observed for the coat condition ($B = .01$, $SE = .02$, $p = .422$). We also compared insight problem-solving accuracy between the coat and no-coat conditions separately for individuals scoring higher or lower on the WMC measure, by recentering the WMC variable at 1 *SD* above and below the mean, respectively (Cohen, Cohen, Aiken, & West, 2003). For lower WMC individuals, wearing the coat significantly reduced insight problem-solving accuracy, compared to the accuracy of lower WMC individuals in the no-coat control condition ($B = -.67$, $SE = .31$, $p = .036$, $sr^2 = .04$). For higher WMC individuals, no significant differences in insight problem-solving accuracy were found between conditions ($B = .42$, $SE = .32$, $p = .188$). Wearing a white lab coat appears to have selectively impaired insight problem-solving for lower WMC individuals, leading them to perform in a manner comparable to higher WMC individuals.

DISCUSSION

Attentional control benefits performance on a range of higher-order cognitive tasks (see Barrett et al., 2004, for a review). Indeed, it is generally assumed that individuals with higher trait attentional control hold a performance advantage over those with lower attentional control (Engle, 2002; Hambrick & Meinz, 2011; Unsworth, Redick, Heitz, Broadway, & Engle, 2009). Recent interest in situational factors that temporarily increase state attentional control (Autin & Croizet, 2012), and the potential for training (Sternberg, 2008), is guided by such findings. The current study examined whether two factors previously shown to increase controlled attention—higher WMC (Kane et al., 2001) and wearing a white lab coat (Adam & Galinsky, 2012)—have the counterintuitive effect of decreasing insight problem-solving accuracy, thought to rely on associative processes operating largely outside of conscious control (e.g., Bowden et al., 2005; Bowers et al., 1990; Durso et al., 1994; Schooler et al., 1993; Siegler, 2000).

Participants completed insight problems (matchstick arithmetic; Knoblich et al., 1999), while either wearing a white lab coat (coat condition) or not (no-coat condition). Afterward, participants completed a measure of WMC. Higher WMC was associated with poorer insight problem-solving accuracy in the no-coat control condition. However, when participants wore a white lab coat, an act commonly associated with deliberative thinking, lower WMC individuals performed just as poorly as higher WMC individuals. Wearing the lab coat appears to have co-opted lower WMC individuals' advantage during insight problem-solving.

These findings contribute to a growing body of research demonstrating that higher WMC does not confer a performance advantage on all tasks, and can even hinder performance on tasks that demand a less-controlled approach (DeCaro & Beilock, 2010). In the context of problem solving, a more diffuse focus of attention may allow individuals to see less obvious but potentially insightful solution paths (Wiley & Jarosz, 2012a). Previous studies have demonstrated that trait and state factors that reduce controlled attention increase insight accuracy (DeCaro et al., under review; Jarosz et al., 2012; Reverberi et al., 2005; Wieth & Zacks, 2011). The current study complements and expands upon this literature by demonstrating that factors that increase controlled attention interact to harm insight. Critically, increasing state attentional control selectively impaired the performance of individuals who would otherwise excel (i.e., those with lower WMC).

In addition, these findings suggest that situational factors that temporarily increase attentional control lead lower WMC individuals to adopt information-processing strategies that are more characteristic of higher-capacity individuals. Previous research suggests several possible ways this processing shift may occur. For example, individuals may be more likely to persist with algorithmic, attention-demanding strategies that are less optimal for insight problem-solving (cf. Beilock & DeCaro, 2007; DeCaro et al., 2008; Gaissmaier et al., 2006). Alternatively, the white lab coat may have induced a more local (i.e., narrow) information-processing style, leading individuals to focus on the component parts of a problem (Luria & Vogel, 2011; Soto, Hodsoll, Rotshtein, & Humphreys, 2008). Local processing has been shown to detriment insight problem-solving, relative to a more global processing style, in which attention is directed towards overall patterns and meaningful relationships or configurations (Friedman et al., 2003; see Förster & Denzler, for a review). Similarly, greater attentional control may lead individuals to "overshadow" non-verbal processes important for insight, by promoting explicit, detail-oriented verbal representations that rely more heavily on attentional control (Chin & Schooler, 2008; Schooler et al., 1993). Future research is needed to more fully explore the mechanisms by which increasing attentional control harms insight.

The current findings also provide additional evidence for the impact of enclothed cognition on information processing and task performance. The theory of enclothed cognition suggests that physically wearing clothing associated with certain symbolic meaning (e.g., a white lab coat, associated with qualities typically attributed to scientific or medical professions) leads the wearer to behave in accordance with that symbolic meaning (Adam & Galinsky, 2012). In support of this theory, Adam and Galinsky (2012) found that wearing a white lab coat was associated with carefulness and attentiveness, and likewise improved performance on attention-demanding tasks. We extend this finding to demonstrate that wearing a lab coat can lead to sub-optimal insight problem solving. Although Adam and Galinsky's findings imply that wearing certain types of clothing is more likely to lead to success, the current results suggest that optimal performance depends on a fit between situational factors (e.g., clothing type), individual differences, and task demands.

The theory of enclothed cognition is based on more general theories of embodied cognition, which emphasize the role that the body and the environment play in perception, knowledge, and behavior (e.g., Niedenthal, 2007; Pezzulo et al., 2011; Wilson, 2002; Wilson & Golonka, 2013). The majority of research on embodied cognition demonstrates that embodiment activates existing knowledge. However, recent studies have also explored the role of embodiment in the creation of new knowledge or insights. For example, enacting certain metaphors for creative thinking, such as "thinking outside the box" (Leung et al., 2012) or "going with one's gut" (Aiello, Jarosz, Cushen, & Wiley, 2012), increases performance on creative tasks. The current findings contribute to this discourse by demonstrating the converse—that embodiment can inhibit the creation of new knowledge or insights.

In conclusion, situational factors that temporarily increase attentional control, such as the embodied act of wearing a white lab coat, may have a counterproductive impact on the production of insight. These findings reveal an important potential downside to trait- and state-based working memory training and enhancement. Although improving attentional control generally benefits performance on attention-demanding tasks, it may selectively impair performance for individuals who might otherwise be more insightful.

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