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When Prevention Promotes Creativity: The Role of Mood, Regulatory Focus, and Regulatory Closure

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Promotion-focused states generally boost creativity because they associate with enhanced activation and cognitive flexibility. With regard to prevention-focused states, research evidence is less consistent, with some findings suggesting prevention-focused states promote creativity and other findings pointing to no or even negative effects. We proposed and tested the hypothesis that whether prevention-focused states boost creativity depends on regulatory closure (whether a goal is fulfilled or not). We predicted that prevention-focused states that activate the individual (unfulfilled prevention goals, fear) would lead to similar levels of creativity as promotion-focused states but that prevention-focused states that deactivate (closed prevention goals, relief) would lead to lower levels of creativity. Moreover, we predicted that this effect would be mediated by feelings of activation. Predictions were tested in 3 studies on creative insights and 1 on original ideation. Results supported predictions. Implications for self-regulation, motivation, mood, and creativity are discussed.

Keywords: regulatory focus, motivation, mood, activation, creativity

Humans regulate their goals, emotions, and behavior on the basis of two fundamental motivational systems: promotion and prevention (Higgins, 1997). The promotion system is mainly concerned with the regulation of desired outcomes—people operating under a promotion focus are oriented toward opportunities and accomplishing aspired goals and generally engage in approach-related behaviors toward positive end states, such as acquiring or consuming desired objects. A promotion focus associates with feelings of cheerfulness when there is good progress toward and successful attainment of a desired end state, with dejection-related negative emotions such as disappointment and anger when obstacles frustrate progress toward achieving the desired end state, and with sadness and discouragement when one fails to achieve the desired end state (e.g., Amodio, Shah, Sigelman, Brazy, & Harmon-Jones, 2004; Förster, Higgins, & Idson, 1998; Higgins, 1997; Idson, Liberman, & Higgins, 2000; Shah, Higgins, & Friedman, 1998). The prevention system is mainly concerned with the regulation of aversive end states—people operating under a prevention focus are oriented toward security and responsibilities and generally engage in avoidance-related behaviors away from negative outcomes, such as withdrawing from harmful situations and rejecting aversive end states. A prevention focus associates with quiescence-related emotions (relief, feeling relaxed) when prevention goals are fulfilled. When goals remain unfulfilled, prevention focus associates with fear, tension, and worry (e.g., Brockner & Higgins, 2001; Higgins, 1997; Idson et al., 2000; also see Carver, 2009; Frijda, 1986; Mowrer, 1960).[1]

In recent years, these self-regulatory and affective processes have been connected to the human capacity for creativity—the ability to generate ideas, insights, and solutions that are new and potentially useful (Amabile, 1996; Runco, 2004). Specifically, it has been argued and shown that promotion-focused individuals engage in more global, inclusive, and flexible thinking and are thus more creative than prevention-focused individuals (e.g., Förster & Dannenberg, 2010; Friedman & Förster, 2001, 2002). In a seemingly related line of work, it has been argued and shown that cheerful and happy individuals take broader and more flexible approaches (Ashby, Isen, & Turken, 1999; Fredrickson & Branigan, 2005; Murray, Sujan, Hirt, & Sujan, 1990), allowing them to be more creative than individuals in mood-neutral control conditions or individuals feeling sad (e.g., Baas, De Dreu, & Nijstad, 2008; Lyubomirsky, King, & Diener, 2005). One possible link between these two sets of findings is that happy individuals have a stronger activation of the promotion system than mood-neutral controls and sad individuals (Baas et al., 2008). However, this explanation remains untested. Moreover, it appears inconsistent with the finding that whereas prevention focus is not or negatively related to creativity (Friedman & Förster, 2001, 2002; also see Baas et al., 2008), prevention-focused mood states, such as fear and anxiety, can sometimes promote creative performance (Clapham, 2001; De Dreu, Baas, & Nijstad, 2008). In short, the

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[1] Individuals may also chronically fail and withdraw from goal pursuit, which associates with feelings of deactivation, depression, and helplessness (Dweck, 1975; Mowrer, 1960). However, because it is beyond the scope of the current article, we have not experimentally investigated the effects of goal failure and goal abandonment.

interplay between regulatory focus, specific mood states, and creative performance remains poorly understood.

The present work seeks to further the understanding of how regulatory focus and specific mood states associate with one another and how they promote or inhibit creative performance. We integrate recent work on the cognitive functions underlying creativity (e.g., De Dreu et al., 2008; Förster & Dannenberg, 2010; Nijstad, De Dreu, Rietzschel, & Baas, 2010) with work on the interplay between regulatory focus, moods, and activation (e.g., Baas et al., 2008; Higgins, 1997; Idson & Higgins, 2000). We propose that especially in the case of prevention goals, regulatory closure is vital: Successful closure of a prevention goal is associated with deactivation and deactivated mood states (e.g., relief), whereas an unfulfilled prevention goal is associated with activation, alertness, and activating mood states (e.g., anxiety). The extent to which the individual is cognitively activated, in turn, drives creative performance. We tested these predictions in three studies on creative insights and one on idea generation.

Creative Outcomes, Cognitive Functions, and the Role of Activation

Researchers have identified several creativity outcome variables (Nijstad et al., 2010; Runco, 2004; Simonton, 2003). The hallmark of creativity probably is originality—an idea, insight, or solution is original when it is novel, infrequent, or uncommon (Amabile, 1996; Guilford, 1967). Originality is often studied with divergent thinking tests and ideation tasks—open-ended assessments of an individual's ability to generate multiple alternative solutions (Mumford, 2001). For example, participants are asked to generate as many possible uses for a brick, and independent coders rate these ideas for originality (i.e., the extent to which an idea is unusual and novel; e.g., Friedman & Förster, 2001; Guilford, 1967). In addition to originality, researchers often look at creative insights—solutions to problems that have a single demonstrably correct solution and that are likely to produce an impasse after initial attempts toward solution and a state of high uncertainty as to how to proceed; only after prolonged efforts at solution and some restructuring of the problem information does the correct solution pop up into mind as a flash of insight (e.g., Duncker, 1945; Gilhooly & Murphy, 2005; Schooler, Ohlsson, & Brooks, 1993).

Originality and creative insights can be seen as end-products of cognitive processes and functions that involve a combination of flexible, associative, and global thinking and persistent and systematic task-directed cognitive effort (Amabile, 1996; De Dreu et al., 2008; Förster & Dannenberg, 2010; Nijstad et al., 2010). Flexible thinking leads to creativity because it facilitates accessibility of more remote informational links and the finding of new connections among categories and concepts (Förster & Dannenberg, 2010; Koestler, 1964). Indeed, higher levels of creativity have been linked to the use of broad, global, and inclusive cognitive categories (e.g., De Dreu, Nijstad, & Baas, in press; Eysenck, 1993; Förster, 2009; Hirt, Devers, & McCrea, 2008; Murray et al., 1990) and the adaptive switching among categories, approaches, and sets (Ashby et al., 1999; Knoblich, Ohlsson, Haider, & Rhenius, 1999; Smith & Blankenship, 1991). For example, because the initial or dominant response to creative insight problems is likely to be incorrect, these problems often require individuals to actively restructure the presented problem material and to approach the problem from multiple angles, which requires cognitive flexibility (Gilhooly & Murphy, 2005; Schooler & Melcher, 1995).

In addition to cognitive flexibility, originality and insights are a function of the extent to which the individual invests cognitive resources and focuses attention and effort on the task at hand (e.g., Nijstad et al., 2010; Shalley, 1991). Solving insight problems and generating novel ideas can be achieved through hard work and motivated effort (Eisenberger & Rhoades, 2001; Fodor & Carver, 2000; Hirt, Levine, McDonald, Melton, & Martin, 1997; Rietzschel, De Dreu, & Nijstad, 2007). Indeed, correct solutions to insight problems usually take prolonged effort at solution (e.g., Schooler et al., 1993), and idea generation can benefit from a systematic and effortful exploration of problem space and incremental search processes (Boden, 1998; Finke, 1996; Newell & Simon, 1972; Nijstad & Stroebe, 2006; Rietzschel et al., 2007). For example, when generating possible uses for a brick, individuals might explore an existing category in depth (e.g., a brick to build something) and through combinatorial processes come up with several ideas within that category (e.g., a brick to build a wall, to build a street, to repair the Great Wall of China, and to construct a palace for their fish). Both idea generation and solving insight problems involve the retrieval of existing concepts from memory and the combination and transformation of these concepts in working memory (Finke, 1996; Nijstad & Stroebe, 2006; Oberauer, Süss, Wilhelm, & Wittmann, 2008).

Although creativity is a function of various cognitive operations, including flexible processing, sustained attention, working memory performance, and cognitive persistence, all these operations require some level of cognitive activation (e.g., Andrews & Farris, 1972; Baddeley, 2000; Broadbent, 1972; Colzato, Kool, & Hommel, 2008; Dreisbach & Goschke, 2004; Flaherty, 2005; Floresco & Phillips, 2001; Robbins, 1984). Activation refers to increased engagement of centrally organized promotion or prevention motivational systems (Bradley, 2000; Derryberry & Tucker, 1994; Lang, Bradley, & Cuthbert, 1990; Watson, Wiese, Vaidya, & Tellegen, 1999) to mobilize energy to sustain attention and effort toward goal-related activities (Brehm & Self, 1989; Elliot, 1999).[2] As such, activation involves a combination of physiological, cognitive, and affective reactions (Bradley, 2000; Humphreys & Revelle, 1984; Neiss, 1988) and is reflected in self-reported feelings of alertness, activation, and attentiveness (cf. Russell & Barrett, 1999; Watson et al., 1999); in physiological indicators of the sympathetic nervous system, such as increased blood pressure and heart rate (Bradley, 2000; Brehm & Self, 1989); and in metabolic load (Bradley, 2000; Gailliot et al., 2007). Indeed, recent work has shown that moderate levels of activation associate with enhanced creativity (Byron, Khazanchi, & Nazarian, 2010; De Dreu et al., in press) and moods that energize and activate (e.g., feeling happy or

[2] Activation is different from general arousal. General arousal can be seen as a nonspecific, autonomic, energizing force that is not necessarily tied to motivation (Anderson, 1990; Bradley, 2000). For example, as a consequence of performing physical exercise (e.g., taking the stairs), arousal can take the form of increased heart rate and stronger self-reported feelings of activation (Isen, Daubman, & Nowicki, 1987). Likewise, arousal naturally rises and falls in a circadian rhythm (Saper, Scammell, & Lu, 2005). However, because these physiological changes are not governed by motivational systems in response to goals and motives, they are not necessarily indicative of changes in increased cognitive activation.

angry) lead to more originality and insight problem solving than deactivating moods (e.g., feeling sad or relaxed; Baas et al., 2008; De Dreu et al., 2008).

From this initial work on activation and creative performance, it follows that both promotion- and prevention-related states promote creativity to the extent that these motivational states cognitively activate the individual. However, this is not what research on promotion and prevention seems to show. To the contrary, ample evidence exists that promotion-focused, relative to prevention-focused, states lead to more originality and insights, primarily through enhanced flexibility and global processing of information (for reviews, see Baas et al., 2008; Förster & Dannenberg, 2010; Friedman & Förster, 2010). For example, Friedman and Förster (2001) had participants focus on positive and desired end states (promotion focus) or on negative and threatening end states (prevention focus) and subsequently had them perform creativity tasks. Results showed that a promotion focus produced more flexibility and greater originality and insight problem solving than a prevention focus. Moreover, individual differences in promotion (vs. prevention) focus could be linked to enhanced activation (J. R. Gray & Braver, 2002; Pickering & Gray, 1999) and creativity (Friedman & Förster, 2001). Finally, a meta-analysis on the relationship between mood and creativity showed that mood states typically associated with the promotion system (e.g., happiness, anger) more strongly related to creativity than moods typically associated with the prevention system (e.g., fear, anxiety; Baas et al., 2008).[3]

A possible solution to this apparent conundrum lies in what we refer to as regulatory closure—is the prevention or promotion goal fulfilled or not?[4] Unfulfilled goals remain activated, and motivation to goal fulfillment is maintained (Förster, Liberman, & Higgins, 2005; Marsh, Hicks, & Bink, 1998; Zeigarnik, 1927). In the case of both promotion and prevention foci, unfulfilled goals result in enhanced effort and activation (Förster et al., 1998; also see Brown & Jacobs, 1949; Carver, 2004; Frijda, 1986; Mowrer, 1960) and trigger mood states that signal the goal is not yet achieved (Carver & Scheier, 1981; Higgins, 1997; Mowrer, 1960). Blocked promotion goals and lack of progress toward attaining a desirable end state result in frustration, anger, or disappointment. Active withdrawal from aversive stimulation and lack of progress in moving away from an undesirable end state result in vigilance, fear, and anxiety (Carver, 2004; Higgins, 1997; Mowrer, 1960). Frustration, anger, disappointment, fear, and anxiety all signal that more effort and motivation are needed toward goal fulfillment, and indeed, these emotional states are typically seen as activating and engaging (Carver, 2004; Frijda, 1986; Izard & Ackerman, 2000; Reisenzein, 1994; Watson et al., 1999). In other words, regardless of whether self-regulation is concerned with promotion or prevention, unfulfilled goals are activating.

Whereas unfulfilled promotion and prevention goals activate and energize because activation is needed for further goal pursuit, closure of these goals is likely to have different effects in the case of promotion than prevention. If the individual is focused on obtaining desired end states, regulatory closure results in enhanced activation, effort, and persistence (Förster et al., 1998, 2001; Idson & Higgins, 2000; Van-Dijk & Kluger, 2004). Promotion success triggers the individual to pursue new goals and flexibly explore new cognitive pathways (Carver, 2004). Moreover, the joy, happiness, and elation typically associated with the successful attainment of desired end states are mood states that activate the individual (e.g., Russell & Barrett, 1999; Watson et al., 1999) and mobilize energy for further engagement with the environment (Kreibig, 2010). However, if the individual is focused on avoiding aversive end states, regulatory closure lowers effort and persistence and leads to deactivation (Brown & Jacobs, 1949; Carver, 2004; Förster et al., 2001; Frijda, 1986; Idson & Higgins, 2000; Mowrer, 1960). The state of relief that is associated with successful fulfillment of prevention goals is typically seen as a deactivating state that disengages rather than engages the individual (Carver, 2004, 2009; Frijda, 1986; Mowrer, 1960). Relief signals that energy resources should be restored and replenished after a successful escape or when an anxious situation is resolved (Fredrickson, Mancuso, Branigan, & Tugade, 2000). In other words, whereas regulatory closure in the case of promotion focus associates with relatively high levels of activation, it leads to deactivation and disengagement in the case of prevention focus.

Our reasoning thus far indicates that individuals with a promotion focus are more activated than those with a prevention focus, especially when there is regulatory closure; absent such closure, both promotion and prevention foci are activating. Because activation facilitates creative performance, we expect promotion focus to lead to more creativity than prevention focus under regulatory closure, but not when such closure is pending. This was our key hypothesis. A related question we addressed was whether it is indeed activation in and of itself that mediates effects of regulatory focus and closure on creativity or whether the affective states that are associated with regulatory focus and closure play a role as well. We suspect the latter not to be the case, as Friedman and Förster (2001, 2002) failed to find that self-reported feelings mediated effects of regulatory focus on creativity. Because this is the only evidence to date and essentially resting on a null finding, we explore whether specific feeling states or, instead, particular regulatory foci and regulatory closure and concomitant activation are essential for creativity to come about.

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[3] It is important to note that in contrast to promotion-related moods, which were oftentimes experimentally manipulated, prevention-related moods without exception were measured as chronic tendencies (e.g., with the State-Trait Anxiety Inventory [STAI]; Spielberger, Gorsuch, & Lushene, 1970). Consequently, this meta-analysis does not allow conclusions about the causal impact of prevention-related moods.

[4] Although regulatory closure refers to goals that are successfully achieved and fulfilled versus unfulfilled and actively pursued, individuals may also fail and abandon goal pursuit. Failure to reach desired end states associates with discouragement and sadness (Higgins, 1997; Idson et al., 2000) and will lead to deactivation, reduced motivation, and withdrawal from the pursuit of promotion goals (Förster, Grant, Idson, & Higgins, 2001; Idson & Higgins, 2000). Failure to avoid aversive end states will initially lead to feelings of fear and agitation (Idson et al., 2000) and enhanced motivation (Förster et al., 2001; Idson & Higgins, 2000), but prolonged failure will eventually result in deactivation, withdrawal from the pursuit of prevention goals, and feelings of helplessness (Dweck, 1975; Mowrer, 1960). Obviously, we do not predict prolonged failure, rejected goals, and sadness and helplessness to lead to increased creativity. Indeed, a meta-analysis showed that sad moods are not associated with enhanced levels of creativity (Baas et al., 2008).

The Present Studies: Overview and Basic Hypotheses

Motivational states that activate rather than deactivate the individual promote originality and creative insights. Promotion-focused states lead to activation because the desired end state is not attained, signaling that additional effort is needed to remedy the situation, or because the desired end state is successfully achieved and promotion success triggers the individual to actively pursue new goals. Prevention-focused states activate and energize the individual as long as the undesirable end state is not successfully avoided, but when it is successfully avoided, the individual ends goal pursuit, experiences relief, and is deactivated and disengaged. Accordingly, our basic hypothesis is that in the case absent regulatory closure, both promotion- and prevention-focused individuals show high levels of originality and insight performance; in the case of regulatory closure, however, prevention-focused individuals show lower levels of creativity than those with a promotion focus (Hypothesis 1). Furthermore, we expected activation to mediate this effect (Hypothesis 2). These predictions were tested in four studies, two focusing on conceptual insight performance (Studies 1 and 2), one focusing on idea generation (Study 3), and one focusing on perceptual insight performance (Study 4). Additionally, we examined whether specific feeling states or particular regulatory foci and regulatory closure are essential for activation and creativity to come about. Specific additional hypotheses are given when introducing each study.

Study 1

Study 1 was set up to directly examine the interaction between regulatory focus and regulatory closure. We predicted that absent closure, both promotion- and prevention-focused individuals would show high levels of creativity; however, in the case of regulatory closure, prevention-focused individuals were expected to show less creativity than promotion-focused individuals (Hypothesis 1). We further measured participants' cheerfulness and relief to examine whether these feeling states mediated this effect.

Method

Design and participants. University of Amsterdam (Amsterdam, the Netherlands) undergraduate students ($N = 95$, 73% female) with a mean age of 20.1 years ($SD = 3.5$) participated for partial fulfillment of a course requirement. They were randomly assigned to one of four different conditions that were obtained by varying regulatory focus (promotion vs. prevention) and regulatory closure (goal attainment vs. not). Dependent variables were the number of correctly solved insight problems and self-reported ratings of relief and cheerfulness.

Procedure, manipulations, and creativity task. Participants were seated behind a personal computer, which displayed all materials and registered responses to questions. Participants were asked to participate in two different and independent studies, one about autobiographical memory (the task used to manipulate regulatory focus and regulatory closure) and the other a verbal performance task. Participants were then asked to write down their gender and age and to write a short essay about a situation that happened to them. In the promotion focus condition, they were asked to write about a situation in which they successfully attained a positive outcome (closure) or were unsuccessful in attaining a positive outcome (no closure); in the prevention focus condition, they were asked to write about a situation in which they successfully avoided a negative outcome (closure) or were unsuccessful in avoiding a negative outcome (no closure). Participants were specifically asked to write their essay in such a way that another person could imagine the situation they were in.[5]

Upon completion of the autobiographical memory task, participants continued with 30 items of the Remote Associates Test (RAT; Mednick, 1962) that were presented in random order. The RAT is a creative insight task that assesses the ability to identify associations among words that are not normally associated with each other (Gilhooly & Murphy, 2005; Harkins, 2006). Participants are provided with three words (e.g., *envy, golf, beans*) and are instructed to generate a word that relates to all of these three words (i.e., *green*). To come up with the correct solution, participants need to break up the presented material to identify potentially correspondent attributes and relations associated with the three provided words. Following the RAT, participants answered a short questionnaire, were debriefed, and were dismissed.

Dependent variables. We coded the number of correctly solved RAT problems (range between 0 and 30). Furthermore, participants indicated their current mood on a Likert-type scale ranging from 1 (*not at all*) tot 5 (*very much*). As a measure of relief, we asked participants to rate how relieved (anxious, fearful; reverse-coded) they felt ($\alpha = .88$). As a measure of cheerfulness, we asked how eager/joyous (dissatisfied; reverse-coded) they felt ($\alpha = .68$).

Results

RAT performance. We submitted the number of solved RAT problems to a 2 (regulatory focus) × 2 (regulatory closure) ANOVA. First, we obtained main effects of regulatory focus and regulatory closure. Promotion-focused participants solved more problems ($M = 11.87$) than prevention-focused participants ($M =$

[5] To validate our manipulation of regulatory focus and regulatory closure, we content-analyzed the stories the participants wrote. For each story, an independent coder counted the number of prevention-related goals and concerns (e.g., safety, security, oughts, duties; see Higgins, 1997; Molden, Lee, & Higgins, 2008), the number of promotion-related goals and concerns (e.g., nurturance, personal growth, aspirations, hopes, ideals; see Higgins, 1997; Molden et al., 2008), and reference to goal completion. Next, we submitted these measures to separate 2 (regulatory focus) × 2 (regulatory closure) analyses of variance (ANOVAs). For the prevention focus and promotion focus measures, we found reliable main effects only of regulatory focus. As expected, participants wrote more about prevention-related goals and concerns in the prevention focus condition ($M = 1.00$, $SD = .84$) than in the promotion focus condition ($M = 0.00$, $SD = .00$), $F(1, 91) = 79.88$, $p < .001$, $\eta_p^2 = .47$, and participants wrote more about promotion-related goals and concerns in the promotion focus condition ($M = 0.85$, $SD = .55$) than in the prevention focus condition ($M = 0.03$; $SD = .17$), $F(1, 91) = 85.09$, $p < .001$, $\eta_p^2 = .48$. Finally, for the goal completion measure, we only found a reliable main effect of regulatory closure, $F(1, 91) = 189.91$, $p < .001$, $\eta_p^2 = .68$. As expected, participants referenced more fulfilled goals and concerns in the regulatory closure condition ($M = 1.53$, $SD = .51$) than in the nonclosure condition ($M = 0.17$, $SD = .42$). On the basis of these results, we conclude that our manipulation of regulatory focus and regulatory closure was reliable.

10.40), $F(1, 91) = 4.15$, $p = .045$, $\eta_p^2 = .04$. Participants in the closure-absent condition tended to solve more problems ($M = 11.81$) than participants in the closure-present condition ($M = 10.53$), $F(1, 91) = 3.28$, $p = .07$, $\eta_p^2 = .04$. Both main effects were qualified by our predicted interaction between regulatory focus and regulatory closure (Hypothesis 1), $F(1, 91) = 3.88$, $p = .05$, $\eta_p^2 = .04$. Figure 1 shows no difference in RAT performance between promotion-focused and prevention-focused individuals in the closure-absent condition ($F < 1$). However, in the closure-present condition, prevention-focused participants solved fewer problems than promotion-focused participants, $F(1, 91) = 6.48$, $p = .01$, $\eta_p^2 = .07$.

Posttask feeling states. We submitted ratings of relief and cheerfulness to separate 2 (regulatory focus) × 2 (regulatory closure) ANOVAs. The ANOVAs revealed a main effect of regulatory closure on relief, $F(1, 91) = 11.78$, $p = .001$, $\eta_p^2 = .12$. Participants in the closure-present condition reported more relief ($M = 4.36$) than participants in the closure-absent condition ($M = 3.98$). We also found an interaction between regulatory focus and regulatory closure, $F(1, 91) = 3.89$, $p = .05$, $\eta_p^2 = .04$. Contrast analyses showed that promotion-focused participants felt moderate relief regardless of regulatory closure ($F < 1.8$, $p > .19$; $M_{\text{closure}} = 4.21$, $SD = .45$, and $M_{\text{no closure}} = 4.03$, $SD = .60$); however, participants with a prevention focus reported stronger relief in the closure-present condition ($M = 4.53$, $SD = .44$) than in the closure-absent condition ($M = 3.87$, $SD = .65$), $F(1, 91) = 12.08$, $p = .001$, $\eta_p^2 = .12$. For cheerfulness, we found an interaction only between regulatory focus and regulatory closure, $F(1, 91) = 4.86$, $p = .030$, $\eta_p^2 = .05$. Contrast analyses showed that prevention-focused participants felt moderate cheerfulness regardless of regulatory closure ($F < 1$; $M_{\text{closure}} = 3.22$, $SD = .74$, and $M_{\text{no closure}} = 3.28$, $SD = .49$); however, participants with a promotion focus reported stronger cheerfulness in the closure-present condition ($M = 3.54$, $SD = .63$) than in the closure-absent condition ($M = 2.98$, $SD = .68$), $F(1, 91) = 10.25$, $p = .002$, $\eta_p^2 = .10$.

Mediation. To test whether feeling states mediate the effects on creative performance, we regressed the number of solved RAT items on cheerfulness and relief. For cheerfulness ($\beta = .09$, $t < 1$, *ns*) and relief ($\beta = -.13$, $t < 1.3$, *ns*), no significant regressions were observed. Thus, conscious affective feelings did not mediate the effects of regulatory focus and regulatory closure on creative insight performance. This is consistent with Friedman and Förster (2001, 2005), who also failed to find self-reported feelings to mediate effects of regulatory focus on creativity.

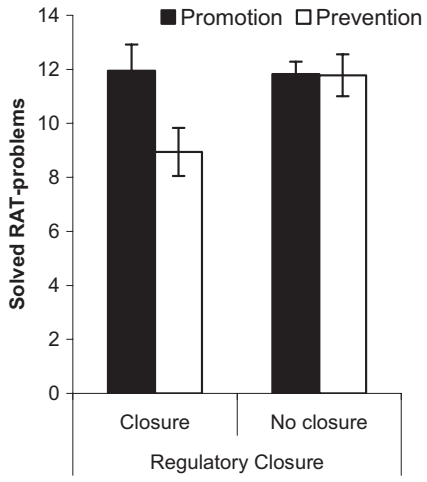

Figure 1. Insight performance as a function of regulatory focus and regulatory closure (Study 1). Number of solved RAT problems ranges between 0 and 30 (displayed ±*SE*). RAT = Remote Associates Test.

Discussion and Introduction to Study 2

Study 1 showed that successfully regulated prevention goals, but not unsuccessfully regulated prevention goals, lower creativity compared to promotion-focused states. Our finding that prevention focus can promote creativity may appear inconsistent with earlier work by Friedman and Förster (2001, 2002), who found that compared to promotion focus, prevention focus decreased performance on creative insight and divergent thinking tasks. One way to reconcile this apparent discrepancy is to assume that these earlier studies compared prevention versus promotion under regulatory closure. For example, Friedman and Förster used the mouse-in-maze task to manipulate regulatory focus. In this task, participants received on paper a cartoon mouse trapped in a maze and were instructed to find a way out of the maze. In the promotion condition, a piece of cheese (gain) was lying outside the maze; in the prevention condition, an owl (threat) was depicted as hovering above the maze. Participants finished this maze task before moving to the creativity task and thus were likely to experience regulatory closure—the mouse attained the cheese and, in the prevention condition, found a safe haven the owl could not get to.

Our first objective in Study 2 was to examine the interaction between regulatory focus and regulatory closure using this mouse-in-maze task, so as to enable reconciliation of our findings with those reported earlier by Friedman and Förster (2001, 2002). We manipulated regulatory focus but altered the mouse-in-maze task to additionally manipulate regulatory closure. We expected a replication of Friedman and Förster in the case of regulatory closure, but absent such closure, we expected similar levels of creativity among promotion- and prevention-focused individuals (Hypothesis 1). A second aim was to test the assumption that motivational states have their effects on creativity because they either activate or deactivate. Thus, we measured the level of activation and tested whether activation mediated the interaction between regulatory focus and regulatory closure (Hypothesis 2).[6]

Method

Design and participants. University of Amsterdam undergraduate students ($N = 77$, 67% female) with a mean age of 20.7

[6] We thus expected that (un)finished goal states in one task transfer to a subsequent, unrelated task (also see Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001; Friedman & Förster, 2001, 2005). However, an alternative hypothesis would be that unfinished tasks may interfere with performance on a subsequent, unrelated task because the unfinished task could distract (Rothermund, 2003) and decrease motivation for the new task (Shah & Kruglanski, 2002). If this were the case, we would expect a main effect of regulatory closure, showing better insight performance in the condition in which the maze is finished than in the condition in which it is not. The design of Study 2 allowed us to examine this possibility.

years ($SD = 6.0$) were randomly assigned to one of four different conditions that were obtained by varying regulatory focus (promotion vs. prevention) and regulatory closure (goal fulfillment vs. not). Dependent variables were the number of solved RAT items and self-reported ratings of activation, relief, and cheerfulness.

Procedure, manipulations, and creativity task. Participants first engaged in the frozen-mouse task (a modified version of the mouse-in-maze task from Friedman & Förster, 2001, 2002) to manipulate regulatory focus and regulatory closure. Participants saw a mouse trapped in a maze and were instructed to find a way out of the maze with the aid of their computer mouse. In the promotion condition, a piece of cheese (gain) was lying outside the maze; in the prevention condition, an owl (threat) was depicted as hovering above the maze. In the closure-present condition, participants finished the maze task, and as such, the mouse successfully attained the piece of cheese (i.e., promotion goal closure) or successfully escaped the owl (i.e., prevention goal closure). In the closure-absent condition, the maze task was unexpectedly frozen at two thirds of the way through the maze. Participants received a seemingly inserted operator message that due to technical problems, they would now continue to the next task and return to the maze later on in the experiment. Then followed 30 problems from the RAT that were presented in random order (see Study 1). Following the RAT, participants answered a short questionnaire and were debriefed.

Dependent variables. We coded the number of correctly solved RAT problems (range between 0 and 30). Cheerfulness ($\alpha = .81$) and relief ($\alpha = .80$) were measured as before. Finally, we measured *level of activation*. Following Watson et al. (1999), participants indicated how activated (alert, attentive) ($\alpha = .75$) they felt during the task on a Likert-type scale ranging from 1 (*not at all*) to 5 (*very much*).

Results

Creative performance. We submitted the number of solved RAT problems to a 2 (regulatory focus) × 2 (regulatory closure) ANOVA. We obtained our predicted interaction effect between regulatory focus and regulatory closure, $F(1, 73) = 7.72$, $p = .007$, $\eta_p^2 = .10$. Figure 2A shows that in the closure-absent condition, no effect of regulatory focus was observed ($F < 1.90$, $p > .18$). However, in the case of regulatory closure, prevention-focused participants solved fewer problems than promotion-focused participants, $F(1, 73) = 6.49$, $p = .01$, $\eta_p^2 = .08$. No other effects were found ($F < 1$).

Activation and posttask feelings. We submitted ratings of activation, relief, and cheerfulness to separate 2 (regulatory focus) × 2 (regulatory closure) ANOVAs. For activation, we found a main effect of regulatory focus, $F(1, 73) = 6.11$, $p = .016$, $\eta_p^2 = .08$, showing that promotion-focused participants felt more activated ($M = 3.13$) than prevention-focused participants ($M = 2.58$). This effect was qualified by an interaction between regulatory focus and regulatory closure, $F(1, 73) = 9.29$, $p = .003$, $\eta_p^2 = .11$. Figure 2B shows that when closure was absent, no difference in activation was found between promotion-focused participants and those with a prevention focus ($F < 1$). However, in the case of regulatory closure, promotion-focused participants reported more activation than prevention-focused participants, $F(1, 73) = 15.10$, $p < .001$, $\eta_p^2 = .17$. With regard to ratings of cheerfulness, we found a nonsignificant trend for regulatory focus, showing that promotion-focused participants tended to report more cheerfulness ($M = 3.49$) than prevention-focused participants ($M = 3.24$), $F(1, 73) = 3.03$, $p = .086$, $\eta_p^2 = .04$. No other effects involving cheerfulness were found (Fs < 1, *ns*). For self-reported relief, no significant effects were found (Fs < 2.8, ps $> .10$).

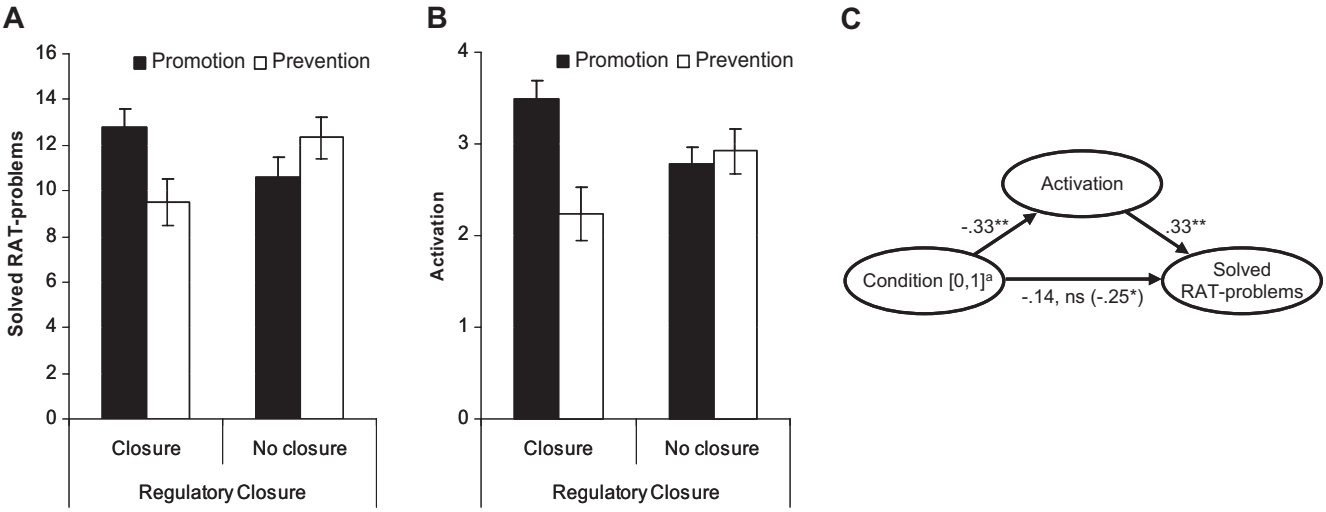

Figure 2. Insight performance and activation as a function of regulatory focus and regulatory closure (Study 2). A: Insight performance (ranging between 0 and 30) as a function of regulatory focus and regulatory closure (displayed ±*SE*). B: Participant's level of activation (measured on a 5-point Likert-type scale, ranging between 1 [low] and 5 [high]) as a function of regulatory focus and regulatory closure (displayed ±*SE*). C: Mediation of the interaction between regulatory focus and regulatory closure on insight performance by activation. RAT = Remote Associates Test. [a]Successful prevention = 1; other conditions = 0. $^{*}p < .05$. $^{**}p < .01$.

Mediation tests. To test for mediation, we computed a series of regression analyses along the criteria set forth by Kenny, Kashy, and Bolger (1998) in which we compared the fulfilled prevention goal condition (set as 1) versus the other conditions (set as 0). As can be seen in Figure 2C, activation regressed significantly on condition, $\beta = -.33$, $t(75) = -3.02$, $p = .003$. When we regressed RAT performance on condition after controlling for activation, the originally significant effect of condition, $\beta = -.25$, $t(75) = -2.22$, $p = .029$, dropped to nonsignificance ($\beta = -.14$, $t < 1.3$, *ns*); the effect of activation was significant, $\beta = .33$, $t(74) = 2.87$, $p = .005$. A Sobel test confirmed that the mediation was significant ($Z = -2.09$, $p = .036$).[7] This supports Hypothesis 2.

Discussion and Introduction to Study 3

Replicating findings from Study 1, we found that the effect of regulatory focus on creative performance was qualified by regulatory closure. Supporting Hypothesis 1, we found that prevention-focused individuals in the closure condition solved fewer RAT problems than the individuals in other conditions. Moreover, we found that successful prevention lowers creativity because it reduced activation (Hypothesis 2). Finally, our results do not support the alternative hypothesis that unfinished tasks interfere with performance on a subsequent, unrelated task (see footnote 6).

Our objective with Study 3 was to replicate our findings with a divergent thinking task that allowed us to assess idea originality and fluency—the number of unique ideas and solutions an individual generates (e.g., Simonton, 1997; Torrance, 1966). We expected that originality and fluency would be lower in the successful prevention condition than in the other conditions (Hypothesis 1) and that this effect would be mediated by activation (Hypothesis 2).

Method

Design and participants. University of Amsterdam undergraduate students ($N = 98$, 72% female) with a mean age of 22.1 years ($SD = 5.8$) participated for €5 (approximately U.S. $6.50) and were randomly assigned to the conditions of a 2 (regulatory focus: promotion vs. prevention) × 2 (regulatory closure: goal fulfillment vs. not) between-subjects factorial. Dependent variables were rated originality, infrequency of ideas (an alternative measure of originality; see below), creative fluency, and self-reported activation ($\alpha = .79$), relief ($\alpha = .74$), and cheerfulness ($\alpha = .77$).

Procedure, manipulations, and creativity task. These were the same as in Study 2, except that we replaced the RAT with the unusual uses task (De Vet & De Dreu, 2007; Friedman & Förster, 2001; Guilford, 1967). Participants were given 4 min to write down as many different creative ways to use a tin can as possible. They were told that the ideas had to be neither typical nor virtually impossible. Following the unusual uses task, participants answered a short questionnaire and were debriefed, paid for participation, and dismissed.

Dependent variables. Four raters separately counted the number of nonredundant ideas generated per participant (henceforth, *fluency*). In addition, ideas were rated for originality and scored on infrequency. To obtain measures of rated originality, independent coders rated each unique idea for originality, being defined as an idea or suggestion that is infrequent, novel, and uncommon (1 = *not original at all,* 9 = *very original*). Interrater agreement was .82, which is excellent following criteria per Cicchetti and Sparrow (1981). We used the aggregation across raters as an indicator of originality. We averaged originality ratings across all ideas an individual generated to correct for possible differences in fluency. To validate and triangulate this measure, we also derived a measure of infrequency by assessing the number of ideas per participant that were mentioned by less than 5% of the other participants in this experiment (Guilford, 1967; Torrance, 1966). Feelings of activation, cheerfulness, and relief were measured as before.

Results

Descriptive statistics. Table 1 shows the means and standard deviations, along with the zero-order correlations for all study variables. Originality correlated with infrequency, and both measures were correlated with fluency. Furthermore, and more important, Table 1 shows that all creativity measures positively related to self-reported activation but did not correlate significantly with ratings of relief and cheerfulness.

Creative performance. We submitted originality, infrequency of ideas, and fluency to separate 2 (regulatory focus) × 2 (regulatory closure) ANOVAs. For originality, we found our predicted interaction only between regulatory focus and regulatory closure, $F(1, 94) = 6.96$, $p = .01$, $\eta_p^2 = .07$. Figure 3A shows that in the closure-absent condition, no effect of regulatory focus was observed ($F < 1$); however, in the closure-present condition, prevention-focused participants were less original than promotion-focused participants, $F(1, 94) = 7.31$, $p = .008$, $\eta_p^2 = .07$. Similar results were obtained with the analyses regarding infrequency of ideas. We found an interaction only between regulatory focus and regulatory closure, $F(1, 94) = 4.51$, $p = .036$, $\eta_p^2 = .05$. Figure 3B shows that in the closure-absent condition, no effect of regulatory focus was observed ($F < 1$); however, in the closure-present condition, prevention-focused participants produced fewer original ideas than promotion-focused participants, $F(1, 94) = 4.78$, $p = .031$, $\eta_p^2 = .05$. For fluency, we found a main effect of regulatory focus, $F(1, 94) = 6.81$, $p = .011$, $\eta_p^2 = .07$. Promotion-focused participants ($M = 11.23$) generated more ideas than prevention-focused participants ($M = 9.27$). This main effect was qualified by our predicted interaction between regulatory focus and regulatory closure, $F(1, 94) = 6.11$, $p = .015$, $\eta_p^2 = .06$. Figure 3C shows that in the closure-absent condition, no effect of regulatory focus was observed ($F < 1$); however, in the closure-present condition, prevention-focused participants generated fewer ideas than promotion-focused participants, $F(1, 94) = 11.12$, $p < .001$, $\eta_p^2 = .11$. Together, these results are once again consistent with Hypothesis 1.

Activation and posttask feelings. We submitted ratings of activation, cheerfulness, and relief to separate 2 (regulatory fo-

[7] Because we did not find significant effects of regulatory focus and regulatory closure on self-reported relief and cheerfulness, formal mediation by these feelings cannot be established. However, for the sake of completeness, we computed correlations among ratings of relief and cheerfulness and the number of solved RAT problems. Correlations failed to reach significance (all *p*s > .25).

Table 1
Descriptive Statistics for Study 3

Variable	*M*	*SD*	1	2	3	4	5	6
1. Rated originality	3.90	0.83	—					
2. Infrequency of ideas	0.67	0.87	.30**	—				
3. Fluency	10.33	4.31	.31**	.50**	—			
4. Activation	2.75	0.48	.32**	.33**	.43**	—		
5. Cheerfulness	3.30	0.57	.11	−.06	.06	−.14	—	
6. Relief	4.31	0.45	.03	−.17†	−.05	−.29**	.35**	—

Note. $N = 98$.
† $p < .10$. ** $p < .01$.

cus) × 2 (regulatory closure) ANOVAs. For self-reported activation, we found a significant interaction between regulatory focus and regulatory closure, $F(1, 94) = 6.46$, $p = .013$, $\eta_p^2 = .06$. In the closure-absent condition, no effect of regulatory focus was observed ($M_{promotion} = 2.74$, $M_{prevention} = 2.86$; $F < 1$). In the closure-present condition, prevention-focused participants reported less activation ($M = 2.48$) than those with a promotion focus ($M = 2.83$), $F(1, 94) = 5.63$, $p = .020$, $\eta_p^2 = .06$. With regard to ratings of cheerfulness, we found a nonsignificant interaction between regulatory focus and regulatory closure, $F(1, 73) = 3.50$, $p = .065$, $\eta_p^2 = .04$, but results obtained from contrast analyses within regulatory focus conditions were not reliable ($Fs < 2.2$, $p > .14$). This renders it difficult to interpret this effect. No other effects involving cheerfulness were found ($Fs < 1$, *ns*). For self-reported relief, no significant effects were found ($Fs < 2.6$, $p > .11$).

Mediation by activation. To test for mediation for originality, infrequency of ideas, and fluency, we computed a series of regression analyses in which we compared the successful prevention condition (set as 1) versus the other conditions (set as 0). Activation regressed significantly on condition, $\beta = -.28$, $t(96) = -2.81$, $p = .006$. When we regressed rated originality on condition after controlling for activation, the originally significant effect of condition, $\beta = -.29$, $t(96) = -2.88$, $p = .005$, dropped but remained significant, $\beta = -.21$, $t(95) = -2.08$, $p = .041$; the effect of activation was significant, $\beta = .28$, $t(96) = 2.76$, $p = .007$. A Sobel test confirmed that activation partially mediates the effect of condition on rated originality ($Z = -2.00$, $p = .045$). Mediation analyses involving the infrequency measure of originality corroborated these results. When we regressed infrequency of ideas on condition after controlling for activation, the originally significant effect of condition, $\beta = -.23$, $t(96) = -2.27$, $p = .025$, dropped to nonsignificance ($\beta = -.15$, $t < -1.5$, *ns*); the effect of activation was significant, $\beta = .30$, $t(95) = 2.96$, $p = .004$. A Sobel test confirmed that the mediation was significant ($Z = -2.06$, $p = .039$). Finally, when we regressed creative fluency on condition after controlling for activation, the originally significant effect of condition, $\beta = -.35$, $t(96) = -3.51$, $p < .001$, dropped but remained significant, $\beta = -.25$, $t(95) = -2.55$, $p = .013$; the effect of activation was significant, $\beta = .36$, $t(95) =$

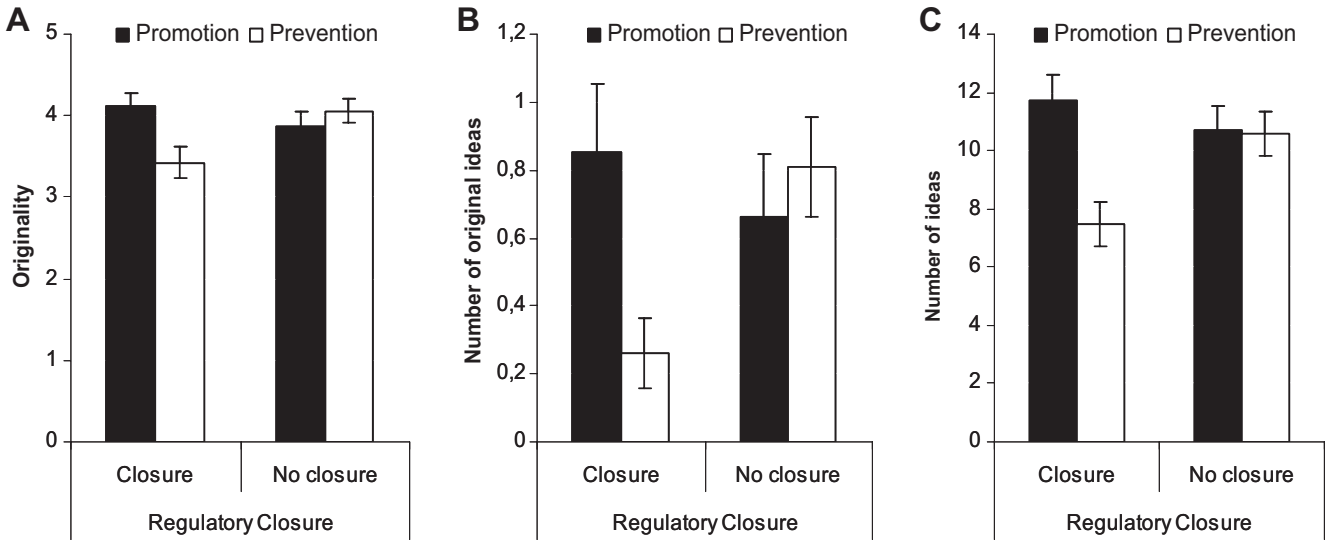

Figure 3. Originality, infrequency of ideas, and fluency as a function of regulatory focus and regulatory closure (Study 3). A: Originality (ranging between 0 and 9) as a function of regulatory focus and regulatory closure (displayed ±*SE*). B: Infrequency of ideas as a function of regulatory focus and regulatory closure (displayed ±*SE*). C: Fluency as a function of regulatory focus and regulatory closure (displayed ±*SE*).

3.67, $p < .001$. A Sobel test confirmed that activation partially mediates the effect of condition on fluency ($Z = -2.24$, $p = .025$). In other words, consistent with Hypothesis 2, participants in the successful prevention condition were less original and fluent and produced fewer original ideas than participants in the unfulfilled prevention and promotion conditions combined, partly because of lowered levels of activation.

Discussion and Introduction to Study 4

Studies 1–3 showed that successful prevention, but not unfulfilled prevention, lowers creativity compared to promotion-focused states. This effect was fully mediated by activation in Study 2 and partially mediated by activation in Study 3. Interestingly, in none of the studies was it mediated by (self-reported) feelings of cheerfulness, a mood state typically associated with regulatory closure in the case of promotion goals, or of relief, a mood state typically associated with regulatory closure in the case of prevention goals (Carver, 2009; Mowrer, 1960). This suggests that it is the combination of regulatory focus and regulatory closure, more than the associated feelings, that drives creativity. This suggests that were one to induce anger, happiness, fear, and relief, it should be the (implicitly) associated prevention focus and the experience of absence versus presence of closure that drive creative performance. Put differently, our findings thus far suggest why and how moods drive creativity. Putting this idea to the test was our goal in Study 4.

Our second objective was to further our understanding of the interrelation between specific mood states, regulatory foci, regulatory closure, and activation, and their effects on creativity. As said, in none of the reported studies here were self-reported feelings associated with enhanced activation and creativity. However, when regulatory focus and regulatory closure were directly manipulated, successfully closed promotion goals and unfulfilled promotion and prevention goals were associated with more activation than successfully regulated prevention goals, with enhanced creative performance as a consequence (Studies 2 and 3). Together, these results point to the possibility that moods have their effects on creativity because of their association with regulatory focus and regulatory closure and the concomitant feelings of activation. Accordingly, when we directly induce moods associated with unfulfilled (fear) versus completed prevention goals (relief) and moods associated with unfulfilled (anger) versus completed promotion goals (happiness), we would expect to find more creativity in fearful, angry and happy than in relieved participants (Hypothesis 3), and this effect should be mediated by perceived regulatory closure of prevention concerns (Hypothesis 4) and activation (cf. Hypothesis 2).

Method

Design and participants. University of Amsterdam undergraduate students ($N = 151$, 71% female) with a mean age of 21.5 years ($SD = 5.7$) participated for partial fulfillment of a course requirement and were randomly assigned to one of five different conditions that were obtained by varying mood (fear, anger, happiness, relief, neutral). Gender and age had no effects and are not discussed further. Dependent variables were the number of solved insight problems and measures of regulatory closure, activation, relief, and cheerfulness.

Procedures and independent variables. Participants were asked to write a short essay about a situation that happened to them and that made them feel really fearful (angry, happy, relieved). They were asked to pay attention to the vivid emotional aspects of the situation and write their essay in such a way that another person could imagine the situation they were in. In the mood-neutral condition, participants were asked to write a short essay about the route they took to the psychology department (see Friedman, Förster, & Denzler, 2007). Upon completion of the mood manipulation task, participants continued with 10 items from the Gestalt Completion Task (GCT; Ekstrom, French, Harman, & Dermen, 1976), a test that consists of insight problems that involve recognizing fragmented pictures of familiar objects. According to Förster, Friedman, and Liberman (2004), "this task may also be seen as requiring visual insight inasmuch as each item is ultimately soluble by the average problem solver and is likely to produce an impasse that may be suddenly overcome after continued efforts at solution" (p. 179; also see Friedman & Förster, 2001, 2002). Hereafter, participants answered a short questionnaire and were debriefed and dismissed.

Dependent variables. The number of correctly solved items was our measure of creative performance. Following Higgins (1997) and Carver (2004), successful prevention regulation (i.e., regulatory closure in the case of prevention goals) was measured by asking participants to rate their autobiographical stories in terms of the extent to which these reflected an event that was about the successful avoidance of negative outcomes, such as dangers and misbehaviors (1 = *not at all,* 7 = *very much*). To do so, participants returned to their autobiographical story that they could go through it before answering our measure of successful prevention regulation. Activation ($\alpha = .76$), cheerfulness ($\alpha = .83$), and relief ($\alpha = .80$) were measured as before.

Results

Descriptive statistics. Table 2 shows the means and standard deviations, along with the zero-order correlations for all study variables. It shows, first, that the number of solved insight problems correlated positively with self-reported activation and negatively with the extent to which the mood-related stories reflected an event that was about the successful avoidance of a negative outcome. Second, our measure of successful prevention regulation negatively correlated with activation. Third, ratings of relief and cheerfulness did not correlate significantly with our creativity measure.

Posttask feeling states. We submitted ratings of cheerfulness and relief to separate ANOVAs with mood condition as the

Table 2
Descriptive Statistics for Study 4

Variable	*M*	*SD*	1	2	3	4	5
1. Solved insight problems[a]	7.01	1.38	—				
2. Successful prevention[b]	3.09	2.09	−.32**	—			
3. Activation[a]	3.15	0.73	.53**	−.33**	—		
4. Cheerfulness[a]	2.99	0.94	.11	.03	.37**	—	
5. Relief[a]	3.00	0.93	.06	−.00	.08	.35**	—

[a] $N = 151$. [b] $N = 134$.
** $p < .01$.

between-subjects factor. With regard to cheerfulness, we found a main effect of our mood manipulation, $F(4, 146) = 5.60$, $p < .001$, $\eta_p^2 = .13$. Planned comparisons showed that angry participants felt less cheerful and happy participants felt more cheerful than those in the fear, relief, and mood-neutral control conditions, $t(146) = 4.23$, $p < .001$ (see also Table 3). Furthermore, we found a main effect of our mood manipulation on relief, $F(4, 146) = 8.51$, $p < .001$, $\eta_p^2 = .19$, with planned comparisons showing that fearful participants felt less relief and relieved participants felt more relief than those in the anger, happy, and mood-neutral control conditions, $t(146) = 4.81$, $p < .001$ (see also Table 3). These results indicate that our mood manipulation was successful.

Creativity. A one-way ANOVA with mood condition as the between-subjects factor and the number of correctly closed gestalts as the measure of creativity revealed a main effect of our mood manipulation, $F(4, 146) = 5.30$, $p = .001$, $\eta_p^2 = .13$. As can be seen in Figure 4A, participants in fearful, angry, and happy moods closed more GCT items than those in relieved moods and the mood-neutral control condition. This supports Hypothesis 3 and our earlier finding that absent closure, promotion-focused states (anger) and prevention-focused states (fear) are associated with enhanced creativity, and with similar levels of creativity as promotion-focused states in the case of regulatory closure (happiness).

Activation. We submitted ratings of activation to a one-way ANOVA with mood condition as the between-subjects factor. We found a significant effect of our mood manipulation, $F(4, 146) = 6.79$, $p < .001$, $\eta_p^2 = .16$. As can be seen in Figure 4A, participants in fearful, angry, and happy moods reported being more activated than those in relieved moods and the mood-neutral control condition.

Successful prevention regulation. We submitted ratings of successful prevention regulation to a four-level one-way ANOVA with mood condition as the between-subjects factor (the mood-neutral control condition was excluded from this analysis). The ANOVA revealed a main effect of our mood manipulation, $F(3, 130) = 5.86$, $p = .001$, $\eta_p^2 = .12$. As can be seen in Figure 4A, relieved participants indicated that their autobiographical story reflected successful prevention regulation to a greater extent than fearful, angry, and happy participants.

Mediation tests. To test for mediation, we computed a series of regression analyses in which we compared relief (set as 1) to fear, anger, and happiness (set as 0). Successful prevention regulation regressed significantly on mood condition, $\beta = .33$, $t(132) = 4.01$, $p < .001$. When we regressed insight performance on mood condition after controlling for successful prevention regulation, the originally significant effect of mood condition, $\beta = -.31$, $t(132) = -3.76$, $p < .001$, dropped but remained significant, $\beta = -.23$, $t(131) = -2.70$, $p = .008$; the effect of successful prevention regulation was significant, $\beta = -.25$, $t(131) = -2.87$, $p = .005$. A Sobel test confirmed that successful prevention regulation partially mediates the effect of mood condition on insight performance ($Z = -2.35$, $p = .019$). In other words, consistent with Hypothesis 4, relieved participants solved fewer creative insight problems than fearful, happy, and angry participants, partly because relief is associated more strongly with successful prevention regulation.

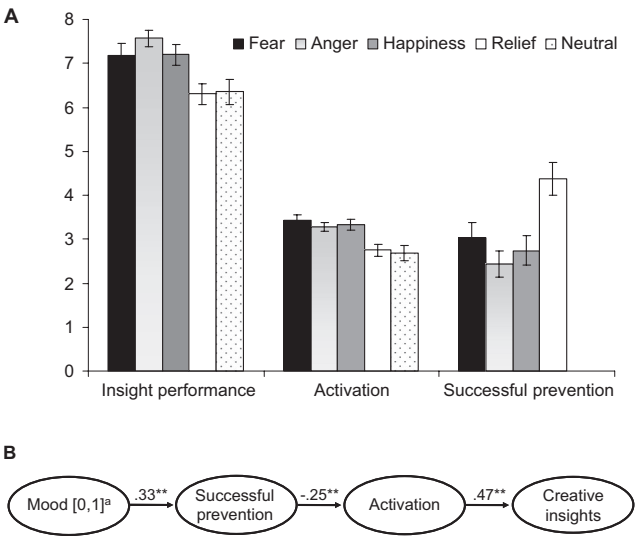

Figure 4. Insight performance, activation, and successful prevention regulation as a function of mood condition (Study 4). A: The effect of mood condition on insight performance (ranging between 0 and 10; displayed ±*SE*), participant's level of activation (measured on a 5-point Likert-type scale, ranging between 1 [low] and 5 [high]; displayed ±*SE*), and successful prevention (measured on a 7-point Likert-type scale, ranging between 1 [low] and 7 [high]; displayed ±*SE*). B: Mediation of the effect of mood condition on insight performance by successful prevention and activation. [a]Relief = 1; fear, anger, happiness = 0. ** $p < .01$.

In a second series of regression analyses, we tested whether successful prevention regulation has its effect on creative insights through decreased activation. First, when we regressed ratings of activation on mood condition after controlling for regulatory closure, the originally significant effect of mood condition, $\beta = -.34$, $t(132) = -4.21$, $p < .001$, dropped but remained significant, $\beta = -.26$, $t(131) = -3.12$, $p = .002$; the effect of regulatory closure was significant, $\beta = -.25$, $t(131) = -2.94$, $p = .004$. A Sobel test

Table 3
Means and Standard Deviations for Mood Ratings as a Function of Mood Condition (Study 4)

Self-reported feelings	Mood condition									
	Fear		Anger		Happiness		Relief		Neutral	
	M	*SD*	M	SD	M	SD	M	*SD*	*M*	*SD*
Cheerfulness	3.00	.89	2.49	.96	3.38	.79	3.26	.78	2.74	.73
Relief	2.51	.94	2.67	.99	3.33	.79	3.54	.60	2.97	.81

confirmed that successful prevention regulation partially mediates the effect of mood condition on activation ($Z = -2.37$, $p = .018$). Second, when we regressed insight performance on mood condition after controlling for activation, the originally significant effect of mood condition, $\beta = -.31$, $t(132) = -3.76$, $p < .001$, dropped to nonsignificance, $\beta = -.14$, $t(131) = 1.79$, $p = .074$; the effect of cognitive activation was significant, $\beta = .50$, $t(131) = 6.54$, $p < .001$. A Sobel test confirmed that the mediation was significant ($Z = -3.54$, $p < .001$), which gives additional evidence in support of Hypothesis 2. Finally, as can be seen in Figure 4B, when we entered mood condition, regulatory closure, and activation in the regression model, only the effect of activation was significant, $\beta = .47$, $t(130) = 5.97$, $p < .001$. Thus, because of its strong association with regulatory closure, relief leads to deactivation and therefore to fewer creative insights than fear, anger, and happiness.

Conclusions and General Discussion

Recent work on motivational states and creativity has suggested that promotion-focused states (induced by primes of positive outcomes or being elated or frustrated) result in greater creativity than prevention-focused states (Baas et al., 2008; Förster & Dannenberg, 2010; Friedman & Förster, 2001, 2002). However, our results suggest that prevention-focused states can produce similar levels of creativity as promotion-focused states. When prevention-focused states lead to activation (fear, unfulfilled prevention goals), they lead to many and original ideas, insights, and problem solutions; when prevention goals are successfully regulated (relief, fulfilled prevention goals), they lead to deactivation, and creativity breaks down. Thus, across all four studies, our results show that greater originality and more creative insights emerge when the individual is activated and energized, regardless of whether self-regulation is concerned with promotion or prevention. This general finding contributes to earlier work on the role of promotion versus prevention focus and creativity (e.g., Friedman & Förster, 2001, 2002) and has important implications for thinking about the interrelation between specific moods, self-regulation, and creativity (Baas et al., 2008; De Dreu et al., 2008; Friedman & Förster, 2005). Below, we discuss these implications in more detail and discuss possibilities for new research.

Theoretical and Practical Implications

Creativity can be achieved through cognitive processes and functions that require the individual to somehow be cognitively activated and energized (De Dreu et al., 2008). This is a critical deviation from the widely shared notion that creativity results from being relaxed, unfocused, and unengaged (e.g., Bransford & Stein, 1984; Martindale, 1999). Rather, consistent with the classic notion that performance is related to stress in a curvilinear way (Broadbent, 1972; Staw, Sandelands, & Dutton, 1981; Yerkes & Dodson, 1908), De Dreu et al. (2008; see also Byron et al., 2010; Chermahini & Hommel, 2010) proposed that at moderate levels of activation, creativity-enhancing functions, such as cognitive flexibility, sustained attention, working memory performance, and cognitive persistence, can be facilitated more than under excessively low or excessively high levels of activation.

In line with this proposition, our results suggest that any motivational state that activates the individual, regardless of its association with promotion or prevention, will enhance creativity. Whether promotion- or prevention-focused states activate depends on regulatory closure: whether the goal is fulfilled and successfully achieved or is unfulfilled and actively pursued. Promotion-focused states are activating, regardless of whether promotion goals are successfully achieved or not yet fully attained (e.g., Carver, 2004; J. R. Gray & Braver, 2002; Pickering & Gray, 1999), which results in enhanced creativity. However, for prevention focus, regulatory closure does matter. When avoiding a negative outcome, unfulfilled goals (e.g., being blocked, a lack of progress, or unfinished escape) result in enhanced activation, effort, and persistence, but when prevention goals are successfully regulated, the individual is deactivated and in a state of disengagement (Förster et al., 2001; Idson & Higgins, 2000; also see Carver, 2004; Frijda, 1986; Mowrer, 1960). In other words, prevention-focused states that are associated with unfulfilled goals (fear, unfulfilled prevention regulation) are activating, whereas prevention-focused states that are associated with regulatory closure (relief, successful prevention regulation) are deactivating. Indeed, activation mediated the effects of regulatory focus and regulatory closure on creative insight performance and creative ideation both when goal states were primed (Studies 2 and 3) and when moods were induced (Study 4). Obviously, individuals may also fail and abandon goal pursuit. Failure to reach desired end states and prolonged failure to avoid aversive end states will lead to deactivation, withdrawal from goal pursuit, and feelings of sadness, depression, and helplessness (Dweck, 1975; Higgins, 1997; Mowrer, 1960). Although not the focus of our study, from our reasoning it follows that these states of deactivation do not lead to increased creativity, and this is indeed what previous work has shown (e.g., Baas et al., 2008; Wolfradt & Pretz, 2001).

The finding that activation (but not feeling cheerful or relieved) mediated the effects of regulatory focus and regulatory closure on creativity has several implications. First, in our meta-analysis of research on the mood–creativity relationship (Baas et al., 2008), we found that deactivating moods, such as sadness and relaxed state, were not related to creativity; that activating promotion-related states, such as happiness and anger, were positively related to creativity; and that anxiety, an activating prevention-related mood, was negatively correlated with creativity. Although four out of five meta-analytic findings are in line with an activation model of creativity, the finding that anxiety negatively correlated with creativity is not and may appear inconsistent with current findings that show that fearful and anxious mood states lead to increases in creativity. However, it is important to note that the vast majority of studies involving anxiety included in the meta-analysis looked at measures of flexibility and that only for flexibility, not for other measures of creativity, was a negative correlation with anxiety obtained. Second, and more importantly, in contrast to promotion-related moods, which were oftentimes experimentally manipulated, activating prevention-related moods were, without exception, measured as chronic tendencies (e.g., with the STAI; Spielberger et al., 1970). Consequently, our meta-analysis did not allow conclusions about the causal impact of activating prevention-related moods. Current findings show that experimentally induced fear and anxiety led to more creativity than relaxed and neutral moods and to similar levels of creativity as happy and

angry moods (Study 4; also see De Dreu et al., 2008). As such, we do not think that current findings are incompatible with our meta-analytic results but that instead they expand on and qualify the meta-analytical results.

Second, in contrast to some earlier statements (Lyubomirsky et al., 2005; Murray et al., 1990; Schwarz & Clore, 2007), self-reported affect, such as relief and cheerfulness, appeared less important in predicting creativity than regulatory focus, regulatory closure, and activation. In fact, in none of our four studies did we find affect to mediate the effects of our manipulations on creativity. Instead, activation mediated effects of regulatory focus and regulatory closure on conceptual insight performance (Study 2) and the number and originality of ideas (Study 3). Finally, Study 4 showed that because of its strong association with successful prevention regulation, relief leads to deactivation and therefore leads to fewer creative insights than fear, anger, and happiness. Together, these results support and extend the conclusion that

> effects of motivational states on attention, memory, and problem solving (including creativity) may rely heavily on the extent to which the anticipatory versus arousal components are rendered predominant. Ironically, it follows from this reasoning that many of the effects of emotion on cognition may result from the "cold" cognitive aspect of emotion states (e.g., their regulatory focus; Higgins, 2000; or their underlying appraisal themes; Lerner & Keltner, 2000). . . . (Friedman & Förster, 2005, p. 272)

Current findings add to those by Friedman and Förster (2001, 2005) and the conclusion reached by Baas et al. (2008) in our meta-analytic review of the mood–creativity literature: (a) that earlier findings need to be understood in terms of the interaction between regulatory focus and regulatory closure and (b) that activation is crucial for the positive effects on creativity to come about.

Third, our findings shed new light on at least three distinct lines of research. First, using the mouse-in-maze task, Friedman and Förster (2001, 2002) showed that participants who found a way out of the maze while an owl was depicted as hovering above it (prevention focus) solved fewer creative insight problems and generated fewer original ideas than participants who found a way out of the maze while a piece of cheese (gain) was lying outside the maze (promotion focus). However, all participants finished the maze and therefore successfully attained a desired outcome and successfully avoided a threatening situation. This might be the reason for the obtained results—according to our reasoning and findings, in comparison to promotion-focused states, successfully regulated prevention goals lead to reduced creative performance because they deactivate and lead to disengagement. However, levels of creativity similar to those in the promotion focus condition are to be expected in a prevention focus condition where regulatory closure is pending (i.e., if the mouse-in-maze task is stopped before participants can finish it). This is indeed what we found in Study 2 and 3—prevention-focused states that activate the individual (unfulfilled prevention goals) lead to similar levels of creativity as promotion-focused states. Only prevention-related states that deactivate and lead to disengagement (successful prevention regulation) lead to lower levels of creativity.

Second, Akinola and Mendes (2008) asked participants to deliver a speech to two evaluators who either gave explicit positive feedback and exhibited positive nonverbal behavior or gave explicit negative feedback and exhibited rejecting nonverbal behavior. Participants who received positive feedback showed lower levels of creativity on a subsequent artistic task than those who received negative feedback. Inasmuch as delivering a stressful public speech is a negative event that participants would like to avoid (i.e., a situation that elicits prevention concerns; Geer, 1965; Kirschbaum, Pirke, & Hellhammer, 1993), negative feedback signals unsuccessful regulation of the prevention goal and induces fear and anxiety, while positive feedback signals successful prevention regulation and induces relief. In current terms, anxiety (or unfulfilled prevention goal) is activating and therefore produced higher levels of creativity than relief or successful prevention regulation.

Third, previous work has shown that individual differences in anxiety and prevention focus do not relate or relate negatively to creativity (Baas et al., 2008; Friedman & Förster, 2001; Mikulincer, Kedem, & Paz, 1990). However, measures of trait anxiety, such as the STAI (Spielberger et al., 1970), or measures of prevention focus, such as the Lockwood Scale (Lockwood, Jordan, & Kunda, 2002), reflect a propensity to experience anxiety or other prevention-related states. This proneness to anxiety and prevention goals associates with vigilance and increased arousal (J. A. Gray, 1990; Mowrer, 1960) but only when task- and context-dependent prevention concerns are highlighted (cf. Cesario, Grant, & Higgins, 2004; Seibt & Förster, 2004) or threats are present or mentally activated (Heller, Nitschke, Etienne, & Miller, 1997). In the absence of threat and task-induced prevention concerns, the prevention system is at rest, and little activity and activation are expected. We suspect this is the reason why individual differences in anxiety and prevention focus do not relate or relate negatively to creativity. Only when fear is aroused by imagery or induced by prevention-related task features, or when one is in the presence of stressful and threatening conditions, is creativity enhanced (Study 4; also see Akinola & Mendes, 2008; De Dreu et al., 2008).

Study Limitations and Avenues for Future Research

Moods and emotions involve multiple dissociable components that are elicited in the pursuit of individual goals and the regulation of personally relevant concerns (e.g., Carver, 2004; Fishbach & Labroo, 2007; Frijda, 1986; Higgins, 1997; Lerner & Keltner, 2000; Mowrer, 1960; Tamir, 2009). These include feelings of pleasure and activation, appraisals of a stimulus or situation (e.g., whether it is benign, controllable, uncertain), the cognitive anticipation of desired or aversive end states (i.e., regulatory focus) in combination with regulatory closure, and physiological changes (e.g., in heart rate and metabolic load). In the current article, we have explored which of these components comprising mood are essential for creativity to come about. The results of this article provide converging evidence that concurrent emotional experience has little effect on creativity and suggest that earlier findings of mood on creativity need to be understood in terms of the interaction between regulatory focus and regulatory closure and the concomitant feelings of activation.

It is a relatively new development in the literature on mood and emotion to link the cognitive aspects of moods (i.e., their underlying regulatory focus and closure) to cognitive activation, information-processing modes, and creativity (cf. Baas et al., 2008), and clearly, more primary research is needed to further the

understanding of the ways moods exert their effects on these outcome variables and to establish which of the components that comprise mood are involved. For example, in Study 4, we found first-time evidence that it is a mood state's association with regulatory focus and the absence versus presence of closure that drive the effects on activation and creativity. Building on this correlational evidence, future work might use moderation-of-process designs (Spencer, Zanna, & Fong, 2005) to unequivocally establish the causal role of a mood state's (implicit) prevention focus and regulatory closure in the link between mood and creativity. For example, participants in promotion-focused (e.g., anger, happiness) and prevention-focused moods (e.g., fear, relief) could work on a creativity task for which the future prospect of either successful or unsuccessful promotion or prevention has been highlighted in the participants' minds.

Such new research could also endeavor to use alternative measures of activation to provide stronger causal evidence for activation as the proposed mediator. In the current set of studies, we measured activation via self-report following the creativity task. Although this approach has the strength of testing the full mediational model within single studies (Kenny et al., 1998), it is inherently correlational in nature. For example, the reader may argue that participants reported more activation because they felt good about their performance on the creativity tasks.[8] An important avenue for future research would therefore be to use other designs where activation is manipulated with metabolic load (e.g., Gailliot et al., 2007; see Spencer et al., 2005) or to link the effects of our manipulations on creativity to physiological indicators of activation that are less likely to be influenced by self-perception processes, such as increased blood pressure, heart rate, and pupil dilation (e.g., Bijleveld, Custers, & Aarts, 2009; Bradley, 2000; Brehm & Self, 1989).

Current results show that creativity is enhanced by any motivational state that activates the individual. However, an important avenue for future research lies in answering the question of how these motivational states exert their effects. Two possibilities exist. First, creative insights and original ideas come about when the individual engages in flexible, loose, and divergent thinking. Such cognitive flexibility is enhanced under a positive activating mood (Ashby et al., 1999; De Dreu et al., 2008), under approach motivation (Mehta & Zhu, 2009), and in the case of promotion focus (Friedman & Förster, 2001, 2005). Second, creative performance benefits from focused, systematic thinking in which specific combinations are thoroughly thought through and a few cognitive categories are explored in depth (e.g., Finke, 1996; Newell & Simon, 1972; Nijstad et al., 2010; Rietzschel et al., 2007). Such cognitive persistence requires activation and engagement and emerges in particular when the individual is anxious and worried (De Dreu et al., 2008), under behavioral avoidance (Cretenet & Dru, 2009; Koch, Holland, Hengstler, & Van Knippenberg, 2009), and in the case of prevention focus (absent closure; e.g., Friedman & Förster, 2010; Luu, Tucker, & Derryberry, 1998). Our goal here was to uncover the conditions under which regulatory focus influences creative performance, and the tasks used here do not allow conclusions about the processes involved. New work is needed to test the idea that regardless of closure, promotion focus drives creativity because it enhances cognitive flexibility, whereas, absent closure, prevention focus drives creativity because it enhances cognitive persistence.

A final avenue for future research is to analyze the effects of regulatory focus and regulatory closure on dependent variables other than creative insights and original ideation. An interesting possibility is to examine the effects on analytical problem solving. Analytical problem-solving tasks benefit from detailed and focused attention on the problem material and require deductive reasoning to draw correct conclusions (Amabile, 1996). Because prevention focus associates with systematic thinking and an attentional focus on central details to a greater extent than promotion focus (Förster & Dannenberg, 2010; Luu et al., 1998), our hypothesis would be that prevention focus, relative to promotion focus, facilitates analytical problem solving, especially when regulatory closure is absent (cf. Friedman & Förster, 2010).

Conclusion

Our work has revealed that prevention-focused states can result in similar levels of creativity as promotion-focused states and that activation is the key mediating variable. When prevention-focused states are activating and stimulating the individual, high levels of creativity are to be expected; it is only in cases where prevention goals are successfully regulated that the individual gets deactivated and as a consequence is less creative. As such, it is likely that anxious artists, engineers under stressful pressure, and managers facing a major crisis will be more creative than when they feel relieved, have escaped failure, or have successfully confronted the crisis.

[8] This would, however, be inconsistent with findings obtained in Study 2 that the extent to which participants felt good about their performance did not significantly correlate with activation ($r = .06$, $p > .58$) and actual creative performance ($r = .12$, $p > .28$).

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