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Paradoxical frames and creative sparks: Enhancing individual creativity through conflict and integration

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ABSTRACT

Across industries, organizations operate in increasingly complex and uncertain environments. To succeed in such environments, organizations require their members to think creatively and integrate conflicting demands. We propose that the adoption of paradoxical frames—mental templates that encourage individuals to recognize and embrace contradictions—increases creativity. In four laboratory studies using different creativity tasks and different manipulations for eliciting paradoxical frames, participants who adopted paradoxical frames were more creative than their counterparts who did not. Our results suggest that the positive influence of paradoxical frames on creativity is due to the paradoxical relationship between task elements and not merely to their joint activation. This paradoxical relationship creates a sense of conflict in individuals and enhances their ability to integrate contradictions, which in turn increases creativity.

Introduction

Creativity management in organizations is rife with tensions and paradoxes (DeFillippi, Grabher, & Jones, 2007), requiring employees to integrate conflicting agendas and contradictory demands (Lewis, 2000). Copywriters, for example, are asked to generate original slogans that are also meaningful and useful as advertisement campaigns (Beersma & De Dreu, 2005). Similarly, product developers have to consider cost issues and follow specifications when developing new ideas (Lewis, Welsh, Dehler, & Green, 2002; Miron, Erez, & Naveh, 2004); and employees have to think outside of the box when solving problems and at the same time offer practical solutions that can be implemented given organizational constraints (Oldham & Cummings, 1996).

Organizational members' typical reactions to these and other contradicting demands include a sense of threat, defensiveness, and a tendency to focus on one demand at the expense of the other (Lewis, 2000). Yet focusing on only one demand can be maladaptive. Too much focus on originality, for example, with little or no emphasis on constraints (such as cost) may result in novel but overpriced products that do not meet consumers' needs (Wind & Mahajan, 1997). By contrast, overemphasis on specifications and constraints can thwart the flexibility and exploration required for creativity (Benner & Tushman, 2003).

It has been suggested that, to facilitate the integration of conflicting agendas and contradictory demands, managers and employees should adopt *paradoxical frames* (Lewis, 2000; Smith & Tushman, 2005). According to Lewis, "[p]aradox denotes contradictory yet interrelated elements—elements that seem logical in isolation but absurd and irrational when appearing simultaneously" (Lewis, 2000, p. 760). Accordingly, paradoxical frames are mental templates that individuals impose on an environment in order to recognize and embrace contradictions (Smith & Tushman, 2005, p. 523). More specifically, throughout this paper, we define paradoxical frames as *mental templates individuals use to embrace seemingly contradictory statements or dimensions of a task or situation*. When embracing the paradox, individuals recognize the contradictions inherent in the dimensions or statements, yet understand their potential relationship as complementary or reinforcing. For example, an employee may receive directions from her boss that seem contradictory (e.g., "Make sure everything is planned and organized for the release of our new product. Also be sure to remain flexible so that we can deal with last-minute requests from customers in a timely manner"). If a paradoxical frame is activated when an employee receives these directions, she recognizes the inherent incompatibility of simultaneously achieving high levels of planning and flexibility but also understands the potential for planning and flexibility to complement or positively reinforce

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one another. Planning and organizing, for example, can help prepare for alternative reactions of customers and thus enable greater flexibility when addressing their needs (Vera & Crossan, 2005). But if a paradoxical frame is not activated, then the employee is likely to focus on only one dimension and not the other and miss the opportunity to achieve both.

In general, paradoxical frames encourage "paradoxical inquiry," in which a problem is identified, its contradictory elements and their links are revealed and explored, and alternative solutions are found and tested (DeFillippi et al., 2007; Luscher & Lewis, 2008). The degree to which managers understand and accept contradictions affects whether they "embrace the tensions and benefit from them or are halted by the inconsistencies" (Smith & Tushman, 2005, p. 526). Furthermore, scholars have argued that adopting paradoxical frames improves managers' ability to attend to and deal with strategic contradictions (Smith & Tushman, 2005) and leads managers to reach new insights to existing problems (Luscher & Lewis, 2008). Despite these important insights into the possibilities of paradoxical frames, no empirical study has examined the effects of paradoxical frames on creativity.

Addressing this gap, the present work examines the influence of paradoxical frames on the ability of individuals to be creative. We bring the phenomenon of paradoxical frames into a controlled laboratory setting and manipulate paradoxical frames using different priming tasks. Across four laboratory studies, we also employ different creativity tasks to examine the generalizability of our findings and explore the psychological mechanisms explaining the relationship between adopting paradoxical frames and creativity.

Paradoxical frames and creativity

Paradoxical frames provide individuals with a structure of assumptions and boundaries that influence the way they make sense of a situation, seek information, and make decisions (Smith & Tushman, 2005). Instead of eliciting "either/or" thinking, paradoxical frames elicit the type of "both/and" thinking that can result in the discovery of links between opposing forces and the generation of new frameworks and ideas (Lewis, 2000; Luscher & Lewis, 2008). When adopting a paradoxical frame, one acknowledges the tension between opposing task elements, yet understands that combining opposing task elements tempers the undesirable side effects of each element alone and leads to new solutions that integrate both elements (Gebert, Boerner, & Kearney, 2010; Lewis, 2000).

Paradoxical frames may be especially effective in helping people perform creative tasks. Creativity is commonly defined as the generation of novel yet useful ideas or solutions to a problem (Amabile, 1983; Amabile, 1996). The ideation process consists of making new combinations of associative elements and selecting an idea or solution that is useful or appropriate to a given problem (Mednick, 1962). This process is guided by the available cognitive elements that individuals bring to the process and combine into new ideas or solutions as well as by the relationship between these elements (Finke, Ward, & Smith, 1992). The larger the number of cognitive elements that are relevant to the task and activated during the ideation process, the higher the likelihood that unusual associations or solutions will be generated and the larger the pool of available novel ideas (Amabile, Barsade, Mueller, & Staw, 2005; Simonton, 1999). Yet, only knowledge accessible to memory can be used in the creativity process. Increasing the accessibility of less retrievable knowledge enlarges the number of generated ideas (Rietzschel, Nijstad, & Stroebe, 2007).

Compared to either/or frames, paradoxical frames encourage cognitive juxtaposition of inconsistent elements and therefore increase the breadth of attention and the accessibility of knowledge related to the different elements. Broader attentional span and diverse knowledge allow greater flexibility and generation of new connections between activated elements. For example, comic book writers who combined diverse knowledge from various genres were more creative than those who based their ideation process on a limited number of genres (Taylor & Greve, 2006). Similarly, priming individuals with two knowledge categories (e.g., nutrition and hygiene) increased their creativity compared to priming them with only one category (Rietzschel et al., 2007). In a similar vein, people primed with paradoxical frames are likely to generate more ideas compared to individuals primed with only one of the contradictory elements (an either/or frame).

Creative ideas can also result from an unusual perspective on old problems as well as from new combinations of familiar ideas (Hargadon & Bechky, 2006; Schooler & Melcher, 1995). Paradoxical frames reduce the likelihood that people will fall back on conventional lines of thought (Luscher & Lewis, 2008). Research suggests that individuals tend to draw primarily on typical thinking, or implicit assumptions and prior experience, when solving a problem. Specifically, they tend to approach a problem in the usual way for that class of problems, to make implicit assumptions without their own awareness, and to be guided by mental mindsets acquired through prior experience (Smith, 2003). Even when individuals are encouraged to think creatively and respond uncritically to problems (Paulus, Larey, & Ortega, 1995; see also Paulus & Yang, 2000), they may apply creative solutions discovered within a given context to other contexts (Goldenberg, Mazursky, & Solomon, 1999).

The atypical relationship between primed task elements in a paradoxical frame signals that an environment is unusual and allows elements that would typically be perceived as contradictory to be reconciled (Smith & Tushman, 2005). This perception of the environment may result in frame-breaking experiences and recognition of new combinations of old knowledge into new meanings and solutions (Lewis, 2000). For example, research examining the relationship between ambivalent emotions and creativity found that individuals who perceived an environment as unusual showed an enhanced ability to recognize unusual associations (Fong, 2006). In a similar vein, paradoxical templates have been found to be associated with greater tolerance for interpersonal conflicts and willingness to solve them through compromise (Peng & Nisbett, 1999).

By inspiring individuals to discover how contradictory elements can coexist and even reinforce each other, paradoxical frames stimulate the reconciliation of elements that are assumed to be contradictory. Goldenberg et al. (1999) showed that the activation of uncommon mental templates channeled the ideation process and enhanced the originality and value of generated ideas in a product-development task. Similarly, we suggest that paradoxical frames channel individuals' idea generation process and encourage them to integrate seemingly opposing elements into new concepts and solutions. Specifically, we propose that individuals who employ a paradoxical frame are more likely to engage in creative behavior and to combine knowledge in new ways than are individuals not primed with paradoxical frames or individuals primed to focus on only one of the contradictory elements. Thus, we hypothesize that:

Hypothesis 1. Individuals are more creative when they are primed with paradoxical frames than when they are primed with other cognitive frames.

Explaining the link between paradoxical frames and creativity

We propose that paradoxical frames elicit a sense of conflict in individuals and increase their willingness and ability to recognize

contradictory elements and to identify possible new linkages and synergies between them. These cognitive operations, in turn, enhance exploration of each element and generation of new associations and ideas (Smith & Tushman, 2005). Below, we elaborate on each of these psychological processes. Fig. 1 portrays the set of relationships included in our theoretical framework.

A sense of conflict

When individuals adopt paradoxical frames, they are faced with contradictory dimensions or factors that are not commonly associated or linked. The contradictory relationships between dimensions and the atypicality associated with this experience may lead individuals to experience a sense of conflict and discomfort. Drawing on cognitive tuning theory (Schwarz, 1990; Schwarz & Bless, 1991), we suggest that this sense of conflict signals the type of context in which a person finds herself and directs her to think and behave in ways that will help her adapt to the context. In an attempt to adapt to the context, people are likely to draw on their creative thinking and become more sensitive to complementary relationships between seemingly contradicting stimuli (Fong, 2006). This explorative processing style facilitates insight-related processing, bolstering the ability to break away from inappropriate initial assumptions and strategies, and enabling an unconstrained mental search for novel information.

Indeed, a sense of conflict has been suggested to be a crucial trigger for perspective taking and exploration of novel associations (Huang & Galinsky, 2010). For instance, people who live abroad "may experience culture shock, feeling anxious and disoriented," and this disorientation is a fundamental factor in explaining the relationship between multicultural experience and creativity (Leung, Maddux, Galinsky, & Chiu, 2008). Similarly, the sense of disorientation and conflict individuals experience when reading an absurd short story has been shown to enhance their desire to learn novel patterns (Proulx & Heine, 2009). Research testing the effect of a conflict mindset on creativity has shown that individuals experiencing a conflict mindset generated broader conflict-related categories and more original solutions to conflict-related situations compared to individuals experiencing a cooperation mindset (De Dreu & Nijstad, 2008). In a similar vein, experienced conflict increases the tendency of team members to scrutinize and deeply explore different alternatives and, as a result, to find novel insights (e.g., Beersma & De Dreu, 2005; Nemeth, Personnaz, Personnaz, & Goncalo, 2004). Based on this reasoning, we hypothesize the following:

Hypothesis 2A. Individuals experience a greater sense of conflict when they are primed with a paradoxical frame than when they are primed with a control frame.

Hypothesis 2B. Individuals' sense of conflict mediates the relationship between adopting a paradoxical frame and creativity.

Integrative complexity

Paradoxical frames may also increase individuals' willingness and capacity to tolerate different perspectives and to integrate these different perspectives by generating new linkages among them. That is, paradoxical frames can increase integrative complexity (Tetlock, Peterson, & Berry, 1993). Integrative complexity was originally conceived to reflect individual differences in thinking style. Individuals who are low on integrative complexity dislike ambiguity and dissonance, seek cognitive closure, and tend to form dichotomous (good-or-bad) impressions of other people. In contrast, individuals who score high on integrative complexity have a more flexible, open-minded, and multidimensional stance toward the world. They are able to recognize contradictions and can tolerate inconsistencies in others' motives and behavior. Although most past research viewed integrative complexity as a stable disposition, more recent studies have demonstrated the effect of situational and environmental cues on integrative complexity. It was found, for example, that integrative complexity is affected by accountability pressures, stress and value conflict (Tetlock, Peterson, & Lerner, 1996); by a sense of conflict resulting from exposure to a different culture (Tadmor & Tetlock, 2006; Tadmor, Tetlock, & Peng, 2009); and by exposure to inconsistent verbal and nonverbal expressions (Miron-Spektor, Efrat, Schwarz-Cohen, Rafaeli, in press).

Integrative complexity is commonly conceptualized in terms of two cognitive processes: evaluative differentiation and conceptual integration. Differentiating entails recognizing contradictions and clarifying distinctions between contradictory elements. Integrating involves identifying new linkages between the elements (Smith & Tushman, 2005). High levels of integrative complexity (high differentiation and integration) reflect the capacity to juxtapose contradictory elements, understand their sources, and search for ways to amalgamate them (Tetlock, Armor, & Peterson, 1994).

Adopting paradoxical frames is likely to increase the sensitivity to contradictory elements in the environment as well as the capacity to understand them and search for ways to combine them. The mental activation of contradictory elements leads to deep examination and improved understanding of each element. This deeper exploration of concepts and categories increases the generation of ideas related to the category and enhances creativity (Rietzschel et al., 2007). Activating paradoxical frames also stimulates the integration of opposing elements. Forming new linkages and synergies between commonly unrelated or opposing elements is a vital source of creativity (Simonton, 1999).

Consider, for instance, the creativity-cost efficiency tension which is often present in product development settings. Viewing this tension through a paradoxical lens allows the exploration of different elements as well as a search for new solutions in which creativity and efficiency coexist and reinforce each other (Lewis, 2000). When differentiating between creativity and efficiency, individuals realize that, while creativity requires exploration, risk taking, flexibility, and tolerance of mistakes, efficiency, by contrast, is associated with

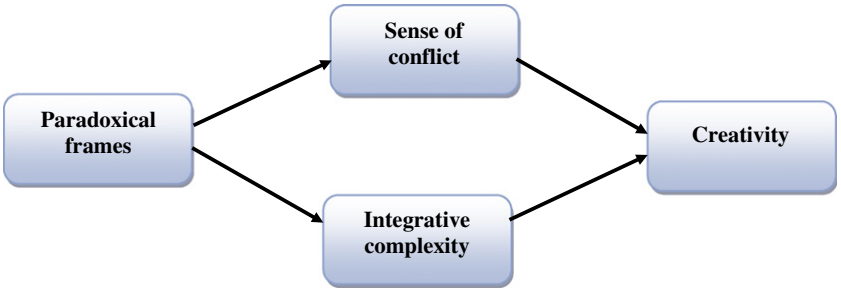

Fig. 1. Theoretical framework.

exploitation, adherence to constraints, and structure (Lewis et al., 2002; Miron-Spektor, Erez & Naveh, 2011). By contrasting these elements, individuals gain a better sense of the antecedents and consequences of each element and as a result can integrate them effectively, searching for new strategies, processes, and structures that allow their coexistence. Organizational examples of such new solutions are ambidextrous organizations (Benner & Tushman, 2003) and semi-structures (Brown & Eisenhardt, 1998). Representing wholes that are composed of contradictions (Lewis, 2000), these solutions enable both creativity and efficiency to thrive.

In short, we suggest that paradoxical frames increase both differentiation and integration thought processes (as reflected in individuals' level of integrative complexity), and these processes in turn augment individual creativity. Thus, we hypothesize,

Hypothesis 3A. Individuals demonstrate greater integrative complexity when they are primed with paradoxical frames than when they are primed with other cognitive frames.

Hypothesis 3B. Individuals' integrative complexity mediates the relationship between paradoxical frames and creativity.

Overview of the research

We conducted four laboratory studies to test whether adopting paradoxical frames enhances creativity through a sense of conflict and integrative complexity (i.e., identifying and integrating multiple perspectives). To examine the robustness of the link between paradoxical frames and increased creativity, we used multiple methods to prime paradoxical frames and multiple measures of creative thinking, including insight, category inclusiveness, and associative ability tests. These creativity measures require individuals to generate original and useful insights or to recognize underlying connections and associations among seemingly unrelated stimuli. In addition, we used both a general priming task to induce paradoxical frames by having individuals think of paradoxical statements (Studies 2 and 3) and more specific manipulations in which we activated paradoxical frames regarding two dimensions that are often viewed as contradictory in product-development tasks, namely creativity and efficiency (Studies 1 and 4).

Our studies also examined whether the effect of paradoxical frames on creativity is due to the activation of two contradictory elements or to the paradoxical relationship between them (Study 1), and whether it derives from the contradictory relationships between elements, their complementary relationship or from both the contradictory and complementary relationships between elements (Study 4).

Furthermore, our studies investigated the psychological processes underlying the relationship between paradoxical frames and creativity. We proposed and found that a sense of conflict and discomfort explains this link. We measured people's feelings of conflict by using both an explicit self-reported measure (Study 2) and an implicit measure (Study 3) (a word-fragment task, see Tulving, Schacter, & Stark, 1982). Thus, we tested whether the self-reported measures of feelings of conflict experienced when adopting paradoxical frames as well as the accessibility of conflict-related concepts mediate the relationship between adopting paradoxical frames and creativity. In addition, we demonstrated that the effect of paradoxical frames on creativity is mediated by both feelings of conflict and increased integrative complexity (Study 3).

Study 1: Paradoxical frames and creativity

In Study 1, we tested our first hypothesis by using a commonly employed creativity task (Fong, 2006; Mednick, 1962). We examined whether paradoxical frames enhance creativity relative to the activation of a single element (i.e., creativity-frame or efficiency-frame). To test whether the *paradoxical* relationship between the activated elements matters for creativity, we also included a *creativity–efficiency-frame* condition in which both creativity and efficiency-frames were activated together, but in contrast to the paradoxical-frame condition, the paradoxical relationship between them was not specified.

Method

Participants and design

Eighty-one students (52% females; M_{age} = 22.92, SD = 3.13) participated in the study in exchange for $10 payment. The study employed four cognitive frame conditions (creativity, efficiency, creativity–efficiency, and paradoxical) and a between-subjects design. Participants were randomly assigned to one of the four experimental conditions.

Procedure. The study consisted of two parts: a priming task to manipulate cognitive frames and a creativity task to assess our dependent measure.

Priming task. We manipulated cognitive frames by using a priming task in which participants read a description of a craft product and then wrote about features they believed made the product successful. The product was the same across conditions, but several elements in its description were varied to create a paradoxical frame, a creativity frame, an efficiency-frame, or a creativity–efficiency-frame.

The description all participants received read:

> Below are pictures of a prototype for a table vehicle that was developed by "Forever Young Toys," a small but highly successful company in the toy business. The table vehicle is able to carry a small cup of water for a distance of 3.28 feet (1 meter) without spilling the water. This prototype was chosen by a committee of product designers out of 200 prototypes due to its high creativity (*creativity-frame condition*)/ low production cost (*efficiency-frame condition*)/ high creativity and low production cost (*paradoxical-frame condition and creativity–efficiency condition*). This prototype was chosen to represent the company in Simple Design, a prestigious competition of designers.

Next, the instructions reported the product designers' impressions and explanations for choosing this product (the "Twisting Slide") to represent the company. The impressions varied across conditions. We used this procedure to activate different cognitive frames through which the participants would filter their knowledge and attention (Smith & Tushman, 2005).

In the *creativity-frame* condition, the frames emphasized the product's uniqueness and novelty (e.g., "This product is unique and creative. Especially I like the novel uses the designers found for the materials"). In the *efficiency-frame* condition, the descriptions emphasized the product's low cost and efficient production process (e.g., "This product is very cheap. I can tell that the designer carefully chose the materials to assure that the final product would not be expensive"). In the *paradoxical-frame* condition, the impressions emphasized both the creative and efficient aspects of the product as well as the tension between creativity and efficiency (e.g., "This product is both unique and efficiently built. The most difficult thing is to make creative products that are cheap"). Finally, in the *creativity–efficiency-frame* condition, participants' material read: "This prototype was chosen by a committee of product designers out of 200 prototypes. Some judges liked the fact it is efficient while others liked its creativity"). In the reported

judges' impressions and explanations for choosing this product, some judges emphasized its creativity (e.g., "This product is unique and creative. Especially I like the novel uses the designers found for the materials") and others its efficiency (e.g., "This product is very cheap. I can tell that the designer carefully chose the materials to assure that the final product would not be expensive"). In contrast to the paradoxical-frame condition, none of the judges evaluated the product as being both creative and efficient, and none of them referred to the relationship between creativity and efficiency.

Creativity task. In the second part of the study, participants completed the Remote Association Task (RAT, Mednick, 1962), a commonly used measure of creativity. The RAT has been shown to capture changes in creative performance resulting from situational factors (Fong, 2006). This task requires individuals to form "mutually distant associative elements into new combinations which are useful and meet specified as well as unforeseen requirements" (Mednick, 1962). The RAT measures divergent and creative thinking by testing the ability of individuals to identify associations between words that are normally associated. In this task, participants are asked to find a word that is logically linked to all of three words provided. For instance, "cold" is the common word linking the words "sore-shoulder-seat" together. Participants had six minutes to solve ten RAT items. Based on instructions developed by Mednick (1962), we counted the number of correct responses for each individual and used this number as our measure of creativity in the analyses presented below.

Pilot study. We conducted a pilot study to test the validity of our framing manipulation. A non-overlapping group of participants ($N = 92$) was randomly assigned to one of the four conditions of the priming task. Afterwards, all participants indicated their agreement with six statements using a 7-point scale (1 = strongly disagree, 7 = strongly agree). Three of these statements measured conflict between creativity and efficiency ([1] It is very difficult to create a new product that is also very cheap; [2] Saving costs when developing new products is almost impossible; and [3] The designers of the Twisting Slide invested in creativity but did not pay enough attention to cost restrictions), and the other three statements measured complementarity between these two dimensions ([1] The Twisting Slide is an example of a very creative product that is not too expensive; [2] Compared to other products the Twisting Slide is economical and novel; and [3] The designers of the Twisting Slide created a product that is both creative and affordable). We aggregated each set of items into a measure for conflict ($\alpha = .91$) and complementarity ($\alpha = .82$).

Conflict ratings varied by condition, $F[3, 88] = 7.25$, $p < .001$, $\eta^2 = .20$: they were higher in the paradoxical-frame condition ($M = 5.62$, $SD = 1.25$) than in either the creativity-frame ($M = 4.03$, $SD = 1.23$; $p < .01$), the efficiency-frame ($M = 3.96$, $SD = 1.36$; $p < .01$), or the creativity–efficiency-frame ($M = 4.29$, $SD = 1.66$; $p < .05$) conditions. Differences in conflict ratings between the creativity-, efficiency- and creativity–efficiency-frame conditions were insignificant. Similarly, complementarity ratings varied by condition, $F[3, 88] = 18.88$, $p < .001$, $\eta^2 = .39$: they were higher in the paradoxical-frame condition ($M = 5.59$, $SD = 0.75$) and in the creativity–efficiency-frame condition ($M = 5.67$, $SD = 0.87$) than in either the creativity-frame ($M = 4.23$, $SD = 0.97$; both $ps < .001$) or the efficiency-frame ($M = 4.04$, $SD = 1.18$; both $ps < .001$).

These results indicate that only in the paradoxical-frame condition ratings for conflict and ratings for complementarity were both high, suggesting that both relationships were primed in this condition. Thus, the priming task used in the main study was effective in manipulating paradoxical frames.

Results

Hypothesis 1 predicts that creativity will be higher when individuals are primed with paradoxical frames than when they are primed with other cognitive frames. Supporting this hypothesis, an ANOVA analysis revealed a significant effect of cognitive frame on creativity performance ($F[2, 59] = 3.36$, $p < .05$, $\eta^2 = .12$). Participants solved a significantly higher number of RAT problems in the paradoxical-frame condition ($M = 6.00$, $SD = 2.59$) than in either the creativity-frame ($M = 4.20$, $SD = 2.54$; $p < .05$), the efficiency-frame ($M = 3.71$, $SD = 3.34$; $p < .01$), or the creativity–efficiency-frame ($M = 3.72$, $SD = 2.27$; $p < .01$) conditions. Differences in creativity as measured by the number of correctly solved RAT problems between the creativity-, efficiency- and creativity–efficiency-frame conditions were insignificant.

Study 2: activating paradoxical frames through paradoxical statements

The results of Study 1 demonstrated that paradoxical frames enhance creativity: Participants were more creative in the paradoxical-frame condition than in the creativity-, efficiency-, or creativity–efficiency-frame conditions. Importantly, the findings also showed that the positive effect of paradoxical frames on creativity was due to the paradoxical relationship between creativity and efficiency (i.e., the paradoxical-frame condition) and not merely to their joint activation (the creativity–efficiency-frame condition).

In our second study, we tested whether paradoxical frames lead to increased individual creativity when they are activated without specific dimensions or criteria. Furthermore, the study included various creativity tasks. In addition to sensitivity to association measured through the RAT, we investigated the effects of paradoxical frames on creative insight (the solution of which require a change in approach and problem representation) and on category inclusiveness (Isen & Daubman, 1984), which assesses participants' perceptions of how prototypical exemplars are of a particular category. Broader inclusive categories reflect cognitive flexibility in generating new associations (Rietzschel et al., 2007).

Method

Participants and design

One hundred eighty-three individuals ($M_{age} = 30.36$, $SD = 10.31$; 98 males) participated in the study for pay. They were randomly assigned to one of two conditions: paradoxical statements versus neutral statements.

Procedure

As explained to participants, the study consisted of several tasks and questions that examined individuals' decision-making behavior in different cognitive and social contexts. The first task participants encountered was a "Recall Skills task" in which we introduced our manipulation of paradoxical frames. The task was followed by a series of questions measuring participants' sense of conflict and disorientation, three different tasks measuring creativity, manipulation checks, and a few demographic questions.

Manipulation of paradoxical frames. The instructions to the Recall Skills task informed participants that, in this part of the study, we were interested in how people recall their past experiences. Participants were asked to engage in a writing task for a few minutes after reading the task instructions. In the paradoxical-frames condition, the instructions read:

> Please think of paradoxical statements you encountered in the past, or paradoxical statements that you think are interesting.

> Then, please write them in the space provided below. PLEASE PROVIDE AT LEAST THREE SUCH STATEMENTS. By "paradoxical" we mean seemingly contradictory but nonetheless possibly true. For instance, one such statement could be "it is paradoxical that standing is more tiring than walking."
>
> In the control condition, instead, the instructions read:
>
> Please think of statements you encountered in the past, or statements that you think are interesting. Then, please write them in the space provided below. PLEASE PROVIDE AT LEAST THREE SUCH STATEMENTS. For instance, one such statement could be "people often believe that standing is more tiring than walking."

Participants spent a few minutes thinking and writing down their statements. Then, they progressed to the next task.

A sense of conflict. On an 11-point scale (ranging from 1 = not at all, to 11 = very much), participants indicated how much discomfort, conflict, and disorientation the sentences they created made them experience and feel. We aggregated these three items into a measure we refer to as experienced conflict ($\alpha = .80$).

Creativity task #1: Association task: As in Study 1, we assessed participants' associative ability using the RAT. For each of seventeen association problems, we asked participants to find a word that was logically linked to all three of the words provided. Participants were instructed to solve as many problems as possible in four minutes.

Creativity task #2: The Candle task: The second creative task we employed was the Duncker candle problem (Duncker, 1945). Participants were shown a picture containing several objects on a table: a candle, a pack of matches, and a box of tacks, all of which were next to a cardboard wall. Participants were given three minutes "to figure out, using only the objects on the table, how to attach the candle to the wall so that the candle burns properly and does not drip wax on the table or the floor." The correct solution consists of emptying the box of tacks, tacking it to the wall, and placing the candle inside, so that the box of tacks is used as a candleholder. In this task, finding the correct solution is considered a measure of insight creativity because it involves the ability to see objects as performing atypical functions (i.e., the box is not just a repository for tacks but can also be used as a stand) (Maddux & Galinsky, 2009). Thus, there is a hidden solution to the problem that is inconsistent with the preexisting associations and expectations individuals bring to task (Duncker, 1945; Glucksberg & Weisberg, 1966).

Creativity task #3: Category inclusion task: We assessed category inclusiveness by asking participants to rate how prototypical exemplars were of a particular category (1 = not at all, 11 = very prototypical). For each of the four categories we used, three exemplars were presented, one being strongly, one being moderately, and one being weakly prototypical (Isen & Daubman, 1984; Rosch, 1975). Specifically, the four categories (with strong, intermediate, and weak exemplars) were vehicle (bus, airplane, camel), vegetable (carrot, potato, garlic), clothes (skirt, shoes, handbag), and furniture (couch, lamp, telephone).

Manipulation check. After completing the creativity tasks, participants were asked to think back to the initial Recall Skills task and then indicate the extent to which they agreed with the following statements regarding the statements they had created: (1) In the statements there are conflicts about ideas or factors; (2) In the statements there are differences of opinions or contradictions; and (3) In the statements there are disagreements on how things are or how things should be done. Participants answered all questions on an 11-point scale (1 = strongly disagree, and 11 = strongly agree). The three items were highly correlated, so we aggregated them into a composite measure ($\alpha = .83$).

Results

Table 1 reports the means and standard deviations of the main measures included in the study by condition.

Manipulation check

Participants in the paradoxical-frame condition rated the statements they created to be more contradictory and conflicting ($M = 7.55$, $SD = 2.10$) than did participants in the control condition ($M = 6.73$, $SD = 2.70$), $t(181) = 2.29$, $p < .03$.

Association task

On average, participants solved a significantly higher number of RAT problems in the paradoxical-frame condition ($M = 6.42$,

Table 1
Means (and standard deviations) of main measures, Study 2.

	Manipulation check	Feelings of conflict (mediator)	RAT problems	Candle task	Category inclusion: weak	Category inclusion: moderate	Category inclusion: strong
Paradoxical frames	7.75 (2.10)	5.80 (2.68)	6.42 (5.02)	31/89 (35%)	5.34 (2.00)	7.12 (1.82)	8.31 (2.61)
Control	6.73 (2.70)	5.03 (2.20)	4.95 (4.28)	20/94 (21%)	4.61 (2.03)	6.56 (1.82)	8.35 (2.52)

Correlations among main measures, Study 2

	2.	3.	4.	5.	6.	7.	8.
1. Paradoxical frames	.17*	.16*	.16*	.15*	.18*	.15*	−.01
2. Manipulation check		.09	.08	−.05	−.04	.07	.13^
3. Feelings of conflict			.40***	.34***	−.09	−.01	.13^
4. RAT problems				.41***	−.19*	.05	.27***
5. Candle task					−.11	.03	.07
6. Weak category inclusion						.25**	−.34***
7. Moderate category inclusion							.47**
8. Strong category inclusion							

^$p < .10$,
*$p < .05$,
**$p < .01$,
***$p < .001$.

$SD = 5.02$) than in the control condition ($M = 4.95$, $SD = 4.28$), $t(181) = 2.13$, $p < .04$. Consistent with Hypothesis 1, adopting paradoxical frames increased participants' ability to find associations.

Candle task

A larger percentage of participants correctly solved the candle task in the paradoxical-frames condition (35%, 31/89) compared to the control condition (21%, 20/94), $\chi^2(1,N = 181) = 4.18$, $p < .05$. This result suggests that adopting paradoxical frames enhanced participants' creative insight.

Category inclusion

Following previous research (e.g., Isen & Daubman, 1984), we conducted separate t-tests on weak, intermediate, and strong exemplars. Compared to the control condition (C), adopting paradoxical frames (PF) led to greater category inclusiveness ratings on weak ($M_{PF} = 5.34$, $SD = 2.00$ vs. $M_C = 4.61$, $SD = 2.03$), $t(181) = 2.44$, $p < .02$, and intermediate exemplars ($M_{PF} = 7.12$, $SD = 1.82$ vs. $M_C = 6.56$, $SD = 1.82$), $t(181) = 2.09$, $p < .04$. For strong exemplars, the difference was not significant ($M_{PF} = 8.31$, $SD = 2.61$ vs. $M_C = 8.35$, $SD = 2.52$), $t(181) < 1$, $p = .90$. Consistent with Hypothesis 1, adopting paradoxical frames led participants to expand the boundaries of conceptual categories, seeing atypical (i.e., weak and intermediate) exemplars as representative members of cognitive categories.

Feelings of conflict

Consistent with Hypothesis 2A, participants reported experiencing a significantly higher sense of conflict in the paradoxical-frame condition ($M = 5.80$, $SD = 2.68$) than in the control condition ($M = 5.03$, $SD = 2.20$), $t(181) = 2.12$, $p < .04$.

Mediation analyses

Hypothesis 2B predicted that participants' sense of conflict would mediate the relationship between adopting paradoxical frames and creativity (as measured by number of correct solutions in the Remote Association Task). We tested this mediation hypothesis (Baron & Kenny, 1986) using bootstrapping procedures, which establish a confidence interval for the indirect effect; mediation is established when the confidence interval does not include zero (MacKinnon, Fairchild, & Fritz, 2007; Shrout & Bolger, 2002). The effect of adopting paradoxical frames was reduced to non-significance (from $\beta = .16$, $p < .04$, to $\beta = .10$, $p = .16$) when participants' experienced conflict was included in the equation, and this sense of conflict was a significant predictor of associative ability ($\beta = .38$, $p < .001$). A bootstrap analysis showed that the 95% bias-corrected confidence interval for the size of the indirect effect excluded zero (0.061, 1.265), suggesting a significant indirect effect of conflict on creativity (MacKinnon et al., 2007; Shrout & Bolger, 2002).

We conducted similar analyses using creative insight (as measured by finding the correct solution for the candle task) as the dependent variable. Participants' sense of conflict again mediated the effect of adopting paradoxical frames on creative insight (95% bias-corrected CI = 0.005, 0.103).[3] Taken together, these results provide support for Hypothesis 2B.

Study 3: paradoxical frames, conflict, integrative complexity, and creativity

The results of Study 2 demonstrated that adopting paradoxical frames led to increased creativity across a variety of tasks. Adopting paradoxical frames enabled participants to identify creative linkages among seemingly unrelated stimuli and enhanced their ability to discover hidden insights. Furthermore, adopting paradoxical frames led participants to expand their categories, seeing distantly associated exemplars as representative members of superordinate categories. The results also indicated that participants who adopted paradoxical frames experienced a sense of conflict, as they were asked to embrace and consider seemingly contradictory dimensions. In turn, this sense of conflict accounted for the relationship between paradoxical frames and both associative ability and creative insight.

In Study 3, we examined whether paradoxical frames enhance creativity also because they increase integrative complexity (Hypotheses 3A and 3B). Integrative complexity refers to the complexity of thought that individuals use when processing and synthesizing social information. We test whether adopting paradoxical frames increases individuals' ability to differentiate and integrate multiple perspectives when they analyze a social situation and whether this ability enhances creative thinking. Following the methods employed in prior research, we assessed integrative complexity by showing participants a vague picture from the Picture Story Exercise (Tetlock et al., 1993) and then asking them to write a complete story about the picture, including a beginning and an end.

In addition, Study 3 examined whether adopting paradoxical frames *implicitly* triggers a sense of conflict in individuals. That is, we investigated whether experiencing a sense of conflict is a mechanism through which paradoxical frames enhance creativity by employing an implicit measure (i.e., accessibility to conflict-related concepts). Including this measure allows us to test whether the accessibility of conflict-related concepts mediates the relationship between adopting paradoxical frames and creativity.

Method

Participants and design

One-hundred twenty-one individuals ($M_{age} = 26.97$, $SD = 8.42$; 69 males) participated in the study for pay. They were randomly assigned to one of two conditions: paradoxical statements vs. neutral statements.

Procedure

This experiment used the same procedure as in Study 2 to manipulate cognitive frames. After the manipulation, participants were given a word-completion task (our implicit measure of experienced conflict), the integrative complexity task, the RAT, and a final questionnaire. The questionnaire included a manipulation check (the same questions we employed in Study 2, $\alpha = .76$), and a few demographic questions.

Association task. We measured associative ability using seventeen RAT problems. Participants were instructed to solve as many problems as possible in four minutes.

Conflict-related word-completion task. Participants next completed a word-completion task that involved turning word fragments into meaningful words using the first word that came to mind. We wanted to determine whether adopting paradoxical frames increases the mental accessibility of conflict-related words. Of the six word fragments, three (B _ T _ _ _, CON _ _ _ _ _, and _ _ R) could be completed as conflict-related words (battle, conflict, and war) or as unrelated words (e.g., bottle, consumer, and car).

Integrative complexity. We assessed integrative complexity by using a vague picture from the Picture Story Exercise (Tetlock et al., 1993). Participants were presented with a picture and were

[3] We conducted similar mediation analyses using category inclusion as the dependent variable but did not find evidence for mediation.

asked to spend four minutes writing an imaginative complete story about the picture. The story had to include a beginning, middle, and an end. The instructions read:

> Try to portray who the people in the picture might be, what they are feeling, thinking, and wishing for. Try to tell what led to the situation depicted in the picture and how everything will turn out in the end. Don't worry about grammar, spelling, punctuation – they are of no concern here. If you have seen this picture before, feel free to react to it as you did before or differently, depending on how you feel now. You will have about 4 minutes for writing the story. Here are some guiding questions. NO need to answer them specifically. What is happening? Who are the people? What happened before? What are the people thinking about and feeling? What do they want? What will happen next?

Three independent raters who were blind to the hypotheses of the study read the stories participants wrote following the integrative complexity scoring manual (Baker-Brown et al., 1992). With this scoring system, higher scores are given to stories that both incorporate disparate and competing themes and that make connections and links between these different and competing perspectives. The three raters showed good inter-rater reliability ($\alpha = .78$).

Manipulation check. We used the same three statements as in Study 2 as manipulation check questions.

Results

Table 2 reports the means and standard deviations of the main measures included in the study by condition.

Manipulation check

Participants in the paradoxical-frame condition rated the statements they created to be more contradictory and conflicting ($M = 6.80$, $SD = 2.35$) than did participants in the control condition ($M = 5.72$, $SD = 2.08$), $t(119) = 2.69$, $p < .01$.

Association task

On average, participants solved a significantly higher number of RAT problems in the paradoxical-frame condition ($M = 7.75$, $SD = 4.86$) than in the control condition ($M = 6.05$, $SD = 4.07$), $t(119) = 2.09$, $p < .04$.

Conflict-related words accessibility

Participants in the paradoxical-frames condition generated more conflict-related words ($M = 0.41$, $SD = 0.76$) than did those in the control condition ($M = 0.13$, $SD = 0.39$), $t(119) = 2.51$, $p < .02$, demonstrating that adopting paradoxical frames enhanced the accessibility of conflict-related concepts.

Integrative complexity

Integrative complexity scores were higher in the paradoxical-frames condition ($M = 3.37$, $SD = 1.47$) compared to the control condition ($M = 2.73$, $SD = 1.45$), $t(119) = 2.42$, $p < .02$.

Mediation analyses

We tested whether the implicit measure of experienced conflict and integrative complexity mediated the relationship between adopting paradoxical frames and creativity (Baron & Kenny, 1986). The effect of adopting paradoxical frames was reduced to non-significance (from $\beta = .19$, $p < .04$, to $\beta = .03$, $p = .73$) when the two mediators were included in the equation, and both the implicit measure of conflict ($\beta = .36$, $p < .001$) and integrative complexity ($\beta = .38$, $p < .001$) were significant predictors of associative ability. A bootstrap analysis showed that the 95% bias-corrected confidence interval for the size of the total indirect effect (of paradoxical frames through both conflict and integrative complexity) excluded zero (.43, 2.67), suggesting a significant indirect effect (MacKinnon et al., 2007; Shrout & Bolger, 2002). This was also the case for each of the two separate indirect effects (conflict: [.11, 1.51], and integrative complexity: [.15, 1.52]).

Study 4: from conflict to integration

Study 3 provided additional support to the psychological mechanisms that mediate the effect of paradoxical frames on creative thinking. The results indicated that paradoxical frames implicitly activate a sense of conflict and they increase individuals' ability to reason with greater integrative complexity. A sense of conflict and integrative complexity, in turn, mediated the relationship between paradoxical frames and creativity.

In Study 4, we further investigated the link between paradoxical frames and creativity by unpacking paradoxical frames into the underling processes of differentiating and integrating. Specifically, we manipulated whether or not the elements included in a paradox are presented as contradictory (differentiation) and whether or not they are integrated into a solution (integration). The inclusion of this additional manipulation allowed us to examine whether the positive effect of paradoxical frames on creativity is derived from the contradictory relationships between elements, their integration, or a combination of these processes.

Method

Participants and design

One hundred eighty-nine individuals ($M_{age} = 30.18$, $SD = 10.38$; 87 males) participated in the study for pay. They were randomly assigned to one of four experimental conditions in a 2 (differentiation: high vs. low) $\times$ 2 (integration: high vs. low) between-subjects design.

Procedure

The study consisted of two parts: a priming task to manipulate cognitive frames and induce paradoxical thinking and a creativity task in which we assessed our dependent measure. Participants also completed a final questionnaire with a manipulation check and demographic questions.

Priming task. We manipulated cognitive frames by adapting the priming task used in Study 1. As in Study 1, we used the same product across conditions, but varied product designers' impressions that participants received in the various conditions.

In the *low differentiation-low integration* condition, product designers viewed the product as either novel or inexpensive. The instructions read, "Some of the committee members thought that it is efficient while others thought it is creative." Some of the product designers' comments emphasized the product's novelty (e.g., "This is a wonderful example for a very creative prototype! You can see that the designers looked for an unusual idea for a product"), while others emphasized the product's cost effectiveness (e.g., "This product is very cost-effective").

In the *high differentiation-low integration* condition, product designers were portrayed as viewing novelty and low cost to be incompatible. The instructions read, "The committee members thought that the product is highly creativity *but* too expensive." The product designers' comments emphasized this contrast (e.g., "This product is unique. I haven't seen such a model before! However it seems that the designer did not consider cost issues").

Table 2
Means (and standard deviations) of main measures, Study 3.

	Manipulation check	Conflict-related words (mediator)	RAT problems	Integrative complexity
Paradoxical frames	6.80 (2.35)	0.41 (0.76)	7.75 (4.86)	3.38 (1.47)
Control	5.72 (2.08)	0.13 (0.39)	6.05 (4.07)	2.73 (1.45)

Correlations among main measures, Study 3

	2.	3.	4.	5.
1. Paradoxical frames	.24**	.22*	.19*	.22*
2. Manipulation check		.20*	.25**	.05
3. Conflict-related words			.54***	.45***
4. RAT problems				.55***
5. Integrative complexity				

^$p < .10$,
*$p < .05$,
**$p < .01$,
***$p < .001$.

In the *low differentiation-high integration* condition, the instructions did not emphasize that novelty and low cost were incompatible but rather mentioned that both were achieved. The instructions read, "The committee members thought that the product is both highly creativity *and* inexpensive." The product designers' comments reflected both qualities as complementary (e.g., "This product is both unique and efficiently built").

Finally, in the *high differentiation-high integration* condition, the instructions emphasized that although novelty and affordability often incompatible, they can be achieved together. The instructions read, "The committee members thought that despite the great difficulty of saving costs when developing new products, this product is both highly creative *and* inexpensive." The product designers' comments reflected both qualities as complementary ("This is a wonderful example for a very creative prototype that is also very cheap!"). As part of the manipulation, participants wrote a description of five features of the prototype that they thought influenced its success.

Association task. Associative ability was assessed using ten of the RAT problems, which participants were asked to solve in 4 min.

Pilot study

We conducted a pilot study on a non-overlapping group of participants ($N = 112$) to test the validity of our manipulations for differentiation and integration. Using a 7-point scale (1 = strongly disagree, 7 = strongly agree), participants indicated their agreement with each of the six statements used in Study 1 to assess conflict ($\alpha = .83$) and complementarity ($\alpha = .86$). Mean and standard deviations for both types of ratings are reported in Table 3. A 2 (differentiation) × 2 (integration) between-subjects ANOVA using conflict ratings as the dependent variable revealed a significant main effect for differentiation ($F[1,108] = 88.00$, $p < .001$, $\eta^2 = .45$) but not for integration ($p = .58$), nor for their interaction ($p = .53$). A similar analysis using complementarity ratings as the dependent variable revealed a significant main effect for integration ($F[1,108] = 80.99$, $p < .001$, $\eta^2 = .43$) but not for differentiation ($p = .36$). In this case, the interaction was also significant, $F(1,108) = 4.70$, $p < .05$, $\eta^2 = .04$. These results indicate that ratings for conflict and complementarity were both high only in the high differentiation/high integration condition, thus suggesting that the manipulations employed in the main study were effective.

Results

Association task

We conducted a 2 (differentiation) × 2 (integration) ANOVA using the number of RAT problems correctly solved as the dependent variable. This analysis revealed a significant main effect for both differentiation ($F[1,185] = 7.72$, $p < .01$, $\eta^2 = .04$) and integration ($F[1,185] = 18.80$, $p < .001$, $\eta^2 = .09$). More interestingly, we found a significant interaction between the two manipulations, $F(1,185) = 3.98$, $p < .05$, $\eta^2 = .02$ (depicted in Fig. 2). When differentiation was low, integration did not produce significant differences in creativity (the difference was only marginally significant, $F[1,185] = 2.80$, $p = .10$). But when differentiation was high, creativity was higher in the presence of high rather than low integration ($F[1,185] = 20.59$, $p < .001$).

Table 3
Manipulation check for pilot study, Study 4.

		Conflict ratings	Complementarity ratings
Low differentiation	Low integration	3.62 (1.55)	3.91 (0.79)
	High integration	3.61 (1.27)	5.24 (0.92)
High differentiation	Low integration	5.35 (0.64)	3.67 (1.53)
	High integration	5.59 (0.59)	5.84 (0.45)

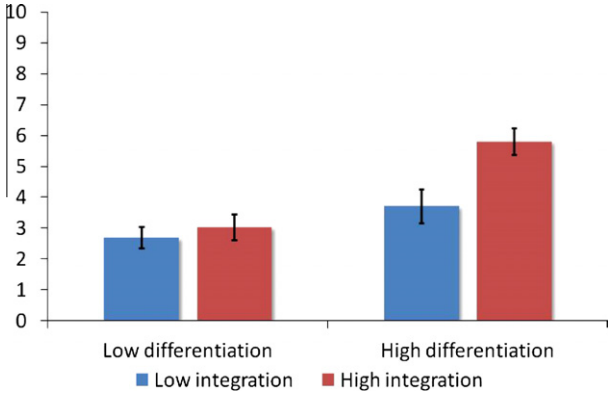

Fig. 2. Number of RAT problems correctly solved by condition, Study 4. Error bars represent standard errors.

We also conducted simple effect tests to examine differences within the same integration level. When integration was low, differentiation did not produce significant differences in creativity ($F < 1$). But when integration was high, creativity was higher in the presence of high rather than low differentiation ($F[1,185] = 12.18$, $p = .001$).

These results indicate that the highest levels of creativity can be reached by highlighting the contradictory relationships between two elements (in this case, efficiency and creativity) and stressing the possibility that, while contradictory, they can complement one another.

General discussion

In four studies using different manipulations for activating paradoxical frames and different creativity tasks, we demonstrated the positive effect of paradoxical frames on creativity. Participants who were primed with a paradoxical frame demonstrated higher creativity levels than did participants who were primed with creativity, efficiency, or creativity–efficiency-frames. Our findings also shed light on the psychological processes through which paradoxical frames enhance creativity. Paradoxical frames elicit an implicit or explicit sense of conflict and enhance individuals' complex thinking. These processes in turn increase exploration, sensitivity to unusual associations, and generation of new associations between seemingly contradictory elements. Finally, we demonstrated that the combination of differentiation and integration contribute to creativity above and beyond the contribution of each process in separation.

Together, this consistent pattern of results across our studies suggests that adopting paradoxical frames is particularly likely to lead people to embrace atypical possibilities, thus enhancing their creativity. Importantly, this effect was produced using different manipulations of paradoxical frames as well as multiple tasks to measure creative performance, demonstrating the robustness of the link between paradoxical frames and creativity.

The finding that paradoxical frames enhanced creativity may seem counterintuitive in light of prior creativity research (e.g., Amabile, Conti, Coon, Lazenby, & Herron, 1996) demonstrating that people were more creative when focusing exclusively on a difficult creativity goal than when focusing on both difficult creativity and efficiency goals (Kremer & Erez, 2007). By contrast, we found that, compared to a frame that focuses attention solely on creativity, focusing attention on the paradoxical relationship between creativity and efficiency enhanced creative performance. Thus, while providing both creativity and efficiency goals may elicit incompatible action tendencies that reduce performance, providing a frame that reconciles creativity and efficiency enhances creative performance.

Paradoxical frames shift the focus from competitive to complementary thinking, thus allowing people to accept the inherent contradiction and find ways in which both task demands can be accomplished. We found that when participants perceived creativity and efficiency as simultaneously contradictory and complementary, they were most creative. Our findings are consistent with a related effect documented in the emotions literature, which shows that individuals primed with contradictory emotions are more creative than those primed with only one emotion (Fong, 2006; George & Zhou, 2007).

Theoretical and practical contributions

Our research offers four main contributions to the existing literature. First, we add to the creativity literature by offering new insights on the importance of adopting paradoxical frames in order to increase creativity. Prior work has identified several variables that significantly enhance or inhibit creative performance, such as job complexity (Amabile & Gryskiewicz, 1989; Farmer, Tierney, & Kung-McIntyre, 2003; Oldham & Cummings, 1996), prior experience (Gino, Argote, Miron-Spektor, & Todorova, 2010; Gino, Todorova, Miron-Spektor, & Argote, 2009), supervisory (Amabile & Conti, 1999; Frese, Teng, & Wijnen, 1999; Shalley & Gilson, 2004) and coworker (Madjar, Oldham, & Pratt, 2002; Zhou & George, 2003) relationships, rewards and evaluation systems (Amabile, 1996; Baer, Oldham, & Cummings, 2003; Zhou & Shalley, 2003), the physical workspace (Oldham, Cummings, & Zhou, 1995; Shalley & Oldham, 1997), and psychological safety (George, 2008; Lee, Edmondson, Thomke, & Worline, 2004), to mention just a few. Here, we identified an important new factor, namely paradoxical frames. Unlike this previous work, our research focused on an individual state: a mental frame that individuals can adopt when facing tasks that require creativity. We showed that this mental frame can be manipulated and activated by situational and external factors.

Second, we contribute to prior work on cognitive tuning theory to understand the link between internal states and creativity. Our findings support the idea that people use their current phenomenological experiences or somatic states as cues to identify the type of environment they are in and the type of cognitive approach they should take (Damasio, Tranel, & Damasio, 1991; Forgas, 2000; Izard & Tomkins, 1966; Mowrer, 1960; Schwarz & Clore, 1983; Schwarz & Clore, 1996; Smith & Lazarus, 1990). Similar to emotional ambivalence, where two contradictory emotions are mentally experienced simultaneously (Fong, 2006), adopting paradoxical frames signals that one is in an unusual environment and therefore should embrace atypical exemplars. The current findings extend Fong's work (2006) by showing that ambivalence also occurs between two seemingly contradictory dimensions, which a person is simultaneously considering when embracing a paradox.

Third, our findings extend prior research on the effect of conflict on creative thinking. Although the overall effect of conflict on performance has been shown to be negative (De Dreu & Weingart, 2003), recent studies suggest that conflict has opposite effects on performance on divergent and convergent tasks (Beersma & De Dreu, 2005). Conflicts enhance divergent thinking and deep processing of task-relevant information as well as the exploration of new ideas (Jehn, 1995; Nemeth et al., 2004). Building on this literature, our findings suggest that when individuals experience a sense of conflict activated by paradoxical frames (and not by an adversary), they react in a more creative way.

Finally, our research contributes to prior work on the role of paradox in organizational life. In the past, scholars have proposed that adopting paradoxical frames improves managers' ability to attend to and deal with strategic contradictions (Smith & Tushman, 2005) and leads them to reach new insights to existing problems (Luscher & Lewis, 2008). Despite this important work, no prior empirical study had explored the effects of paradoxical frames on creativity. Our research addressed this gap directly by investigating the influence of paradoxical frames on the ability of individuals to be creative and on the psychological processes underlying such link.

Limitations and future research

The primary limitation of this work is the use of laboratory studies, which may limit the external validly of our findings. Van den Bos (2001) suggested that researchers working with new models and theories should first test their hypotheses in experimental settings and then take these models into the field for further validation. We began our investigation of the effects of paradoxical frames on creativity in a controlled laboratory setting. By taking advantage of random assignment and creativity measures that have been validated in previous research, our laboratory study

provided consistent and robust evidence that paradoxical frames enhance creativity. Future research could benefit from investigating the effects of paradoxical frames using different methodological approaches and samples within organizations. The correlation between the effect sizes obtained in the field and those obtained in the lab are generally high (Anderson, Lindsay, & Bushman, 1999). Therefore, we expect this investigation to strengthen the generalizability of the present results and uncover important boundary conditions of both the findings and the theory presented in this paper.

Another limitation of this work is that our manipulations of paradoxical frames focused on either a general manipulation for paradoxical thinking (generating paradoxical sentences) or a specific one (focusing on the dimensions of creativity and efficiency). Future research could explore whether specific manipulations for paradoxical frames that focus on other contradicting dimensions (e.g., exploration vs. exploitation; experimentation vs. error prevention) operate in the same manner as observed in our studies.

In addition to such explorations, our work points to many other avenues for future research. The four studies presented in the paper suggest the importance of further examining the consequences and antecedents of adopting paradoxical frames. It is necessary for scholars to gain more knowledge regarding both the positive and negative consequences of adopting paradoxical frames before fully embracing the recommendation to stimulate paradoxical thinking at work. Indeed, the sense of conflict individuals experience when they adopt paradoxical frames may affect their job satisfaction or even their well-being. In addition, future research could test whether the effects of paradoxical frames demonstrated here persist over time or should be reactivated before engaging in a creative task.

It is also possible that some individuals may benefit more than others from adopting paradoxical frames. For example, it may be easier for individuals high on openness to experiences and integrative complexity to adopt paradoxical frames, yet individuals low on these characteristics are more likely to benefit from them (Tierney, Farmer, & Graen, 1999; Zhou, 2003). Paradoxical frames may also influence the motivation to engage in a creativity task, and the extent to which individuals perceive the task as difficult and challenging. Research investigating the personal, motivational and situational factors that trigger paradoxical frames and that moderate their effect on creativity may uncover important insights into our understanding of the role of cognitive frames in organizations.

Finally, future studies could examine the consequences of adopting paradoxical frames at multiple levels of analyses and compare the beneficial effects of embracing paradoxes for both individual and team creativity. Because groups bring together the diverse perspectives and experiences of individual members, work teams may benefit more than individuals from developing shared paradoxical frames that simultaneously focus their attention on contradictory task requirements. By exploring a paradox together, team members can overcome the common tendency of individuals to exploit familiar knowledge at the expense of exploring new domains. Examining the effects of adopting paradoxical frames in teams would allow useful comparisons to the findings presented here.

By calling attention to a previously underexplored construct in the organizational behavior, that of paradoxical frames, our studies have uncovered a relationship of both theoretical and practical importance. We hope this research will stimulate future endeavors that can further our understanding of how embracing contradictions through paradoxical frames can lead to beneficial effects in organizations.

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