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STIMULATING CREATIVITY IN GROUPS THROUGH MENTAL SIMULATION

Elaine M. Wong, Laura J. Kray, Adam D. Galinsky and Keith D. Markman

ABSTRACT

A growing literature has recognized the importance of mental simulation (e.g., imagining alternatives to reality) in sparking creativity. In this chapter, we examine how counterfactual thinking, or imagining alternatives to past outcomes, affects group creativity. We explore these effects by articulating a model that considers the influence of counterfactual thinking on both the cognitive and social processes known to impact group creative performance. With this framework, we aim to stimulate research on group creativity from a counterfactual perspective.

As individuals increasingly work in groups (Guzzo, 1996), and organizations are driven by the need to innovate (Cummings & Oldham, 1997), researchers across a number of disciplines have sought to better understand group creativity. Creativity is typically defined as ideas that are novel and useful (Amabile, 1983), and a growing literature has recognized the importance of mental simulation (e.g., imagining alternatives to reality) in

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sparking creativity. In this chapter, we seek to examine the impact of one form of mental simulation on creativity: counterfactual thinking. Counterfactual thinking occurs whenever people consider alternatives to past events or consider what almost was; thoughts of "if only" and "what if" are signposts for counterfactual musings. For example, a student who does poorly on a test might consider, "If only I had studied more, I would have done better on the test."

Counterfactual thinking is already known to impact individual-level performance on both creative association tasks (Kray, Galinsky, & Wong, 2006) and creative idea generation tasks (Markman, Lindberg, Kray, & Galinsky, 2007), yet less is known about the influence of counterfactuals on group creativity. To address this gap, we propose that counterfactual thinking affects group creativity through its effects on a number of cognitive and social group processes. Specifically, we propose that counterfactuals influence creativity through its effects on cognitive antecedents of creativity, such as divergent thinking and analogical reasoning. We also explore how counterfactuals influence social processes that are known to impact creative output, such as information sharing, coordination, and motivation. Through this examination, we develop a model that illustrates the impact of counterfactual thinking on both cognitive and social processes relevant to group creative performance.

The purpose of this chapter is to articulate a model linking counterfactual thought and group creativity, and to develop a research agenda that will both further our understanding of this relationship and provide practical implications for organizations that desire to maintain a competitive advantage through innovation. In the following sections, we first define group creativity. Next, we discuss the dimensions of counterfactual thinking. We then turn our attention to the ways in which counterfactual thinking may impact group-level cognitive and social creative processes. We conclude with a summary and discussion of future research directions.

DEFINING GROUP CREATIVITY

Creativity can be parsimoniously defined as ideas that are novel and useful (e.g., Amabile, 1983; Amabile, Conti, Coon, Lazenby, & Herron, 1996). Because groups are defined as two or more individuals who are interdependent and work together to achieve a common goal, we view group creativity as individuals working collaboratively to generate novel and useful ideas (Paulus, 2000).

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While the cognitive processes promoting creativity may be similar at both the individual and group levels, group creativity is unique because of the ways in which social interactions affect creativity. For instance, social processes that improve group creativity include information sharing, synergistic coordination, and motivation and goal setting (Paulus, 2000; Thompson, 2003; West, 2002). Thus, group creativity can be achieved in two ways: first, group creativity can result from the aggregated efforts of creative individuals (e.g., individuals working independently and then aggregating their separate project components); second, the interaction of group members can synergistically enhance group creative processes (Pirola-Merlo & Mann, 2004).

Beyond the different ways by which group creativity can be achieved, group creativity can also be assessed according to different criteria. Steiner's (1972) typology of group tasks distinguishes between *disjunctive* tasks, where the best group member determines group performance, and *additive* tasks, in which group members' performance can be summed to determine group performance. This typology is useful for categorizing group creativity. With disjunctive creativity, the most creative idea by an individual member determines overall group creative performance (Pirola-Merlo & Mann, 2004). Examples of disjunctive creativity include groups who are tasked with solving an insight problem in which only a limited number of solutions exist (e.g., the Duncker candle task). In these tasks, the creative insight of a single group member can lead to success for the entire group. With additive creativity, individual members' creative ideas can be aggregated to determine group creative performance (Pirola-Merlo & Mann, 2004). Examples of additive group creativity tasks include idea generation tasks (e.g., brainstorming). Creative performance on these tasks requires the input of the entire group.

DIMENSIONS AND ACTIVATION OF COUNTERFACTUALS

A growing literature has examined the cognitive and social inhibitors and stimulants of group creativity (e.g., Diehl & Stroebe, 1987; Paulus, 2000). We add to this literature by considering the impact of counterfactual thinking. When individuals consider "If only" and what might have been, they are imagining alternatives to past events and outcomes. These reflections are termed *counterfactual thoughts*. Counterfactuals tend to be conditional statements in which outcomes are mentally "undone" and

possible changes to the outcome are contemplated (Kahneman & Miller, 1986; Kahneman & Tversky, 1982; Pennington & Roese, 2003; Roese, 1994). For instance, when an individual considers what might have been had he attended a different university, accepted a different job, or moved to a different state, he is engaging in counterfactual thinking.

Cognitive and social psychologists have studied both the antecedents and the consequences of counterfactual reflection. In terms of antecedents, Kahneman and Tversky (1982) argued that people tend to undo abnormal events by mentally altering antecedents that are perceived to be atypical. Moreover, close calls or near misses, in which an alternative outcome is easily generated, are also likely to stimulate counterfactual thinking. A classic example is that a flight missed by 5 min is more likely to generate counterfactual thoughts than a flight missed by 1 h, because it is easier to mentally undo antecedent events leading up to the narrowly missed flight (Kahneman & Tversky, 1982). Finally, negative, unexpected, or surprising events increase the production of counterfactual thoughts (Roese & Hur, 1997; Roese & Olson, 1997; Sanna & Turley, 1996).

In considering the consequences of counterfactual thought, it is important to note that people rarely ponder just how things could have been different, but rather how things could have been better or worse (Mandel, 2005), or how things could have been added or subtracted from what actually occurred (Roese, 1994). These two dimensions of counterfactual thought – direction and structure – determine the effect that counterfactual thinking has on a range of variables. With regard to direction, *upward counterfactuals* consider alternatives that are better than the current reality (Roese, 1994, 1997). For example, a student who does poorly on an exam might consider the following upward counterfactual: "If only I had studied more, I would have earned a better grade." Because upward counterfactuals imagine improvements to past outcomes, these counterfactuals tend to generate emotions such as regret and disappointment, yet serve a preparative function by guiding future behavior (Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1994; Roese & Olson, 1995). In contrast, *downward counterfactuals* consider alternatives that are less positive than the current reality by focusing on how things could have been worse (Roese, 1994, 1997). For instance, the same student who did poorly on an exam might think, "It's a good thing that I went to the review session or I could have failed." By imagining outcomes that are worse than reality, downward counterfactuals elevate affect by generating relief and surprise but may leave individuals less motivated to improve future performance (Roese & Olson, 1995, but see also McMullen & Markman, 2000).

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Another dimension of counterfactuals is how they are structured; this dimension focuses on whether antecedents are added or subtracted from the past event. *Additive counterfactuals* reconstruct reality by adding antecedents (e.g., "If only I had brought my calculator, I would have done better"). In generating these additions people are generally quite specific (i.e., focus on one particular change), but also more creative (i.e., involve imagination of any number of possible antecedents; Roese, 1994). In contrast, *subtractive counterfactuals* reconstruct reality by subtracting antecedents (e.g., "If I hadn't gone to the career fair, I wouldn't have found my current job").

Counterfactual thoughts can also be distinguished by the process through which they influence outcomes, which is either *content-specific* or *content-neutral* (Epstude & Roese, 2008). Counterfactuals have content-specific effects when they influence behavioral intentions, and ultimately behavior, through the information contained in the counterfactual thought. Conversely, counterfactuals have content-neutral effects when they indirectly affect behavior through indirect processes, such as motivation.

Having discussed the direction, structure, and processes of counterfactual thoughts, we turn briefly to a discussion of how they are activated. A common approach for examining its cognitive impact is to examine the mind-set that is activated when people have just considered a counterfactual: that is, a counterfactual mind-set gets activated or primed by simply engaging in counterfactual thought. Counterfactual mind-sets are typically activated by having people consider how fictional scenarios could have turned out differently. For example, participants might read about a protagonist, Jane, who is attending the concert of one of her favorite bands. Seating is on a first come, first serve basis. Jane selects a seat, but then later moves to obtain a better view of the stage. At the concert, the announcer reveals that a trip to Hawaii will be given to a lucky fan and that the winner will be determined by the seat number currently occupied. In half the scenarios, Jane wins the trip to Hawaii when the new seat she had just switched to (in order to get a better view of the stage) was chosen, while in the other half, Jane loses the trip to Hawaii when the seat that she had just switched from wins the trip. After reading the scenario, participants are asked to generate some thoughts going through Jane's mind. A typical response to Jane's win might be "Wow, If I hadn't changed seats, I wouldn't have won the trip!" whereas Jane's loss might elicit the thought, "If only she hadn't changed seats she would have won." To activate this mind-set at the group level, participants are asked to read the scenario together and jointly determine some thoughts going through Jane's mind (e.g., Galinsky & Kray, 2004; Kray & Galinsky, 2003).

Simply reading the scenario in which Jane switches seats influences decision-making, group interaction, and creative expression. What is remarkable is that both the upward and downward counterfactuals lead to the same effects. Because of this, Galinsky and Moskowitz (2000) used the phrase "counterfactual mind-set" because *processes* of thought, as opposed to the *content* of thoughts, appeared to be driving the effects. The effects of counterfactual mind-sets are thus content neutral.

Counterfactual thoughts may also be primed when people communicate their counterfactual thoughts to others. Although both counterfactual mind-sets and counterfactual communication activate a consideration of "what if," the effects of counterfactual communication are content specific, meaning that the content of the counterfactual is important information that can be utilized in future actions (Epstude & Roese, 2008). For example, after a failed presentation, one colleague may tell another how the presentation could have been better had he included more technical information. In this counterfactual, the technical information is viewed as a causal factor influencing the presentation outcome, and thus, may directly affect future behavior.

Now that we have articulated the dimensions and mechanisms of activation of counterfactual thoughts that are relevant to a range of outcome measures, we now focus more specifically on the relationship between counterfactuals and creativity. We propose that counterfactuals affect group creativity through its effects on cognitive and social group processes. These relationships are depicted in Fig. 1. Although there are a number of

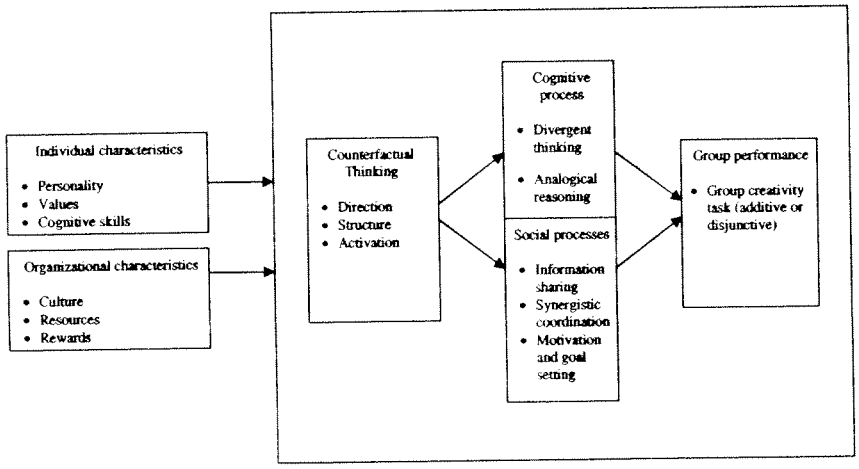

Fig. 1. A Model of Counterfactual Effects on Group Creativity.

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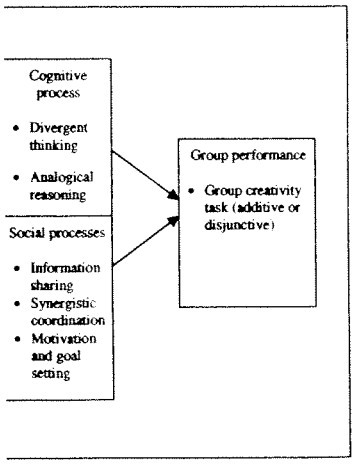

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cognitive and social processes on which we could focus, we limit our consideration to those processes that have been previously identified as positively influencing creativity. We focus on the cognitive processes of divergent thinking and analogical reasoning; the social processes we consider are information sharing, synergistic coordination, and motivation and goal setting. Our model also acknowledges the role of other variables that might play important moderating roles in this process, including individual and organizational characteristics; however, our primary discussion will focus on counterfactual thinking, creative group performance, and potential underlying cognitive and social group processes.

COUNTERFACTUALS AND COGNITIVE PROCESSES IN GROUP CREATIVITY

Below we detail the relationship between counterfactual thinking and two cognitive processes associated with creativity: divergent thinking and analogical reasoning.

Divergent Thinking and Counterfactual Mind-Sets

Creativity is often equated with divergent, as opposed to convergent, thinking (Milliken, Bartel & Kurtzberg, 2003). The former task requires dispersed attention (Anastasi, 1982), whereas the latter is characterized by convergence on a single response (Thompson, 2003). Divergent thinking, which is frequently referred to as "thinking outside of the box," can be stimulated by open-ended questions and the consideration of impossibilities (Thompson, 2003). Thompson notes that divergent thinking helps individuals better identify influential factors in opposing scenarios and that doing so prevents drawing premature conclusions. Because counterfactual thinking involves the consideration of alternatives and multiple perspectives, we expect it to prevent premature convergence on initial creative ideas and to promote an appreciation for divergent perspectives.

The notion that counterfactual primes increase the ability to identify opposing or different viewpoints was first supported in research by Galinsky and Moskowitz (2000), who examined the effects of counterfactual primes on the Duncker Candle problem (Duncker, 1945). In this "thinking outside of the box" task, participants are shown three objects: a small candle, a full book of matches, and a box filled with thumbtacks. They are then asked to

affix the candle to a wall such that it will burn properly and not drip wax onto the floor. The correct solution requires people to recognize that the box may function not only as a container, but also as a platform. The tacks can be dumped out of the box and the box tacked to the wall to support the candle. Participants tend to focus on the typical singular function of the box as a container and thereby fail to see the novel use for it that is required to solve the problem. However, activating a counterfactual mind-set resulted in dramatic improvement in solution rate (56%) relative to a baseline condition (6%, Galinsky & Moskowitz, 2000, Experiment 1), suggesting that counterfactual mind-sets lead people to consider a broader range of alternatives. Although this study was conducted at the individual level, we might expect that similar effects would emerge at the group level: if there are more group members present, the likelihood that the correct solution will be identified should increase on this disjunctive task.

Beyond the identification of multiple perspectives, counterfactual mind-sets might also improve divergent thinking by increasing group members' resistance to premature conclusions. Kray and Galinsky (2003) examined whether those exposed to counterfactual primes were more likely to arrive at a correct decision through the use of disconfirmatory information, than were those in a control (noncounterfactual) condition. They tested this prediction using the Carter Racing case, where individuals work together to make tactical decisions as part of a racecar team (Brittain & Sitkin, 1986). While the context of the case is fictional, the decisions teams made were based on actual data from the Space Shuttle Challenger accident. The quandary facing the team was whether or not to race in an event that was marked by exceedingly cold temperatures. Information given to the teams was ambiguous with regard to whether engine failure was magnified in cold temperatures. Participants were given a chart that only contained information about the air temperature when the car experienced engine failure, and did not include any information on races that did not experience any problems. Reaching the correct decision in this case (concluding *not* to race) requires teams to request information about air temperatures during successful races, which reveals a strong correlation between race success and ambient temperature. Because counterfactual mind-sets aid awareness of alternatives, groups exposed to the counterfactual prime requested information regarding the successful races, thereby entertaining the alternative hypothesis that a relationship exists between air temperature and engine failure. Mediation analyses indicated that counterfactual primes increased the generation of counterfactual thoughts, which in turn increased the search for disconfirmatory information, and ultimately improved decision accuracy.

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By increasing the awareness of different perspectives and the search for disconfirmatory information, counterfactual mind-sets may aid group creativity in several different ways. First, awareness of alternatives may increase performance on creative association tasks. As Galinsky and Moskowitz (2000) illustrated, performance on some creative association tasks requires that people be able to overcome their biases (e.g., functional fixedness) and be able to see alternative functions in order to solve the problem. Because creative association tasks are disjunctive, they require only one member of the group to make the necessary connection. As counterfactual mind-sets increase awareness of alternatives, they may increase group creativity by enabling people to view the problem or resources from a different perspective, thereby increasing the chances that at least one group member will generate the necessary solution. Second, the findings from Kray and Galinsky (2003) suggest that awareness of alternatives increases people's search for disconfirmatory evidence. To the extent that creative association tasks require one correct solution, identifying this disconfirmatory evidence increases the likelihood of more accurate decisions.

The search for disconfirmatory evidence following counterfactual mind-set activation may also decrease the conformity pressure that impairs additive group creative tasks, such as brainstorming (Thompson, 2003). Increased awareness of different perspectives may affect group members' willingness to listen to dissenting perspectives. Research on minority dissent finds that groups are more likely to demonstrate creative idea generation when they are exposed to minority perspectives, compared to when no dissent is voiced. For instance, Nemeth (1986) explored how effectively groups created words from strings of letters (e.g., DAMrpt). Nemeth found that groups exposed to minority dissent were more likely to form more words using forward (e.g., dam), backward (e.g., mad), and mixed sequencing (e.g., pad) than were those exposed to only the majority perspective. Nemeth interpreted this as evidence for the positive relationship between minority dissent and divergent thinking. As applied to the present chapter, counterfactual thinking may increase a group's willingness to listen to minority dissent, and in turn, exposure to these differing perspectives may improve creative idea generation.

In summary, we propose that through the effect of counterfactual mind-sets on individuals' awareness of alternatives, performance on creative association tasks and creative idea generation tasks will improve. The search for disconfirmatory evidence following counterfactual mind-set activation may also decrease the conformity pressure that impairs group brainstorming (Thompson, 2003). Increased awareness of alternatives may affect group members' willingness to listen to dissenting perspectives.

Divergent Thinking and Counterfactual Structure

In the previous section, we argued that counterfactual mind-sets in general are associated with processes that improve divergent thinking. In this section, we argue that the structure of the counterfactual mind-set is crucial in determining how these mind-sets are associated with divergent and convergent thinking. Specifically, we propose that additive counterfactual thoughts that add some factor to the original event conditions will improve divergent thinking more so than counterfactuals that delete an antecedent factor from the original event conditions.

Kray et al. (2006) first examined the effects of subtractive counterfactual mind-sets (i.e., mentally deleting an antecedent) on individual-level creativity. They argued that these mind-sets promote a *relational processing style* characterized by a tendency to consider relationships and associations among a set of stimuli. Consistent with this processing style, counterfactual mind-sets facilitated performance on creative association tasks, including Law School Admissions Test (LSAT) problems and the Remote Associates Task (RAT; Mednick, Mednick, & Mednick, 1964) by allowing people to recognize connections. Conversely, subtractive counterfactual mind-sets impaired performance on creative idea generation tasks, such as brainstorming new pasta names and drawing a creature from another planet, because they structure thought and imagination. To the extent that divergent thinking aids performance on idea generation tasks, the implication of these findings is that subtractive counterfactual mind-sets decrease divergent thinking.

In contrast to performance on idea generation (i.e., additive) tasks, Kray et al.'s (2006) research indicates that subtractive counterfactual mind-sets *improve* individual performance on disjunctive tasks such as the RAT, LSAT, and Duncker Candle problems. This occurs because the counterfactual mind-set elicits relational processing. In this cognitive state, participants are able to foster connections between stimuli. This same logic carries over to the group level as well. Since disjunctive tasks require associations to be made, relational processing is likely to increase disjunctive task performance. Given that only one individual needs to arrive at the correct answer in order to solve this task, we predict that subtractive counterfactual mind-sets impact group performance on creative association tasks in the same manner as they do at the individual level: When one individual in the group is able to identify the correct solution, she or he increases the group's creative performance.

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assertion that additive counterfactuals are more creative, and posited that additive counterfactual mind-sets promote the broadening of conceptual attention. As such, people in these mind-sets are likely to do better on creative generation tasks. In support of this prediction, they examined the effects of counterfactual structure on novel idea generation (e.g., Scattergories, uses for a brick). They found that participants who generated additive counterfactuals performed better – their work was rated as more novel – than did those who generated subtractive counterfactuals or no counterfactuals.

Recent negotiation research (conducted at the dyadic level) has implications for the effects of counterfactual thinking on group creativity. One way in which negotiators can be creative is to explore interests that underlie stated positions and to craft a novel solution to an impasse by addressing those interests. Using both the rock concert mind-set activation prime and a more individualistic account of counterfactuals from participants' past negotiations, Kray, Galinsky, and Markman (2009) demonstrated that negotiators who generated additive counterfactuals were subsequently more likely to create an integrative deal than were negotiators who generated subtractive counterfactuals. By adding hypothetical elements to the past, an expansive processing style is invoked that aids in creative generation (cf. Guilford, 1950). Taken together this research on additive counterfactual mind-sets may work to improve divergent thinking within groups.

Beyond divergent thinking, the structure of the counterfactual may also influence another valuable tool in the creative process: analogical reasoning (Gentner, Brem, Ferguson, & Wolff, 1997; Thompson, 2003). A simple analogy such as "tree is to forest as water is to ocean" illustrates comparable relationships across distinct domains. Analogical reasoning facilitates creativity by allowing the value of an idea or solution from one domain to be recognized in the current domain. For example, Edison's development of an electric light system borrowed heavily from his knowledge of gas light systems: the light bulb was originally called a burner and was designed to approximate the same amount of light emitted by a candle (Weisberg, 1997). An additional benefit to analogical reasoning in group creative contexts is that one group member's infeasible idea may lead another member to engage in analogical reasoning to identify a more appropriate solution. Because subtractive counterfactuals have been shown to promote a relational processing style, analogical reasoning should be facilitated by subtractive counterfactual thinking.

Divergent Thinking and Counterfactual Communication

The above discussion has centered on the impact of counterfactual mind-sets, or the ways in which thinking counterfactually influences subsequent creative performance. However, it is possible that counterfactuals may also directly affect group creativity through the communication of creative thoughts. In other words, whereas counterfactual mind-sets focus on the intrapersonal cognitive orientation of *thinking* about alternatives, counterfactual communication is interpersonal and involves explicitly *communicating* a counterfactual between a sender and a receiver. Counterfactual communication may be particularly important in groups because sharing thoughts regarding how something could have been better may be important to individual and group learning and future performance (Wong, 2009). Moreover, unlike counterfactual mind-sets, the content of the counterfactual thought plays an important informational role that guides behavioral intentions and future performance (Roese, 1994; Wong, 2007).

Although research has yet to examine the role of counterfactual communication on cognitive processes related to group creativity, there are two ways in which counterfactual communication might impact divergent thinking. First, it is possible that the communication of counterfactuals will stimulate counterfactual thinking, which in turn will activate an awareness of multiple perspectives and a search for disconfirmatory information. Second, by verbalizing these "what ifs," other group members may also begin to consider or share their counterfactuals, thereby increasing the diversity of ideas and potentially piggybacking off each others' ideas. These behaviors benefit divergent thinking and hence may contribute to higher levels of performance on additive group tasks.

COUNTERFACTUALS AND SOCIAL PROCESSES IN GROUP CREATIVITY

In this section, we consider group creativity that arises due to social processes. An assumption underlying most models of group creativity is that group processes moderate the relationship between group knowledge and creativity (e.g., West, 2002). For instance, Paulus (2000) focuses on both social stimulation (e.g., competition/accountability and upward comparisons/goals) and cognitive stimulation (e.g., attention, conflicts, incubation) in discussing factors that generate high creativity in groups. Likewise, in a

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model of group processes affecting group creativity and innovation, West (2002) attends to processes including group commitment, conflict management, and minority influence. In this section, we focus on the processes that have been associated with stimulating creativity, which include information sharing, synergistic coordination, and motivation and goal setting.

Information Sharing

Information Sharing and Counterfactual Mind-Sets

Group diversity is an important factor in creative group performance (e.g., Paulus, 2000; Thompson, 2003; West, 2002) because diverse group members will have access to different information, perspectives, and experience, which should ultimately improve performance. However, groups are rarely as successful as we would hope. Groups' inability to achieve novel combinations may stem from their inability to share information efficiently (Paulus, 2000). A large body of research indicates that information sharing in groups is biased such that group members tend to discuss shared information as opposed to unique information (Larson, Foster-Fishman, & Keys, 1994; Stasser & Stewart, 1992; Stasser & Titus, 1985; Winquist & Larson, 1998).

Building on Kray and Galinsky's (2003) link between counterfactual mind-sets and the search for disconfirmatory information, Galinsky and Kray (2004) argued that these mind-sets might also increase the likelihood that groups would share unique information. Galinsky and Kray tested this predication by having the groups complete Stasser and Stewart's (1992) murder mystery task. In this task, groups were told that they were investigating a homicide and group members are given clues from which they must identify a suspect. Galinsky and Kray found that groups exposed to the Jane scenario designed to elicit counterfactuals were more likely to identify the correct suspect than were those who were exposed to a neutral scenario. Groups exposed to the counterfactual scenario were more likely to discuss information originally held by only one group member than were those exposed to the noncounterfactual scenario, which suggests that counterfactual mind-sets increased discussion of unique information that ultimately increased decision-making accuracy.

An implication of Galinsky and Kray's (2004) work is that, through the sharing of unique information, counterfactual mind-sets may increase group creativity. Specifically, information sharing may improve performance on additive tasks. To the extent that sharing unique information allows group members to build off others' ideas, this may increase divergent thinking,

fluency, and flexibility of ideas. However, Galinsky and Kray's research also suggests that disjunctive task performance may be improved through counterfactual mind-sets. Through the sharing of unique information, groups were better able to identify the one correct solution. Given that disjunctive tasks have one correct response, it is therefore possible that, through the sharing of unique information and perspectives, disjunctive task performance may also increase. In sum, sharing of unique information may benefit both types of creative task performance.

Information Sharing and Counterfactual Communication

We expect that the extent to which counterfactual communication improves information sharing may depend on group members' relationships with one another. Research from the impression management literature suggests that performance-enhancing behaviors, such as feedback seeking, may be avoided if people are concerned that they might have a negative effect on the impressions others form of them (Ashford & Northcraft, 1992; Lee, 1997). As applied to counterfactual communication, while the sharing of counterfactuals might improve performance, individuals may avoid sharing them if doing so could affect others' perceptions of them. Such an effect may be similar to the evaluation apprehension that has been documented to inhibit group creativity (Diehl & Stroebe, 1987).

Group members, however, may be more willing to share their counterfactual thoughts if there is a high level of trust and psychological safety, which refers to "a shared belief that the team is safe for interpersonal risk taking" (Edmondson, 1999, p. 354) in the group. By sharing this information, the team may achieve higher levels of creative group performance. Depending on the content of the counterfactual communicated, it is possible that both additive and disjunctive creative task performance may be improved in a similar fashion as with counterfactual mind-sets. On the one hand, additive task performance may be increased when sharing information leads to building off each others' ideas, and in turn, higher fluency scores, for example. On the other hand, disjunctive task performance may also be improved as group members share information and potentially isolate the one correct answer.

Synergistic Coordination and Counterfactual Mind-Sets

Synergistic coordination refers to increased information sharing, increased receptivity to others' ideas, and increased ability to coordinate and integrate

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this information (Liljenquist, Galinsky, & Kray, 2004). Liljenquist et al. (2004) hypothesized that the impact that counterfactual mind-sets have on group tasks will depend on how they are activated. They expected that considering counterfactual worlds collectively would create synergistic coordination but that considering counterfactuals individually would create silos separating group members from each other. Consistent with this hypothesis, when groups collectively constructed counterfactual thoughts, group performance and information sharing were facilitated. However, when each individual privately constructed counterfactual thoughts, group members were unable to effectively share their thoughts and coordinate their information.

In terms of group creativity, since disjunctive tasks require that individuals work together to share information, disconfirm current beliefs, engage in hypothesis testing, and identify the one correct solution, the collective activation of counterfactual mind-sets should benefit performance on this type of task by promoting synergistic coordination. This reinforces the notion that counterfactual mind-sets can have cognitive and social influences on group creativity – not only will counterfactual mind-sets allow group members to generate a wide variety of alternatives, but they will be more willing and able to integrate these differing views together.

With regard to additive tasks, group-level counterfactual mind-sets may have an ironic impact on team performance. Creativity research suggests that task conflict is a key process to idea generation (Paulus, 2000). Because counterfactual mind-sets increase synergistic coordination, it is possible that the increased coordination may come at the expense of task conflict. Thus, counterfactual mind-sets may increase disjunctive task performance through their effects on synergistic coordination but decrease additive task performance due to decreased task conflict.

Motivation, Goal Setting, and Counterfactuals

Models of creativity at both the individual and group level have suggested the importance of motivation (e.g., Amabile, 1988; Ford, 1996; Paulus, 2000). For example, Paulus (2000) applied goal-setting research to the creative process and proposed that specific goals and explicit feedback about performance can improve additive task performance. Counterfactual research has likewise demonstrated links to motivation, suggesting that an integration of these literatures may be fruitful. While in previous sections we have distinguished between counterfactual mind-set and communication

effects, in this section, we find it helpful to draw upon content neutral and specific counterfactual effects because previous research suggests that the content of the counterfactual is key to the influence of counterfactuals on motivation (Roese, 1994).

Motivation and Content-Neutral Counterfactuals

One means by which counterfactual generation may benefit group motivation, and ultimately creativity, is by enhancing the meaning of group members' shared endeavor. We use the term mutability to refer to the mental ease with which aspects of reality are imaginatively altered. By extrapolating from mutability, individuals perceive a structure to their lives and the world in which they live. To be sure, finding meaning *from* mutability is in a sense ironic; the recognition of multiple possibilities might make the world seem capricious, even random. Yet because our brains work overtime to impose meaning in the face of surprising circumstances, the consideration of "what might have been" can produce beliefs that render one's life and experiences all the more remarkable, and hence, all the more meaningful (Galinsky, Liljenquist, Kray, & Roese, 2005). In an empirical test of this idea, Kray et al. (in press) recently determined that counterfactual thinking enhances meaning in life for pivotal turning points. By considering how life would be different if these transitions had never occurred, the growth, lessons, and "silver linings" of events from the past crystallize. In the context of groups, the belief that their shared activity is meaningful will likely increase group members' intrinsic motivation and commitment to the task at hand, which will very likely increase their creative output.

Motivation and Content-Specific Counterfactuals

Research on counterfactuals has demonstrated its effects on motivation. Some have argued that counterfactuals can function as a form of goal-setting such that upward counterfactuals provide explicit goals and increase accountability to these goals (Roese, 1994). For instance, Morris and Moore (2000) found that aviation operators who made upward counterfactuals about things they personally could have done better were more likely to learn from near accidents than were those who generated other forms of counterfactuals (e.g., other-focused, or downward counterfactuals). Wong (2007) explored the impact of counterfactual communication on motivation and argued that the direction of the counterfactual (upward vs. downward) communicated by a speaker would have differential effects on receivers' motivation and that this relationship would be mediated by

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Finally, Kray and Haselhuhn (2007) found that individuals with incremental beliefs of negotiation ability (i.e., that negotiation skills can be learned) were more likely to achieve integrative outcomes and have higher grades at the end of a negotiation course than were those who held entity beliefs of negotiation ability (i.e., negotiation skill is fixed). Wong, Haselhuhn, and Kray (2009) posit that counterfactual direction might be one underlying mechanism driving this relationship between counterfactuals and performance. In particular, they hypothesized and found that incremental beliefs increased the generation of upward counterfactuals, thereby allowing them to learn from their previous experiences (cf. Kray et al., 2009). In contrast, entity beliefs led to the generation of downward counterfactuals, which typically do not promote learning from the past. Together these findings suggest that upward counterfactuals may increase motivation and function as a form of goal setting.

In considering the implications of this discussion for group creativity, it is important to note that disjunctive tasks merely require the ability to identify relationships among stimuli. This ability is unlikely to be affected by motivation. For instance, one could be highly motivated to exert effort and persist on a RAT problem, in which the connection between three seemingly unconnected words must be made (e.g., chocolate– fortune–tin), but if the connection cannot be identified, no benefit to creativity will be obtained from this motivation. Conversely, additive tasks include sheer measures of quantity, which is a product of effort. Therefore, if upward counterfactuals increase motivation to generate more ideas, then additive task performance may increase. In summary, upward counterfactual generation may increase motivation and lead individuals and teams to set higher goals. This increased motivation should improve performance on additive tasks but not disjunctive tasks. Initial support for this prediction is supported by Markman, McMullen, and Elizaga (2008), who found that upward counterfactuals enhanced anagram performance (arguably, an additive task), and, moreover, the effect of counterfactual thinking on performance was mediated by motivation (as indicated by task persistence).

In this section, we have considered the ways in which counterfactual mind-sets affect group creativity through their impact on group creative processes. We proposed that increased information sharing would increase performance on additive and disjunctive tasks. In contrast, synergistic

coordination and motivation were expected to influence each type of creative task differently. While synergistic coordination was expected to increase performance on disjunctive tasks and decrease performance on additive tasks, motivation was predicted to improve performance only on additive tasks.

RESEARCH AGENDA

In this chapter, we suggested that counterfactual mind-sets affect group creativity through cognitive processes (e.g., divergent thinking) as well as social processes (e.g., information sharing, synergistic coordination, motivation, and goal setting). In this final section, we develop a research agenda.

Group Creativity: Additional Processes and Perspectives

Additional Processes

While we have argued that counterfactual thinking affects group creativity through its influence on cognitive and social group processes, beyond these processes, it may be useful to consider how counterfactuals impact group creativity through its influence on affect. Experimental research on induced positive affect and creativity has typically found that positive affect as opposed to negative affect increases one's ability to make word associations, relate various stimuli, use and create categories, and solve insight problems (e.g., Amabile, Barsade, Mueller, & Staw, 2005; Isen & Baron, 1991, but for an exception see George & Zhou, 2002).

As previously mentioned, research has established links between counterfactual thinking and emotion. Specifically, downward counterfactual thinking has been linked with more positive affective states (as these thoughts allow people to feel better about a particular outcome), while upward counterfactual thinking has been associated with more negative affective states (as these thoughts remind people of how things could have been better). Therefore, holding all else equal, downward counterfactual generation may enhance creativity to a greater extent than upward counterfactual generation through its influence on affect. Given that affect in groups may spread from one group member to another (Barsade, 2002), downward counterfactuals may enhance creativity at both the individual and group level.

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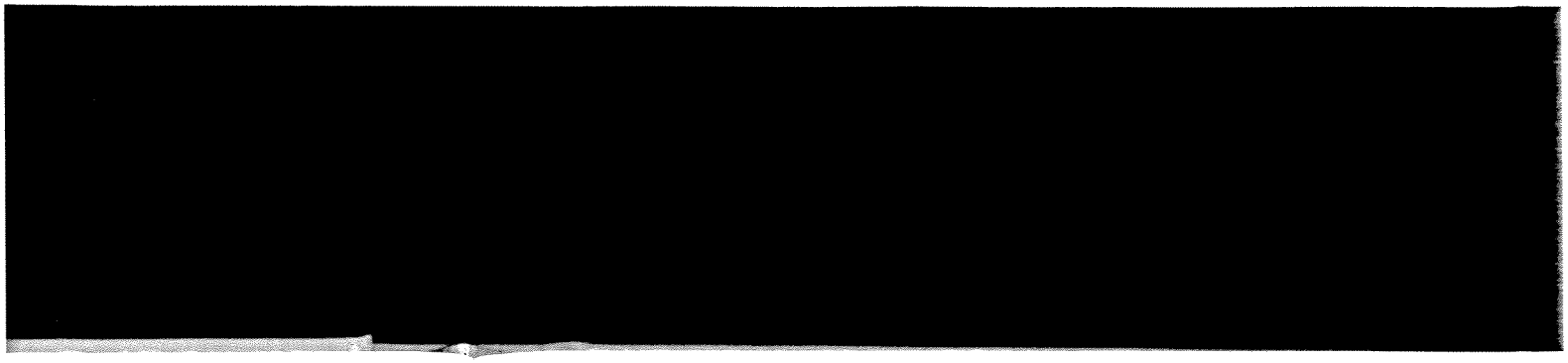

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Additional Perspectives

While our discussion on group creativity has attended to the task structure as either additive (sum of the group members' creativity) or disjunctive (one member identifies the correct solution), one other notion of group creativity that is less frequently considered is that group creativity may involve "each individual mak[ing] a contribution, but the importance of that contribution to the creativity of the group product is weighted in some way (e.g., the most creative member's contribution is the most important)" (Pirola-Merlo & Mann, 2004, p. 238). The key to this perspective is how weights might be assigned.

Based on research examining counterfactual communication and its impact on performance, it is possible that the way in which counterfactual thinking is activated may affect this weighting process. Recall that Wong (2007) explored the impact of counterfactual communication on motivation and found that speakers who communicated upward counterfactuals were more positively perceived than were those who communicated downward counterfactuals, and that these impressions were positively related to receivers' future motivation and performance. Through its effect on impression formation, we expect that counterfactual communication will influence the weighting of individual member contributions to group creativity. Group members who communicate upward counterfactuals will be more positively viewed by other members of their team and may therefore be more influential. Weighting of individual member contributions may be more important for additive, or creative idea generation tasks, than for disjunctive tasks, which involve a single correct solution.

Moreover, this notion of weighting of creative ideas may have implications for the innovation process, and in particular the process by which creative ideas are implemented. According to Kanter (1988), the innovation process includes idea generation, coalition building, idea realization, and transfer. This notion of weighting may also be pertinent to coalition building such that individuals with higher status or expertise are viewed as more creative, important, or having more potential. To the extent that those with higher status or expertise are able to form coalitions to support their ideas, weighting may affect not only group creativity but also innovation processes.

The Impact of the Organizational Context

In this chapter, we acknowledged the importance of the organizational context (e.g., culture) but focused on the impact of counterfactual thinking

on group creativity. We did so in order to gain a basic understanding of the influence of counterfactuals on group creativity, holding constant other factors that might help or hinder counterfactual effects on group creativity. However, moving forward, it will be important to consider several issues relating to counterfactuals and group creativity in organizational contexts.

First, our research has typically been conducted in laboratory settings. In future research, it will become important to determine methods by which counterfactual mind-sets can be activated and sustained in organizations. Models of group creativity (e.g., Amabile, 1988) highlight the importance of team and organizational variables such as team values and norms as well as organizational resources.

Team Values and Norms

Recall that Wong (2009) notes that while individuals may generate counterfactual thoughts, they may not be willing to share such thoughts with others out of concern for how it might affect others impressions of them. As such, Wong, Galinsky, and Kray (2008) suggest the importance of psychological safety. If individuals feel safe, they will be more willing to share their counterfactual thoughts and therefore the potential benefits to group creativity might be realized.

Beyond psychological safety, another important value for the relationship between counterfactuals and creativity may be valuing failure. Such a perspective is at the heart of the culture of IDEO, an innovation and design firm. They view failure as "the best way to clear the fog to see a path to success" (Rodriguez & Jacoby, 2007, p. 56). Valuing failure may also increase individuals' willingness to share counterfactual thoughts, particularly those that consider how things could have been better after negative events. It is through this communication of counterfactuals that information is shared, which we have argued is related to increased group creativity.

Organizational Resources

Most models of organizational creativity and/or innovation consider the role of organizational resources. We expect organizational processes and resources such as reward systems, education, and information systems to influence counterfactual thinking in organizations. Reward systems need to support values and norms, in this case, psychological safety and valuing failure. One way in which organizations can reward counterfactual thinking is by providing incentives to report such thoughts. For instance, in the Aviation Safety Reporting System (ASRS), aviation operators voluntarily submit incident reports. Such reports might detail near accidents, passenger

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misconduct, or mechanical problems. Aviation operators are guaranteed confidentiality in their reports and are provided incentives to report, such as waiving fines or penalties for unintentional violations of aviation laws and regulations (ASRS, 2008). Although the extent to which the entire population of aviation operators utilizes this system cannot be determined, it has certainly functioned to increase flight safety through discussion of the incident and the lessons learned.

CONCLUSION

In this chapter, we acknowledged the importance of mental simulation on creativity. We proposed that counterfactuals influence creativity through its effects on cognitive processes (e.g., divergent thinking) and social processes (e.g., information sharing, synergistic coordination, motivation, and goal setting). In this way, we developed a model that articulates the impact of counterfactuals on group creativity. Finally, we aim to stimulate research on counterfactuals and group creativity through not only our model but also our research agenda.

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