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The debiasing effect of counterfactual mind-sets: Increasing the search for disconfirmatory information in group decisions

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Abstract

We hypothesized that the activation of a counterfactual mind-set minimizes decision errors resulting from the failure of groups to seek disconfirming information to test an initial hypothesis. To test this hypothesis, we conducted two experiments examining the decision making processes of groups. The task for both experiments was modeled after the Space Shuttle Challenger disaster, and groups had to actively seek disconfirmatory information to make a correct decision. Prior to beginning the group decision making task, groups were exposed to one of two pre-task scenarios in which the salience of counterfactual thoughts was manipulated. In Experiment 1, groups in the counterfactual prime condition were significantly more likely to make the correct decision than groups in the non-counterfactual prime condition. In Experiment 2, we replicated the effect of counterfactual primes on decision accuracy and demonstrated that groups in the counterfactual prime condition were more likely to seek disconfirmatory information than groups in the non-counterfactual prime condition. We also conducted mediation analyses that clarify the decision making process. Implications for group decision making are discussed.

1. Introduction

On January 28, 1986 the eyes of the world watched as the Space Shuttle Challenger launched into the Florida sky, embarking on a much-publicized mission to deliver the world's first civilian to outer space. The mission had recently experienced a series of delays due to bad weather, and NASA's decision to proceed with the launch was remarkable given the fact that the air temperature was a full 15° colder on January 28 than any other previous launch date. As many people vividly recall, the shuttle exploded after just 73 s, killing all of its crew members. Although the data compiled after the disaster by the Presidential Commission investigating the accident clearly indicated, O-ring resiliency is directly related to its temperature.'' this relationship between ambient temperature and O-ring failure was not fully grasped prior to the accident (Report of the Presidential Commission on the Space Shuttle Challenger Accident, 1986). Perhaps most disturbing of all was the Commission's conclusion that ''there was a serious flaw in the decision making process'' leading up to the launch. If only the NASA officials had adopted a more systematic approach to examining the relationship between air temperature and O-ring failures prior to the launch, the true risks of the launch might have been realized, and disaster averted.

Like the NASA officials who convened with engineers and contractors to decide whether to launch the space shuttle on that fateful winter day, many complex decisions are made by groups. Erroneous decisions can occur in group contexts and one category of factors that leads to flawed group decision making is the manner in which information is sought, shared, and processed in a social context (Janis, 1982). With the Challenger accident being just one horrific example of decision making gone awry, the question of how to reduce this type of group bias has important theoretical and practical implications. Clearly, a host of social, political, and psychological factors contributed to the decision to launch the Challenger. Whereas examining each of these processes is a worthwhile endeavor, in this paper, we focus

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on just one: the manner in which information is sought and processed in a group context. Specifically, we examine how the induction of a counterfactual mind-set affects the ability of groups to seek out disconfirmatory information and make accurate decisions.

One reason that group decision making is complex is that group members are often dependent on each other and sources outside of the group for information. If a decision making group does not have all of the information it needs in front of them and they engage in a biased information search, sub-optimal decisions are likely to result. A known bias in the information seeking processes of groups is the tendency to prefer information that supports a chosen alternative compared to conflicting information (Schulz-Hardt, Frey, Luthgens, & Moscovici, 2000). In a series of studies, Schulz-Hardt et al. demonstrated that groups show a preference for information that conforms to member pre-decision preferences and that this effect is particularly pronounced for groups comprised of individuals with homogeneous preferences. Although a confirmation bias in information seeking was demonstrated, these studies did not directly examine whether this approach was detrimental or beneficial to actual group decisions.

In this paper, we examine how altering the mind-set of group members affects decisions. Previous research has established the impact of several mind-sets, ranging from deliberation (Gollwitzer, Heckhausen, & Steller, 1990), to impression management (Chen, Shechter, & Chaiken, 1996). In the current experiment, we focus on counterfactual mind-sets, which we define as a cognitive orientation that facilitates engaging in mental simulations and the consideration of alternatives (Galinsky & Moskowitz, 2000; Galinsky, Moskowitz, & Skurnik, 2000). We argue that counterfactual minds-sets affect the search for information in groups and, ultimately, group decisions. By increasing the search for disconfirmatory information, we expect counterfactual mind-sets to allow group members to avoid making faulty decisions, as is vividly illustrated with the Space Shuttle Challenger example.

1.1. Counterfactual mind-sets

Counterfactuals are thoughts of what might have been and they represent alternative realities for past events. Counterfactual thoughts are typically expressed as conditional propositions that link an antecedent and a consequent and are often characterized by expressions of "if only..." (Roese, 1994). Through counterfactuals, we reconstruct the past. Counterfactual thoughts are often activated when an event *nearly* occurred (Kahneman & Varey, 1990; Miller & McFarland, 1986) or when antecedents to that event were exceptional in some way (Kahneman & Miller, 1986; Kahneman & Tversky, 1982). In addition, taking action tends to produce more counterfactuals in one's initial responses to an event than not taking action (Gilovich & Medvec, 1995; Kahneman & Miller, 1986; Kahneman & Tversky, 1982).

Thinking about "what might have been" can affect how we approach what is not yet. In other words, being presented with a situation in which a salient counterfactual exists—or a sense of what *almost or might have* happened—influences problem solving and information processing at the individual level. For example, exposure to a scenario in which a protagonist loses out on a valuable drawing prize because she switched seats before the prize was awarded to the current occupant of her original seat, tends to activate counterfactual thoughts such as "if only I had not switched seats I would have won" (Galinsky & Moskowitz, 2000; Galinsky et al., 2000). Galinsky and Moskowitz (2000) argue that exposure to a salient counterfactual heightens an individual's awareness that there is more than one possibility to be considered when making decisions, which increases the likelihood of engaging in mental simulations of alternate states of reality. Counterfactual mind-sets make simulations and awareness of relevant alternatives more accessible.[1]

Individual decision making and problem solving can be influenced by having engaged in counterfactaal thinking in a prior context. When attempting to test a hypothesis about the traits an individual possesses, people often fall prey to a confirmation bias, or the tendency to seek evidence that confirms one's hypothesis and to neglect evidence that disconfirms it (Pyszczynski & Greenberg, 1987; Snyder & Swann, 1978), paying little or no attention to alternative hypotheses (Trope & Liberman, 1996). Galinsky and Moskowitz (2000) demonstrated that the tendency of individuals to fall prey to the confirmation bias in hypothesis-testing situations is reduced after the invocation of a counterfactual mind-set. Participants in their experiment were given a list of 25 questions designed to help them investigate the hypothesis that an interviewee was an extrovert. Ten of the questions were designed to elicit hypothesis-confirming answers (e.g., "what do you like about parties?"), 10 of the questions were designed to elicit hypothesis-disconfirming answers (e.g., "what factors make it hard for you to open up to people?"),

[1] Our notion of a counterfactual mind-set is closely related to the simulation heuristic (Kahneman & Tversky, 1982). Kahneman and Tversky originally discussed the concepts of counterfactual thinking and mental simulation within the context of the availability heuristic. According to Kahneman and Tversky's (1973), the "simulation heuristic" involves the mental construction of scenarios or examples. By running a mental simulation, complex questions are answered about both future and past events, including prediction, assessments of probabilities, and assessments of causality. Once activated, the simulation heuristic increases the propensity to simulate, attend to and consider alternative possibilities (Hirt & Markman, 1995).

and for five of the questions, a typical answer would neither confirm nor disconfirm the hypothesis. Exposure to a counterfactual in an earlier, unrelated context increased the selection of hypothesis disconfirming questions, presumably by increasing the accessibility of the alternative and converse hypothesis. Counterfactual mind-sets also appear to increase cognitive flexibility and assist in overcoming functional fixedness, a situation in which individuals can only see the typical or usual functions for an object. In one experiment, individuals primed with a counterfactual mind-set were more likely to solve the Duncker candle problem, suggesting that they noticed an alternative and atypical function for one of the objects (Galinsky & Moskowitz, 2000). Individuals are often more adept at processing information in a decision making context after exposure to a scenario in which what might have been has been made salient.

The bulk of the research on counterfactual mind-sets has focused on individual decision making. In this investigation, we explore whether activating a counterfactual mind-set in the minds of group members can be a tool for redirecting the focus of group discussion to information that is critical, yet often ignored. Stasser and Stewart (1992) showed that how a decision is framed can affect the processes groups use to solve a problem and ultimately their decision accuracy. In their investigation, they showed that framing a group task as a problem to be solved, with a demonstrably correct solution, led to better problem solving performance than framing the task as a judgment to be made, involving personal opinions. Stasser and Stewart demonstrated that how a task is framed can create a cognitive orientation in group members that alters the sharing of unique information and the solicitation of discrepant information. We argue that mind-sets can be activated independent of the group decision making context.[2] That is, cognitive orientations that have been acquired by group members in a previous, unrelated context will affect subsequent judgments and group problem solving behavior.

1.2. Overview of experiments

In this paper, we explore the effect of activating counterfactual thoughts in one context on subsequent group decision making. Several features of the current set of experiments allow us to extend our theoretical and empirical understanding of counterfactual mind-sets. First, the task was structured such that the group constructed counterfactual thoughts and made a collective decision, rather than exposing individual group members to the manipulation and pooling their individual decisions. Although counterfactual mind-sets can influence individual decisions, the increased complexity of coordinating information and constructing a group decision imply that their ability to influence group decisions may only be a suggestive possibility. Second, the manipulation of mind-sets in the current set of experiments occurred before groups were exposed to task information. In this way, we could examine how counterfactual activation affects the manner in which groups process and seek out task-relevant information. Third, the task used for both experiments required groups to search for information outside of their original set of materials in order to produce the correct decision. In this way, we could examine the effect of counterfactual mind-sets on information seeking, or the solicitation of disconfirming information.

Stasser and Stewart's (1992) examination of mind-sets involved explicitly instructing groups how to approach a problem solving task. In the current context, we aim to demonstrate that cognitive orientations that reduce group biases do not have to be activated in the group decision making context, as in the Stasser and Stewart experiment, but can be made accessible in an earlier, separate context. In terms of intervening processes, we aim to demonstrate that counterfactual primes increase the construction of counterfactual thoughts, which affects later problem solving. Previous research (Galinsky & Moskowitz, 2000; Galinsky et al., 2000) demonstrated that counterfactual primes affect behavior, but did not investigate the intervening decision making process.

2. Experiment 1

Using data gathered from the Report of the Presidential Commission on the Space Shuttle Challenger Accident (1986), groups in this experiment were tasked with making a decision that paralleled the decision made by NASA officials concerning whether to launch the Challenger back in January of 1986. Rather than cueing participants as to the source of the data and the problem's correct solution, the data were disguised as pertaining to the relationship between air temperature and car engine failures. As members of a racecar team, groups had to decide whether to go ahead with a race that was set to begin in the immediate future.

Although we were interested in the confirmation bias in group decision making, we departed from the procedure used by Schulz-Hardt (2000) to examine it by presenting groups with one half of a coin—only information that was consistent with an existing hypothesis. The task was structured so that the vast majority of

[2] We distinguish the term *mind-set* from a similar term *mental model* on the basis of the context in which the cognitive process occurs. Mind-sets generally refer to cognitive processes that result from an unrelated, prior context (Gollwitzer et al., 1990), whereas mental models generally refer to cognitive processes that result from the current context (Klimoski & Mohammed, 1997).

groups initially preferred to proceed with the race, and it was only through the careful examination of data about the relationship between air temperature and engine failure that this hypothesis was disconfirmed (Brittain, Sitkin, & Neale, 1986). Therefore, groups would have to discover, seek out and utilize information that would disconfirm their initial preference in order to improve decision accuracy. By manipulating counterfactual mind-sets among group members prior to the commencement of the race task, we were able to examine whether such mind-sets influence how groups process information.

3. Method

3.1. Overview and design

The experiment involved two conditions: a counterfactual prime condition and a non-counterfactual prime condition. Acting as a racecar pit team, the task involved a group decision as to whether to go ahead with a scheduled race or to terminate the planned participation in the race.

3.2. Participants

Participants were 84 upper-division undergraduate business students enrolled in a course on group processes. Each group consisted of 3 students who had not previously interacted as a cohesive unit, which resulted in 28 groups. Individuals were randomly assigned to groups, and therefore not grouped according to demographic variables. Fifty-seven percent of participants were female. The exercise task took place as part of a classroom exercise during the midpoint of a 15-week course. Although not explicitly rewarded for their performance, the classroom environment contributed to participant engagement.

3.3. Procedure

Participants were divided into groups of three individuals and given separate workrooms for each group. Groups engaged in the Carter Racing exercise, written by Brittain and Sitkin (1986), which involves acting as members of a racecar team charged with deciding whether to go ahead with a race that was scheduled to begin in less than one hour. Although participants were unaware of the source of the data at the time in which they completed the task, the actual data presented to groups was obtained from the Report of the Presidential Commission on the Space Shuttle Challenger Accident and pertained to O-ring failures and air temperature (Brittain et al., 1986). Thus, groups who decided to go ahead with the race made a decision that was parallel to the decision to go ahead with the Space Shuttle Challenger launch.

3.4. Counterfactual mind-set manipulation

Prior to beginning the actual race team task, groups were instructed to engage in a "team building exercise." Embedded in the pre-task team building exercise was the manipulation of counterfactual primes. We based our manipulation on a scenario used by Galinsky and Moskowitz (2000). Participants in the counterfactual prime condition read a scenario in which the protagonist Sue was at a rock concert of her favorite band. Because her seat was not very close to the stage, Sue switched to a vacant seat in the third row. Shortly thereafter, the emcee walked out on stage and announced that a valuable prize would be awarded to one lucky winner. The woman then reached her hand into a receptacle filled with ticket stubs and announced the winner was the person who currently occupied Sue's old seat. In the non-counterfactual prime condition, a similar scenario was presented, except that Sue did not switch seats and the lucky winner was someone in a different seat altogether. Groups read the team building scenario together and were then asked to "list some thoughts running through Sue's mind" as a group. The sheet on which they listed their thoughts was numbered from 1 to 10, but groups were told to list only as many thoughts as came to their mind.

3.5. Group decision task

Upon completion of the pre-task scenario, groups were asked to read the materials for the racecar task together. The task contained several pages of description about the dilemma facing the race team, which involved deciding whether to go ahead with the race that would begin shortly. The experimenter informed each group that, after reading the materials, they were free to ask the experimenter for additional information that they thought necessary to decide on the race, but that they would have to be specific about the information they sought.

The race was described as important for the team because of the sponsorship, prize money and television exposure it promised. If the team did well they would be rewarded with a lucrative sponsorship deal. The problem that the team faced was that they had recently experienced a series of engine failures. If the engine were to fail on national television, the team could be doomed in terms of their current sponsorships. In addition, a threat of engine failure posed a considerable threat to the safety of the driver. In the scenario, the engine mechanic guessed that the engine failures were related to ambient air temperature but the chief mechanic disagreed. The engine mechanic believed that the risk of engine failure

was magnified in cold temperatures, and because it was below freezing the previous night, the team could be assured it would be a cold morning for starting the race. Groups were given a chart composed by the chief mechanic that purported to prove that there was no relationship between temperature and engine failure. The chart only contained information about the temperatures during the last 7 engine failures, which showed a range of temperatures (53–75°) and a mean temperature of 64°. Because the chart did not contain information about the air temperature when the car did not experience an engine failure, the chart was essentially inconclusive and ultimately misleading. To accurately assess the situation, groups had to recognize that the data they possessed was inconclusive. Once this fact was recognized, groups could ask the experimenter for the air temperatures when the engine had not failed. If they did so, the experimenter would provide them with an additional chart that showed the range of air temperatures for the last 17 races without an engine failure, which were clearly warmer than when engine failures did occur (range of 66–82°) and a mean temperature of 73°.

Upon reading the initial set of materials, individuals heavily favor racing because they believe that racing is crucial to elevating the status of the team and that the risks are worth the vast benefits that will accrue by doing well in the race (Brittain et al., 1986). Baseline data provided in the case notes (Brittain et al., 1986) suggests that 84% of individuals favor racing when no manipulation of mind-sets occurs. Given the overwhelming tendency to choose to race and the case description that clearly described racing as the preferred course of action among the race team, the opinion of the chief mechanic that air temperature is unrelated to engine failure can be viewed as confirmatory information that supports this decision to race. Thus, information concerning the temperature when the engine did not break down can be viewed as disconfirming information. Groups who have the complete set of data, which includes air temperatures when engine failures did and did not occur, overwhelmingly favor not racing. In addition to the information about air temperature, groups were given information about the potential financial payoffs and costs associated with racing versus not racing. From a purely financial perspective, going ahead with the race had the highest expected value if groups used the probabilities of engine failure ascertained by the chief mechanic who did not believe a temperature-engine failure relationship existed. For groups who had the complete set of data (disconfirmatory information included), the choice not to race had a significantly higher expected value than racing.

Groups were given 45 min to complete the task. In addition to indicating whether they had decided to go ahead with the race, groups were asked to list the reasons they saw in support of the decision to race versus not to race. Finally, groups indicated how confident they were that they had made the right decision on an 11-point scale, with endpoints of "confident that we made the wrong decision" and "confident that we made the right decision" and a midpoint of "neutral."

4. Results

4.1. Counterfactual activation

To determine whether the two versions of the Sue scenario produced different levels of counterfactual thoughts, two independent coders identified the number of thoughts listed by groups as to what might be going through Sue's mind that were counterfactual in nature (Galinsky & Moskowitz, 2000; Morris & Moore, 2000; Roese & Olson, 1996, 1997). We determined inter-rater reliability by computing an alpha score, which takes into account the number of raters. The reliability for counterfactual thoughts was high ($\alpha = .90$) and therefore the ratings of the two coders were averaged. As expected, groups in the counterfactual prime condition ($M = 1.10$) listed significantly more counterfactual thoughts than groups in the non-counterfactual prime condition ($M = .42$), $F(1, 26) = 15.02$, $p < .001$. On average, counterfactual mind-set groups constructed twice as many counterfactual thoughts as non-counterfactual mind-set groups.

4.2. Group decision

We hypothesized that, armed with a counterfactual mind-set, groups in the counterfactual prime condition would be more likely to correctly recognize the relationship between air temperature and engine failure, and therefore decide not to proceed with the race. The likelihood of making the correct decision to pull out of the race was significantly higher in the counterfactual prime condition ($M = 66.7\%$) compared to the non-counterfactual prime condition ($M = 23.1\%$), $\chi^2(n = 28, df = 1) = 5.32$, $p < .05$. Groups primed with a counterfactual mind-set were almost three times as likely to make the correct decision to not go ahead with the race compared to groups who had not been primed with counterfactual thinking.

4.3. Relationship between counterfactual thinking and decision accuracy

We also conducted an analysis to better understand the relationship between counterfactual activation and group decision accuracy. Consistent with our hypotheses, the number of counterfactual thoughts listed in the pre-decision task was positively related with group

decision accuracy, $r(28) = .48$, $p < .02$.[3] Groups who listed more counterfactual thoughts were less likely to make an erroneous group decision and continue with the race. When controlling for the amount of counterfactual activation with an analysis of covariance (ANCOVA), experimental condition no longer had a significant effect on group decision accuracy, $F(1, 25) = 1.25$, $p = .14$. Although not conclusive, this finding is consistent with the assertion that the effect of the activation of counterfactual mind-sets on group decision accuracy was mediated by counterfactual thoughts.

4.4. Decision justifications

To gain a better understanding of the nature of the task and the types of factors that influenced groups in their decision making process, we examined the number of times that groups listed air temperature as a reason to race versus not race with a repeated-measures ANOVA, including group decision as a between-groups factor. Consistent with the assertion that groups needed to recognize the relationship between air temperature and engine failures to make an accurate decision, the interaction between reasons to race versus not race and group decision was statistically significant, $F(1, 26) = 10.18$, $p < .001$. Groups who correctly pulled out of the race were more likely to list air temperature in the "reasons not to race" category ($M = 1.23$) than the "reasons to race" category ($M = .08$); groups who incorrectly continued to race did not differ in how they interpreted the air temperature information (Ms = .40 versus 40). We also examined the correlation between the number of reasons groups listed that suggested air temperature was related to engine failures and decision accuracy. The two were significantly related, $r(28) = .44$, $p < .05$. These findings suggest that the way groups interpreted the information about air temperature influenced their decision to race versus not race. Finally, we also examined whether the number of times groups mentioned air temperature as a reason to race versus not race differed across counterfactual and non-counterfactual prime conditions. It did not, $F < 1$, *ns*.

[3] It should be noted that we are not claiming that groups in a counterfactual-mind-set produced counterfactual thoughts (i.e., if–only thoughts) in their group discussion about whether to race. Counterfactual thoughts refer to past events. Instead, we are claiming that generating specific counterfactual thoughts in one context put group members into a counterfactual mind-set. This counterfactual mind-set is a cognitive orientation that involves mental simulation, consideration of alternatives and cognitive flexibility. The number of counterfactual thoughts expressed should increase the action potential, or activation strength, of the counterfactual mind-set (Bargh & Pietromonaco, 1982; Devine, 1989). Thus, the number of counterfactual thoughts generated in the concert scenario should correlate with decision accuracy.

4.5. Confidence judgments

Our final analysis involved group confidence judgments reported after the race decision was made. Overall confidence of groups in the accuracy of their decision did not differ across experimental conditions, but there was a trend for groups who decided to continue with the race ($M = 9.1$) to be more confident that they had made the correct decision than groups who decided not to race ($M = 8.2$), $F(1, 26) = 2.79$, $p = .11$. Groups that chose to race, and to potentially produce disastrous results, tended to be more confident, demonstrating that confidence and decision accuracy are not just unrelated, but are often negatively related (Lichtenstein, Fischhoff, & Phillips, 1982).

5. Discussion

This experiment examined one procedure for improving group decisions, which involves invoking a mind-set in group members that makes accessible thoughts of what might have been, or counterfactual thoughts. The counterfactual manipulation increased the accessibility of counterfactual thoughts, which had a facilitative effect on group decisions. Because the air temperature on race day was significantly lower than previous race days, and air temperature was associated with engine failures, the correct decision for groups was to abandon participation in the race. Upon an initial read of the race scenario, groups overwhelmingly favor racing (Brittain et al., 1986), and it is only through a careful search for disconfirmatory information that groups ultimately conclude not to race. Arming group members with a counterfactual mind-set before addressing the race issue reduced the error rate by more than half. Given that the data groups examined were actual data compiled following the Space Shuttle Challenger accident, data that were available prior to the launch, the implications from this set of findings are potentially far-reaching.

We have argued that counterfactual mind-sets have a facilitative effect on group decisions because they reduce the confirmation bias, or the tendency to seek information that is consistent with an existing hypothesis (Galinsky & Moskowitz, 2000; Snyder & Swann, 1978). We provided evidence that groups who chose not to continue with the race were more likely to list air temperature as a negative factor that spoke against racing than groups who chose to race, whereas groups who chose to race were more likely to list air temperature as an irrelevant or inconclusive factor that supported their decision to race. Given that the data initially presented to groups were consistent with the hypothesis that no relationship existed between air temperature and engine failure, and groups had to seek additional information

about air temperature when there were no engine failures, we can infer that it was groups who sought disconfirmatory information that chose not to race.

A remaining question concerns whether groups in the counterfactual mind-set condition were more successful in their group decision making due to an increased vigilance in obtaining disconfirmatory information. The lists generated by groups regarding the reasons to race and not to race did not differ across experimental conditions, which might suggest that the counterfactual mind-set prime did not affect the search for disconfirmatory information. Alternatively, the quantity of reasons generated might not be a precise gauge of the thought processes guiding groups because they might have included reasons that did not ultimately impact their decision. A better measure of the search for disconfirmatory information might be an assessment of whether groups specifically requested additional information about air temperature when no engine failures occurred, a measure we obtain in Experiment 2.

6. Experiment 2

The goals of this experiment were threefold. First, we aimed to replicate the finding from Experiment 1 that the activation of a counterfactual mind-set improves decision accuracy. Second, we aimed to gain a better understanding of the decision making process that is affected by the activation of a counterfactual mind-set. Experiment 1 explored the decision making process by examining the relationship between the perceived diagnosticity of air temperature and the group's decision. Because this measure only indirectly examines the search for disconfirmatory information, the current experiment aimed to document more directly the information search process of groups. To do so, we included a measure of information requests. Finally, we aimed to understand the mediating processes that affect the relationship between our manipulation of counterfactual priming and decision accuracy. Specifically, we examined the causal role of counterfactual activation in the relationship between experimental condition and disconfirmatory information requests. We also examined the causal role of disconfirmatory information search in the relationship between counterfactual activation and decision accuracy.

7. Method

7.1. Overview and design

The experimental design involved two conditions that were identical to the conditions in Experiment 1 (counterfactual prime; non-counterfactual prime).

7.2. Participants

Participants were 129 MBA and upper-division undergraduate students enrolled in courses on group processes. The exercise task took place as part of a classroom exercise during the midpoint of a 15-week course. Each group consisted of 3 students, which resulted in 73 groups. Individuals were randomly assigned to groups for this exercise, without regard to demographic variables. Thirty-five percent of participants were female. The same incentive structure from Experiment 1 was in place for the current experiment.

7.3. Procedure

The experimental task was identical to the one used in Experiment 1. In addition to measuring group decision accuracy, we also examined the decision making process more closely by recording information requests by groups. Recall that groups were encouraged to approach the experimenter (who was blind to experimental condition) to request additional information. In addition to recording the sheer number of requests made by groups for additional information, we also identified whether groups sought disconfirmatory information. Groups who specifically asked, "What was the air temperature for races in which the engine did not fail?" were given a chart that contained this disconfirmatory information. An example of a request for non-disconfirmatory information is the question, "What is the air temperature at race time?" This type of information request was not regarded to be disconfirmatory because: (a) groups already had this information in their materials; and (b) it would not help diagnose whether there was a relationship between air temperature and engine failures. We recorded whether groups asked for the disconfirming information regarding the temperature when the engine did not break down as well as the total number of information requests.

8. Results

8.1. Counterfactual activation

To determine whether the two versions of the Sue scenario produced different levels of counterfactual thoughts, two independent coders identified the number of thoughts listed by groups as to what might be going through Sue's mind that were counterfactual in nature. The reliability for counterfactual thoughts was high ($\alpha = .88$) and therefore the ratings of the two coders were averaged. As in Experiment 1, groups in the counterfactual prime condition ($M = .79$) listed significantly more counterfactual thoughts than groups in the non-counterfactual prime condition ($M = .27$), $F(1, 69) = 19.89$, $p < .001$.

8.2. Group decision

Replicating the results of Experiment 1, the likelihood of making the correct decision to pull out of the race was significantly higher in the counterfactual prime condition ($M = 39.5\%$) compared to the non-counterfactual prime condition ($M = 15.2\%$), $\chi^2(n = 71,\ df = 1) = 5.16$, $p < .05$.[4]

8.3. Information search

To test the hypothesis that the activation of a counterfactual mind-set increases the search for disconfirmatory information, we examined if the counterfactual prime manipulation influenced whether groups requested information regarding air temperatures during races in which the engine had not failed. As expected, groups in the counterfactual prime condition ($M = 44.7\%$) were significantly more likely to request this information compared to groups in the non-counterfactual prime condition ($M = 18.2\%$), $\chi^2(n = 71,\ df = 1) = 5.69$, $p < .05$. To determine whether this effect was merely a by-product of groups in the counterfactual prime condition making more information requests in general, rather than a focused search for disconfirmatory information, we also examined the number of information requests made by groups across conditions. Contrary to this alternative explanation, the difference in the number of information requests between counterfactual prime groups ($M = 2.97$) and non-counterfactual prime groups ($M = 2.86$) was not reliable, $F < 1$, *ns*.

8.4. Mediation analysis

To gain a better understanding of the process by which the manipulation of counterfactual mind-sets in group members increased decision accuracy of groups, we conducted two sets of mediation analyses (see Fig. 1). First, we examined whether the relationship between experimental condition and disconfirmatory information search was mediated by the activation of counterfactual thoughts. Second, we examined whether the relationship between counterfactual activation and decision accuracy was mediated by the search for disconfirmatory information. To examine each of these relationships, we followed the procedure specified by Baron and Kenny (1986).

We propose a process whereby exposure to a counterfactual scenario increases the number of counterfactual thoughts in response to the scenario, which subsequently increases mental simulations and the consideration of alternatives. In the context of the current task, evidence of these processes is found by considering the search for disconfirmatory information.

To examine the relationship between experimental condition, counterfactual activation, and disconfirmatory information search, we conducted three regression equations. First, regressing counterfactual activation on experimental condition was statistically significant, $\beta = .47$, $t(69) = 4.46$, $p < .05$. Second, regressing disconfirmatory information search on experimental condition was statistically significant, $\beta = .28$, $t(69) = 2.45$, $p < .05$. Third, regressing disconfirmatory information search on both experimental condition and counterfactual activation rendered counterfactual activation statistically significant, $\beta = .28$, $t(69) = 2.20$, $p < .05$, but not experimental condition, $\beta = .15$, $t(69) = 1.18$, *ns*. Exposure to a scenario in which counterfactual thoughts were relevant increased the accessibility of counterfactual thoughts, which subsequently affected the search for disconfirmatory information.

Our next set of analyses examined whether disconfirmatory information search mediated the effect of counterfactual activation on decision accuracy. First, regressing disconfirmatory information search on counterfactual activation was statistically significant, $\beta = .35$, $t(69) = 3.12$, $p < .01$. Second, regressing decision accuracy on counterfactual activation was statistically significant, $\beta = .29$, $t(69) = 2.50$, $p < .02$. Third, regressing decision accuracy on both counterfactual activation and disconfirmatory information search rendered disconfirmatory information search statistically significant, $\beta = .69$, $t(69) = 7.49$, $p < .001$, but not counterfactual activation, $\beta = .05$, $t(69) = .50$, *ns*. Amount of counterfactual activation was related to the search for disconfirmatory information, and it was this search for disconfirmatory information that improved decision accuracy. In other words, the effect of counterfactual activation on decision accuracy was mediated by the search for disconfirmatory information.

9. Discussion

The current experiment extends our understanding of how counterfactual mind-sets improve decision accuracy. First, we demonstrated the robustness of the effect of counterfactual mind-sets on decision accuracy by replicating the findings from Experiment 1. To aid in the understanding of this effect, the current experiment shows that the activation of a counterfactual mind-set in one context increased the propensity of groups to engage in mental simulations and to consider alternatives in a later, unrelated context. Groups in the counterfactual mind-set condition were more likely to explore the

[4] It is worth noting the difference in the magnitude of the debiasing effect across the two experiments. Although no theoretical reason is offered for this difference, we can speculate that the fact that the data were collected at different universities with different subject populations and by different experimenters affected accuracy rates.

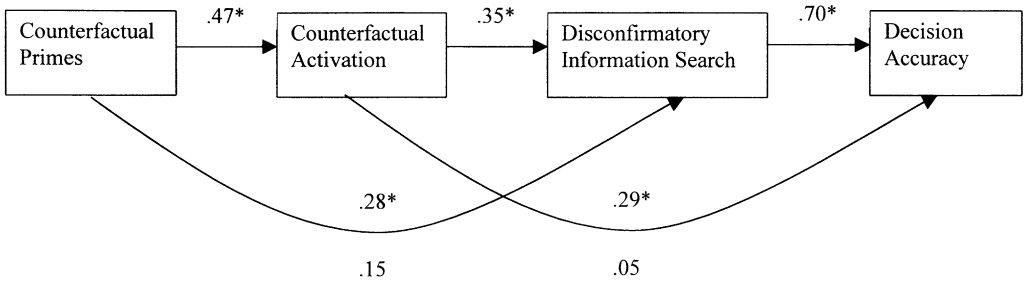

Fig. 1. Mediation analysis for Experiment 2.

converse of the existing hypothesis asserted by the chief mechanic that no relationship existed between air temperature and engine failures. Evidence of this disconfirmatory information search was obtained by examining the requests made by groups for additional information. A critic might argue that the implementation of a counterfactual mind-set is of limited use as a tool for improving group decisions in situations in which information seeking is costly because the mind-set leads to the greater consideration of both relevant and irrelevant information. By examining the raw number of requests made by groups for additional information to the experimenter, we ruled out this possibility because no differences were observed across experimental conditions in the number of information requests made. Evidence of this focused search is consistent with work by Galinsky and Moskowitz (2000) in which counterfactual mind-sets increased the selection of hypothesis relevant, disconfirming questions without increasing the selection of neutral and hypothesis irrelevant questions in an individual hypothesis testing task. Counterfactual mind-sets appear to lead to the selective search and discussion of critical information.

The final goal of this experiment was to elucidate the mediating mechanisms by which counterfactual priming affects decision accuracy. Consistent with our hypotheses, exposure to Sue switching seats at the rock concert scenario increased the search for disconfirmatory information via the increased accessibility of counterfactual thoughts. Also consistent with our model, the activation of counterfactual thoughts improved decision accuracy via the search for disconfirmatory information. These mediation analyses suggest a clear path by which our experimental manipulation of counterfactual priming improved decision accuracy: counterfactual primes increased the number of counterfactual thoughts, which increased the search for disconfirmatory information, which ultimately increased decision accuracy.

10. General discussion

This paper extends our understanding of group decision making and builds on the existing literature in a number of important ways. Unlike previous research that structured the group members' cognitive orientation within the group task (Stasser & Stewart, 1992), the current experiments manipulated cognitive orientations with one task and examined their effect on a subsequent task, demonstrating that exposure to a counterfactual scenario in ore context can affect group decision making in an unrelated context. Another important contribution involves extending research on counterfactual mind-sets to the group domain. Whereas previous research established that counterfactual mind-sets affect individual decision making (Galinsky & Moskowitz, 2000), the current research demonstrates the counterfactual mind-sets can be activated in the minds of group members and affect group problem solving behavior. Regardless of whether group members or individuals are exposed to counterfactual primes and whether the problem solving task is undertaken at the group or individual level, the activation of a counterfactual mind-set promotes mental simulation and the consideration of alternatives. Counterfactuals appear to be a powerful mechanism for guiding group information processing and, ultimately, group decisions.

We have argued that counterfactual mind-sets have the effect that they do because they lead to mental simulations and the consideration of alternatives. That is, thinking about what almost did happen or might have happened in one context allows people in a later context to simulate what might be or might happen (Hirt & Markman, 1995; Kahneman & Tversky, 1982). An alternative explanation is that the counterfactual scenario in which Sue lost out un a valuable prize because she switched seats simply impacted the group's sensitivity to risk. If staying in one's assigned seat is considered more cautious than moving forward to an unassigned seat, the message from the scenario might be that it pays to be cautious. Thus, the manipulation might lead groups to be more cautious in future endeavors, and therefore decide not to go ahead with the race. To address this concern, Galinsky et al. (2000) asked participants to judge the probability of a plan succeeding after being exposed to the rock concert manipulation, and observed no differences across the two versions of the scenario, which suggests that counter-

factual primes do not affect risk assessments. Counterfactuals appear to prime the process of mental simulation, which affects subsequent judgments and decisions, and do not directly make people risk averse.

Galinsky and Kray (2003) examined the impact of counterfactual mind-sets on information sampling within groups using a task in which all elements of risk were removed. Previous research has shown that group discussions are characterized by the tendency to focus on commonly shared information to the relative detriment of uniquely held information (Larson, Foster-Fishman, & Keys, 1994; Stasser & Stewart, 1992; Stasser & Titus, 1985; Winquist & Larson, 1998). Using a murder mystery task in which groups sought to identify the correct murder suspect, Galinsky and Kray demonstrated that counterfactual mind-set groups were more likely to share information that was unique to one group member and were more likely to correctly identify the murderer than non-counterfactual mind-set groups. Counterfactual mind-sets alter the search and sharing of information in groups rather than simply decreasing the propensity to take risks.

Another alternative explanation for our findings concerns the different mood states that may have resulted from exposure to our counterfactual scenarios. In both experiments, our manipulation of counterfactual thoughts involved an upward counterfactual, or comparisons to a better alternative to reality. If Sue had not switched seats, she would have won the valuable prize. Roese (1994) argues that upward counterfactuals elicit negative affect, such as disappointment and regret, and that these negative emotions serve a preparative function for future tasks. If the elicitation of these emotions dampened group members' moods, then this could explain why counterfactual mind-set groups appear to have engaged in more careful, deliberative processing of information (Mackie & Worth, 1989; Schwarz & Bless, 1991).

To address this concern, Galinsky and Kray (2003) conducted an experiment in which the counterfactual manipulation was downward, rather than upward, in nature. Whereas upward counterfactual thoughts occur when an individual compares the current reality to a better possible world, downward counterfactual thoughts occur when an individual compares his or her own outcome to a worse possible alternative. Upward counterfactuals evoke emotional reactions that include feelings of regret and disappointment. Downward counterfactuals, on the other hand, tend to produce positive emotions ranging from increased joy to a sense of relief because one avoided an alternative negative outcome (Medvec & Savitsky, 1997; Roese, 1994). Galinsky and Kray altered the Sue at the rock concert scenario such that Sue switched seats and, by doing so, won the valuable prize. In the non-counterfactual condition, Sue did not switch seats and her original seat was the winner. In both scenarios Sue won the trip, but only when she switched seats were counterfactual thoughts generated. Despite the difference in mood states that upward and downward counterfactuals produce, their findings on the debiasing effect of counterfactual mind-sets held true with both upward and downward scenarios, suggesting mood is not the driving force behind the group decision making effects. Type of counterfactual prime, upward versus downward, has also been manipulated in the individual problem solving domain, and across a variety of unique problems, no differences have been observed in the strategies and outcomes obtained between upward and downward counterfactual conditions (Galinsky & Moskowitz, 2000; Galinsky et al., 2000). These results suggest that it is the cognitive process of engaging in counterfactual thinking, namely mental simulation and consideration of alternatives, and not the affective reaction associated with the direction of the counterfactual thoughts, that affects decision making.

Why does activating a mind-set, whether it is deliberation, impression management, or mental simulation, persist from one context to a later, unrelated one? Once activated, a mind-set endures because it is a well-learned functional strategy for comprehending the world (Gollwitzer et al., 1990). Roese (1994) suggests that counterfactual thinking is functional because it assists in performing goal-directed behavior. A counterfactual mind-set, like other mind-sets, affects subsequent decisions even when the later context is functionally unrelated and irrelevant to the context that activated counterfactual thoughts. Winning or losing trips to Hawaii after switching seats and focusing on alternative hypotheses that air temperature and engine failure are related (and that the information currently possessed is insufficient to determine this relationship) are not logically connected. But in seeing a person switch seats and lose, one becomes aware of both the actual outcome and its converse alternative. It is the process of recognizing both reality and its divergent possibilities with counterfactual activation that leads participants to see and seek both confirming and disconfirming information.

Although counterfactual mind-sets influence decision accuracy, they appear not to lead to greater calibration of decision accuracy judgments. The observed disconnection between accuracy and confidence lends support to the assertion that counterfactual mind-sets operate on an implicit level among group members. Groups do not appear to have been aware of the benefit they derived from exposure to a counterfactual. In fact, there was a trend for groups who made the correct decision in Experiment 1 to be less confident in their decision accuracy than groups who made the wrong decision. The ability of individuals to correctly predict their level of accuracy has been shown to improve by imposing a variant of the devil's advocacy strategy, wherein a decision maker is

presented with the opinion of an expert and a subsequent critique of that opinion from another expert (Cosier, 1978). A comparison of that finding with the current findings leads us to speculate about a relationship between awareness of a decision making structure and confidence in decision accuracy. We suggest that decision confidence is derived in part from an assessment by group members of the decision making process undertaken, which can be strongly influenced by experimental manipulations. A number of contextual features, such as familiarity with the task, can increase subjective perceptions of accuracy without actually increasing objective accuracy (Lichtenstein et al., 1982). Experiencing the effect of a devil's advocate during group discussion can lead people to believe (correctly) that a greater variety of information has been shared. The influence of a counterfactual mind-set is not so directly experienced during group discussion and therefore confidence levels do not rise to match accuracy. Future research should explore the relationship between decision accuracy, confidence, and awareness of the processes initiated by counterfactual mind-sets (see also Galinsky et al. (2000) for a discussion of the differentiation of mind-set primes from semantic construct primes).

10.1. Future directions and limitations

Whereas the current set of experiments provide compelling evidence that counterfactual mind-sets improve decision accuracy, several aspects of the experimental paradigm speak to the generalizability of the findings. First, the exclusive use of student participants in our sample who did not have a history of interactions and had little investment in their decision begs the question of whether the effect of counterfactual mind-sets would be as robust in organizational settings. In this type of environment, group members might have more experience interacting together, and might be affected by a variety of phenomena, such as sunk costs and political pressures, all of which could limit the degree to which their decision making process is susceptible to counterfactual primes.

This limitation of the current set of experiments speaks to several directions for future research. Expanding the participant sample to include existing groups with considerable experience working together would be a worthwhile endeavor. Also, comparing the effect of counterfactual mind-sets to more deliberate group decision making interventions would speak to the relative power of counterfactual mind-sets as a debiasing tool. For example, the devil's advocate strategy involves assigning a group member the task of challenging other group members' ideas. Like counterfactual mind-sets, the devil's advocacy strategy leads to the consideration of more alternative solutions to a problem, which results in higher quality decisions (Valacich & Schwenk, 1995). Similarly, the "consider the opposite strategy" for debiasing individual judgments (Lord, Lepper, & Preston, 1984; Mussweiler, Strack, & Pfeiffer, 2000) works by consciously redirecting the focus of decision making to alternative states of reality. Whereas these debiasing techniques involve the deliberate introduction of contrary information, counterfactual mind-sets require that group members seek out information on their own, without encouragement or direction from the experimental manipulations themselves. Counterfactual mind-sets appear to work at an implicit level, below the conscious awareness of group members—in all of the experiments by Galinsky et al. (2000) and Galinsky and Moskowitz (2000) none of the participants made a connection between the counterfactual primes and the subsequent decision making or impression formation context. Comparing the relative strengths and weaknesses of various decision making interventions will allow practitioners to understand the circumstances under which one strategy is preferable. For example, a group whose decision making structure is fairly well set might hesitate to assign a group member the role of devil's advocate, yet invoking a counterfactual mind-set in group members might be effective for subtly improving information processing.

On a practical level, this research leaves open the question of how groups might naturally invoke a counterfactual mind-set. If a group member deviates from her normal route on her way to work and encounters a traffic jam, then is she more likely to seek disconfirmatory information in a subsequent group discussion? Future research might profitably explore how counterfactual mind-sets naturally occur and the consequences of different methods for activating such mind-sets. An open question is whether all members of a group must be in a counterfactual mind-set in order for its facilitative effect to come to fruition, as opposed to a minority of group members. Going back to the devil's advocacy strategy and to research on minority influence (Nemeth, 1986; Stewart & Stasser, 1998), there is reason to believe that a vocal minority of group members who have experienced a counterfactual recently is enough to guide the group in a productive direction, but this remains an empirical question.

Although mental simulations, like other mind-sets (Gollwitzer et al., 1990), are functional, in that they assist in goal-directed behavior, a counterfactual mind-set will not always have beneficial effects on the decision making process and decision accuracy. Galinsky and Moskowitz (2000) suggested that counterfactual mind-sets can both bias and debias thought and action, depending on the nature of the task (see also Galinsky, Seiden, Kim, & Medvec, 2002). Counterfactual primes can lead to the discovery of hidden solutions but also hidden errors. For example, there is often a relationship between rumination and counterfactual thinking (Sher-

man & McConnell, 1995). One possibility is that self-relevant counterfactuals may lead to rumination and concomitant narrowing of focus, which could have a negative impact on the process of making certain decisions. The role of counterfactual primes in debiasing thought has been likened to the effects of accountability (Tetlock, 1992). Accountability often leads individuals to think in flexible, multidimensional ways, but it can lead to a rigid defense of positions and actions (Tetlock, Skitka, & Boettger, 1989) and can lead to reliance on non-diagnostic information (Tetlock & Boettger, 1989). Although in the present experiment counterfactual primes increased the decision accuracy of groups, it is important to explore the group decision making contexts in which counterfactual mind-sets will lead to decreased decision accuracy.

10.2. Conclusion

When the Space Shuttle Challenger launched into the Florida sky that historic day in 1986, the individuals comprising the decision making group for the mission had available to them a host of information suggesting the air temperature was too cold to warrant a safe lift-off. Yet it was not until after the tragic explosion that this decision making group systematically examined and gave proper weight to information that would disconfirm the existing belief that it was safe to launch. Perhaps it is the exception to the norm to have all information—both confirmatory and disconfirmatory—available in a decision making group. Counterfactual mind-sets appear to provide one mechanism for groups to more effectively harness the vast information available to them to make high quality decisions.

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