Cooperative Criticism: When Criticism Enhances Creativity in Brainstorming and Negotiation

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Abstract. Long-standing wisdom holds that criticism is antithetical to effective brainstorming because it incites intragroup conflict. However, a number of recent studies have challenged this assumption, suggesting that criticism might actually enhance creativity in brainstorming by fostering divergent thinking. Our paper reconciles these perspectives with new theory and a multimethod investigation to explain when and why criticism promotes creativity in brainstorming. We propose that a cooperative social context allows criticism to be construed positively, spurring creativity without inciting intragroup conflict, whereas a competitive social context makes criticism more divisive, leading to intragroup conflict and a corresponding reduction in creativity. We found support for this theory from a field experiment involving 100 group brainstorming sessions with actual stakeholders in a controversial urban planning project. In a cooperative context, instructions encouraging criticism yielded more ideas and more creative ideas, whereas in a competitive context, encouraging criticism yielded fewer ideas and less creative ideas. We replicated this finding in a laboratory study involving brainstorming in the context of a union-management negotiation scenario, which allowed us to hold constant the nature of the criticism. Taken together, our findings suggest that the optimal context for creativity in brainstorming is a cooperative one in which criticism occurs but is interpreted constructively because the brainstorming parties perceive their goals as aligned.

Creativity is so delicate a flower that praise tends to make it bloom while discouragement often nips it in the bud.

(Osborn 1948, p. 103)

Permission to critique, even criticize, can create an atmosphere of freedom and enhance the generation of creative ideas.

(Nemeth et al. 2004, p. 367)

In almost every organizational setting, creative ideas can benefit all parts of an organization to help it achieve its goals (Woodman et al. 1993, Amabile et al. 2005). As such, the process of creativity has taken center stage in research on organizational innovation (Sauermann and Cohen 2010, Boudreau and Lakhani 2016, Keum et al. 2017). Group creativity in particular is fundamental for generating innovative ideas (Sutton and Hargadon 1996, Paulus and Nijstad 2003, Hargadon and Bechky 2006). An increasing number of managerial tasks are accomplished by groups (Woolley et al. 2010), and online platforms or large-scale innovation contests that require group creativity

are becoming more prevalent (e.g., Jeppesen and Lakhani 2010, Boudreau et al. 2011). For more than 60 years, the most widespread approach to generating creative ideas in groups has been the process of "brainstorming" (Isaksen and Gaulin 2005, Coskun and Yilmaz 2009, Putman and Paulus 2009, Lehrer 2012, Henningsen and Henningsen 2013), which is defined as "a conference technique by which a group attempts to find a solution for a specific problem by amassing all the ideas spontaneously contributed by its members" (Osborn 1963, p. 151).

The cornerstone of group brainstorming, as originally conceived by Alex Osborn in the 1940s (Osborn 1948), was freewheeling, nonjudgmental thinking, which many believe is best achieved by explicitly prohibiting criticism. For example, at the renowned product design firm IDEO, observers noted that while employees were brainstorming ideas, a facilitator rang a bell whenever a project team member criticized another team member's idea because of the firm belief that unchecked criticism would undermine the quality

of ideas (Kelley and Littman 2001). A similar belief about the importance of prohibiting criticism during idea generation persists in the field of negotiation, a process of decision making in which two or more parties communicate to resolve their opposing interests (Pruitt 1983). In negotiation, brainstorming without criticism is widely prescribed to help parties generate creative options for mutual gain (Fisher et al. 1991, Lewicki et al. 1996, Susskind et al. 1996, Mnookin et al. 2000).

Because the absence of criticism is such a prevalent, defining feature of brainstorming in organizational contexts ranging from product design to negotiation, it is striking that theorists nevertheless disagree about whether criticism obstructs or improves creativity (Goldenberg and Wiley 2011). One school of thought warns that criticism can lead to interpersonal tensions, such as evaluation apprehension (i.e., a fear of negative appraisal), which can undermine group productivity (Maginn and Harris 1980, Diehl and Stroebe 1987, Mullen et al. 1991). However, another set of theorists postulate that criticism during brainstorming can prevent groupthink and conformity, thereby enabling divergent thinking (Connolly et al. 1990, Nemeth et al. 2004). We aim to reconcile these opposing viewpoints by empirically testing whether the effect of criticism on creativity in brainstorming depends on context. Specifically, we examined the moderating role of goal interdependence—that is, the extent to which group members' goals are compatible (fostering a cooperative context) versus oppositional (fostering a competitive context; Deutsch 1949, 1973; see also Tjosvold 1998).

Our research contributes to organization theory in two important ways. First and foremost, we reconcile a long-standing debate in the brainstorming literature about how criticism affects group creativity, qualifying the long-held conventional wisdom that criticism should be ruled out during idea generation. Although scholars have made many advances in brainstorming research over the past few decades (for recent reviews, see Paulus et al. 2016, Williams et al. 2016), almost no prior studies have directly tested whether criticism should be encouraged or prohibited (Litchfield 2008).

Second, our research contributes to negotiation theory, because creativity plays a fundamental role in the process of group problem-solving and conflict resolution (Kurtzberg 1998, Wilson and Thompson 2014). Specifically, our research qualifies a prominent theory in the negotiation field that brainstorming without criticism facilitates the generation of creative options for resolving disputes (e.g., Fisher et al. 1991, Lewicki et al. 1996, Mnookin et al. 2000).

Should Criticism Be Discouraged or Encouraged During Brainstorming?

Given the debate about the role of criticism in brainstorming, one might expect there to be a large body of empirical research investigating the effect of criticism instructions on creativity in group brainstorming. Yet very few studies have tested experimentally the effect of encouraging versus prohibiting criticism in brainstorming (Litchfield 2008); of those that do exist, their findings contradict one another. For example, an early yet frequently cited study by Weisskopf-Joelson and Eliseo (1961) found that groups instructed to criticize generated fewer ideas than did groups instructed to remain noncritical (see also Parnes and Meadow 1959, D'Zurilla and Nezu 1980). By contrast, a more recent study by Nemeth and colleagues (2004, p. 369) showed that brainstorming groups generated more ideas when they were encouraged to "debate and even criticize each other's ideas" than when they were instructed to avoid criticism.[1]

Another relevant line of research, although not on criticism per se, compared the productivity of brainstorming groups versus nominal groups (i.e., the same number of individuals generating ideas by themselves). The underlying assumption of group brainstorming is that people in groups can contribute their expertise and draw upon one another's diverse perspectives to collaboratively generate novel and useful ideas (Osborn 1948, Nemeth and Wachtler 1983, Nemeth 1997, Page 2008). However, an abundance of research demonstrates that groups of individuals working together produce fewer and less creative ideas than the same number of individuals working alone (Taylor et al. 1958, McGrath 1984, Diehl and Stroebe 1987, Putman and Paulus 2009). Several theorists assert that this difference arises from the naturally occurring criticism that transpires among members of a group with diverse viewpoints, causing evaluation apprehension and production blocking, which can undermine group creativity (Maginn and Harris 1980, Diehl and Stroebe 1987, Seta et al. 1991, Paulus and Dzindolet 1993, Brown and Paulus 1996).

Research on criticism and negative feedback conducted outside the group brainstorming context suggests that criticism can lead to perceptions of conflict (Baron 1988, Raver et al. 2012), which may have negative consequences in a group setting. For example, conflict may lead to weakened group solidarity (Seta et al. 1991), a decrease in trust among members within the group (Paulus and Dzindolet 1993), and evaluation apprehension (Maginn and Harris 1980, Diehl and Stroebe 1987, Mullen et al. 1991, Camacho and Paulus 1995).

On the other hand, an abundance of studies suggest that intragroup conflict is not always detrimental for

group performance and creativity (e.g., Simons and Peterson 2000, Jehn and Bendersky 2003, De Dreu 2006, Bradley et al. 2012; for reviews, see Van Dyne et al. 2002 and Rispens 2014). Under certain circumstances, intragroup conflict could lead to behaviors that are positively associated with creativity or group performance, such as revealing previously unshared information (London 1975, Postmes et al. 2001, Page 2008), engaging in counterfactual thinking (Wong et al. 2010), and embracing paradoxical frames (Miron-Spektor et al. 2011). Nemeth and Nemeth-Brown (2003) theorized that minority dissent (i.e., expressing opposition to the majority opinion) should be encouraged in group brainstorming because it fosters divergent thinking (see also Asch 1956, Nemeth 1986). An environment in which opposing viewpoints challenge one another might lead to "creative abrasion," which in turn could foster innovation (Hirschberg 1999, Hill et al. 2014). For example, Connolly and colleagues (1990) found that groups with a critical confederate (i.e., a "devil's advocate") generated more ideas than groups with a supportive confederate (see also Janis 1972, De Dreu and West 2001, Nemeth et al. 2001, Huang et al. 2015).

In short, very few studies and an abundance of theory offer conflicting evidence and perspectives regarding whether criticism should be encouraged or discouraged in brainstorming. Encouraging criticism may lead to interpersonal tensions that could hinder creativity, yet encouraging criticism may also lead to divergent thinking and thus greater creativity.

The Moderating Effect of Goal Interdependence

The brainstorming literature does not clearly identify under which circumstances criticism is beneficial versus detrimental for group creativity. However, research on intragroup conflict sheds some light on this question. Many conflict scholars have argued that the effect of intragroup conflict on group performance is contingent on factors such as social context (Bradley et al. 2012), conflict intensity (De Dreu 2006, Farh et al. 2010, Weingart et al. 2015), and conflict type (Jehn 1995, De Dreu and Weingart 2003, De Wit et al. 2012; for reviews, see Jehn and Bendersky 2003 and Rispens 2014).

In a comprehensive integration of prior theories and frameworks on conflict and performance, Tjosvold et al. (2014) argued that conflict tends to be more productive in mutually beneficial relationships. Of particular relevance to group brainstorming, Tjosvold's (1998, 2008) theory of constructive controversy holds that cooperative (versus competitive) contexts can transform the effect of conflict on group performance. Specifically, Tjosvold (1998) theorized that conflict

in a cooperative social context tends to be constructive, involving open-minded discussion of diverse perspectives (which Tjosvold calls "cooperative conflict"), whereas conflict in a competitive social context is typically destructive, involving closed-minded discussion and coercion (which Tjosvold calls "competitive conflict"; see also Deutsch 1973, Lovelace et al. 2001, Beersma and De Dreu 2005). Tjosvold's theory does not distinguish between conflict types (see also De Dreu and Weingart 2003, De Wit et al. 2012, Carton and Tewfik 2016). Rather, what we refer to in this paper as "intragroup conflict," Tjosvold and colleagues would call "competitive conflict" (Tjosvold et al. 2014), which has been found to be highly correlated with both task conflict (i.e., disagreements over content) and relationship conflict (i.e., interpersonal tensions; Jehn 1995, Tjosvold et al. 2006).

Of course, criticism is not the same as conflict; but as mentioned earlier, criticism may give rise to conflict (Baron 1988), especially when criticism co-occurs with competitiveness (Raver et al. 2012). In a study of negative feedback (defined synonymously with criticism; Baron 1988), Raver and colleagues (2012) found that negative feedback paired with trait competitiveness impeded individuals' performance on a complex task because it led to attributions of malevolent intent and blame, which can escalate perceptions of conflict (see also Baron 1988, Kluger and DeNisi 1996, Andersson and Pearson 1999). These findings suggest that criticism (like conflict) may interact with competitiveness to impede performance. Accordingly, we reasoned that in group brainstorming, competitiveness would be associated with negative attributions of criticism, leading to the potential for conflict and an associated reduction in creativity, whereas cooperativeness would allow criticism to be construed more positively.

Whereas Raver and colleagues explored trait competitiveness, our study examined competitiveness brought about by the situation, drawing upon research highlighting the importance of social context in group creativity (e.g., George 2007, Goncalo and Duguid 2012, Zhou and Hoever 2014, Goncalo et al. 2015). Specifically, we used Deutsch's construct of positive versus negative goal interdependence to operationalize situational cooperativeness versus competitiveness, respectively (Deutsch 1949, 1973). Positive goal interdependence exists in a group when participants' goals are largely "promotively interdependent," meaning that members have compatible interests, a situation that fosters a cooperative context. Negative interdependence exists in a group when goals are largely "contriently interdependent," meaning that members have opposing interests, a situation that fosters a competitive context (Deutsch 1949, p.132; see also Deutsch 1973).[2]

In summary, extending previous research on conflict and group performance, we predicted that goal interdependence (i.e., whether the situational context is cooperative versus competitive) would moderate the effect of criticism on creativity in group brainstorming. Criticism in a competitive context is likely to be construed negatively, triggering intragroup conflict and undermining creativity. Conversely, criticism in a cooperative context is likely to be construed positively (or at least not as negatively), fostering divergent thinking and spurring creativity without inciting intragroup conflict. In other words, we hypothesized that goal interdependence would moderate the mediating effect of intragroup conflict on the association between criticism and creativity.

Our theoretical model is depicted in Figure 1 and summarized in the following three hypotheses:

Hypothesis 1. *Goal interdependence (i.e., whether the context for brainstorming is cooperative versus competitive) moderates the effect of criticism on the number of ideas generated during brainstorming.*

Hypothesis 2. *Goal interdependence moderates the effect of criticism on the creativity of ideas generated during brainstorming.*

Hypothesis 3. *The conditional effect of criticism on creativity is mediated by intragroup conflict.*

Overview of Studies
We tested these hypotheses across two studies with different settings and complementary methodological strengths. Whereas most studies of brainstorming involve undergraduate participants engaging in thought experiments or considering topics of limited importance to their lives (Kavadias and Sommer 2009, Goldenberg and Wiley 2011), Study 1 was a field experiment with a high level of ecological validity. We were fortunate to have access to the planning process of a controversial urban redevelopment project, which enabled experimental manipulations of brainstorming instructions provided to groups of actual stakeholders.

Figure 1. Conceptual Model (Moderated Mediation)

We also recorded each group's interaction and coded transcripts for the presence of intragroup conflict, our proposed mediator, as well as the number and creativity of ideas generated. Study 2 tested the generalizability of our model by exploring brainstorming in a different setting (i.e., a negotiation), measuring a different kind of creativity, and using a different method for rendering the context cooperative versus competitive. Specifically, we gave laboratory participants a union-management conflict scenario with the potential for a creative, mutual-gain solution. This laboratory setting allowed us to control for the nature of the criticism. In both studies, we explored the moderating effect of goal interdependence, hypothesizing that criticism in a competitive context would result in less creativity, whereas criticism in a cooperative context would result in more creativity.

Study 1
Study 1 took place at a private university in the Northeastern United States, where university administrators were convening brainstorming sessions regarding a plan for redesigning its urban campus. This project involved many controversial issues, such as the construction of affordable graduate student housing, commercial development encroaching upon academic spaces, and gentrification. An important element of the public planning process was the gathering of thoughts, feedback, and concerns from the university and local community members, which included university faculty, staff, and students, as well as local residents, business owners, and other types of employees.

The university hosted eight public forums, each drawing 30–60 people, most of whom had a personal stake in the outcome. We recruited participants from these public forums and advertised using relevant community group email lists and flyers. To qualify for the study, an individual had to be at least 18 years of age and either affiliated with the university, involved in the planning process, or residing or working in the affected urban area. Each participant received $25 for their involvement in the study.
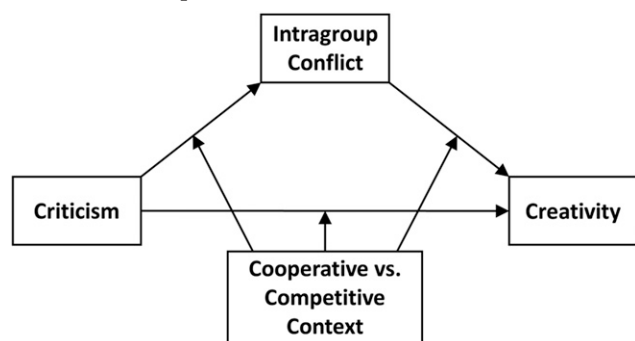
Method
Participants
Our prespecified stopping rule was 100 groups, a number determined based on effect sizes from related research. Given our design, this targeted sample size would provide 80% power to detect a medium-sized effect (Cohen's $d = 0.5$) based on Cohen's (1988) classification. The number of participants per group was determined by the number of sign-ups minus no-shows, and subject to the constraint that each group would have two to six members, resulting in a total of 422 participants (203 males and 219 females).

Of these participants, 176 were affiliated with the university, of which 32% were undergraduates, 27% were graduate students, 29% were staff, 11% were alumni, and 1% were faculty. Of the 246 individuals who were not affiliated with the university, 45% were residents of the affected neighborhoods and 41% worked in the affected neighborhoods. The participants self-identified as white (67%), Asian (21%), African American (13%), and/or Latinx (7%). One group was dropped from the analysis because its members failed to complete their surveys and responses could not be reconciled with certainty.

Design and Procedure

A researcher escorted participants to a room with a large map and photographs of the development areas as well as a table with a timer on it. The researcher explained to the group members that they were to brainstorm ideas for the university's urban redesign project and that their ideas would be shared with university planners. Groups were instructed to list their ideas on a flipchart.

The researcher then set the timer for 20 minutes and left the room. A research assistant video recorded and observed each brainstorming session through a one-way mirror. After 20 minutes, the researcher reentered the room and ended the brainstorming session. Participants then individually completed a postsurvey that assessed their perceptions of the session and collected demographic information.

Experimental Manipulations

To manipulate criticism and goal interdependence, we employed a 2 (criticism instructions) × 2 (goal interdependence) between-group factorial design. In the sections below, we describe our experimental manipulations of criticism instructions and goal interdependence, respectively.

Criticism Instructions Manipulation. All participants were told, "Most research suggests that the best way to come up with good solutions is to come up with many solutions." In the criticism-discouraged condition, participants were also told, "Experts have long advised that criticism is bad for brainstorming, so please be careful not to criticize anyone else's ideas." By contrast, in the criticism-encouraged condition, participants were instructed as follows: "Contrary to conventional wisdom about brainstorming, most recent studies about brainstorming suggest that you should feel free to criticize each other's ideas as you list them on the flipchart" (cf. Nemeth et al. 2004).

Goal Interdependence Manipulation. Although the term "brainstorming" typically refers to the process of idea generation, nearly every creative problem-solving model prescribes a first phase where ideas are generated and a second phase in which the ideas are evaluated (Osborn 1963, Delbecq et al. 1975, Puccio and Cabra 2010, Harvey and Kou 2013, Schuler 2015). In theory, the idea-generation phase and the idea-selection phase should be kept separate; but in practice, the mere anticipation of an idea-selection phase can overshadow the idea-generation process (see Harvey and Kou 2013). When a group is tasked solely with brainstorming ideas, without any expectation of subsequently evaluating them (e.g., in a focus group), group members can engage in purely divergent thinking (Guilford 1950). This situation creates a more *cooperative context* because all members of the group share the same goal of generating as many ideas as possible, and therefore the interests of group members are compatible. By contrast, in most organizational settings, the ultimate goal of brainstorming is to determine a final solution, and idea generation serves simply as a means toward that end (Mintzberg et al. 1976). In those cases, group members at some point must engage in convergent thinking; this winnowing down of options can create a more *competitive context* because often only one "best" solution can be enacted (Cropley 2006; see also Hommel et al. 2011, Chermahini and Hommel 2012). Although group members share the goal of convergence, reaching consensus can be a highly conflictual process (Susskind and Cruikshank 1987), particularly when discussing real-world issues, because participants often judge the quality of ideas based on their personal beliefs (Rietzschel et al. 2010). As such, convergence when discussing real-world issues can provoke serious differences of opinion (Graham 1977), especially in diverse groups, because convergence may engender competition when different factions tend to defend ideas suggested by their own group (Nishii and Goncalo 2008).

Building on this theoretical distinction, we manipulated goal interdependence by assigning each brainstorming group's goal as being either to invent options for its own sake or to invent options with the ultimate objective of determining a single course of action. In the cooperative condition, participants were instructed simply to generate options, whereas in the competitive condition, participants were informed that after generating options they would need to "agree upon one idea from the list your group generates to be emphasized above all the others when we share your group's ideas."

Pretest

A pretest was conducted to verify that the additional instructions given to participants in the competitive condition would be construed by participants as making the situation more competitive. A sample of

313 participants on Amazon's Mechanical Turk read a verbatim transcript of the basic instructions and then were asked to indicate if they thought the additional instructions (i.e., to "agree upon one idea") would lead to "more competition," "more cooperation," or would have "no effect." Roughly two-thirds (65.7%) of participants indicated that the additional instructions would lead to more competition, $\chi2$ (2, $N = 313$) = 165, $p < 0.001$.

Dependent Variables

While the session was in progress, a researcher (observing through a one-way mirror) counted the number of ideas generated (i.e., fluency; see Diehl and Stroebe 1987, Paulus et al. 2011). To assess interrater reliability, a second research assistant blind to hypotheses also watched a subset of sessions and counted the number of ideas. A two-way mixed, single-measure intraclass correlation coefficient (ICC; McGraw and Wong 1996) was found to be in the acceptable range, ICC = 0.79 (Cicchetti 1994), indicating that ideas were counted consistently across coders.[3]

To assess the creativity of ideas generated in each group, we used the Consensual Assessment Technique (CAT), which asserts that the best measure of creativity is the combined assessment of experts in the field based on their tacit personal meanings of creativity (Amabile 1982). The CAT has been validated in a wide range of contexts (Hennessey and Amabile 2010) and is sometimes called the "gold standard" in measuring creativity because it is not dependent on any theoretically derived definition and it mirrors the way people judge creativity in the real world (Baer 2010a). Six judges with expertise in urban planning, design, and community development individually ranked and then rated the creativity of each group's ideas using a scale from 1 ("least creative") to 6 ("most creative"; cf. MacKinnon 1962, Domino 1974, Sobel and Rothenberg 1980, Amabile 1982, Hennessey et al. 2011). All judges were professionals with advanced degrees in urban planning working in public or private agencies and were blind to hypotheses and experimental condition. To test the reliability of their ratings, we assessed all intercorrelations among the six judges. Using the Spearman-Brown formula, we determined that the overall reliability was 0.90. We also examined the creativity of each group's most creative idea (cf. Girotra et al. 2010). Hypothesis tests using this variable yielded the same conclusions as those using the average creativity variable, so we present only average creativity for the sake of brevity.[4]

Manipulation Check

As a check of our experimental manipulation, we asked on the postsurvey, "How much criticism took place during your group's interaction?" Participants responded on a scale ranging from 1 ("none at all") to 5 ("a great deal").

Control Variables

Prior research suggests that certain other demographic and relational factors can promote or inhibit creativity and, if unmeasured, might suppress findings or lead to spurious results. Therefore, for potential use as control variables, we assessed additive effects of sex, age, and level of education (Karnes et al. 1961, McCabe 1991, Simonton 2000, Baer and Kaufman 2008, Clark 2008). Prior research also suggests an association between affiliation and creativity (Uzzi and Spiro 2005, Perry-Smith 2006, Baer 2010b), so we assessed whether group members knew one another. Finally, group size was an important control variable because prior research found that the number of group members is positively associated with fluency—that is, the number of ideas generated (Bouchard and Hare 1970, Gallupe et al. 1992, Coskun 2011).

Results

Descriptive Statistics and Bivariate Associations

The average number of ideas generated by each group was 18.8 ($SD = 5.73$), and the average creativity of each group's output was 3.15 ($SD = 1.25$). Examples of the most and least creative ideas can be found in the online appendix (Table A1), along with descriptive statistics and bivariate associations among all variables (Table A2). Consistent with past research on brainstorming (Bartis et al. 1988, Paulus et al. 2011), there was a significant correlation between measures of quantity and quality—that is, the number of ideas generated by a group was positively associated with the average creativity of the group's ideas, $r(99) = 0.49$, $p < 0.001$. The number of ideas generated was also positively associated with the number of participants in the group, $r(99) = 0.40$, $p < 0.001$ (see Bouchard and Hare 1970) and with the presence of prior affiliation among group members, $r(99) = 0.26$, $p = 0.010$ (see Uzzi and Spiro 2005, Perry-Smith 2006, Baer 2010b) but negatively associated with the education level of group members, $r(99) = -0.22$, $p = 0.028$ (where past findings have been mixed; see Fasko 2001, Shalley and Gilson 2004, Shaheen 2010). Finally, prior affiliation predicted average creativity, $r(99) = 0.23$, $p = 0.023$ (see Baer 2010b).

Control Variables

Based on prior theory and on the bivariate associations reported above, we controlled in all subsequent analyses for the number of participants in the group (Bouchard and Hare 1970), the presence of prior affiliation (Uzzi and Spiro 2005, Perry-Smith 2006,

Baer [2010b]), and the education level of group members (Fasko [2001]).

Manipulation Check

We first checked the effectiveness of our manipulation of criticism. We applied analysis of covariance (ANCOVA) to perceived criticism, with our criticism and goal interdependence manipulations as independent factors. As expected, we found that groups encouraged to criticize one another's ideas had higher levels of perceived criticism ($M = 1.86$, $SD = 0.49$) than groups discouraged from engaging in criticism ($M = 1.47$, $SD = 0.55$), $F(1, 92) = 12.3$, $p = 0.001$, $\eta_p^2 = 0.12$. Neither the main effect of goal interdependence nor the interaction between criticism and goal interdependence was significant in predicting perceived criticism, $F_{\text{goal interdependence}}(1, 92) = 0.50$, $p = 0.48$, $\eta_p^2 = 0.00$; $F_{\text{criticism} \times \text{goal interdependence}}(1, 92) = 0.46$, $p = 0.50$, $\eta_p^2 = 0.00$.

Tests of Hypotheses

To test our moderation hypothesis regarding the number of ideas (Hypothesis 1), we applied ANCOVA to the number of ideas generated, with criticism and goal interdependence as independent factors. Supporting Hypothesis 1, the predicted criticism × goal interdependence interaction was significant, $F(1, 92) = 5.77$, $p = 0.018$, $\eta_p^2 = 0.06$. As illustrated in Figure 2, groups in the cooperative condition generated more ideas when criticism was encouraged ($M = 20.7$, $SD = 5.92$) than when criticism was discouraged ($M = 17.9$, $SD = 6.01$, $p = 0.022$), whereas groups in the competitive condition generated fewer ideas when criticism was encouraged ($M = 16.7$, $SD = 5.74$) than when

criticism was discouraged ($M = 19.8$, $SD = 4.43$, $p = 0.022$). Neither the main effect of criticism nor the main effect of goal interdependence was significant in predicting the number of ideas, $F_{\text{criticism}}(1, 92) = 0.01$, $p > 0.250$, $\eta_p^2 < 0.01$, $F_{\text{goal interdependence}}(1, 92) = 2.28$, $p = 0.135$, $\eta_p^2 = 0.02$.[5]

To test our moderation hypothesis regarding the creativity of ideas (Hypothesis 2), we applied ANCOVA to the judges' creativity ratings, with criticism and goal interdependence as independent factors. Supporting Hypothesis 2, the predicted criticism × goal interdependence interaction was significant, $F(1, 92) = 4.12$, $p = 0.045$, $\eta_p^2 = 0.04$. As shown in Figure 3, groups in the cooperative condition generated ideas that were more creative on average when criticism was encouraged ($M = 3.50$, $SD = 1.15$) than when criticism was discouraged ($M = 3.13$, $SD = 1.24$, $p = 0.018$), whereas groups in the competitive condition generated ideas that were less creative on average when criticism was encouraged ($M = 2.77$, $SD = 1.45$) than when criticism was discouraged ($M = 3.30$, $SD = 1.02$, $p = 0.061$). Neither the main effect of criticism nor the main effect of goal interdependence was significant in predicting the creativity of ideas, $F_{\text{criticism}}(1, 92) = 0.00$, $p > 0.250$, $\eta_p^2 < 0.01$, $F_{\text{goal interdependence}}(1, 92) = 2.35$, $p = 0.128$, $\eta_p^2 = 0.02$.

Intragroup Conflict as a Mediator

To measure intragroup conflict, we transcribed all brainstorming sessions and then coded the transcripts using participants on Amazon's Mechanical Turk.[6] A sample of 840 participants was recruited such that each transcript could be coded by 10 respondents who were blind to condition and hypotheses.

Figure 2. Number of Ideas Generated as a Function of Experimental Condition (Study 1)
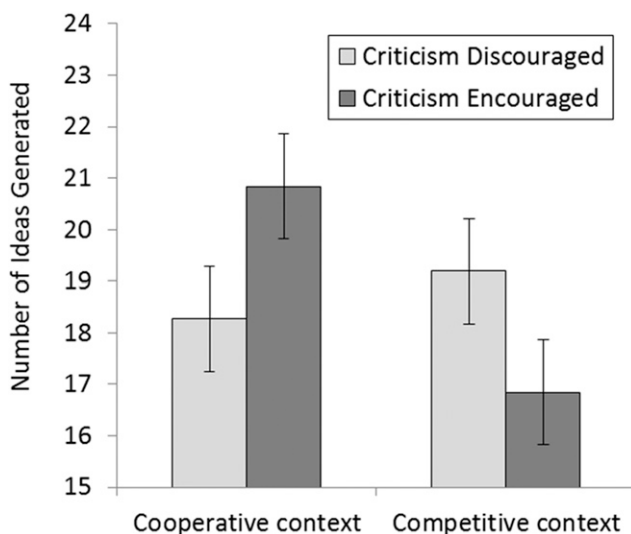
Note. Error bars represent ± 1 standard error of the mean.

Figure 3. Average Creativity of Ideas Generated as a Function of Experimental Condition (Study 1)
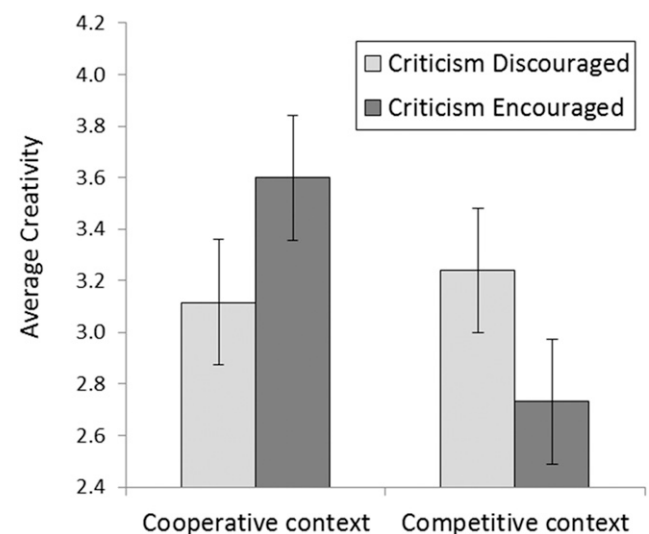
Note. Error bars represent ± 1 standard error of the mean.

For each transcribed utterance, respondents were asked to indicate whether that utterance contained "any expression of conflict among group members, no matter how subtle." Utterances coded as conflict tended to be disputes over whether a change would be beneficial or detrimental for the neighborhood—for example, "No! There used to be one. No banks! There are so many banks here." (Transcript #123). To test the reliability of conflict counts, we assessed all intercorrelations among the 10 respondents for each transcript. Using the Spearman-Brown formula, we calculated the overall reliability to be 0.91. This procedure enabled us to generate a reliable variable indexing the number of intragroup conflicts per group.[7]

To investigate whether intragroup conflict mediates the conditional effect of criticism on creativity (Hypothesis 3), we conducted a moderated mediation analysis using an SPSS macro (PROCESS, Model 59) designed by Hayes (2013). In this model (depicted in Figure 1), we included criticism as the predictor variable, intragroup conflict as the mediator, and goal interdependence as the moderator. In the competitive condition, the indirect effect of criticism on creativity was significant, $B = -0.35$, 95% CI [−0.84, −0.07]. By contrast, in the cooperative condition, the indirect effect of criticism on creativity was not significant, $B = 0.02$, 95% CI [−0.06, 0.33]. Comparing these two indirect effects, the index of moderated mediation was significant, $B = -0.37$, 95% CI [−0.89, −0.05], indicating that goal interdependence moderated the mediation effect of intragroup conflict, supporting Hypothesis 3. As can be seen in Figure 4, in the

Figure 4. Results of Moderated Mediation Analysis (Study 1)

Index of moderated mediation = -0.37**

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

competitive condition, the encouragement to criticize was associated with more intragroup conflict, which in turn was associated with less creativity. By contrast, in the cooperative condition, the encouragement to criticize was not significantly associated with intragroup conflict and intragroup conflict was not significantly associated with creativity.

Discussion

When brainstorming was conducted in a cooperative context, instructions encouraging criticism resulted in 16% more ideas and in ideas rated as 17% more creative than did instructions discouraging criticism. However, when brainstorming was conducted in a competitive context, encouraging criticism resulted in 16% fewer ideas and in ideas rated as 23% less creative. These results support our predictions that the effect of criticism instructions on creativity in group brainstorming depends on whether the context for group brainstorming is cooperative or competitive.

Further, our analysis of transcripts suggests that intragroup conflict played an important role in these effects, statistically mediating the negative relationship between the encouragement of criticism and creativity in the competitive condition but not in the cooperative condition. In the competitive condition, the encouragement of criticism led to more intragroup conflict, which in turn led to ideas that were less creative, whereas in the cooperative condition, the encouragement of criticism was not significantly associated with intragroup conflict and intragroup conflict was not significantly associated with creativity.

Although the findings of Study 1 provided support for all aspects of our theoretical model, we note two potential shortcomings. While one of the strengths of Study 1 was its ecological validity, the real-world setting made it impractical to hold constant the *types* of criticism employed across groups. Therefore, it was not possible for us to determine whether the divergent effects of criticism were due to differences in how criticism was conveyed or how it was construed. As detailed below, we address this shortcoming in Study 2 by holding constant the nature of the criticism.

Another shortcoming in Study 1 was the blunt measure of intragroup conflict. Although Tjosvold and colleagues (2014) argued that most people equate conflict with competitive conflict, we wanted to investigate exactly how divergent construals of criticism map onto cooperative and competitive conflict. Therefore, in Study 2, we pretested our experimental manipulation to examine whether goal interdependence gives rise to constructive versus destructive criticism, which in turn gives rise to open-minded thinking and consideration of diverse perspectives (i.e., cooperative conflict) versus close-minded thinking and coercion (i.e., competitive conflict).
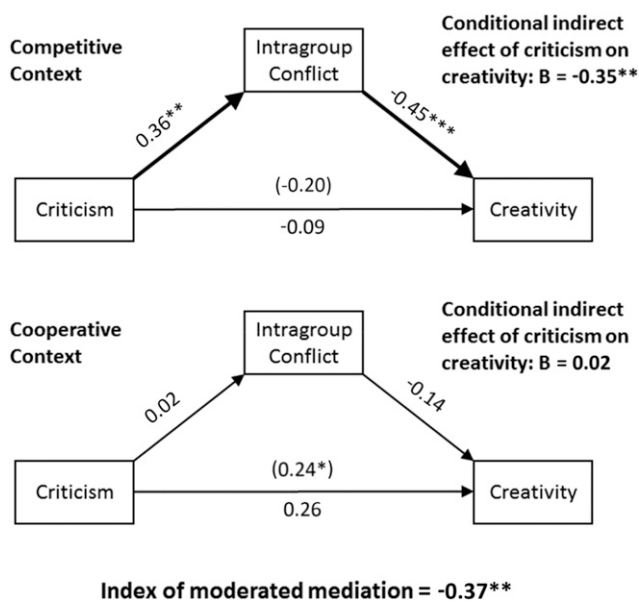
Study 2

Study 2 extends the findings of Study 1 in two important ways. First, we conducted a controlled laboratory study to ensure that all participants in the criticism condition would receive the same criticism, thereby addressing an alternative explanation in Study 1. Second, to improve the generalizability of our findings, we explored whether our hypothesized interaction effect would replicate in a different setting (i.e., a negotiation), with a different measure of creativity, and with a different experimental manipulation of goal interdependence.

The setting for Study 2 was a union-management conflict scenario. Negotiation scholars have long argued that creativity plays a fundamental role in successful negotiation (Raiffa 1982, Lax and Sebenius 1986, Bazerman and Neale 1992, Kurtzberg 1998). Without flexible, creative problem-solving, negotiators tend to be biased in their construal of conflict situations as representing a fixed pie (Schelling 1960, Bazerman and Neale 1992, Thompson and Hrebec 1996, Thompson 2012). Yet, thinking outside the box sometimes reveals nonobvious, "Eureka!"-type solutions that enlarge the pie (Wilson and Thompson 2014). Consequently, the practice of brainstorming has long been advocated as a technique to help negotiators generate creative options for mutual gain (e.g., Fisher et al. 1991).

One prominent method for creating value in negotiation involves contingent contracts (Bazerman and Gillespie 1999, Moffitt 2004). The basic premise of a contingent contract is that differences in forecasts or predictions about the future represent opportunities for value creation. For example, in an employment negotiation, a job candidate might have high confidence in his or her ability to generate revenue for the company, whereas the recruiter may have doubts, leading to an impasse over how much the job candidate should be paid. Yet a contingent contract could potentially break the impasse by using the difference in forecasts to create value. For example, the candidate might agree to a lower rate of base pay combined with a bonus or commission structure that rewards high performance. In the end, a contingent contract might not always provide the best outcome for the focal party; but in many cases, it allows agreements to occur where they otherwise would not be feasible. As such, contingent contracts represent a fundamental mode of problem-solving in negotiation; they are nonobvious solutions that require creative, outside-the-box thinking (Thompson 2012, Wilson and Thompson 2014).

In Study 2, we provided participants with a negotiation scenario where it was possible for them to invent a contingent contract to create value for both parties. We assessed their creativity as a function of whether participants spontaneously generated an idea involving a contingent contract. Using this binary criterion as our measure of creativity allowed us to assess a different kind of creativity measure than that used in Study 1, thereby adding to the generalizability of our findings. Creativity scholars have long argued that there are two main types of creativity tests. "Divergent-thinking tests" measure ideation fluency, or the number of different solutions to a particular question or prompt, whereas "convergent-thinking tests" measure creativity by presenting a problem where there is only one "right" answer (Guilford 1968, p. 8). The dependent variables in Study 1 assessed divergent thinking, whereas the dependent variable in Study 2 measured convergent thinking.

Our experimental manipulation of goal interdependence was also designed to test the generalizability of our findings. Whereas in Study 1 we varied the brainstorming group's ultimate goal (i.e., idea generation only in the cooperative condition versus idea generation plus evaluation in the competitive condition), in Study 2 we varied the composition of the brainstorming group, with brainstorming occurring either among parties on the same side of the conflict (the cooperative context) or on opposite sides of the conflict (the competitive context).

Method
Participants

Our sample consisted of 402 participants recruited from Amazon's Mechanical Turk (52% female) and paid the equivalent of $7.50 per hour.[8] Given our design, this sample size would provide 80% power to detect a small to medium-sized effect (Cohen's $d = 0.3$) based on Cohen's (1988) classification.

Design and Procedure

Participants read a scenario describing a wage dispute between union and management, told from the perspective of the union. Underlying the dispute over wages was a fundamental disagreement in forecasts. The union representative believed that company profits would go up, whereas the management believed that profits would go down.

Experimental Manipulations

In this study, goal interdependence was manipulated through the composition of the group purportedly doing the brainstorming. In the cooperative condition, participants were instructed to imagine that the brainstorming session was taking place in a two-person group comprised of themselves plus a member of their own side (i.e., "a fellow union representative"),

whereas in the competitive condition, participants were instructed to imagine that the brainstorming was taking place in a two-person group comprised of themselves plus a member of the other side (i.e., a "management representative"). In all experimental conditions, participants were told to imagine that they themselves had already suggested a 10% wage increase for all workers. In the criticism condition, participants were informed that the other individual (union or management) in their brainstorming group had responded with the following criticism: "Your idea doesn't take the management's perspective into consideration. Management believes profits are likely to go down." This criticism was carefully worded so that it would not add any new information beyond what was already stated in the initial scenario. In the no-criticism condition, participants did not receive any criticism. After reading the scenario, the task for participants was to brainstorm options for how to settle the dispute.

Pretest

A pretest was conducted to verify that our manipulation of goal interdependence would have the intended effects on participants' perceptions and attitudes. A sample of 270 participants on Amazon's Mechanical Turk (separate from the main Study 2 sample) were randomly assigned to read either the competitive scenario (i.e., brainstorming with "the management representative") or the cooperative scenario (i.e., brainstorming with "a fellow union representative"). As a goal interdependence manipulation check, we asked participants to characterize the context on a scale ranging from 1 ("highly competitive") to 7 ("highly cooperative"). As expected, being in the competitive (versus cooperative) condition was strongly associated with perceiving the context as more competitive (versus cooperative), $r = 0.383$, $p < 0.001$.

We also presented the criticism language to the pretest sample and administered a scale to measure the extent to which respondents construed the criticism as destructive versus constructive. The items were adapted from the Attributions of Criticism Scale (Allred and Chambless 2013, 2014). Because we were interested in the balance between whether the criticism was construed as destructive versus constructive, we examined the ratio of destructive criticism (e.g., "He/she was trying to hurt or have a negative impact on you") to constructive criticism (e.g., "He/she has your best interests at heart"). As expected, being in the competitive (versus cooperative) condition was strongly associated with a tendency to construe the criticism as more destructive (versus constructive), $r = 0.349$, $p < 0.001$.

Additionally, we had participants rate the interaction between themselves and their fellow brainstormer on a survey of cooperative and competitive conflict (Alper et al. 2000). As expected, construing the criticism as more destructive was associated with competitive conflict (i.e., close-minded thinking), $r = 0.624$, $p < 0.001$, whereas construing the criticism as more constructive was associated with cooperative conflict (i.e., open-minded thinking), $r = 0.594$, $p < 0.001$.

Finally, we conducted two mediation analyses using the PROCESS macro (Model 4; Hayes 2013), with experimental condition as the predictor variable, conflict ratings as the dependent variable, and destructive (versus constructive) criticism as the mediator. The indirect effect of the experimental condition (competitive versus cooperative) on conflict ratings was significant both for competitive conflict, $B = 0.24$, 95% CI [90.14, 0.35], and for cooperative conflict, $B = -0.31$, 95% CI [-0.45, -0.20]. This finding suggests that the context for brainstorming is associated with how criticism is construed, which in turn is associated with whether participants anticipate closed-minded discussion and coercion (i.e., competitive conflict) versus open-minded discussion of diverse perspectives (i.e., cooperative conflict).

Taken together, findings from the pretest confirmed that we could use our manipulation of goal interdependence in Study 2 with confidence. More specifically, the pretest suggested that in Study 2 (1) being paired with a brainstorming partner on the same side of the negotiation would be perceived as a cooperative context, whereas being paired with a brainstorming partner on the opposing side of the negotiation would be perceived as a competitive context; (2) the same criticism is likely to be construed as more destructive (versus constructive) by participants in the competitive condition than by participants in the cooperative condition; finally, (3) construing criticism as more destructive (versus constructive) mediates the relationship between a competitive (versus cooperative) context and competitive (versus cooperative) conflict.

Dependent Variables

Similar to Study 1, our dependent variables were the quantity and creativity of ideas generated. However, in this study, we used a convergent measure of creativity, so our primary dependent variable was whether participants spontaneously mentioned a contingent contract in at least one of their ideas.

Results
Identifying Contingent Contracts

The 402 participants generated a total of 1,676 ideas (averaging 4.17 ideas per participant; $SD = 2.55$). To identify contingent contracts, the first author examined a randomly selected subsample of 500 ideas (blind to condition) and indicated in each case whether the idea included any mention of a contingent contract.

Of these 500 ideas, 450 were fed into a computer to "train" a natural language processing and machine and learning computer algorithm in how to code for contingent contracts. We then used the remaining 50 ideas to test the reliability between categorizations made by the human versus categorizations made by the computer. Classifications made by the computer matched the human classifications 96% of the time; Cohen's κ was 0.78, which is considered to be in the "substantial" range (Landis and Koch 1977). Examples of responses with and without contingent contracts can be found in the online appendix (Table A3).

Hypothesis Testing

Our two dependent variables were the number and creativity of ideas. To examine the number of ideas (Hypothesis 1), we applied ANOVA to number of ideas with criticism (yes/no) and goal interdependence (cooperative/competitive) as independent factors. We found no significant main effects or interactions, all ps > 0.55. However, when we examined the creativity of ideas (Hypothesis 2), the results were consistent with our moderation hypothesis. As illustrated in Figure 5, the proportion of participants mentioning at least one contingent contract in the cooperative condition was higher when the scenario included criticism ($M = 0.33$, $SD = 0.47$) than when the scenario did not include criticism ($M = 0.15$, $SD = 0.36$, $p = 0.037$), whereas in the competitive condition, the proportion was slightly lower with criticism ($M = 0.20$, $SD = 0.40$) than without it ($M = 0.24$, $SD = 0.43$), although this latter difference was not

Figure 5. Proportion of Contingent Contracts as a Function of Experimental Condition (Study 2)

Notes. Graph depicts the proportion of participants in each experimental condition who mentioned at least one contingent contract. Error bars represent ± 1 standard error.

significant ($p > 0.10$). We applied logistic regression to the likelihood of mentioning a contingent contract, with criticism, goal interdependence, and the interaction between criticism and goal interdependence as independent factors. Supporting Hypothesis 2, the interaction between criticism and goal interdependence was significant, $\beta = -1.286$, $p = 0.009$, indicating that the effect of criticism on creativity depended on whether the context for brainstorming was cooperative or competitive.

Discussion

Results of Study 2 yielded a replication of the interaction effect between criticism and goal interdependence and further showed that this effect extended into a negotiation setting with a different operationalization of goal interdependence as well as a different measure of creativity. As hypothesized, participants who imagined themselves to be brainstorming with a member of their own team (cooperative context) were approximately twice as likely to generate a creative contingent contract when they were criticized relative to when they were not criticized. In contrast, participants who imagined themselves to be brainstorming with a member of the opposing team (competitive context) had a somewhat lower likelihood of generating a contingent contract when they were criticized. Thus, as in Study 1, the effect of criticism on creativity depended on the context in which brainstorming was taking place; criticism in a cooperative context was conducive to creativity, whereas criticism in a competitive context was not.

Unlike Study 1, there were no differences in fluency (i.e., number of ideas generated) as a function of experimental condition, although as noted earlier, the convergent measure of creativity in Study 2 was designed to assess idea quality rather than quantity. It is possible that production blocking (i.e., interference from other speakers; Diehl and Stroebe 1987) may have played a role in Study 1 but not in Study 2 because each real participant brainstormed in isolation. We also note that the decline in creativity when criticized in a competitive context was relatively small in Study 2 in comparison with the corresponding effect in Study 1, which may have been due to the simulated nature of Study 2. Even when criticism is construed negatively, it may not be as detrimental to creativity when it is not conveyed face-to-face by a real person.

Because Study 2 was a scenario study, it enabled us to address a shortcoming of Study 1 by controlling for the nature of the criticism. Given that the moderation result was replicated in this controlled context, we have reason to conclude that goal interdependence changes the *construal* of criticism. Moreover, results of the pretest corroborated and extended the conflict
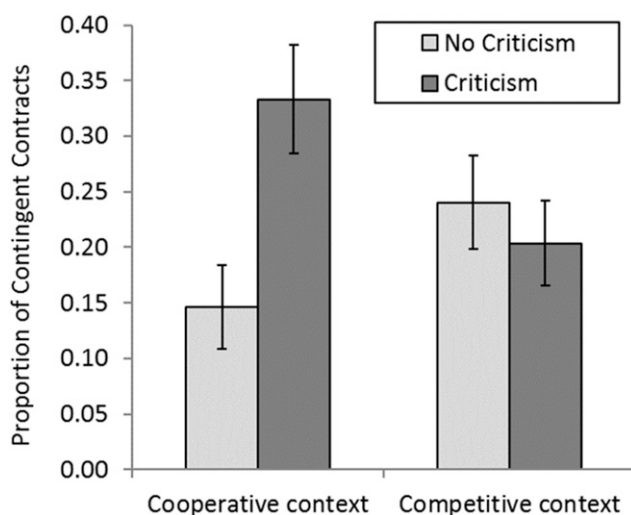
mechanism seen in Study 1. In the Study 2 pretest, the same criticism was construed more destructively (versus constructively) in the competitive (versus cooperative) condition, which in turn was associated with more (versus less) competitive conflict and less (versus more) cooperative conflict. Taken together with results from the main part of Study 2, our findings suggest that criticism in a competitive context is construed negatively, which triggers close-minded thinking and undermines creativity; but the same criticism in a cooperative context is construed positively, triggering open-minded thinking and enhancing creativity.

General Discussion

Previous research on brainstorming presents contradictory findings regarding the effect of criticism on creativity. Does criticism hinder creativity in group brainstorming by leading to interpersonal tensions, such as evaluation apprehension and intragroup conflict? Or does fostering an environment of dissent and debate lead to divergent thinking, thereby facilitating creativity? Our research reconciles these opposing perspectives by highlighting the importance of the social context—in particular, whether the context for brainstorming is cooperative versus competitive. In a cooperative context, participants' goals are aligned, so criticism is more likely to be construed as constructive, advancing the group's shared interest in divergent thinking. By contrast, in a competitive context, criticism is likely to be construed as destructive, leading to intragroup conflict and undermining creativity.

Theoretical Implications

Contributing to a growing body of theory and research on the importance of social context in group creativity (George 2007, Goncalo and Duguid 2012, Zhou and Hoever 2014, Goncalo et al. 2015), our findings suggest that there is not one single "right" way to brainstorm; rather, the procedure should be adjusted based on the context. Osborn's (1948) rule prohibiting criticism is still applicable when the context for brainstorming is contentious or competitive, such as in organizational settings where groups of individuals with diverse goals know they ultimately will need to agree upon one "best" solution. However, when brainstorming is undertaken among parties with cooperative goals, such as in a focus group where there is no expectation of evaluating the ideas that have been generated, prohibiting criticism is likely to be counterproductive.

Our findings also have important implications for negotiation theory. The results qualify the long-standing assertion of negotiation scholars that brainstorming without criticism facilitates the generation of creative options for resolving conflicts. Heated conflicts among adversaries are exactly the types of competitive situations in which criticism during idea generation is likely to exacerbate conflict and undermine creativity. However, brainstorming sessions among parties with mostly compatible interests, such as parties who perceive themselves to be on the same side of a conflict, may actually benefit from criticism during idea generation because criticism in this context tends to be construed as constructive. To the extent that criticism is related to assertiveness, our findings are consistent with the well-known dual-concern model of negotiation (Pruitt and Rubin 1986), which holds that creative problem-solving is maximized when assertiveness is paired with cooperation (see also Walton and McKersie 1965, Lax and Sebenius 1986, Mnookin et al. 1996, De Dreu et al. 2000, De Dreu 2006, Bechtoldt et al. 2012, Barnier et al. 2016, Choi et al. 2018).

Finally, our findings support Tjosvold's theory of constructive controversy (Tjosvold 1998, 2008). Tjosvold and others (Deutsch 1973; Tjosvold 1985, 1998; Johnson et al. 2000) assert that conflict in a cooperative social context leads to open-minded discussion of diverse viewpoints (or cooperative conflict), whereas conflict in a competitive social context leads to close-minded, defensive reactions (or competitive conflict). Although criticism is not the same as conflict, across both of our studies, criticism *led* to conflict (specifically competitive conflict in Study 2) in a competitive context only. Notably, our theoretical model in Figure 1 suggests that goal interdependence moderates both (1) the effect of criticism on conflict and (2) the effect of conflict on creativity. Although it was beyond the scope of the current paper, it would be theoretically valuable in future research to test each of these moderation effects separately, ideally by experimentally manipulating (rather than measuring) intragroup conflict.

Limitations and Future Directions

There are several differences between Study 1 and Study 2, which could be seen as a limitation of the research. However, we argue that one advantage of running studies with different methodologies is that the strengths of one study can mitigate the weaknesses of another. For example, the naturalistic design of Study 1 could not rule out potential differences in the nature of the criticism between the cooperative and competitive conditions, whereas the experimental design of Study 2 held constant the nature of the criticism. Similarly, the lack of extensive social information in Study 1 transcripts made it challenging to code for fine-grained distinctions between productive and unproductive forms of conflict, whereas in the Study 2 pretest we were able to make

those kinds of distinctions by administering a survey of cooperative and competitive conflict (Alper et al. 2000).

Conversely, the highly controlled design of Study 2 had its own shortcomings. For example, in the cooperative condition, the criticism always came from a fellow union worker, whereas in the competitive condition, the criticism always came from a manager. The relative status of the person delivering the criticism might have affected how the feedback influenced creativity. To address this concern, we reran the Study 2 pretest, replacing the phrase "a fellow union representative" with "the leader of your union" in order to test whether criticism might be construed differently if the criticism was always coming from a higher-status individual. Notably, we found that the results did not change in effect size or significance level. Furthermore, this same potential social status confound is not present in Study 1, suggesting that the effects of criticism on creativity were not due to social status.

Also, a common critique of experimental simulations like the one used in Study 2 is a potential lack of generalizability to real-world contexts. After all, participants in Study 2 brainstormed ideas by themselves, even though they were instructed to imagine a group brainstorming setting. However, the pairing of the laboratory experiment in Study 2 with the field experiment in Study 1, plus the fact that each study measured a different kind of creativity (i.e., divergent thinking in Study 1 and convergent thinking in Study 2), enhances the generalizability of the findings resulting from this program of research.[9]

Notably, across both studies, our sample consisted mostly of strangers, whereas in many real-world organizational contexts brainstorming group members know one another. What role does the existence of prior relationships play in criticism's effect on creativity? Our results showed greater creativity among groups with at least one prior relationship; although we controlled for this effect in all of our models, it remains to be seen whether the findings of our study would apply equally well to brainstorming groups whose members were already well acquainted with one another. A prior investigation suggests that our results would generalize to this kind of organizational context. De Dreu and West (2001) measured minority dissent and innovation among organizational teams comprised of well-acquainted members. Although their research was not conducted in the context of brainstorming, and causation could not be established because the research design was observational and cross-sectional, the results showed a positive association between the expression of dissent and team innovation but only among teams where members perceived themselves as having a high level of participation in the team's decision making (which could be seen as a cooperative context).

Practical Implications

Assuming that creativity is the goal of brainstorming, what can be done to realize the benefits of divergent thinking without incurring the cost of intragroup conflict? Should the manager of a brainstorming session encourage or prohibit criticism? Our findings, together with existing research, suggest that the answer depends on the nature of the group and its task. If the context of brainstorming is cooperative—because of goal interdependence, prior relationships among group members, the type of the task being undertaken, the surrounding organizational culture, or even the personalities of group members—then encouraging criticism is likely to facilitate creativity. A manager of course could take steps to influence the cooperative nature of the group by framing the purpose of brainstorming around the interests of the whole group (as opposed to highlighting differences among subgroups) or helping participants perceive their goals as primarily aligned, thereby instilling a more cooperative mindset among group members. If, ultimately, the nature of the group or its task is competitive, then it may be prudent to prohibit criticism so as to avoid intragroup conflict and its deleterious effect on creativity. By attending to the context in which brainstorming is taking place, managers can customize brainstorming instructions to help groups realize their full creative potential.

Endnotes

[1] It should be noted that the methods of these two studies were far from comparable. The early study by Weisskopf-Joelson and Eliseo (1961) was underpowered by today's standards, and the unit of analysis was the idea as opposed to the group. Also, the two experimental conditions produced a roughly equal number of high-quality ideas (as evaluated by raters), so the difference in number of ideas was due to a greater number of low-quality ideas in the noncritical group. The later study by Nemeth and colleagues (2004) did not include a measure of idea quality. Moreover, there was no significant difference between the criticism-prohibited condition and the debate condition in the number of ideas generated during the

group brainstorming phase of the study. The significant difference between these two conditions emerged only when examining the total number of ideas pooled across the group brainstorming phase plus a subsequent private brainstorming phase.

[2] Notably, the concept of "goal interdependence" is closely related to the concept of "social value orientation," although social value orientation generally refers to an individual difference variable, whereas goal interdependence (or the related term "motivational goal") generally refers to situational differences (De Dreu and Boles 1998; see also Tjosvold et al. 2014). We use the term "goal interdependence" because our operationalization of this variable is through experimental manipulations of the situation, but prior research suggests that variables focused on individual differences would be functionally equivalent (De Dreu et al. 2000).

[3] The variable *number of ideas* required coding (as opposed to a simple count) because the data on the flipcharts sometimes involved removing duplicates and/or judging where one idea ended and the next idea began.

[4] Judges also rated the feasibility and utility of the ideas, but those ratings were not reliable and therefore discarded. In the field of planning, it is well known that reaching consensus on utility is difficult because of the different priorities and values of stakeholders (and in this case, our judges; Susskind and Cruikshank 1987).

[5] Although the amount of time group members had was equal between the two goal interdependence conditions, we note that groups in the cooperative condition could spend all of their time generating ideas, whereas groups in the competitive condition had to dedicate some of their time to selecting a single idea to emphasize above the others. To address this potential confound, we measured the amount of time spent on idea-generation (versus idea-selection in the competitive condition) and calculated the number of ideas generated per minute, following the procedure outlined in Rietzschel et al. (2006). The results using this measure did not differ from those using the total number of ideas, $F_{\text{interaction}}(1, 89) = 6.57$, $p > .012$, $\eta_p^2 = .07$.

[6] Prior research has shown that untrained coders are more accurate than trained judges at flagging criticism (Chambless and Blake 2009). Moreover, we needed a large number of coders (i.e., 10 coders per transcript) because of the subjectivity of the coding task. Our recruitment criterion was participants from the United States with a 90%–100% approval rating. Data collected through Amazon's Mechanical Turk have been shown to be as reliable as data obtained through traditional methods for social science research (see Buhrmester et al. 2011).

[7] Following the procedure outlined in Grubbs (1950), we determined that many of our conflict counts had outliers, so we used Winsorized means (Barnett and Lewis 1994).

[8] Our recruitment criterion was participants from the United States with a 90%–100% approval rating. We included data from all participants who passed attention checks.

[9] Future research could delve more deeply into how an individual generates creativity under different group contexts. That is, the focal level of analysis would be the individual within the group and it would be measured by holding constant the behavior of other group members.

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