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Intergroup Competition as a Double-Edged Sword: How Sex Composition Regulates the Effects of Competition on Group Creativity

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Building on social role theory, we extend a contingency perspective on intergroup competition proposing that having groups compete against one another is stimulating to the creativity of groups composed largely or exclusively of men but detrimental to the creativity of groups composed largely or exclusively of women. We tested this idea in two separate studies: a laboratory experiment (Study 1) and a field study (Study 2). Study 1 showed that competition had the expected positive effects on the creativity of groups composed mostly or exclusively of men and produced the predicted negative effects on the creativity of groups composed of women, even though the latter effects emerged at the high end of the competition spectrum and for sex-homogeneous groups only. Results of Study 1 also revealed that within-group collaboration mediated the joint effects of competition and sex composition on group creativity. Study 2 replicated the results of Study 1 in a field setting involving research and development teams. We discuss the implications of these findings for theory and practice.

Key words: creativity; competition; groups; sex composition; collaboration; social role theory
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Introduction

Beliefs in the virtues of competition—a zero-sum contest in which two or more parties go head-to-head and one is declared the winner at the expense of the others (Deutsch 1949)—are among the most widely shared, deeply held, and long-standing assumptions in most Western societies (Kohn 1992, Pfeffer and Sutton 2000). Competition is considered essential to the efficient allocation of scarce resources and, more importantly, to fueling creativity and innovation (Birkinshaw 2001, Carroll and Tomas 1995, Marino and Zábojník 2004). Given the rising popularity of teams in the production of novel ideas (Wuchty et al. 2007), contests between teams in an effort to ignite the creative spark necessary for innovation are ubiquitous. For example, India's Tata Group sponsors an annual "Innovista" competition to spur innovation among its various subsidiaries. Most recently, the event attracted 1,700 teams—the most innovative of which would receive Tata's Promising Innovation award (Scanlon 2009).

The motivating premise underlying the frequent use of intergroup competition in stimulating creativity is the notion that competition causes group members to see each other as interdependent and in a positive light (Fiedler 1967, Sherif and Sherif 1953). This, in turn, is thought to blur the distinction between self-interest and group interest propelling members to actively collaborate with one another, thereby allowing the group to leverage the benefits of bringing together individuals with different information and knowledge sets, which ultimately should boost creativity (Bornstein and Erev 1994, Kramer and Brewer 1984, van der Vegt and Bunderson 2005). Although this logic is appealing, research has found that the effects of intergroup competition on outcomes such as creativity and performance are rarely that straightforward. For example, Baer et al. (2010) showed that the effects of competition on group creativity vary depending on whether the groups that go head-to-head are fluid (i.e., exchange members with other groups) or static (i.e., experience no membership change) in their composition. Specifically, these authors found that competition had generally positive effects on group creativity when groups were static but had a U-shaped relation with creativity when groups

were fluid. In addition, there is evidence to suggest that how groups are composed in terms of personality regulates the extent to which intergroup competition benefits performance. Specifically, Beersma et al. (2003) showed that only groups composed of extraverted and agreeable members benefited from operating in a competitive intergroup environment, presumably because the interpersonal skills associated with extraversion and agreeableness provide a good fit for the enhanced need to collaborate instilled by intergroup competition.

Based on this previous work, it appears that compositional factors play an important role in determining the extent to which competition between social units fosters (or hinders) outcomes such as creativity. It is surprising, therefore, that we know little about whether composition in terms of sex—one of the most salient bases for categorization in organizations (Chattopadhyay et al. 2004)—plays a role in determining whether competition may stimulate or constrict group creativity. Considering the role of sex composition would seem to be particularly relevant, because the last 50 years have witnessed a shift in the demographic composition of the workforce—a dramatic increase in women's labor force participation rates (Hayghe 1997). According to recent projections, participation of women in the labor force in the United States will continue to be faster than that of men for the period between 2010 and 2020 and is expected to reach 77 million in 2020 (compared with 87 million men) (Toossi 2012). The goal of the present research was to examine the implications of this demographic shift for the effectiveness of intergroup competition as a vehicle to stimulate creativity in groups.

Extending a contingency perspective on competition (Baer et al. 2010, Beersma et al. 2003), we propose that the sex composition of groups will have a profound impact on whether intergroup competition will spur creativity or constrict it. Specifically, building on Eagly's (1987) social role theory, we suggest that groups composed largely or exclusively of women will exhibit higher creativity than those composed mostly or exclusively of men when the intergroup environment is benign, yet the opposite will be true when the intergroup environment is competitive. In essence, we propose that intergroup competition and sex composition will interact to jointly influence group creativity. In addition, illuminating the group-level mechanism transmitting these interactive effects, we argue that within-group collaboration is the relevant causal mechanism explaining *why* intergroup competition and sex composition jointly affect group creativity. Finally, we report the results of two studies, one laboratory experimental and one field study, that provide general support for our arguments.

Our research makes at least three valuable contributions to the extant literature. First, our study is the first, to our knowledge, to systematically examine the effectiveness of intergroup competition as a vehicle for promoting the creativity of groups with different sex compositions. In doing so, we not only build on insights from existing theoretical work but also extend previous work on a contingency perspective of competition by showing that sex composition is an important factor regulating the effects of intergroup competition on group outcomes such as creativity. Second, by examining within-group collaboration as a mediator, we solidify our understanding of the processes that shape creativity in groups. Third, by testing our hypotheses in both experimental and field settings, we demonstrate that our results are replicable and therefore likely to generalize across settings and samples and, as such, are particularly relevant for managerial practice.

The Effects of Intergroup Competition on Group Creativity: Sex Composition as a Contingency

Competition between groups for scarce resources or various monetary and nonmonetary incentives has long been considered an effective way to increase the performance of groups across a variety of settings (Pfeffer and Sutton 2000). For example, Nalbantian and Schotter (1997) showed that introducing within-firm competition between work units performing the same task is one of the most inexpensive ways to increase group performance. Undoubtedly, intergroup competition has its benefits. However, given recent research highlighting the significance of compositional factors in shaping groups' responses to the introduction of competition (Baer et al. 2010, Beersma et al. 2003), it is not at all clear whether groups composed largely or exclusively of men or of women respond similarly in terms of creativity when placed in an environment in which they are required to compete with other groups. In the next section, we develop arguments to suggest that whereas groups composed largely or exclusively of women are likely to be more creative than groups composed mainly or exclusively of men when the intergroup environment is noncompetitive, the opposite will be true when the intergroup environment becomes competitive. In essence, we suggest that group sex composition serves as an important contingency factor regulating the effects of intergroup competition on group creativity.

To illuminate the nature of the interaction between intergroup competition and sex composition, we first explore the consequences for group creativity when groups are composed of all men or of all women and operate in a noncompetitive environment. One framework that seems to be particularly relevant here is social role theory (Eagly 1987). According to this theory, social roles such as individuals' gender roles can explain many of the different social behavioral tendencies that men and women exhibit when operating in similar circumstances. Gender roles are defined as those "shared expectations (about appropriate qualities and behaviors) that

apply to individuals on the basis of their socially identified gender" (Eagly 1987, p. 12). Gender roles are both descriptive in indicating what men and women typically do and prescriptive in outlining how men and women ought to behave, and they are anchored both in others' expectations (social norms) and in individuals' gender identities (Eagly 2009).

Gender roles arise in large part as a result of the division of labor in society (Eagly 1987). In all cultures, men and women tend to specialize in different activities as a result of the biological differences between the sexes—some tasks are more efficiently accomplished by one sex than the other (Eagly 1987). As a result of this division of labor, people come to form different beliefs about what each sex can do and typically should do (Eagly 2009). These socially shared beliefs then affect individual behavior through people's gender identities—people's view of themselves as male or female—and others' stereotypical expectations (Wood and Eagly 2010). It is through the interplay between these forces that gender role beliefs regulate our behavior.

Many of the beliefs about men and women can be summarized by two dimensions typically labeled *communion* and *agency* (Bakan 1966, Eagly 1987). Women, more so than men, are considered to be communal—that is, unselfish, concerned with others, and expressive. Caring and expressive qualities, in turn, not only facilitate personal relationships but also tend to convey cooperative interdependence with others (Eagly 2009, Fiske et al. 2002). In contrast, men, more so than women, are thought to be agentic—that is, masterful, dominant, and self-reliant. Assertive and self-reliant qualities, in turn, not only promote battles for superior social standing but also tend to imply a social setting in which people often attempt to demonstrate their independence from others (Baumeister and Sommer 1997, Eagly 2009). Previous empirical work supports the notion that men and women differ in the extent to which they see themselves and others as interdependent. For example, Madson and Trafimov (2001) found that women in the United States define themselves primarily by their relationships—as interdependent and connected to others (through both personal relationships and group identities)—whereas men define themselves primarily in terms of their uniqueness and independence from others.

Conformity to gender roles should produce systematic differences in the extent to which men and women collaborate with others in a group setting, so long as gender roles are salient compared with other, potentially competing social roles. Chattopadhyay et al. (2004) suggested that sex is a habitually salient basis for categorization, particularly in organizations, because sex-based attributions are frequently made to explain attitudinal and behavioral differences between employees. Thus, conformity to gender roles is likely in most professional and academic environments. Whether as a result of individuals' views of themselves as male or female or as a result of others' stereotypical expectations, men can be expected to strive to improve their hierarchical position and influence by exerting dominance and demonstrating their independence from other members of the group (Eagly 2009, Moscovici and Nemeth 1974), whereas women can be expected to engage in positive interpersonal behaviors that promote a sense of interdependence among the members of the group (Fiske et al. 2002). As a result, women should exhibit higher levels of collaboration with their fellow group members than men (Vinacke 1959). A study by Chatman and O'Reilly (2004) provides support for this reasoning. They found that men and women working in homogeneous groups in a noncompetitive environment differed in their evaluations of their groups' cooperativeness, with women reporting significantly higher levels of collaboration than men.

The different levels of collaboration exhibited by groups composed of men or of women, in turn, may have important implications for the group's creativity. The reason is that collaboration plays a prominent role in determining a group's creativity (Gilson and Shalley 2004, Leenders et al. 2003, Li et al. 2007, Sawyer 2007), particularly when the creative task requires interpersonal interaction and the integration of different idea components (Leenders et al. 2007, Wood 1987). We define *collaboration* as the extent to which members of the group share their thoughts, consider each other's ideas and suggestions as valuable inputs into their own generative processes, and give meaning to each other's contributions (Baer et al. 2010, Van Knippenberg et al. 2004). Only when members share their thoughts, consider others' ideas, and reinterpret each other's contributions are they likely to form new associations in areas they did not previously think of, to extend others' ideas, or to combine them with ideas of their own (Brown et al. 1998, Dugosh et al. 2000)—all of which are essential for creative ideas to emerge (Hargadon and Bechky 2006). This logic is supported by recent research on idea combination in brainstorming. For example, Kohn et al. (2011) showed that groups that were asked to build on the ideas of others, particularly those ideas that are rare, subsequently developed ideas that were more novel and useful. Thus, groups that are more collaborative in terms of idea generation should be more likely to develop truly creative ideas.[1]

The tendency of women relative to men to more likely engage in collaboration in groups implies that, to the extent that collaboration fosters creativity, groups composed of women should exhibit higher creativity than those composed of men. Specifically, the sense of interdependence that is likely to emerge in groups of women should encourage members to share their thoughts and to consider each other's ideas and use them as valuable inputs into their own generative processes. To the

extent that the combination and integration of a variety of ideas facilitates group creativity, women's tendency to engage in positive interpersonal behaviors should be associated with higher levels of creativity compared with groups composed of men (Wood 1987). Providing some initial support for this line of reasoning, Wood et al. (1985) found that groups composed entirely of women generated more creative solutions to a set of three problems than groups composed entirely of men. In addition, Woolley et al. (2010) found that the proportion of women in a group significantly correlated with the group's collective intelligence—a strong predictor of group performance across a variety of domains, including creativity. Collective intelligence is a characteristic of the group itself (not merely reflective of individual intelligence) and predicts group performance over and above what can be explained by aggregating the abilities of individual team members (Woolley et al. 2010). This work hints at the possibility that the proportion of women in a team may encourage the emergence of certain group-level processes (e.g., equal contribution by all team members and thorough consideration of all ideas and suggestions) that ultimately produce higher performance across a wide range of tasks. Thus, in the absence of intergroup competition, we expect groups composed of women to exhibit higher creativity than groups composed of men, and we expect this difference to be due to differences in collaboration.

When operating in a competitive environment, however, this pattern is likely to change. When groups are forced to go head-to-head with each other, we expect those composed of men to exhibit higher levels of creativity relative to groups composed of women. Our explanation for this pattern again relies primarily on social role theory. As noted, gender roles are anchored in a society's stereotypical expectations about how men and women typically behave or should behave (Wood and Eagly 2010). Among the myriad of gender stereotypes that seem to affect social behavior, the belief that women are less competitive than men is highly pervasive (Sell and Kuipers 2009). Indeed, research has shown that compared with men, women self-select at lower rates into competitive environments (Croson and Gneezy 2009, Niederle and Vesterlund 2007), are less likely to accept competition (Beutel and Marini 1995), and seem to benefit less from it (Amabile 1982, Gneezy and Rustichini 2004, Gneezy et al. 2003). Whether it is because women (men) believe that others expect them to flounder (excel) when there is competition—people tend to conform to gender roles even if others' expectations are just implied in the situation and not explicitly communicated—or because women (men) see themselves as less (more) competitive, the introduction of intergroup competition is likely to differentially affect women's and men's social behavior.

But exactly what actions are men and women likely to take once their groups begin competing with other groups? The adherence to gender roles manifested in the belief that women are less likely to enjoy competition and that others may expect them to flounder under such circumstances may cause women to disengage from the competition. In other words, because women, compared with men, perceive competition to be a less attractive vehicle to stimulate group performance, we expect women to disengage from the competition and the task activities supporting it (i.e., actively collaborating with each other). This tendency for women to disengage from task activities and thus constrict collaboration implies that, to the extent that collaboration fosters creativity, groups composed of women should exhibit lower creativity as the intergroup environment becomes increasingly competitive. The opposite should be true for men. Armed with the belief that they are more likely to succeed when competing and emboldened by the knowledge that others may expect them to do well in competitive circumstances, men should be more likely to invest themselves fully in the competition and the task activities supporting it. This tendency for men to engage in the task activities and thus foster collaboration implies that, to the extent that collaboration fosters creativity, groups composed of men should exhibit higher creativity as the intergroup environment becomes increasingly competitive.

This pattern of results may be expected to emerge not only in sex-homogeneous groups but also in groups of heterogeneous composition. Specifically, as in sex-homogeneous groups, conformity to gender roles should produce systematic differences between men and women in terms of their tendency to collaborate—compared with men, women should be more likely to collaborate when there is no or little competition between groups. Consequently, as the proportion of men in a group increases, the overall level of collaboration is likely to decline. Research on relational demography provides some support for this assertion (Chattopadhyay et al. 2008, Karakowsky and Siegel 1999). For example, Chatman and O'Reilly (2004) found that women experienced the highest level of within-group collaboration when their groups were composed of all women and reported generally declining levels of collaboration as the proportion of men increased. Men, in contrast, reported the lowest level of collaboration when their groups were composed of all men and generally higher levels of collaboration as the proportion of women increased. The overall pattern suggested by this research is one of declining collaboration in groups with increasing numbers of men. Accordingly, we can expect that when the intergroup environment is benign, groups composed of all women should be most collaborative and most creative, with group creativity declining as the proportion of men increases.

The opposite can be expected when the intergroup environment becomes increasingly competitive. Under such circumstances, the tendency of women to disengage from the competition and the activities supporting it should undermine group collaboration. Thus, as the proportion of women in a group increases, overall collaboration is likely to become increasingly constricted, resulting in depressed levels of creativity. Men, in contrast, are expected to exhibit elevated levels of collaboration when they go head-to-head with other groups, ultimately resulting in higher levels of creativity. Thus, we can expect that as the intergroup environment becomes more competitive, groups composed of all men should be most collaborative and most creative, with group creativity declining as the proportion of women increases.

Although no previous study has examined the creativity of groups composed of men or of women under conditions of intergroup competition, some research provides support for the prediction that men are likely to respond to intergroup competition with enhanced within-group collaboration, whereas women are likely to respond with restricted collaboration. Specifically, in a series of three experiments, Van Vugt et al. (2007) showed that men were more likely than women to raise their group contributions in a public goods game when faced with competition from other groups—an effect that was mediated by group identification. In addition, the first of the authors' studies found that women became less collaborative when their groups were forced to compete against other groups. Thus, there seems to be some support for our logic, at least in terms of within-group collaboration. Combining these findings with our earlier arguments, we hypothesize the following.

HYPOTHESIS 1. *The sex composition of groups will moderate the effects of intergroup competition on group creativity such that groups composed largely or exclusively of men will exhibit higher creativity as competition increases, whereas groups composed largely or exclusively of women will exhibit lower creativity as competition increases.*

The logic that the interactive effects of intergroup competition and sex composition on creativity largely operate through collaboration implies that this variable may serve to mediate the effects hypothesized in this study (Wood 1987, Wood et al. 1985). Thus, we also hypothesize the following.

HYPOTHESIS 2. *Collaboration will mediate the interactive effects of intergroup competition and group sex composition on group creativity.*

Overview of the Present Research

We conducted two studies to test our hypotheses. In Study 1, we used an experimental design to test our hypotheses in a controlled laboratory environment. Study 2 replicated the findings from Study 1 using a sample of research and development (R&D) teams in a different cultural context.

Study 1

Study 1 Methods

Experimental Design and Participants. We used a one-factorial (intergroup competition: low, medium, high) between-subjects design to test our hypotheses. Participants were 360 undergraduate students at a large university. Their average age was 21 years, and 49% were men. Participants were randomly assigned to 90 four-member groups, which were then randomly assigned to the three experimental conditions (30 groups per condition) (LePine et al. 2002). We decided to compose groups randomly as participants arrived at our laboratory rather than to systematically create groups of different sex compositions because treating sex composition as an experimental factor would have required a sample too large for practical purposes.[2] In return for their participation, participants earned class credit and were eligible for cash prizes (see the Intergroup Competition Manipulation section).

Experimental Task. Groups assumed the role of a four-person task force that was assigned by the College of Business the mission of developing a strategy to make the university a more attractive option for students. The specific goal of the mission was to generate creative (i.e., novel and potentially useful) ideas that addressed one specific problem related to student life: how to improve the transition from high school to college for students entering the university.

Procedure. Upon arrival in the reception area of the laboratory, participants were assigned to one of two groups of four (to maximally use the laboratory space, two groups were run simultaneously) and asked to write their names on name tags. Participants were then instructed to go to their respective rooms and to complete a consent form. The experimenter then entered the first room and read aloud the instructions for the task. We highlighted the importance for groups to produce truly creative ideas suitable for subsequent adoption (e.g., Sutton and Hargadon 1996). The experimenter then repeated the instructions to the second group in the next room. After 15 minutes, the experimenter reentered both rooms successively and asked the groups to complete the manipulation check. We then debriefed and dismissed participants.

Intergroup Competition Manipulation. Consistent with previous research suggesting the possibility of intergroup competition exhibiting nonmonotonic effects (Baer et al. 2010), we created three different levels of competition.

To this end, we systematically varied two components of competition—the number of groups that could simultaneously win the competition (i.e., win-lose component) and the size of the financial reward associated with being among the winning groups (i.e., reward component) (Amabile 1996). Specifically, we told participants in the *low competition* condition that their opportunity to win a $4 cash prize ($1 per person); to have their ideas forwarded to the College of Business would require their group to be among the top 50% of the most creative groups in the experiment. Participants in the *medium competition* condition were told that their opportunity to win a $40 cash prize ($10 per person) and to have their ideas forwarded would require their group to be among the 10 most creative groups in the experiment. Finally, members in the *high competition* condition were told that their opportunity to win a $400 cash prize ($100 per person) and to have their ideas forwarded would require their group to be the single most creative group in the experiment. We told groups that we would determine the top groups by evaluating the creativity of the ideas developed by each group and then rank ordering all groups according to the creativity of their ideas. Group members were not informed about the total number of groups participating in the experiment or the number of groups per experimental condition.

Measures. The three measures we used in this study were sex composition, collaboration, and group creativity. We outline each below.

Sex composition: Sex composition was operationalized as the proportion of men in the group. Ten groups had 0% men, 20 groups had 25% men, 27 groups had 50% men, 24 groups had 75% men, and 9 groups had 100% men.

Collaboration: To derive an indicator of collaboration, we video recorded all group interactions. Because of technical difficulties with one of the two video cameras, however, only about 70% of the videos were usable. Three raters (two men and one woman), who were blind to the experimental conditions and the hypotheses of the study, coded these interactions. Collaboration captures the extent to which group members share their ideas, attend to others' ideas, and consider these ideas as valuable inputs into their own generative processes. Accordingly, we instructed raters to count the number of times group members used each other's ideas as triggers for new ideas, gave meaning to others' ideas, or built on others' ideas. We then averaged the ratings of the three coders for each group. To examine whether aggregation was justified, we calculated two intraclass correlation coefficients (ICC[2, 1] and ICC[2, k]; see McGraw and Wong 1996, Shrout and Fleiss 1979). Both measures were acceptable, suggesting adequate levels of reliability, thereby justifying aggregation of ratings across coders (ICC[2, 1] = 0.36, ICC[2, 3] = 0.63). The resulting variable ranged from 3.33 to 22.33 (M = 10.17, SD = 3.50).

Group creativity: We developed our measure of creativity following a two-step procedure. In the first step, three additional external raters who were blind to the design and hypotheses of the study underwent training conducted by one of the authors. Consistent with previous theory and research (Amabile 1996, Baer and Oldham 2006, Shalley et al. 2004), we defined creativity as ideas that are both novel and potentially useful. After reading this definition, the raters were instructed to individually rate approximately 5% (randomly selected) of the ideas generated by all groups using a scale ranging from 1 ("not at all creative") to 9 ("extremely creative"). After completing their individual evaluations, the raters jointly discussed their ratings and resolved any differences.

In the second step, the three raters were instructed to independently rate all ideas generated by all groups. The ideas were presented in random order, and groups were not identified. We asked the raters to rate each idea on the same scale as described above. To construct our measures of creativity, we averaged the ratings of the three raters for each idea. To examine whether aggregation was justified, we calculated the median interrater agreement coefficient ($r_{wg[j]}$; see James et al. 1984) and two intraclass correlation coefficients (ICC[2, 1] and ICC[2, k]). All measures were acceptable, suggesting adequate levels of agreement and reliability. This justified aggregation of ratings across raters (median $r_{wg[3]}$ = 0.80, ICC[2, 1] = 0.49, ICC[2, 3] = 0.74) (Bliese 2000).

Organizations are generally not interested in a large number of mediocre ideas but typically charge their project groups to produce a limited number of great ideas (Girotra et al. 2010, Sutton and Hargadon 1996). Consistent with this emphasis, in our instructions, we highlighted the importance for groups to produce truly creative ideas rather than a large number of ideas. In line with these instructions, we operationalized creativity by focusing on a group's *maximum creativity* (highest creativity score across all of a group's ideas). However, to ensure that our results are not restricted to only the highest level of creativity, we developed two additional measures: *high creativity* (average creativity across a group's six highest-rated ideas, which is the median number of ideas produced across all groups) and *average creativity* (average creativity across all of a group's ideas).

Ideas that were rated as creative included the creation of a virtual campus map tool that would allow students to enter their class schedules and correspondingly plan out bus routes, display photos of the buildings in which classes are held, produce pictures and biographical information of the professors teaching the selected courses, and exhibit last semester's syllabus along with reviews from students who had taken the class in the past (average creativity rating across three raters = 9.00). Another idea, for example, suggested the implementation of a student mentor program consisting of upper classmen

being matched based on interests to their mentees and providing them with guidance and expertise and a forum to get to know one another (average creativity rating across three raters = 8.67).

Manipulation Check. After completing their task, participants responded to four items suggested by Baer et al. (2010) using a scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"): "This assignment created quite a bit of competition between my own group and the other groups that participated in this study," "This assignment involved very little competition between the groups that took part in this study" (reverse scored), "There was a good deal of competition about which group produced the most creative idea," and "While completing this assignment, I felt a high degree of competition." The reliability estimate for this measure was satisfactory ($\alpha = 0.81$), and we created an index by averaging scores across the four items.

Since we measured perceived intergroup competition at the individual level, we aggregated it to the group level by averaging scores across the members of each group. Estimates of both interrater agreement (median $r_{wg[4]} = 0.92$) and reliability (ICC[1, 1] = 0.21; ICC[1, 4] = 0.51) were acceptable, thereby justifying aggregation of ratings across group members.

Study 1 Results

Manipulation Check. An analysis of variance conducted on the manipulation check measure yielded a statistically significant main effect ($F[2, 87] = 21.67$, $p < 0.01$). The planned comparisons between the low and medium groups ($t = 2.51$, $p < 0.05$), the low and high groups ($t = 6.53$, $p < 0.01$), and the medium and high groups ($t = 4.01$, $p < 0.01$) were all statistically significant. As expected, groups in the low competition condition reported the lowest level of competition (M = 2.82, SD = 0.47), followed by the groups in the medium (M = 3.23, SD = 0.67) and high (M = 3.89, SD = 0.73) competition conditions. Additionally, there was no statistically significant main effect of sex composition on our manipulation check measure or interaction between intergroup competition and sex composition (p's > 0.05). Thus, our manipulation appeared to be successful in generating three ordered levels of perceived competition that can be labeled low, medium, and high.

Test of Hypotheses. Consistent with previous research (Humphrey et al. 2004), we used hierarchical regression analysis with mean-centered variables to test for the interactive effects of intergroup competition and sex composition on group creativity (Cohen et al. 2003). We introduced into a regression equation the two main effect variables (*intergroup competition* and *sex composition*) followed by the linear *intergroup competition* × *sex composition* interaction term in Step 2. Providing some initial support for Hypothesis 1, the *intergroup competition* × *sex composition* interaction was statistically significant for maximum ($\beta = 0.24$, $t = 2.31$, $p < 0.05$) and high ($\beta = 0.24$, $t = 2.33$, $p < 0.05$) creativity but not for average creativity ($\beta = 0.17$, $t = 1.63$, $p > 0.05$) (see Table 1, Models 1).

In further support of Hypothesis 1, results of post hoc analyses (Aiken and West 1991) revealed that in groups composed mostly or entirely of men, intergroup competition had the predicted statistically significant positive effects on maximum ($b = 0.57$, $t = 2.76$ and $b = 0.89$, $t = 2.83$, p's < 0.01), high ($b = 0.69$, $t = 3.28$ and $b = 1.02$, $t = 3.18$, p's < 0.01), and average ($b = 0.66$,

Table 1 Results of Hierarchical Regression Analysis of Collaboration and Group Creativity on Competition, Sex Composition, and Their Interactions (Study 1)

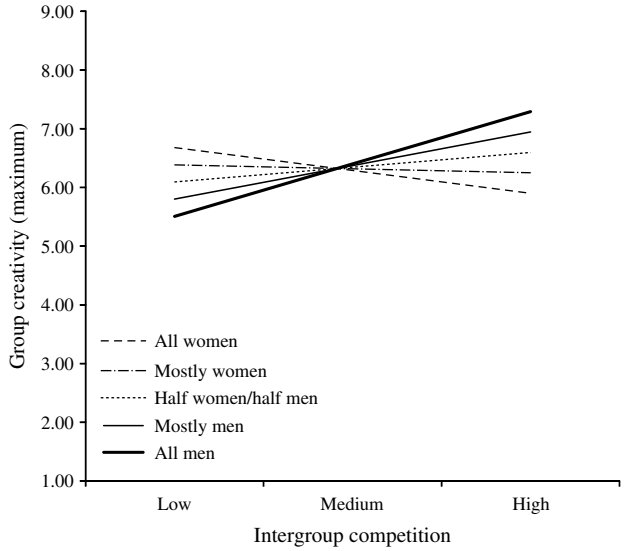
		Maximum creativity		High creativity		Average creativity	
Independent variables	*Collaboration*	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Step 1							
Intergroup competition	−0.03	0.17	0.16^{+}	0.24*	0.23*	0.25*	0.25*
Sex composition	0.12	0.03	−0.28^{+}	−0.03	−0.27^{+}	−0.04	−0.21
Step 2							
Intergroup competition × *Sex composition*	0.18^{+}	0.24*	0.19^{+}	0.24*	0.18^{+}	0.17	0.10
Step 3							
Intergroup competition^{2}	−0.06	0.10	0.12	0.10	0.11	0.12	0.14
Step 4							
Intergroup competition^{2} × *Sex composition*	0.43*	0.44**	0.35*	0.36*	0.25	0.29^{+}	0.16
Step 5							
Collaboration	—	—	0.21*	—	0.26**	—	0.29**
R^2	0.11	0.17	0.21	0.17	0.23	0.13	0.21
F	2.12^{+}	3.38**	3.60**	3.36**	4.08**	2.53*	3.60**

Notes. Entries refer to standardized regression coefficients. Model 1 reports coefficients at each step; Model 2 reports coefficients at Step 5.
$^{+}p \le 0.10$; $^{*}p \le 0.05$; $^{**}p \le 0.01$.

$t = 2.87$, $p < 0.01$ and $b = 0.90$, $t = 2.61$, $p < 0.05$) creativity. However, the effects of intergroup competition on the creativity of groups composed mostly or entirely of women were statistically nonsignificant for maximum ($b = -0.07$, $t = -0.32$ and $b = -0.39$, $t = -1.20$, p's > 0.05), high ($b = 0.03$, $t = 0.16$ and $b = -0.29$, $t = -0.90$, p's > 0.05), and average ($b = 0.16$, $t = 0.67$ and $b - 0.09$, $t = -0.26$, p's > 0.05) creativity. Overall, these results provide partial support for Hypothesis 1: the creativity of groups composed mostly or entirely of men benefits from intergroup competition, whereas the creativity of groups composed mostly or entirely of women remains largely unaffected by such competition (see Figure 1 for the results for maximum creativity as an exemplary display; figures showing results for high and average creativity are available from the authors upon request).

Because we created three different levels of competition, we were able to test for potential nonlinear effects of intergroup competition. Thus, we created two additional terms: a quadratic intergroup competition term and a term for the interaction between quadratic intergroup competition and sex composition. These terms were introduced in the regression equation following the linear interaction term. The coefficients associated with the *intergroup competition*^{2} term were not statistically significant for any of the three creativity measures (p's > 0.05) (see Table 1, Models 1, Step 3), but the *intergroup competition*^{2} × *sex composition* interaction term did reach statistical significance for both maximum ($\beta = 0.44$, $t = 2.63$, $p < 0.01$) and high ($\beta = 0.36$, $t = 2.14$, p's < 0.05) creativity, and it approached significance for average creativity ($\beta = 0.29$, $t = 1.65$, $p = 0.10$) (see Table 1, Models 1, Step 4).[3]

Figure 1 Interaction of Intergroup Competition and Sex Composition on Group Creativity (Maximum) (Study 1)



Results of additional analyses revealed that at low levels, the effects of intergroup competition on the creativity measures were statistically nonsignificant for all sex compositions (p's > 0.05). However, the effects of competition for groups composed mostly or entirely of men, which were somewhat negative at low levels (albeit nonsignificantly so) became positive and significant at medium and high levels, resulting in a U-shaped pattern. Indeed, at medium levels, competition had the predicted significant positive effects on the creativity of groups composed mostly or entirely of men for *all* measures of creativity—maximum ($b = 0.53$, $t = 2.62$, $p < 0.05$ and $b = 0.83$, $t = 2.71$, $p < 0.01$), high ($b = 0.65$, $t = 3.15$ and $b = 0.96$, $t = 3.06$, p's < 0.01), and average ($b = 0.62$, $t = 2.73$, $p < 0.01$ and $b = 0.85$, $t = 2.47$, $p < 0.05$). All of these effects became stronger at high levels of competition for maximum ($b = 2.24$, $t = 3.18$ and $b = 3.73$, $t = 3.51$, p's < 0.01), high ($b = 2.16$, $t = 2.98$ and $b = 3.46$, $t = 3.17$, p's < 0.01), and average ($b = 2.14$, $t = 2.69$ and $b = 3.21$, $t = 2.68$, p's < 0.01) creativity.

Conversely, at medium levels, competition had mostly negative, albeit nonsignificant, effects on the creativity of groups composed mostly or entirely of women for all measures of creativity—maximum ($b = -0.08$, $t = -0.37$ and $b = -0.38$, $t = -1.21$, p's > 0.05), high ($b = 0.03$, $t = 0.13$ and $b = -0.28$, $t = -0.88$, p's > 0.05), and average ($b = 0.16$, $t = 0.68$ and $b = -0.07$, $t = -0.21$, p's > 0.05)—and these effects became stronger at high levels of competition, reaching statistical significance for maximum creativity ($b = -0.74$, $t = -1.00$, $p > 0.05$ and $b = -2.23$, $t = -2.01$, $p < 0.05$), but not for high creativity ($b = -0.45$, $t = -0.59$ and $b = -1.75$, $t = -1.54$, p's > 0.05) or average creativity ($b = -0.01$, $t = -0.01$ and $b = -1.08$, $t = -0.86$, p's > 0.05). Combined with the statistically nonsignificant positive effects at low levels of competition, this resulted in an inverted U-shaped pattern for groups composed mostly or entirely of women (see Figure 2 for the results for maximum creativity as an exemplary display; figures showing results for high and average creativity are available from the authors upon request).

In total, these results are consistent with Hypothesis 1 but suggest two extensions. First, the pattern we predicted is more likely to emerge at high levels of competition. Second, the positive effects of competition on the creativity of groups composed mostly or exclusively of men seem to be more robust than the negative effects of competition on the creativity of groups composed mostly or exclusively of women.

Hypothesis 2 stated that collaboration would mediate the interactive effects of intergroup competition and sex composition on group creativity. Given our finding that the effects of intergroup competition on group creativity seem to be more pronounced at higher levels of competition, we also tested for nonlinear effects

Figure 2 Quadratic Interaction of Intergroup Competition and Sex Composition on Group Creativity (Maximum) (Study 1)

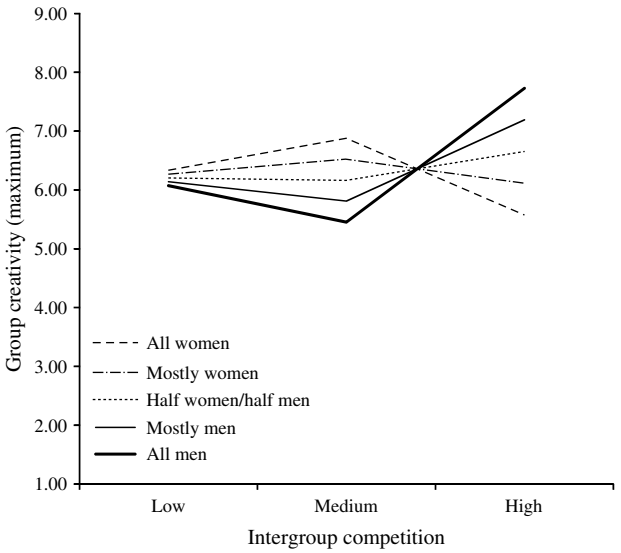
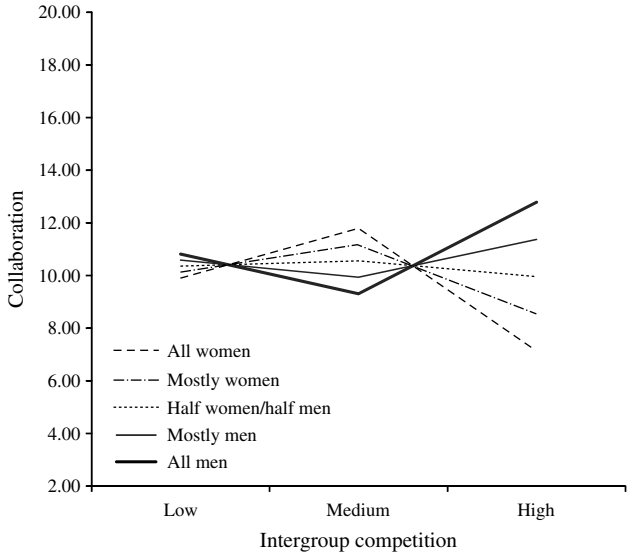


Figure 3 Quadratic Interaction of Intergroup Competition and Sex Composition on Collaboration (Study 1)



of competition on collaboration. If collaboration indeed serves as a mediator of the joint effects of competition and sex composition on group creativity, these variables should affect collaboration in a similar way as they affect group creativity. To test mediation, we employed the procedure outlined by Baron and Kenny (1986) and Mathieu and Taylor (2006). We had already demonstrated that the independent variables affected group creativity consistent with our arguments. Second, we found that intergroup competition and sex composition also exhibited a joint, quadratic effect on collaboration ($\beta = 0.43,\ t = 2.44,\ p < 0.05$) and a marginally significant linear effect ($\beta = 0.18,\ t = 1.68,\ p < 0.10$) (see Table 1). The pattern of the quadratic interaction is shown in Figure 3 and is similar to the pattern for the quadratic interaction involving group creativity (see Figure 2). Finally, when entered in the last step of the equation (see Table 1, Models 2, Step 5), the effects of collaboration were statistically significant for all measures of creativity—maximum ($\beta = 0.21,\ t = 2.02,\ p < 0.05$), high ($\beta = 0.26,\ t = 2.56,\ p = 0.01$), and average ($\beta = 0.29,\ t = 2.81,\ p < 0.01$)—and the statistically significant interactions between *intergroup competition*^{2} and *sex composition* on group creativity were reduced in significance or became nonsignificant for maximum ($\beta = 0.35,\ t = 2.07,\ p < 0.05$), high ($\beta = 0.25,\ t = 1.47,\ p > 0.05$), and average ($\beta = 0.16,\ t = 0.94,\ p > 0.05$) creativity. According to Sobel's (1982) test, the indirect effect approached significance for maximum creativity ($z = 1.56,\ p = 0.06$) and was significant for both high creativity ($z = 1.77,\ p < 0.05$) and average creativity ($z = 1.84,\ p < 0.05$), suggesting that collaboration serves to mediate the joint effects of intergroup competition and sex composition on group creativity, providing some support for Hypothesis 2.

Study 1 Discussion

Consistent with Hypothesis 1, results of Study 1 revealed a significant linear interaction between intergroup competition and sex composition on group creativity. This linear pattern appeared to be due largely to the increase in creativity of groups composed (mostly or exclusively) of men rather than to the predicted decline in creativity of groups composed (mostly or exclusively) of women. However, additional analysis of the nonlinear effect of intergroup competition revealed that the pattern of results was more nuanced than initially assumed and that the expected negative effect of competition on the creativity of groups composed of women did emerge, albeit only at high levels of competition and only when evaluated in terms of the highest level of creativity. Similarly, the expected positive effect of competition on the creativity of groups composed mostly or entirely of men only emerged as competition increased from medium to high levels. Thus, it appears that the effects of competition are concentrated at the higher end of the competition spectrum.

Supporting Hypothesis 2, results also revealed that the extent to which group members engaged in collaboration mediated the joint (quadratic) effect of competition and sex composition on group creativity. Similar to creativity, we found the joint effect of competition and composition on collaboration to be more pronounced at the higher end of the competition spectrum, further highlighting the importance of considering the nonlinear effects of competition on various group processes and outcomes.

Although the results of our first study are generally supportive of our arguments, Study 1 suffers from one potential shortcoming. That is, our use of a laboratory

setting involving undergraduate students may raise questions about the external validity of our findings. To address this issue, in Study 2, we sought to replicate the results of Study 1 in a sample of intact R&D teams. Given our findings that the effects on both collaboration and creativity were localized at the higher end of the competition spectrum, we again examined the possibility of such nonlinear effects in Study 2.

Study 2

Study 2 Methods

Sample and Procedure. Our sample included 64 teams that were composed primarily of scientists, engineers, and technicians of a global oil and gas company. These teams were responsible for a variety of research and development functions requiring heavy doses of creativity, such as identifying new natural gas and petroleum locations and implementing new technologies. To effectively achieve their mutual work goals, employees had to interact frequently, sharing information and other resources and coordinating their collective efforts. Employees belonged to only one team at a time.

The leaders of all 64 teams were approached and asked for their own and their team members' participation in return for feedback. Using an "informant sampling approach" (Van de Ven and Ferry 1980)—an approach that relies on a limited number of selected informants rather than on all members of a collective as sources of information—the leaders of those teams who had indicated their willingness to participate were asked to identify a handful of key informants in their teams (van der Vegt and Bunderson 2005). These members were then invited to complete a team member survey measuring intergroup competition and collaboration. In addition, team leaders completed a brief survey to assess group creativity. A total of 55 supervisor questionnaires (86%) and 227 team member questionnaires (89%) were received. In addition to the supervisor and subordinate survey data, archival data (e.g., demographic information, team size) were obtained from the human resources department to derive a measure of sex composition.

The final usable sample consisted of 50 supervisors and 179 team members who served as the key informants. Overall team size ranged from 4 to 26 members (M = 11.44, SD = 6.14), the percentage of informants per team ranged from 5% to 100% (M = 41.37, SD = 23.59), the percentage of men per team ranged from 58% to 100% (M = 87.04, SD = 13.09), and ages ranged from 22 to 59 years (M = 43.06, SD = 7.50). The majority of the employees in our sample held a master's degree or higher.

Measures. Consistent with the informant sampling approach that was used, all items in the supervisor and team member surveys asked informants not to describe their own personal behaviors or attitudes regarding the team but rather to report their evaluations of the team as a whole (see Van de Ven and Ferry 1980). Before collecting data, items were discussed with two company representatives; as a result of these discussions, multiple changes were made to the wording of the items in an effort to improve clarity and understandability but without changing the meaning or content of the items (van der Vegt and Bunderson 2005).

Intergroup competition: Using a scale ranging from 1 ("completely disagree") to 7 ("completely agree"), informants responded to three items ($\alpha = 0.65$) derived from Campion et al. (1993): "There is little competition between this team and other teams in the company" (reverse scored), "This team cooperates with other teams in the company to get the work done" (reverse scored), and "Other teams in the company try to outperform this team." Since intergroup competition was measured at the individual level, we aggregated it to the group level by averaging scores across the informants for each team. Estimates of both interrater agreement (median $r_{wg[j]} = 0.81$) and reliability (ICC$[1, 1] = 0.22$; ICC$[1, k] = 0.53$) were acceptable, thereby justifying aggregation of ratings across team members.

Sex composition: As in Study 1, we operationalized sex composition as the proportion of men in each team.

Collaboration: This was measured with four items ($\alpha = 0.75$) based on those developed by Chatman and Flynn (2001). Using a scale ranging from 1 ("completely disagree") to 7 ("completely agree"), informants responded to items such as "Members are always ready to cooperate and help each other" and "There is a high level of sharing between team members." Since collaboration was measured at the individual level, we aggregated it to the group level by averaging scores across the informants for each team. Estimates of both interrater agreement (median $r_{wg[j]} = 0.90$) and reliability (ICC$[1, 1] = 0.13$; ICC$[1, k] = 0.37$) were acceptable, thereby justifying aggregation of ratings across team members.

Team creativity: Each team leader responded to a set of four items adopted from previous research (Drach-Zahavy and Somech 2001, West and Wallace 1991) ($\alpha = 0.76$). Supervisor ratings are widely used and accepted in the creativity and innovation literatures (Hammond et al. 2011, Shalley et al. 2004). Using a scale ranging from 1 ("far below average") to 7 ("far above average"), team leaders were asked to compare the creativity of their teams over the past six months with the creativity of other teams that performed similar tasks. Sample items include the following: "The team initiated new procedures and methods" and "The team developed innovative ways of accomplishing work targets/objectives."

Control variables: To eliminate the potential confounding effects of team size, diversity in age, and general team performance on team processes and creativity, we controlled for these variables in all analyses (e.g., Ancona and Caldwell 1992, Shin and Zhou 2007, Zhang and Bartol 2010). *Team size* was measured via a count of the number of members per team based on information provided by the human resources department. *Team age diversity* was measured using the coefficient of variation (standard deviation divided by the mean) also based on archival information. General *team performance* was measured with four items ($\alpha = 0.93$) derived from prior research (e.g., Ancona and Caldwell 1992). Using a scale ranging from 1 ("far below average") to 7 ("far above average"), team members were asked to compare their team to other teams performing similar tasks regarding achieving goals, fulfilling the team's mission, quality of work, and overall achievement level. Estimates of both interrater agreement (median $r_{wg[j]} = 0.95$) and reliability (ICC$[1, 1] = 0.23$; ICC$[1, k] = 0.55$) were acceptable, thereby justifying aggregation of ratings across team members.[4]

Study 2 Results

Correlations among all variables are exhibited in Table 2. As in Study 1, we used hierarchical regression analysis with mean-centered variables to test for the interactive effect of intergroup competition and sex composition on group creativity (see Table 3).

Consistent with the findings from Study 1, there was a statistically significant interaction between *intergroup competition*^{2} and *sex composition* on team creativity ($\beta = 0.49,\ t = 2.31,\ p < 0.05$) (see Table 3, Model 1, Step 5). However, the linear interaction between *intergroup competition* and *sex composition* did not reach significance ($\beta = -0.19,\ t = -1.25,\ p > 0.05$) (see Table 3, Model 1, Step 3). Similar to the more nuanced pattern of results observed in Study 1, it appears that the predicted effects of competition on creativity are more likely to occur at the higher end of the competition spectrum. Indeed, the expected positive effect of competition on the creativity of teams with a high proportion of men and the predicted negative effect on the creativity of teams composed of relatively more women emerged only once competition reached high levels (see Figure 4).

Table 3 Results of Hierarchical Regression Analysis of Collaboration and Team Creativity on Competition, Sex Composition, and Their Interactions (Study 2)

		Team creativity	
Independent variable	*Collaboration*	Model 1	Model 2
Step 1			
Team size	0.05	−0.06	−0.04
Team age diversity	−0.13	0.16	0.25$^+$
Team performance	0.32*	0.25$^+$	−0.02
Step 2			
Intergroup competition × *Sex composition*	−0.20 −0.15	−0.17 0.05	−0.18 −0.15
Step 3			
Intergroup competition × *Sex composition*	0.29*	−0.19	−0.39*
Step 4			
Intergroup competition^2	0.34*	0.17	−0.04
Step 5			
Intergroup competition^2 × *Sex composition*	0.45*	0.49*	0.32
Step 6			
Collaboration	—	—	0.37*
R^2	0.43	0.26	0.34*
F	3.83**	1.84$^+$	2.34*

Notes. *b* refers to standardized regression coefficients. Model 1 reports coefficients at each step; Model 2 reports coefficients at Step 6.
$^+p \le 0.10$; $^*p \le 0.05$; $^{**}p \le 0.01$.

Also replicating our findings from Study 1, there was evidence of a quadratic interaction between intergroup competition and sex composition on collaboration ($\beta = 0.45,\ t = 2.47,\ p < 0.05$). Similar to the pattern of results observed for collaboration in Study 1, the effects of competition on collaboration were concentrated at the higher end of the competition spectrum (see Figure 5). Beyond medium levels, competition boosted the collaboration of teams composed primarily of men and constricted collaboration among teams composed of a greater proportion of women. Providing support for the mediating role of collaboration and Hypothesis 2, results showed that controlling for the significant effect of collaboration ($\beta = 0.37,\ t = 2.21,\ p < 0.05$)

Table 2 Means, Standard Deviations, and Correlations among Study Variables (Study 2)

Variables	M	SD	1	2	3	4	5	6	7
1. *Team size*	11.44	6.14	—						
2. *Team age diversity*	0.15	0.05	0.21	—					
3. *Team performance*	5.31	0.60	0.07	0.06	—				
4. *Intergroup competition*	3.13	0.78	0.20	0.12	−0.28*	—			
5. *Sex composition*	0.87	0.13	−0.02	−0.18	−0.11	0.20	—		
6. *Collaboration*	5.04	0.58	0.04	−0.10	0.32*	−0.30*	−0.20	—	
7. *Team creativity*	5.06	0.95	−0.01	0.16	0.26$^+$	−0.20	−0.04	0.39*	—

Note. Sex coded 0 for women and 1 for men.
$^+p \le 0.10$; $^*p \le 0.05$; $^{**}p \le 0.01$.

Figure 4 Quadratic Interaction of Intergroup Competition and Sex Composition on Team Creativity (Study 2)

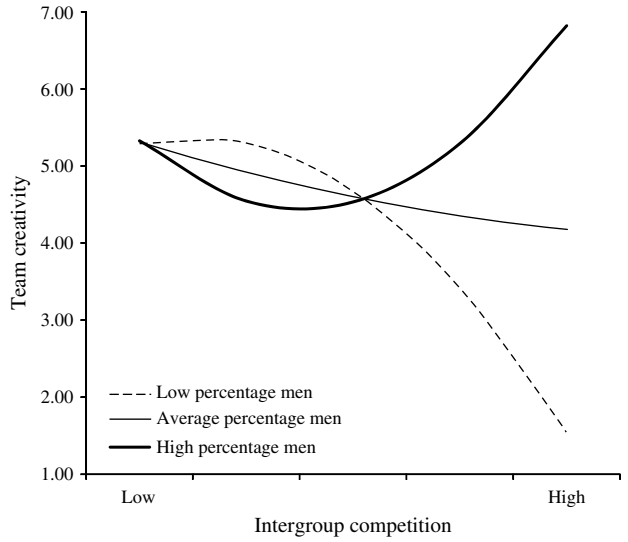
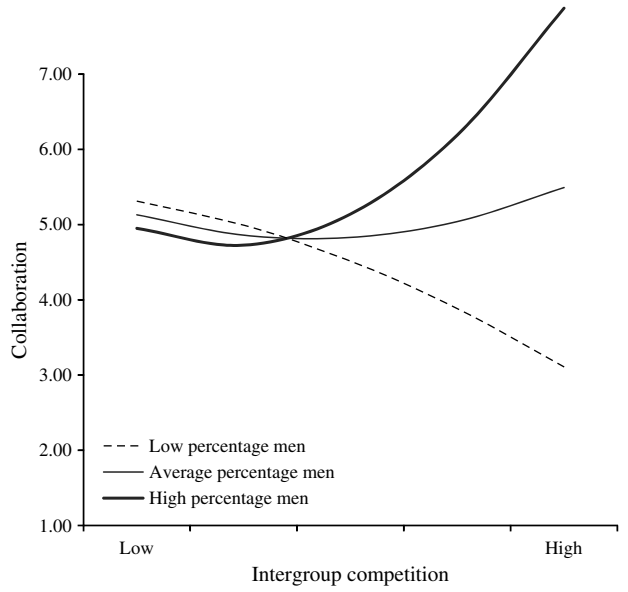


Figure 5 Quadratic Interaction of Intergroup Competition and Sex Composition on Collaboration (Study 2)



in the last step (Table 3, Model 2) rendered nonsignificant the previously significant interaction between *intergroup competition*^{2} and *sex composition* on team creativity ($\beta = 0.32$, $t = 1.35$, $p > 0.05$). The indirect effect was statistically significant according to Sobel's (1982) test ($z = 1.64$, $p = 0.05$), suggesting mediation.

Study 2 Discussion

Our field study replicated the quadratic results of our first study in a sample of R&D teams, indicating that our previous findings are not limited to the laboratory context or to the undergraduate samples we employed. Consistent with our general arguments, teams composed largely of men became more creative as the intergroup environment became increasingly competitive, whereas groups with a larger percentage of female employees experienced decreases in creativity as intergroup competition rose from low to high levels. However, as in our experiment before, the expected positive and negative effects of competition on the creativity of groups composed of men and women, respectively, only emerged once competition reached medium to high levels. In addition, our field study provides additional evidence for the importance of collaboration as the mediating mechanism transmitting the joint effect of intergroup competition and sex composition on group creativity.

General Discussion

Results across two studies—a laboratory experiment and a field study—support our general line of theorizing that the effects of intergroup competition on group creativity are contingent upon the sex composition of the group and are mediated by within-group collaboration. Consistent with Hypothesis 1, results of our laboratory experiment revealed a linear interaction between intergroup competition and sex composition on group creativity. As expected, competition boosted the creativity of groups composed mostly or entirely of men. Yet there was little evidence for the expected decline in creativity among groups composed largely or exclusively of women. This negative relation between competition and creativity among women groups emerged, however, when we considered the nonlinear effects of intergroup competition. Thus, although Study 1 provided general support for our first hypothesis, the results of this study suggested that the effects of competition are not linear as initially assumed but seem to be more pronounced at the higher end of the competition spectrum. This more nuanced version of Hypothesis 1 was underscored by our field study, where we examined the joint effects of competition and composition on the creativity of intact R&D teams. Overall, then, the results of our two studies suggest that groups composed of men benefit creatively from going head-to-head with other groups, whereas groups of women benefit more from operating in less competitive circumstances. These effects seem to be concentrated at the higher end of the competition spectrum, however, and appear to be stronger in groups that are composed of all men or all women.

Providing support for our argument that intergroup competition and sex composition affect group creativity to the extent that they change the way members work with one another, results of our two studies provided converging evidence that within-group collaboration mediated the effects observed in this research. The mediating effects were shown using different measures of collaboration—a count measure of collaborative activity completed by external raters in Study 1 and a

questionnaire measure completed by team members in Study 2. Similar to group creativity, however, the positive effect of competition on collaboration among men and the negative effect of competition on the collaboration among women emerged mainly at the higher end of the competition spectrum (see Figures 3 and 5).

Theoretical Implications, Limitations, and Avenues for Future Research

Our central contribution lies in identifying sex composition as a critical contingency of the effects of intergroup competition on group creativity. Results across our two studies provide clear evidence that intergroup competition does not have uniformly beneficial or detrimental effects on group creativity and that whether competition spurs or constricts creativity depends, to a large extent, on the sex composition of a group or team. Scholars have contended that the effects of intergroup competition on performance are contingent on a number of factors, among them the personality composition of the group (Beersma et al. 2003). Our research is consistent with and extends this contingency perspective by suggesting that the composition of groups in terms of sex also plays a vital role in moderating the effects of intergroup competition on outcomes such as group creativity. Thus, researchers should consider these compositional factors as critical regulating forces when examining the effects of intergroup competition of various outcome variables.

In addition, results of both studies suggest that the moderated relation between intergroup competition and collaboration or creativity is not linear but describes an accelerated pattern in which the positive and negative effects become increasingly more pronounced as competition reaches levels beyond the midpoint. These results suggest that future efforts examining the effects of intergroup competition should explicitly consider nonlinear effects to identify possible thresholds beyond which competition is likely to exert its most powerful effects.

Next, our work is consistent with the central tenets of social role theory. As implied by this theory, we found groups composed of women to be more creative compared with groups composed of men, at least at medium levels of competition (groups composed of all women were significantly more creative than all men groups at medium levels of competition in Study 1). As hypothesized, women's communal nature as opposed to men's more agentic qualities likely fostered a collaborative within-group environment that allowed women groups to leverage the benefits of bringing together individuals with different views and mind-sets. Also consistent with social role theory, we found this pattern to be reversed as the intergroup environment became increasingly competitive (groups composed of all men were significantly more creative than all-women groups at high levels of competition in Study 1). Operating in a competitive environment in which the negative stereotype associated with women in such circumstances may have been activated likely caused women to disassociate themselves from the competition and its associated task activities, undermining collaboration and creativity. In contrast, competing against other groups may have activated a positive stereotype among men, resulting in greater collaboration and creativity.

Although our results are consistent with the tenets of social role theory, we did not assign specific gender roles to participants in Study 1. Thus, it is possible that forces other than gender roles produced the effects we observed in both studies. The purpose of this paper, however, was to apply social role theory rather than to provide a test of it. Nevertheless, we acknowledge the possibility that forces other than gender roles may have been additionally operative in our two studies, and we encourage future research to examine the effects of group sex composition on various outcomes to rule out this possibility by explicitly assigning gender roles to participants.

Our findings further solidify the importance of collaboration for group creativity. Although previous work has highlighted the collective nature of creativity and acknowledged the importance of sharing ideas and of reframing and building on others' ideas for group creativity to flourish (Hargadon and Bechky 2006), relatively few studies have considered the mediating function of collaboration (Baer et al. 2010, De Dreu 2006). Our research extends previous work by showing that competition and sex composition are likely to shape creativity to the extent that they affect within-group collaboration. Thus, examining the mediating function of collaboration may be a fruitful avenue for future research trying to illuminate the social processes that shape creativity in groups.

Not all group tasks are likely to benefit from collaboration to the same extent, however. For example, tasks that are truly disjunctive in nature (Steiner 1972)—more so than the task employed in Study 1—should benefit to a lesser extent from group collaboration. In addition, collaboration may be less instrumental when groups work on tasks that do not explicitly require the generation of truly novel and useful ideas—ideas that are more likely to emerge when members build on each other's contributions (e.g., Kohn et al. 2011). Future research thus may want to explore the mediating role of collaboration as a function of different types of tasks (see Wood 1987). Moreover, there may be additional mediating mechanisms that partially transmit the effects of competition and sex composition on group creativity, such as task focus and task or affective conflict. Future research may want to explore these alternative mechanisms to evaluate their relative potency compared with collaboration.

Finally, our work also contributes to the extant but relatively sparse literature on the effects of sex composition and diversity on group creativity (Cady and Valentine 1999, Wood 1987). Prior research on this topic

has argued that background diversity—which includes non-task-related differences such as sex—is likely to interfere with the creative endeavors of groups. Results of two meta-analyses provide some evidence supporting this conclusion (Hülsheger et al. 2009, Joshi and Roh 2009). This research then implicitly contends that sex-homogeneous groups—groups composed largely or exclusively of either men or women—should be more creative. This theory may be tempting, but our findings suggest that assuming that homogeneous groups, regardless of the sex they are composed of, will behave similarly is too simplistic. Indeed, we find that groups composed of men and women, although both homogeneous with respect to sex, respond quite differently to the absence and presence of intergroup competition. Thus, future research studying the link between background diversity and creativity in groups may want to more carefully distinguish between homogeneous groups of different sex compositions.

Practical Implications

Our research has a number of important practical implications. First and foremost, our results should serve as a caution to managers attempting to use competition between social units as a universal means to spur the creativity of groups. As we demonstrated, the use of competition, particularly competition at relatively high levels, tends to eradicate the creative advantage that groups composed of women tend to enjoy over their male counterparts at medium levels of competition, allowing men to outperform their female counterparts under such circumstances (see Study 1). Thus, one conclusion that seems to be justified based on the data presented here is that intergroup competition is a double-edged sword that ultimately provides an advantage to groups and units composed predominantly or exclusively of men while hurting the creativity of groups composed of women.

Not only does the use of fierce intergroup competition as an organizing principle serve to disadvantage women, it also represents a lost opportunity. Given that women represent a growing portion of the workforce, using competition as a means to enhance the creativity of groups, regardless of how they are composed, implies that the creative potential available to businesses is seldom fully realized. Although competition may propel groups composed largely or exclusively of men to realize their potential, it also has the potential to constrict the creativity of groups composed largely or exclusively of women. At the very least, it is unlikely that the use of intergroup competition will thrust women to higher levels of creativity compared with circumstances in which groups can work side by side.

This analysis has some straightforward implications. For example, managers may want to refrain from using intergroup competition as their modus operandi. Instead, a more nuanced approach needs to be employed that considers the sex composition of groups as an important qualifying factor. Naturally, this logic implies that the use of competition should be limited to environments populated largely by men and should not be used in contexts typically favored by women. However, rather than abandoning competition altogether as a vehicle to stimulate the creativity of women, it may be possible to alter the way in which women are encouraged to compete such that the negative effects of intergroup competition are reduced. A study by Niederle et al. (2013) provided one example of this approach. These authors evaluated the effect of introducing a gender quota in an environment in which high-performing women failed to enter competitions they could win. Specifically, an affirmative action competition was introduced that guaranteed women equal representation among winners (for every two winners, at least one winner was required to be a woman). This rule not only increased the chances that women would win the competition but also made the competition more gender specific (a woman would win the competition if she performed better than her female competitors). Results showed that the affirmative action quota increased the number of women who chose to engage the competition (without significantly lowering the quality of the overall entry pool). Thus, introducing an affirmative action quota may prove to be a viable mechanism to enhance the performance of women groups under conditions of intergroup threat.

Managers may also want to think about ways other than competition to stimulate the creativity of groups. For example, time pressure—particularly when perceived as a challenge or positive stressor—has been found to enhance coordination in teams and ultimately performance, creativity, and innovation (Chong et al. 2011, Pearsall et al. 2009). Given that time pressure should be less likely to evoke a negative stereotype among women, its use may constitute a viable alterative to competition as a vehicle to further stimulate the creativity of groups composed of women. In addition, time pressure may also boost the creativity of groups composed of men when the intergroup environment is relatively benign.

Ultimately, our findings highlight the toxic nature of certain entrenched beliefs—for example, the belief that women are less competitive than men—and identify the negative implications such beliefs may have. Although the behavior that we observed in our study is likely to be the result of evolutionary, biological, and sociocultural influences (Wood and Eagly 2010, Van Vugt et al. 2007), others' stereotypical expectations are nevertheless an integral element to explaining differences in behavior between men and women. Indeed, a recent report concluded that among the many forces that hold women back in contemporary organizations, none are as potent as imbedded institutional mind-sets (Barsh and

Yee 2011). A survey of 2,500 men and women and interviews with 30 chief diversity officers revealed that managers still believe that women are not suitable for certain jobs, thereby perpetuating gender stereotypes. Although companies have started to tackle overt discrimination, it will take more time and energy to eradicate the pernicious forces that mind-sets such as women being less competitive than men may exhibit upon women. Our research should serve as a stark reminder that these mind-sets are still alive and well and need to be countered by managers at all levels in the organization.

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Endnotes

[1]Collaboration does not necessarily imply a cooperative motive. It is possible that people share their thoughts and consider and use each other's contributions in an attempt to develop better ideas to ultimately enhance their standing in the group. A cooperative motive can also not be ruled out, however, especially given that intergroup competition is likely to emphasize collective rather than individual creativity. We thank a reviewer for highlighting this point.

[2]Treating sex composition as an experimental factor would have resulted in a 3 (intergroup competition: low, medium, high) × 5 (group sex composition: all men, mostly men, half men/half women, mostly women, all women) between-subjects design. Assuming 20 groups per cell, this design would have necessitated 300 groups (15 cells × 20 groups), requiring 1,500 participants (300 groups × 5 group members). (We invited five people per group to compensate for one potential no-show.)

[3]Consistent with the extant literature (e.g., Amabile 1996, Shalley et al. 2004), we conceptualized creativity as an amalgam of novelty and usefulness. To evaluate, however, whether the observed effects were due to novelty rather than usefulness, or vice versa, we obtained separate measures of novelty and usefulness for each idea and then constructed the same set of three indicators that we developed for overall creativity: maximum novelty or usefulness, high novelty or usefulness, and average novelty or usefulness. Results indicated that the linear *competition* × *sex composition* interaction was statistically significant for both maximum novelty ($\beta = 0.22$, $t = 2.15$, $p < 0.05$) and high novelty ($\beta = 0.25$, $t = 2.47$, $p < 0.05$), and it approached significance for average novelty ($\beta = 0.17$, $t = 1.67$, $p < 0.10$). In addition, there were significant linear interactive effects on maximum usefulness ($\beta = 0.23$, $t = 2.17$, $p < 0.05$) and high usefulness ($\beta = 0.21$, $t = 2.04$ $p < 0.05$), but not on average usefulness ($\beta = 0.15$, $t = 1.40$, $p > 0.05$). In addition, the quadratic *competition* × *sex composition* interaction was statistically significant for both maximum usefulness ($\beta = 0.52$, $t = 3.11$, $p < 0.01$) and high usefulness ($\beta = 0.40$, $t = 2.36$, $p < 0.05$), and it approached significance for average usefulness ($\beta = 0.32$, $t = 1.85$, $p < 0.10$). However, the quadratic interactive effects on novelty did not reach statistical significance (all p's > 0.05). Thus, it appears that the effects we obtained for our molar measure of creativity also emerged when considering the two attributes of novelty and usefulness individually, albeit somewhat less consistently so.

[4]To minimize problems associated with common source variance, we used team members' ratings of performance rather than ratings provided by team leaders, as team leaders also rated teams in terms of creativity.

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