Does Collectivism Inhibit Individual Creativity? The Effects of Collectivism and Perceived Diversity on Individual Creativity and Satisfaction in Virtual Ideation Teams

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ABSTRACT
One particular problem CSCW and HCI scholars have sought to address through the design of collaborative systems is the issues associated with diversity and creativity. Diversity can promote creativity by exposing individuals to different perspectives and at the same time make it difficult for teams to leverage their differences to be more creative. This paper asserts that through the promotion of cooperation, collectivism will help ideation team members overcome the challenges associated with diversity and promote creativity. To examine this assertion, we conducted an experimental study involving 107 individuals in 33 idea-generation teams. Collectivism was promoted through priming. The results confirm our assertion: collectivism created conditions that facilitated creativity when teams were high in perceived diversity. Collectivism also facilitated more satisfaction among teammates by offsetting negative perceptions of diversity. These results offer new insights on collectivism, perceived diversity and creativity.

Author Keywords
Perceived diversity; collectivism; self-construal; priming; creativity; collaborative ideation.

ACM Classification Keywords
H.5.3. Group and Organization Interface: Computer-supported cooperative work

INTRODUCTION
Ideation is a creative process that involves the generation of new ideas by individuals, teams and organizations [9,32]. Researchers in the computer-supported cooperative work (CSCW) and human–computer interaction (HCI) communities have been interested in ideation because of its importance in both cooperative work and the design of technology (e.g., [17,32,38,104,105,127]). For example, organizations generate ideas to improve planning [5]. Engineers brainstorm to come up with alternative solutions to solve technical problems [121]. Companies rely on design teams to generate ideas for new products and services [32,36,70].

CSCW and HCI scholars have developed new technologies to better support creative idea generation. These include BeachMap [90], BRIDGE [31] and GroupMind [101], which produce concept/mind maps to help break down and organize problems, as well as Momentum [7], which emails textual prompts related to idea topics days before ideation takes place. Other examples include Idea Expander [121] and DesignLibs [10], which provide pictorial or scenario-based stimuli to facilitate creativity.

One particular problem CSCW and HCI scholars have sought to address through the design of collaborative systems is the issues associated with diversity and creativity [43,124]. Diversity, defined as individual differences, is a key driver of creativity in teams [77]. Perceived diversity, which refers to the belief that others are different (e.g., in terms of education, ability, and attitude) [45], has been used to explain the negative effects of diversity on creativity (e.g., [2,20]). Diversity can promote creativity by exposing individuals to different perspectives [74,77,89,97,102]. However, diversity can make it difficult for teams to leverage their differences to be more creative [56,87]. This is because individuals are less likely to share their unique ideas in the presence of others they believe are different from themselves [56,96]. At the same time, in order to exploit the benefits of diversity, team members need to recognize their differences [45,67]. This paradox helps to explain why team diversity is often referred to as a double-edge sword [37,76].

In addressing this issue, CSCW and HCI scholars have explored how priming can be used to design more effective systems to support creativity (e.g., [41,69]). Priming is a psychological phenomenon where individuals are exposed to a stimulus that can change their subsequent behaviors [8]. For example, Lewis et al. [69] primed participants in their study by showing them pictures and found that it increased idea generation.

Employing priming to promote collectivism may hold particular promise for diverse ideation teams. The construct

CSCW '17, February 25-March 01, 2017, Portland, OR, USA
 ISBN 978-1-4503-4335-0/17/03…$15.00
DOI: http://dx.doi.org/10.1145/2998181.2998261

of "collectivism" stems from social psychology and can be defined as an individual's variable state of mind that positively recognizes shared social relationships, social norms, and interdependence with others [52,113]. Collectivism has been found to promote teamwork. It has been associated with decreases in free-riding and increases in cooperation and satisfaction in teams (e.g., [75,120]), all of which have been associated with increases in the number and quality of idea generation by individuals (e.g., [4,12,18,116]). Although collectivism can be viewed as a cultural trait [73], we do not make this assumption. However, we do draw from the literature on cultural collectivism in teams.

In this paper we take a unique view on the relationship between collectivism and creativity. We assert that through the promotion of cooperation, collectivism is likely to help ideation team members overcome the challenges associated with perceived diversity and thus promote creativity. If this hypothesis holds true, perceived diversity should be associated with better ideation results when team members are higher in collectivism. To test this assertion, we conducted a lab experiment with 107 participants in 33 ideation teams. We primed the participants to promote collectivism or reduce collectivism. Our results show that when individuals were primed with higher collectivism, perceived diversity had a much stronger positive relationship with creativity than when individuals were primed with lower collectivism. In addition, we found that collectivism was indirectly related to satisfaction via perceived diversity.

This paper offers several contributions to theory. One, in this paper we identify collectivism as one approach to help individuals in ideation teams overcome the problems associated with perceived diversity. CSCW and HCI researchers have long studied the theoretical mechanisms promoting or hindering creativity enabled through technology (e.g., [99,122]). More specifically, CSCW and HCI scholars have studied ways to promote creativity by investigating conflict, free-riding, cognitive inertia, trust and cultural differences [3,43,54,99,123]. Results of this study extend our understanding of this area. Two, in this paper we extend theory across several disciplines. Previous research has found that collectivism reduces individual creativity in both face-to-face and virtual teams [39,123,124]. However, through this study we were the first to our knowledge to identify and explain the conditions under which collectivism can facilitate rather than hinder team creativity. In doing so, this study contributes to scholars across several disciplines studying teamwork to better understand how to promote both creativity and cooperation.

This study also contributes to the design of collaborative systems. From a design perspective our results can better inform when we should design systems to promote collectivism or for that matter perceptions of diversity. In doing so, this study speaks directly to designers who have studied or implemented theory-driven mechanisms in collaborative systems (e.g., [14,15,35,49,65,92]). In particular, this study contributes to the CSCW literature on the use of priming in collaborative systems and the literature addressing issues around designing to promote creativity in diverse teams (e.g., [69,124]).

THEORETICAL BACKGROUND

Collectivism

The concept of collectivism originally stems from cultural studies (e.g., [52,72]). Collectivism can be defined as a state of mind where individuals see themselves more as a member of group, as opposed to individualism, where individuals view themselves more as apart from the group [73]. A collectivistic versus individualistic orientation can affect a team member's self-concept, wellbeing, attribution style, and relationships with others [84]. While we don't make assumptions about culture-based differences, we are interested in what happens when people are more collectivistic during group ideation.

Previous CSCW research has shown that collectivism can adversely affect individual creativity in teams. A study found that participants who identified as having a more collectivistic orientation were less talkative and responsive during ideation sessions than participants who were more individualistic [123]. This research complements the work on non-CSCW scholars Goncalo and Staw [39], who found that teams high in collectivism were less creative in collocated brainstorming situations than those high in individualism. On the whole, collectivism has been shown to have a negative impact on idea generation in brainstorming teams.

Other scholars have explored how technology can be used to decrease the negative effects of collectivism. For example, one study sought to determine whether individuals in teams with a collectivistic majority would behave similarly to each other and, if so, whether these practices would be heightened by the use of rich media such as video [122]. Both hypotheses were supported. Scholars have also investigated ways to promote creativity in culturally diverse teams (i.e. collectivistic vs. individualistic cultures) using technology. For instance, Wang and colleagues [124] found that the use of task-related pictures in team communication facilitated creativity in mixed teams of collectivistic and individualistic people.

Unlike previous studies, we take a different approach to explaining the relationship between collectivism and creativity. Previous researchers have identified the problems associated with collectivism on creativity and sought to find ways to help individuals in teams overcome the difficulties associated with collectivism. In this paper,

we sought ways to help teams take advantage of collectivism to facilitate creativity in virtual ideation teams.

Perceived Diversity

Perceived diversity refers to the perception that others are different [45]. Researchers have traditionally focused on objective diversity (e.g., [77,78]). A rich set of literature has explored the effect of objective diversity on various team outcomes, such as creativity [77] and decision-making [129]. For example, gender and tenure diversity have been found to be positively related to productivity in GitHub teams [119].

However, the use of objective diversity has several limitations. First, people respond based on their perceptions of reality rather than on objective reality [50]. Second, individuals can have different perceptions and reactions to the same level of objective diversity [53]. Therefore, we are less interested in the impacts of "our definition" of objective diversity and more interested in how individuals perceive diversity [94]. In fact, Zellmer-Bruhn et al. [128] found that the perception of diversity among teammates mediated the relationship between objective differences and team outcomes. Third, in many cases objective diversity may be less salient in a virtual context compared to a face-to-face context [94]. Image, voice and context are commonly missing to some extent in technology-mediated interactions. Therefore, individuals in virtual teams using computer-mediated technologies cannot identify their differences directly; but instead, they develop a perception of differences based on their interactions.

Perceived diversity has come to represent the negative impacts of diversity [94,100]. For example, perceived diversity has been found to be negatively related to some task-related processes, such as information exchange [40] and collaborative decision-making [51], and positively related to subgroup formation processes [128] that lead to group conflict [66]. Previous researchers have also examined the effect of perceived diversity on satisfaction and team creativity in work teams [20,102]. For example, Cunningham [20] found in field teams that individuals had less satisfaction and more turnover intention when they perceived themselves to be more different from their coworkers. Shin et al. [102] found in organizational teams that perceived diversity could be positively related to creativity.

The question of perceived diversity is strongly linked with a parallel set of ideas, namely a collectivist versus an individualist orientation to a team as a whole. We assert that the interplay with collectivism and perceived difference is crucial to creativity in virtual ideation teams.

Ideation and Brainstorming

Brainstorming is a commonly used technique in ideation [10,32]. It is a popular tool to support creativity for both collocated and dispersed teams [23]. Typically, the goal of a brainstorming session is to have teams generate as many ideas as possible [4,36] — often in response to a challenge. For example, teams may be asked to brainstorm ideas to discover potential threats, identify problems, and come up with coping strategies [4]. In organizations, group brainstorming has been employed as a mechanism to promote creativity, support organizational memory of solutions, facilitate employees to use and develop skills, and encourage interpersonal bonds among team members [1,24,108].

Factors that facilitate or hinder the idea-generation process in brainstorming sessions form the basis of much of the literature in this area (e.g., [16,88]). Scholars have studied the mechanisms that affect group brainstorming creativity from both the group perspective (such as group size [34], group dispersion [4,19,107] and group structure of the entire group versus subgroups [26]) and the task-related perspective, such as task structure [22]. Other researchers have examined the effect of providing and organizing related information on ideation improvement, such as providing scenarios in the system [10], using project-specific card-based systems [38] and displaying previously generated ideas [32]. Individual and team differences have also been examined [25].

HYPOTHESES DEVELOPMENT

Based on the research outlined above, we derived a set of hypotheses that links perceived diversity, collectivism and creativity.

Collectivism and Perceived Diversity

We assert that collectivism is associated with decreases in perceived diversity because this orientation puts more emphasis on the group than the individual [112]. According to social categorization theory (e.g., [115]), the path toward understanding the self in the context of the group involves a process of depersonalization, where people tend to perceive themselves as less different from other members within their group. This makes individual uniqueness less accessible [112], which should decrease perceived diversity. Collectivism emphasizes fitting in with the group, and prior research suggests that when this occurs individuals see other team members as more similar to themselves [115]. In all, collectivism leads many to perceive their group members as less diverse.

H1: Members of idea-generation teams high in collectivism have lower perceived diversity than members of idea-generation teams low in collectivism.

Collectivism, Perceived Diversity and Brainstorming

Perceived diversity has been identified as a double-edge sword in regard to creativity. For example, diversity has been negatively related to creativity via its negative impact on social relations, which is detrimental to creativity because good relationships are necessary for team members to listen and share ideas with one another [86]. In addition,

diversity has been shown to be positively related to social loafing [91].

We propose that the negative impacts of perceived diversity are mitigated in teams high in collectivism. Individuals holding collectivistic beliefs put more weight on group goals than personal interests [30] and behave more cooperatively [120]. People holding collectivistic beliefs are more likely to manage their feelings of differences in views and perspectives with more acceptance and openness to such differences [82,114]. In addition, individuals with collectivistic beliefs are more likely to follow social norms of contribution to the team and are less inclined to engage in social loafing [29,129].

However, when brainstorming teams are not high in collectivism we should expect perceived diversity to be weighed down by the negative impacts normally associated with it. Such problems include increases in social loafing from a lack of motivation and decreases in willingness to share with others believed to be different [40,80,91]. For example, Graves and Elsass [40] found that perceived diversity was associated with decreases in information sharing. Taken together, without the benefit of cooperation via collectivism we should expect perceived diversity to have a much less positive impact of creativity in brainstorming teams low in collectivism. This interaction effect leads to our second hypothesis.

H2: Perceived diversity has a more positive relationship with creativity when members of idea-generation teams are higher in collectivism.

Collectivism, Perceived Diversity and Satisfaction

Satisfaction can be defined as a pleasant or enjoyable feeling associated with an experience [98]. Satisfaction has been an important topic in brainstorming and virtual collaboration (e.g., [25,34,98,99,117]) because of its positive relationship to future participation, group performance and group cohesiveness [28,55,57,58].

Typically, perceived diversity is linked to a decrease in satisfaction. Individuals are less likely to hold positive views or have positive interactions with individuals they believe are different [13]. For example, a study on work teams found that satisfaction was negatively related to perceived deep-level diversity (i.e. differences in personality and values) [20]. This has also been explained by reductions in helping behavior [118] and increases in task and relationship conflict [50,81,125], all associated with perceptions of diversity.

We propose that a team's collectivism weakens the negative impact of perceived diversity on individual satisfaction. Because collectivism emphasizes relationships, people in teams high in collectivism tend to be reluctant to disagree with others [11], are more likely to engage in cooperative behavior [120] by managing their feelings of differences through compromise [82,114], and are less likely to engage in social loafing [29,129]. Thus, increases in perceived diversity are less likely to translate into decreases in satisfaction when brainstorming teams are high in collectivism.

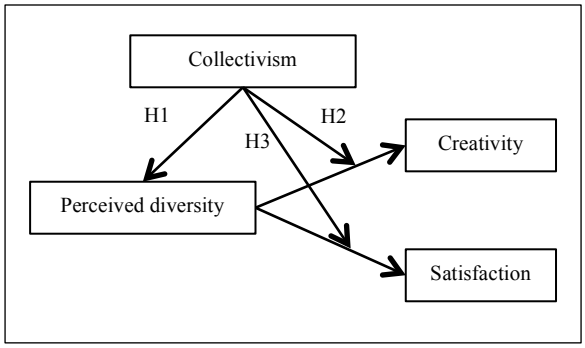

Figure 1. Theoretical model.

H3: The negative relationship between perceived diversity and satisfaction is weaker when members of idea-generation teams are high in collectivism.

Figure 1 summarizes our three hypotheses in a theoretical research model.

RESEARCH METHODOLOGY

We know very little, if anything, about the interplay between collectivism and perceived diversity on creativity. To address this lacuna, we conducted a lab experiment to examine the effect of collectivism and perceived diversity on creativity and satisfaction in brainstorming teams.

Participants

Participants were enrolled at a public university in the United States. A total of 107 subjects were randomly assigned to 33 teams in this study. Sixty-six of the participants were women and 47 were non-white. The participants came from 19 countries. Their ages ranged from 18 years to 45 years, with an average of 21 years. Individuals received $12 for participating in the study. In addition, the team with the best performance was awarded an $80 bonus.

Treatments

We used priming as a method to induce collectivism. Priming is a cognitive phenomenon where individuals are exposed to a stimulus that activates their implicit memory and leads to unintentional subsequent behaviors [8]. Priming has been used successfully as an experimental technique in social psychology (e.g., [46]) and very recently in brainstorming teams research [8,23].

The collective self and the private self, also called the interdependent self and the independent self, are two different self-construals. Self-construal is conceptualized as individuals' belief and behavior regarding their relationship with others and the self that is distinct from others [103]. Different self-construals can lead to variations in personal thoughts and information processing [93,112]. For example,

research has found that self-construal priming can affect an individual's decision-making [126], self-esteem [44] and visual search speed [93].

In this study we employed two types of priming: collective self-priming and private self-priming. The collective self-priming is used to manipulate collectivism while the private self-priming is used to activate individualism [60]. The collective self emphasizes relationships and connections with others, such as group memberships and family, while the private self focuses on cognition about one's personal traits, state and behavior [72,112]. For example, the private self makes the perception of one's uniqueness more accessible while the collective self makes social norms more accessible [126].

Trafimow and colleagues showed that self-construal could be primed by asking individuals to think about a question [112,126], by reading a story [93,112] or by using a specific language [62,111]. We adopted a priming method that has been used in previous studies (e.g., [112,126]). Participants in the collective self-priming condition were given the following instructions: "Please think of what you have in common with your friends and classmates at [National University]. You will have 6 minutes to write down 12 items." In the private self-priming condition, participants were instructed: "Please think of what makes you different from your friends and classmates at [National University]. You will have 6 minutes to write down 12 items." We asked participants to write down their thoughts to make it possible to track whether they were thinking about the self-construal during the given time.

Procedure

The experiment was conducted in a behavioral lab. Participants were randomly assigned to teams. Teams were randomly assigned to self-construal priming conditions. Participants were first welcomed and then guided to individual cubes in a large behavior lab. Team members were seated separately. To ensure anonymity among team members, participants were provided with an experiment ID and were told not to disclose their personal identification information during the experiment.

During the experiment, participants first had a short training session on how to use the chat room on Skype. Participants were instructed that no verbal communication was allowed during the experiment and that the text chat via Skype was the only way to communicate with their teammates.

Upon finishing the training, they were primed with the collective or the private self. Next, participants were given 10 minutes to brainstorm with their team via the chat room on Skype. They were asked to generate as many creative ideas as possible to reduce pollution, a task that has been used in a previous group brainstorming study [23]. Once they finished the brainstorming task, participants completed a survey indicating their collective self-construal (manipulation check), perceived diversity, satisfaction and demographic information.

Here, we would like to note the reasons that we asked the participants to use text-only chatting during the entire experiment. In this study, we are interested in understanding how to promote creativity in text-based collaboration teams rather than how text-based collaboration can alter the effects of creativity. This is because text-based communication is one of the most commonly used forms of communication in organizations [110]. In many cases, teams do not have an option of meeting face-to-face (FTF) and instead communicate through text-based forms of communication like Skype. Even when teams do have the FTF option, many default to text-based communication because it enables individuals to communicate in real time, maintain strong relationships and address important problems [33].

Dependent Variables

In this paper, we examine individual creativity instead of team creativity for three main reasons. First, we would like to understand how differences between and within teams matter. Therefore, our research questions call for examining individual outcomes. This is particularly important in this study because it deals with creativity, which is often viewed as an individual trait [109]. We would also expect perceptions of diversity to differ within as well as across teams. Second, the research we draw from and hope to contribute to primarily examines individual creativity (e.g., [122,123]). Third, group-level creativity in team ideation is essentially a function of the individual inputs from each member. Therefore, understanding what drives individual creativity is an important predecessor to understanding team creativity. As a result, dependent variables were measured at the individual level.

Perceived diversity

Items measuring perceived diversity were taken from previous research [45]. Participants were asked to indicate on a 5-point Likert scale to what extent they thought they and their team members were similar 1) in personal values, 2) in priorities, 3) in commitment to working hard on this task, 4) in how they think their work should be done, 5) in their skills and 6) in their general abilities to do a task like this. We reverse-coded the score to get the measure of perceived diversity. The Cronbach alpha for the six items was 0.80.

Creativity

We measured individual creativity in two ways: quantity and quality. Quantity was measured by the number of unique ideas generated by each participant. This measure has been commonly used in brainstorming research to study creativity (e.g., [25,74,77,106]). Because this study focuses on individual-level creativity, we used the number of unique ideas. Two graduate students were hired and trained to be raters. Both raters independently analyzed the

transcripts of the first six groups. They were instructed to identify all of the unique ideas in each transcript. According to Dennis et al. [23], inter-rater reliability can be calculated as 1 – the number of differences/total ideas coded. The raters agreed on 134 of the 145 unique ideas, suggesting reliability on number of unique ideas was 92.41 percent.

Quality was captured by the total quality of unique ideas generated. It measures the overall creativity of all the ideas generated by an individual. According to previous work, total quality is a more reliable measure and produces more consistent results than other measures, such as the average quality of ideas produced by an individual [22,23,27]. This is because the average quality of ideas does not take into account the quality relative to the number of ideas an individual produces [22]. For example, if team member A generates two highly rated ideas (rated as 5) he/she would have an average score of 5. However, if team member B generated 5 very good ideas (rated as 5) and 1 idea rated as 4, he/she would have an average of 4.83. This would leave the impression that team member A was more creative regarding quality than team member B. Clearly, this would not be an accurate reflection of idea quality during the ideation session. This is why brainstorming scholars came up with an alternative measure [22,23,27]. To produce the total quality of the unique ideas generated by an individual participant, we first took an average of the ratings of the three dimensions for each idea and then summed the averages for each idea generated by an individual participant. Under this approach team member A would receive a score of 10 (i.e. 5 X 2) while team member B would receive a score of 28.98 (i.e. 4.83 X 6). We believe these scores better represent the differences in quality between the two teammates.

Adopted from Dean et al. [21], we used three dimensions to measure the creativity of ideas: originality, applicability and effectiveness. According to Dean et al. [21], originality refers to the degree to which the idea is rare, ingenious, imaginative or surprising. Dean et al. defines applicability as the degree to which the idea clearly applies to the stated problem. Finally, effectiveness, according to Dean et al. [21], refers to the degree to which the idea is expected to solve the problem stated. Two raters independently rated the first 100 ideas on these three dimensions on a 5-point Likert scale. The inter-rater reliability was 95 percent, 91 percent, and 95 percent for originality, applicability, and effectiveness, respectively. Among a total of 300 ratings, the raters agreed on 281. The overall inter-rater reliability was 93.67 percent.

Satisfaction

We measured satisfaction using a 4-item scale taken from Dennis et al. [22]. Participants were asked to rate on a 5-point Likert scale to what extent they were satisfied with their experience. The items were: "How do you feel about the process by which you generated ideas?", "How do you feel about the ideas proposed?", "How do you feel about other members of the group?" and "Overall, how satisfied did you find your experience?" The Cronbach alpha for the four items was 0.86.

Control Variables

Following other researchers and indications of previous literature (e.g., [62,74,94,99,102]), we additionally controlled for variables at both the individual and the team levels. We controlled for demographic factors, including gender [99], age, native language and national culture. The national culture was a dummy variable coded with 0 meaning non-Western culture and 1 meaning Western culture. About 99 percent of the sample fell into Western and Asian cultures. Gender was measured by creating another dummy variable where male was represented by 0 and female by 1. Native language was also measured by using a dummy variables where English (77 out of 107 participants) was coded as 1 and other languages coded as 0. We also controlled for group size [94,102] and group membership (i.e. group ID) for hypotheses testing.

Manipulation Check

We conducted a manipulation check to ensure that our priming took effect. Individuals high in collectivism should have higher levels of the collective self than their counterparts. To be consistent, we employed the same items used in previous studies that manipulated the collective self. These items were taken from the collective self-construal scale for the post-task manipulation check. The scale by Leung and Kim (1997) [68] is one of the three most commonly used self-construal scales [42]. It has been recently used to measure the collective self and the private self (e.g., [6,63,85]). To determine which items to select, we conducted a pilot study with items from Leung and Kim's collective self-construal scale [68]. Based on the results of this pilot study we selected the most reliable items that best represented our context. The items were: "When with my group, I watched my words so I didn't offend anyone," "I considered how I could be helpful to specific others in my group," "I was careful to maintain harmony in my group" and "The security of being an accepted member of a group was very important to me." Participants were asked to indicate to what degree they agreed with the items.

RESULTS

Manipulation Check

A mixed-model analysis showed that participants primed with the collective self had a significantly higher score for the collective self than participants primed with the private self ($t = 2.74$, $p < 0.05$). The Cronbach alpha for the four items was 0.70.

Hypotheses Testing

We wanted to account for the individual differences among team members, so we conducted the analysis at the individual level. Because the individuals were nested in teams and not independent, hypotheses were tested using a

	Variables	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9
1	Number of unique ideas	10.21	5.69									
2	Quality of unique ideas	27.84	15.62	0.97***								
3	Satisfaction	4.01	0.72	0.08	0.11							
4	Collectivism	0.5	0.5	0.17	0.21*	0.19						
5	Perceived diversity	2.51	0.64	-0.12	-0.13	-0.59***	-0.22*					
6	Gender	0.62	0.49	0.10	0.08	-0.01	0.07	-0.19				
7	Age	21.01	3.55	-0.04	-0.02	0.04	0.16	0.13	-0.10			
8	Native language	0.72	0.45	0.16	-0.14	-0.15	0.01	0.00	0.15	0.06		
9	National culture	0.77	0.43	0.22*	0.20*	-0.14	0.12	-0.08	0.11	-0.07	0.54***	
10	Group size	3.36	0.59	-0.17	-0.16	-0.18	-0.42***	0.05	-0.01	-0.12	0.02	-0.08

N=107; Significance of correlations: *p<.05; **p<.01; ***p<.001

Table 1. Means, standard deviations and correlations.

Independent Variables	Perceived diversity		Number of unique ideas			Quality of unique ideas			Satisfaction		
	Model 1	Model 2	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Control variables											
Gender	-0.17	-0.16	0.03	-0.04	0.06	0.17	-0.42	-0.18	0.00	-0.06	-0.06
Age	0.12	0.14	-0.12	-0.10	-0.21	-0.20	-0.11	-0.36	0.01	0.06	0.06
Native language	0.05	0.04	0.89	0.91	0.98	2.06	2.16	2.33	-0.06	-0.05	-0.04
National culture	-0.09	-0.06	0.38	0.31	0.09	1.26	1.00	0.48	-0.05	-0.09	-0.10
Group size	0.06	-0.04	-1.04	-0.77	-0.99	-2.50	-1.50	-2.03	-0.14	-0.11	-0.12
Direct effect											
Collectivism		-0.49*		1.21	1.04		4.30	3.87		-0.01	-0.02
Perceived diversity				-0.38	0.92		-1.43	1.69		-0.44***	-0.36**
Interaction effect											
Collectivism × Perceived diversity					2.78**			6.68*			0.14

N=107; Significance of coefficients: *p<.05; **p<.01; ***p<.001

Table 2. Results of mixed-model analyses.

linear mixed model, controlling for demographic factors and group-level factors. SPSS 22.0 (IBM, Armonk, NY) was used to test the proposed research model. Table 1 lists means, standard deviations and correlations. We further standardized demographic variables for hypotheses testing. Table 2 shows the results of the analysis. Please note that all of these results hold even if we remove national language or national culture from the model.

Hypothesis 1 posited that collectivism would be associated with decreases in perceived diversity. The mixed-model test showed a negative relationship between collectivism and perceived diversity ($\beta = -0.49$, $t = 2.20$, $p < .05$), supporting hypothesis 1.

Hypothesis 2 posited an interaction effect between collectivism and perceived diversity on creativity. The results of the mixed-model test on number of unique ideas ($\beta = 2.78$, $t = 2.87$, $p < 0.01$) and on quality of unique ideas ($\beta = 6.68$, $t = 2.47$, $p < 0.05$) both supported this hypothesis. Figure 2 and Figure 3 display the two-way interaction associated with hypothesis 2. Figure 2 clearly highlights the positive relationship between perceived diversity and the number of unique ideas when participants were primed with high collectivism. Figure 3 clearly highlights the positive relationship between perceived diversity and the quality of ideas when participants were primed with collectivism.

Hypothesis 3 posited that collectivism moderates the relationship between perceived diversity and satisfaction. However, the results failed to support the hypothesis ($\beta = 0.14$, $t = 1.23$, $p = 0.22$). Surprisingly, however, we found that collectivism has an indirect effect on satisfaction via perceived diversity. In other words, collectivism was associated with increases in satisfaction by being negatively related to perceived diversity. We tested for the indirect effect by the Sobel test. The Sobel test was significant ($z = 2.11$, $p < 0.05$), indicating that the indirect effect was significant. Figure 4 summarizes our findings. Numbers in Figure 4 represent the beta coefficients in Table 2.

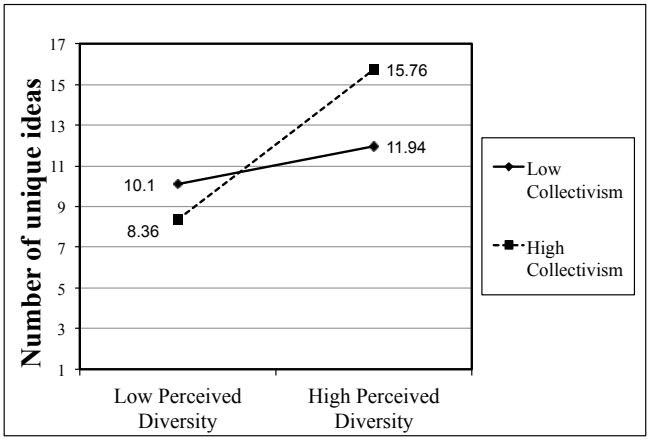

Figure 2. The two-way interaction between perceived diversity and collectivism on the number of unique ideas.

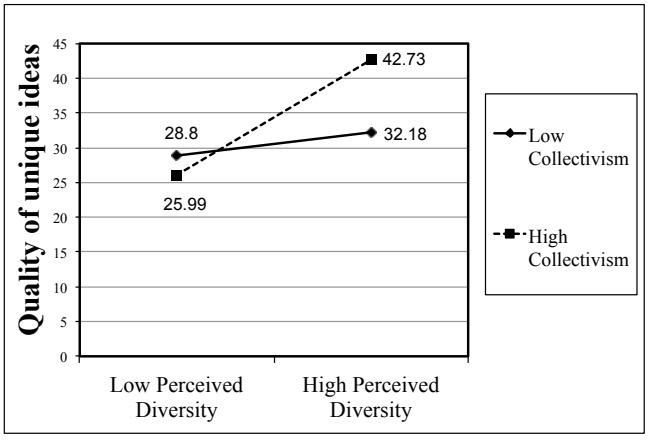

Figure 3. The two-way interaction between perceived diversity and collectivism on quality of unique ideas.

DISCUSSION

The objective of this study was to theoretically explain and empirically examine how collectivism could lead to more creativity in virtual ideation teams high in perceived diversity. Our results highlight the importance of priming individuals in ideation teams with high levels of collectivism. In the following section we discuss the implications for theory as well as for the design of collaborative systems.

First, we found a negative relationship between collectivism and perceived diversity. In other words, when participants were high in collectivism they were less inclined to feel like they were different from their teammates. Perceived diversity has been found to decrease trust, cooperation, coordination and social integration in both collocated and virtual teams [46,91,93]. When we consider the negative implications, we find hope in discovering that collectivism reduces perceived diversity and the problems associated with it. This, in turn, should promote teamwork in many different types of tasks.

Second, we identified collectivism as a moderator of the relationship between perceived diversity and creativity. Our experiment showed that perceived diversity was associated with more and higher-quality unique ideas when participants were high in collectivism. In other words, participants who thought their teammates were different from themselves were significantly more creative when they were high in collectivism. Collectivism facilitates creativity because with it, people are more cooperative and as a result they are more motivated to contribute to the team and are less likely to free-ride on their teammates' work. As a result, collectivism amplified the effect of perceived diversity on creativity.

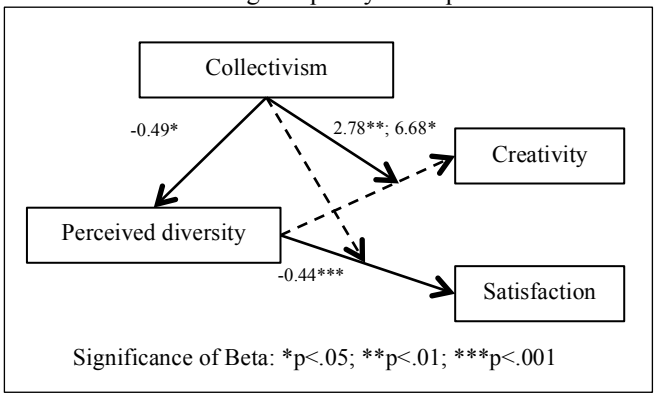

Figure 4. Test results of theoretical model.

Third, our findings contradict previous literature that has found that collectivism decreases individual creativity in teams [39,123,124]. Taken together, findings 1 and 2 help provide an explanation for why collectivism could be associated with increases and decreases in creativity. Our study indicates that the negative relationship between collectivism and creativity may be a result of collectivism's relationship with perceived diversity. Increases in collectivism are likely to correspond with decreases in perceived diversity. To the degree that teams are low in perceived diversity they may be less creative. These individuals are more likely to conform and less likely to think divergently and come up with more creative ideas [11,39,79]. Researchers have shown that teams often need to recognize their differences to take advantage of them [45,67]. In particular, when team members do not believe they have unique contributions to make to the team, they are less likely to contribute to that team [91].

On the other hand, collectivism in our study was associated with increases in idea generation by bolstering the impact of perceived diversity on idea generation. From a theoretical perspective, the duality associated with collectivism is both puzzling and interesting. Many team tasks need both cooperation and creativity; therefore, our findings are important to understanding when collectivism can promote creativity.

Fourth, our results showed that the effect of collectivism on satisfaction was via the impact of perceived diversity.

Although there was no interaction between collectivism and perceived diversity on satisfaction, there was a significant indirect effect of perceived diversity on the relationship between collectivism and satisfaction. In other words, collectivism was negatively related to perceived diversity and perceived diversity was negatively associated with satisfaction. This finding sheds light on why collectivism has often been associated with increases in satisfaction (e.g., [75,83]). These results highlight the important role of perceived diversity in idea-generation teams over and above idea generation.

Finally, our study extends the CSCW/HCI literature on diversity. We found that perceived diversity was central to understanding individuals' perceptions of enjoyment (i.e. satisfaction) and also their level of creativity during brainstorming sessions. While the perception of diversity has attracted attention in work teams (e.g., [51,94,118]), little research has been conducted to examine its effect in areas like ideation and brainstorming teams [94]. Our findings highlight the need for CSCW/HCI scholars to focus more attention on the effects of perceptions to help understanding of how to promote better outcomes in the field of ideation and brainstorming. Perceptions may be particularly important to CSCW/HCI scholars who study brainstorming in virtual or technology-enabled teams, because people in these teams commonly lack physical contact as well as a shared context [47,48,95] and they are more likely to make inferences about their dispersed teammates based on perceptions.

Implications for Design

Results from this study highlight the need to facilitate both collectivism and perceived diversity. In this section we discuss how systems could be designed to promote both collectivism and perceived diversity when needed.

We propose designing systems to prime individuals as one way to increase collectivism. We propose three approaches to embedding priming into collaborative systems. First, as found in previous studies (e.g., [41,69]), priming can be embedded via a pre-task prompt. The system can prompt individuals to write down what they have in common with or what makes them different from their friends or co-workers, depending on the context. The system would only allow users to proceed to the ideation session after they had submitted their list of differences or similarities. Second, a system might be designed to show a message on its starting or loading page that asks participants to think about what they have in common with or how they differ from their teammates. A timer could be preset to the length of time required for the prime. Third, embedding pictures into the background of the interface is another approach [61,64]. For example, a picture where six people hug one another versus a logo where one person spreads his arms and looks toward the horizon could effectively activate collectivism versus individualism (e.g., [61]). The fact that CSCW scholars [69] have successfully incorporated affective primes as background pictures in Adobe Ideas, a system to support creativity, further spotlights the possibility of embedding picture primes of collectivism in ideation systems.

System personalization could be used to facilitate idea generation by promoting perceptions of diversity. Results of our study indicate that perceived diversity could be a key driver of idea generation. Previous studies have shown that allowing users to personalize their system interface can increase users' perception of their own identity (e.g., [59,71]). Therefore, collaborative systems could be designed to promote perceived diversity by allowing users to customize their interface and style. For example, users could be allowed to choose the interface background, the fonts (e.g., style, size, color) and format (e.g., layout, gif versus photo) everywhere in the system, such as starting page, chatting interface and personal profile.

Designers could also add features that can assess the needs of individuals in real time and automatically take corresponding action to promote creativity. For example, these features could include assessing a user's perceptions of diversity and degree of collectivism after a couple of trial brainstorming sessions and then determining whether one of both should be promoted. Once this is done the system could either prompt individuals to list several things they have in common with others or allow users to personalize their interfaces.

In sum, this study has important implications for the design of collaborative systems. Ultimately, the decision whether to promote collectivism or not depends on the need of a particular team. Regardless, we think collaborative systems can be designed to support this decision.

Limitations

There are a few limitations of this research — all of which highlight opportunities for future research. First, participants were randomly assigned and did not know their teammates' identity. Although these conditions are needed for internal validity, they may also limit the paper's external validity. Field research in organizations and online communities with actual working groups could be used to verify the findings in other settings. Second, a single brainstorming task was used in this study. Further studies could be done on projects that require more interactions over a longer period of time. Third, the perceived diversity used in this study was deep-level perceived diversity [45]. We didn't explore the surface-level perceived diversity (e.g., age, gender, ethnicity) because participants didn't know such information in the virtual context we provided. Researchers might want to examine the potential effect of surface-level perceived diversity. Finally, this study examined effects on two brainstorming outcomes, but future work is needed to explore how collectivism and perceived diversity affect other team outcomes, such as decision-making.

CONCLUSION

A collectivistic team culture has been proposed to have both negative and positive effects on brainstorming outcomes. However, researchers have not examined the mechanisms behind these effects. Our findings suggest that perceived diversity could help to explain these divergent effects. We found, experimentally, that priming team members with a collectivist reference decreased their perceptions of diversity and, in turn, helped to engender creativity and satisfaction outcomes. This is a significant finding that offers new insights for scholars of group dynamics as well as designers of group-support systems.

ACKNOWLEDGMENTS

We thank all the volunteers and lab managers for participation and help. We especially thank Sarita Yardi Schoenebeck, Cliff Lampe, Ingrid Erickson, Sangseok You, Youyang Hou and Chanda Phelan for writing and providing helpful comments on previous versions of this document. We gratefully acknowledge the financial support from Rackham Graduate School and the National Science Foundation grant CHS-1617820.

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