

# Far but Near or Near but Far?: The Effects of Perceived Distance on the Relationship between Geographic Dispersion and Perceived Diversity

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## ABSTRACT

Geographic dispersion has been proposed as one means to promote cooperation and coordination in teams high in perceived diversity. However, research has found mixed support for this assertion. This study proposes that the inclusion of perceived distance helps to explain these mixed results. To test this assertion, we examined 121 teams—62 collocated and 59 geographically dispersed. Results demonstrate that perceived distance explains when geographic dispersion benefits teams high in perceived diversity. Results also indicate that the type of perceived diversity matters (surface-level vs. deep-level diversity). This study contributes to our understanding of distance and diversity in teams.

## Author Keywords

Team diversity; virtual teams; geographic dispersion; perceived distance; perceived diversity; distance

## ACM Classification Keywords

H.3.5; H.4.3; K.6.0

## General Terms

Theory; Human factors; design; measurement.

## INTRODUCTION

Geographic dispersion and team diversity are particularly important topics in the Computer Supported Cooperative Work (CSCW)/Human Computer Interaction (HCI) community. For example, the phrase “distance matters” is often used to describe the role of geographic dispersion in teamwork [50]. The importance of distance to teamwork has only increased, as indicated by recent articles,

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conference and speeches titled, “Even Small Distance Matters...” [51] and more recently “Does Distance Still Matter?...” [6]. Similarly, understanding the impacts of diversity has become an increasingly popular and important research topic in the CSCW/HCI community [21,47,48,57,60,69]. Yet, understanding when or how distance matters in diverse teams is still a much-understudied topic in our community [47,57].

Perceived diversity—the belief that others are different (e.g., in terms of race, education and attitudes)—is often accredited with the negative effects of team diversity [29]. Individuals are often less willing to cooperate and coordinate with individuals, who they perceive as different, which, in turn, hurt team performance [18,35,40]. Geographic dispersion was proposed as a solution to this problem. Scholars posit that the impact of perceived diversity on cooperation and coordination should depend on geographic dispersion [5,13,25,62,66]. Geographic dispersion provides separation between team members [13,50,77] and necessitates the use of electronic communications, which facilitate more equality in team communications [5,19,59]. Although this sounds intuitive, research has not found consistent support for this proposition [2,5,25,26,52,63,77].

Recently, perceived distance has emerged as an important topic in understanding relationships between team members in geographically dispersed teams [33]. Perceived distance represents an individual’s perception of how close and how far he or she is from others [51]. Perceived distance is a separate and distinct concept from geographic distance. Perceived distance and geographic distance are not necessarily related [49]. Team members can be geographically dispersed but still feel like their teammates are actually close in proximity [47].

This paper proposes that the inclusion of perceived distance can help us understand the mixed results associated with geographic dispersion in diverse teams. To empirically test this assertion, we conducted a study with 62 collocated and 59 geographically dispersed teams. This study examined two types of perceived diversity: surface-level diversity, which represents age, gender and racial differences; and deep-level diversity, which represents differences in

knowledge, values, attitudes and beliefs. Overall, the results indicate that the inclusion of perceived distance are vital to understanding the role of geographic dispersion on the relationship between perceived diversity and both cooperation and coordination.

This study provides several theoretical contributions to the CSCW/HCI literature. First, it extends our understanding of the effects of distance on teamwork. Results of this study offer an explanation of when and why distance might impact teamwork. Second, it provides new insights into our understanding of perceived diversity in dispersed teams. This study demonstrates that the type of perceptions of diversity (surface vs. deep-level) is important to understanding the effects of geographic dispersion and perceived distance on team cooperation and coordination. Third, this study extends our understanding of perceived distance. Perceived distance had little impact on collocated teams when compared to geographically dispersed teams in this study. This suggests that the effects of perceived distance are much more salient in geographically dispersed teams.

#### **RELATED WORK**

“Diversity refers to an infinite number of objective and perceived differences among members of an organizational unit, such as age, nationality, and work abilities [75]” [64, p. 1]. At the heart of the literature on team diversity is that differences matter. However, what those differences are and how they matter has been the subject of a long, rich and complex debate [27,39,43,44,69]. Differences can range from race, gender and nationality to educational background, work experience and personal values.

The negative effects of team diversity are explained by social categorization and similarity/attraction theories [14,36,74,75]. According to social categorization theory, individuals categorize themselves and others into social groups [67]. People they believe are like themselves are placed into the in-group, and others they believe are not like themselves are placed in the out-group [10]. Similarity/attraction theory asserts that individuals prescribe positive attributes to individuals they believe are like themselves and are attracted to and prefer to interact with people like themselves [54,58,68]. In contrast, individuals often prescribe negative attributes to individuals they believe are different from themselves and at times actively avoid interacting with such people [10].

#### **Perceived Diversity**

Research has attempted to capture the effects of social categorization and similarity/attraction in two ways. The first approach is through actual diversity. Actual diversity is captured by objective measures of differences in race, gender, education, experience and age. The idea behind the use of actual diversity is that it represents the potential for individuals to place themselves and others into social groups [75]. However, research has found that actual diversity does not always lead to the creation of in-groups

and out-groups [29,76]. One explanation is that differences are socially rather than objectively constructed. For example, measures of actual gender and race may not necessarily be a good representation of social constructions of gender and race. A second approach to capturing the effects of social categorization and similarity/attraction is the use of perceptions.

Perceived diversity is the belief that others are different, and it has been found to be a key indication that individuals have engaged in the social categorization process [29,53,64]. In fact, many scholars have argued that the cognitive process of placing others into in-groups and out-groups is best represented by perceived diversity and not actual diversity [27, 29,33,76]. Perceived diversity has been found to reduce cohesion, satisfaction and trust and to increase conflict [23,29,33]. This has led many scholars to focus attention on perceived diversity rather than actual diversity [64].

The benefits of perceived diversity are twofold. One, they allow us to determine whether individuals believe there are differences among them. Two, perceived diversity also allows us to determine whether those differences matter and how they matter. For example, when perceived diversity is positively related to better teamwork (e.g., increases in trust and cohesion, and decreases in conflict) this is a strong indication that team members both recognize their differences and are able to benefit from them. However, when perceived diversity is negatively related to teamwork (e.g., decreases in trust and cohesion, and increases in conflict) this may indicate that teams recognize their differences but are not able to benefit from them. In addition, research has shown that the use of electronic communications within teams often suppresses the salience of some types of actual diversity [25].

As a result of these advantages, we have chosen to examine perceived diversity to understand how distance may or may not matter. There are two types of perceived diversity: surface-level and deep-level [29]. In the following section each type will be discussed.

#### *Perceived Surface-Level Diversity*

Perceived surface-level diversity can be defined as the belief that your team members differ on attributes such as race, gender and age [29]. It represents the effects of social categorization of demographic categories [27,29,76]. It captures how people respond to others they feel are not like themselves in terms of race, gender and age. Simply put, teams high in perceptions of surface-level diversity believe their members differ in race, gender and age [1]. The ability to measure the impact of physical differences makes perceived surface-level diversity important and unique.

Demographics such as race, gender and age can act as triggers that lead other team members to ignore or discount opinions and perspectives simply because they come from others different from themselves on these attributes [56].

Individuals are also more willing to work with others who are similar to themselves in terms of race, gender and age [29]. In fact, differences in race, gender and age are often the basis for conflict [22]. When this occurs, teams are more likely to succumb to the negative effects of team diversity.

Perceived surface-level diversity has been used to understand how beliefs about differences in race, age and gender can impact teamwork [64]. For example, Harrison et al. [29] found that surface-level diversity was negatively related to social integration in the teams they studied. Acer [1] found that surface-level diversity was associated with team conflict. However, it should also be noted that Zellmer-Bruhn et al. [76] found that surface-level diversity had no impact on the teams they studied. Another study found that the relationship between perceived surface-level diversity and team identification depended on whether individuals saw value in diversity [73]. When individuals saw value in diversity, perceptions of surface-level diversity were positively related to team identification, but when individuals did not see value in diversity, perceptions of surface-level diversity were negatively related to team identification. Hentschel et al. [30] found that perceptions of surface-level diversity were negatively related to team identification and positively related to conflict. But when team members saw value in diversity, the negative relationship with identity and positive relationship with conflict decreased.

#### *Perceived Deep-Level Diversity*

Perceptions of deep-level diversity can be described as the perceptions of differences among team members in beliefs, attitudes, knowledge and values [4]. It reflects the social categorization process based on differences in opinions, perspectives or knowledge among team members [29,76]. When team members believe that their teammates are dissimilar on these aspects they should have a high level of perceived deep-level diversity. However, when team members believe their teammates are similar in these aspects they are likely to have low levels of perceived deep-level diversity [72]. In other words, teams high in perceptions of deep-level diversity have members who believe their teammates have different beliefs, attitudes, knowledge and values [29].

Perceptions of deep-level diversity are distinct from perceptions of surface-level diversity in several ways. First, perceptions of deep-level diversity can capture differences among individuals who may be of the same race, gender or age. The social categorization process can be based on factors other than demographics. As such, study of perceptions of deep-level diversity allows researchers to examine the effects of perceived diversity among team members who are similar in demographics yet different in many other ways. Two, unlike surface-level diversity, perceptions of deep-level diversity are not initially automatic. They instead emerge over time through team

interactions [13]. For example, new teammates who have different opinions normally have to interact before these differences become apparent. This delayed judgment might make individuals much more open to such differences once they have gotten to know one another [72].

Overall, the results of studies examining the relationship between perceived deep-level diversity and teamwork have been mixed. Several studies examining perceived deep-level diversity in teams have found that it was negatively related to social integration [29] and team effectiveness [76] while being positively related to conflict [50]. But perceived deep-level diversity has also found to be positively related to team effectiveness [12].

A recent literature review found that the relationship between both perceived surface-level and deep-level diversity with teamwork was inconsistent [64]. They concluded that scholars investigating perceived diversity should search for the contingency factors that help determine whether the relationship between perceived diversity and teamwork will be positive or negative. This study addresses this issue by examining how distance alters these relationships.

## **THEORETICAL DEVELOPMENT**

### **Geographic Dispersion and Team Diversity**

Geographic dispersion, the physical separation of team members, has been proposed as way to decrease the negative effects of perceived diversity [25]. First, geographic dispersion reduces contact among team members [4,8,31,50]. Because individuals prefer to interact with similar others, reducing their contact with others they believe are different should have a calming effect. This allows teammates to better manage their contact with their teammates. This, in turns, allows teammates to have more control over when and how they choose to coordinate and cooperative with their teammates.

Geographic dispersion also increases a team's reliance on electronic communications [20], which should also benefit teams when perceptions of diversity are high [13,25,32,37, 50, 65]. Electronic communications support more equal and open team discussions [19,55,59]. Face-to-face discussions allow one person to speak effectively at any given moment while everyone else has to listen [19,59]. This can facilitate a situation where a few members dominate team discussions [55]. As a result, views from minorities can often be overlooked [19,59]. When this occurs in highly diverse teams, members are less likely to engage in collaborative behaviors like cooperation and coordination [24].

Electronic communications such as email and chat can allow multiple individuals to communicate simultaneously, which should facilitate more equality during team discussions [28]. The link between electronic communications and more equal participation was found by Rains [55], who conducted a meta-analysis involving 48

experiments and found that when teams used electronic communications they had greater participation and equality and experienced less member dominance than face-to-face teams. More equality during team discussions should be particularly important to facilitating teamwork when team members believe they are different from one another [4,13,25]. Taken together, prior literature not only asserts that distance matters [50], but that distance might be beneficial when perceptions of diversity are high among team members.

### **Perceived Distance**

Geographic dispersion is often used to explain the relatively weak bonds found between members of dispersed teams [52]. Nonetheless, scholars have long recognized that individuals often develop strong emotional bonds with dispersed others and have relatively weak emotional bonds with collocated individuals [42,46,70]. This observation suggests that geographic dispersion alone does not fully explain the interpersonal relationships between dispersed team members [71]. Despite this, studies have only recently examined the impacts of perceived distance along with geographic distance [16,49,65]. This work suggests that the effects of distance are not fully captured by geographic distance alone.

Perceived distance represents how far or close individuals believe they are from one another [47,71]. For example, someone may feel like a dispersed co-worker is nearby while feeling like a collocated co-worker is not. This can occur because individuals can have repeated communications with distant others who display such characteristics as “dependability, reliability, accessibility, and likability” [49,71]. This can over time promote low levels of perceived distance irrespective of the actual physical distance between team members. At the same time, a lack of repeated interactions or bad interactions can lead team members to view collocated individuals as distant. When this occurs, geographic distance alone does not account for the effects of distance between team members [16,71]. Perceived distance has been used to explain why individuals can develop strong relationships with dispersed others [65].

Several studies have found little or no relationship between measures of perceived distance and geographic distance. For example, Siebdrat et al. [65] examined software development teams. They found that perceived distance (referred to as subjective distance), defined as a team’s perception of distance between team members, was negatively related to team collaboration but physical distance had no relationship with team collaboration. O’Leary et al. [49] studied both collocated and geographically dispersed co-workers. Results of their study indicated that geographic distance was not related to perceived distance (referred to as perceived proximity). Both studies also found that geographic distance did not predict outcomes like relationship quality or collaboration, but perceived

distance did. Similarly, Cha et al. [16] found that a perceived distance was a better predictor of team collaboration and cohesion than actual distance. Taken together, all three studies demonstrate that geographic distance is not necessarily related to perceived distance and it could have distinct and separate effects.

### **The Impact Distance on Teamwork**

Cooperation and coordination are both vital to the success of geographically dispersed and collocated teams [9,41,45]. Cooperation can be viewed as the act of assisting another or the act of engaging in joint action to accomplish a goal [17]. Team cooperation represents the degree to which team members are willing to assist one another to accomplish team goals [17,24]. Coordination can be defined as the ability to organize [34]. Team cooperation reflects the degree to which team members are able to organize their actions on behalf of the team [59].

A lack of cooperation or coordination is used to explain the negative impacts of perceived diversity across a range of teams [17,61]. Individuals are less likely to engage in cooperation and coordination with others they believe are different from them [29]. Researchers have posited that geographic dispersion in such teams could help facilitate conditions that would make it more likely that such teams would cooperate and coordinate their actions [25].

We propose a three-way interaction between geographic dispersion, perceived distance and perceived diversity. To create conditions where team members who believe they are different are more likely to cooperative and coordinate, these teams need to not only be physical distance but also perceived that they are distant. Geographic dispersion captures the effects of physical but not psychological separation. For example, team members who are geographically dispersed may still believe that their teammates are relatively close in proximity [16,49,65]. In this situation, geographic dispersion will not create the conditions needed to encourage team members who believe they are different to cooperate and coordinate. This may explain the inconsistent effects of the moderation between geographic dispersion and diversity in the literature [2,5,24,25,66,77].

The paper proposes that teams high in perceived diversity should be more willing to cooperate and coordinate with one another when they are both geographically dispersed and have high levels of perceived distance. This is because these teams should have the benefits associated with separation from others they believe are “not like them,” as well as greater equality in team communications. However, geographic dispersion is unlikely to create the conditions that encourage cooperation and coordination in such teams when perceived distance is low. When this occurs, team members maybe physically separated but still feel relatively close.

In summary, the relationship between perceived diversity, cooperation and coordination is dependent on geographic and perceived distance. When teams are both geographically dispersed and have high levels of perceived distance, perceived diversity should be positively related to cooperation and coordination. Our theoretical arguments are summarized in Figure 1.

*H1a & b) Perceived surface-level diversity is positively related to a) cooperation and b) coordination when both geographic dispersion and perceived distance are high.*

*H2a & b) Perceived deep-level diversity is positively related to a) cooperation and b) coordination when both geographic dispersion and perceived distance are high.*

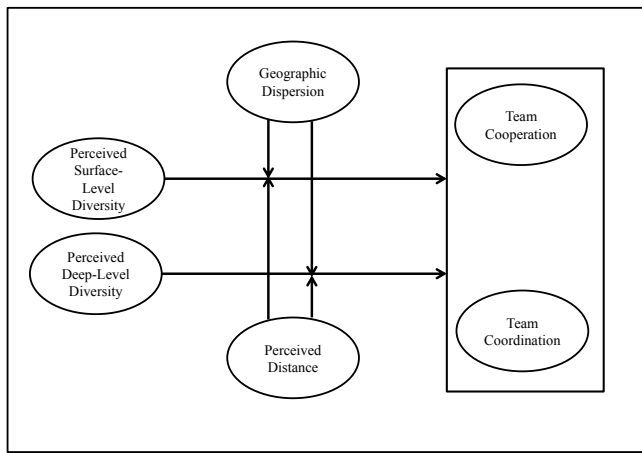


Figure 1. Research Model

## METHOD

### Participants

Participants were enrolled at a public university. Their ages ranged from 18 to 62 with a mean age of 32. Fifty-nine percent of the students were women and 49 percent were non-white. The participants were all U.S. citizens. A total of 423 subjects in 121 teams participated in the study (87% participation rate). Sixty-two teams were collocated and 59 were dispersed. Team size ranged from 3 to 5 with an average of 3.5. Members were randomly assigned to teams

### Data Collection and Team Description

Data were collected from graduate students enrolled in one of 2 graduate sections of an analysis course. Students were working professional enrolled in a part-time graduate program. One section was taught as an evening face-to-face course and the other was an online distance course. The face-to-face section met once a week while the online section never had face-to-face classes. Data were collected via an online survey from each section. The survey was typically administered a week before the project's due date.

### Measurements

#### Comparisons between Collocated and Dispersed Teams

A comparison was done between collocated and dispersed teams to assess whether additional variables should be added. Age, gender, race, work experience, past history,

informal interactions and perceptions of diversity were compared. Teams significantly differed only in age. Age and standard deviation of age was included as control variables.

#### Control Variables

Additional control variables were included: team grade point average, team size and tenure (team duration).

#### Independent Variables

Geographic dispersion was measured as a "0" if the teams were online (i.e. geographically dispersed) or a "1" if they were face-to-face (i.e. collocated) teams. There were 121 teams total, with 62 collocated and 59 dispersed teams.

Perceived distance was measured with items reflecting how far participants felt from their teammates. Perceived surface and deep-level diversity were adapted from Harrison et al. [29]. The scale captures the extent to which teams believe they are similar/different from one another on a Likert-type scale (1 = very similar, 7 = very different) (see Table 1).

#### Dependent Variables

Items measuring team cooperation and coordination were taken from previous research. Items measuring coordination were taken from Hogel et al. [34], while items measuring cooperation were taken from Chatman [17].

#### Team Performance Score and Team Project Description

Performance was an objective score of each team's project, given by their instructor. The objective of each team's project was to assess an organizational problem and determine the functions needed from a system to best address the problem. The project involved several phases. In phase one, the teams reviewed the organization's process documentation and interviewed client representatives to assess the client's problem. In phase two, the teams used logical models to structure the data. In phase three, teams then analyzed the models to generate a series of potential recommendations. In phase four, the team evaluated each recommendation and selected one to present to the client.

## RESULTS

All latent construct measures were obtained at the individual level of analysis. To justify aggregating the data to the team level, an intra-class correlation coefficient (ICC). The ICC indicates how much variance in the individual response was caused by team membership. All ICC values were above the 8% threshold, providing justification for aggregating the data [7].

To determine whether the measurement constructs were valid we assessed convergent and discriminant validity. Both were assessed through factor loadings, which are shown in Table 1. All items loaded at the .7 level or above on each of their own constructs, while no cross-loadings were above .35 which indicates convergent and discriminant validity [23]. These are all indications of convergent and discriminant validity. All reliabilities were above .70. In addition Table 2 lists the means, standard deviations and correlations.

Item		Cronbach alpha	1	2	3	4	5
I feel like my teammates are nearby.*			<b>.90</b>	.12	.16	.16	.14
Irrespective of the actual distance, my teammates seem far away.			<b>.90</b>	.21	.17	.13	.15
It feels like my teammates are far away.	Perceived Distance ICC = .28	0.89	<b>.90</b>	.17	.15	.09	.17
The distance between my teammates and me seem relatively large when compared to the actual distance.			<b>.90</b>	.15	.20	.10	.12
There is a lot of distance between my teammates and me.			<b>.89</b>	.16	.21	.17	.14
It feels like my teammates are physically distant from me.			<b>.85</b>	.24	.10	.06	.05
The work done on subtasks was closely harmonized.			.14	<b>.94</b>	.06	.01	.15
Our team avoided duplication of effort.			.09	<b>.93</b>	.10	.08	.07
Connected subtasks were well coordinated in our team.	Team Coordination ICC = .29	0.83	.18	<b>.92</b>	.11	.02	.15
There were clear and fully comprehended goals for subtasks within our team.			.15	<b>.91</b>	.06	.05	.02
Connected processes and activities were well coordinated with other teams.			.13	<b>.91</b>	.04	.00	.08
We had no problems in coordinating with other teams.			.12	<b>.91</b>	.13	.10	.11
How similar were team members in personal values?			.27	.22	<b>.82</b>	.13	.29
How similar were team members in prior work experience?	Perceived Deep-Level Diversity ICC = .24	0.91	.24	.23	<b>.82</b>	.20	.19
How similar were team members in expertise?			.28	.20	<b>.81</b>	.14	.31
How similar were team members in educational backgrounds?			.29	.15	<b>.76</b>	.32	.04
How similar were team members in age?	Perceived Surface- Level Diversity ICC = .30	0.89	.11	.07	.07	<b>.83</b>	.10
How similar were team members in ethnicity?			.15	.16	.09	<b>.80</b>	.19
How similar were team members in marital status?			.16	.07	.10	<b>.73</b>	.07
It was important for us to maintain harmony within the team.			.26	.31	.28	.03	<b>.70</b>
There was little collaboration among team members, tasks are/were individually delineated. *			.22	.29	.25	.08	<b>.75</b>
There was a high level of cooperation between team members.	Team Cooperation ICC = .32	0.82	.13	.17	.23	.08	<b>.76</b>
People were willing to sacrifice their self-interest for the benefit of the team			.23	.15	.20	.18	<b>.72</b>
There was a high level of sharing between team members.			.22	.19	.21	.24	<b>.70</b>

**Notes:** Extraction Method: Principal Component Analysis.

\*(Reversed Coded)

**Table 1. Factor Loadings**

**Means, Standard Deviations and Correlations**

Variable	Mean	Std. Dev.	1	2	3	4	5	6	7
Cooperation	5.60	0.93							
Coordination	5.00	0.70	0.55 **						
Geographic Dispersion	0.48	0.50	-0.12	0.27 **					
GPA	3.30	0.34	0.32 **	0.21 *	0.05				
Perceived Deep-Level Diversity	2.33	0.65	-0.58 **	-0.40 **	0.10	-0.13			
Perceived Distance	2.50	0.65	-0.44 **	-0.33 **	0.01 **	-0.19 *	0.34 **		
Perceived Surface-Level Diversity	2.60	0.69	-0.22	0.07	0.33 **	0.05	0.50 **	0.11	
Team Tenure	58.00	0.15	0.00	0.00 **	-0.09	0.06	0.08	0.08	0.18 *

N = 121; Significance of correlations: \*p<.05; \*\*p<.01; \*\*\*p<.001

**Table 2. Means, Standard Deviations and Correlations**

Hypotheses were tested using linear ordinary least squared (OLS) multiple regression analysis. SPSS 20.0 was used to test the proposed research model. The results for the models are shown in Table 3. Model 1 shows the effects of control variables on the dependent variable. Model 2 shows the main effects of the independent variables. Model 3 shows the impact of the two-way interaction effects on each dependent variable, followed by Model 4, which shows the three-way interaction effects. The final model, Model 4, for each outcome predicted a significant amount of the variance. In addition, the inclusion of the three-way interaction significantly increased the amount of variance explained.

Team grade point average and team size were significant in Model 1 and Model 4 for team cooperation, while team tenure was not significant in any model. Team size was significant in Models 1 and 2 for team coordination, but no other control variables were significant. Multicollinearity was assessed in each model. Variance inflation factors (VIF) scores did not rise above 4, indicating that multicollinearity was not a major problem [3].

Hypothesis 1a and 1b, which posited that perceptions of surface-level diversity are positively related to a) cooperation and b) coordination when both geographic dispersion and perceived distance are high, was supported. Both three-way interactions involving geographic dispersion, perceived distance and perceived surface-level diversity with cooperation ( $\beta = -0.32, p < 0.05$ ) and coordination ( $\beta = -0.28, p < 0.05$ ) were significant. Figures 2 and 3 display the three-way interactions associated with hypothesis 1. Both figures clearly highlight the strong positive relationship between perceptions of surface-level diversity and cooperation and coordination when teams were geographically dispersed and high in perceived distance.

Hypothesis 2a and 2b, which states that perceptions of deep-level diversity are positively related to a) cooperation and b) coordination when both geographic dispersion and

perceived distance are high, was significant in the opposite direction. The three-way interactions involving geographic dispersion, perceived distance and perceived deep-level diversity with cooperation ( $\beta = 0.37, p < 0.01$ ) and coordination ( $\beta = 0.32, p < 0.01$ ) were significant. However, Figures 4 and 5 demonstrate that the relationship was negative and not positive.

### Summary of the Findings

Taken together, the results indicate that the inclusion of perceived diversity is needed to understand the relationship between geographic dispersion and perceived diversity. Our findings from hypothesis 1 clearly demonstrate how high levels of perceived distance create conditions where perceived surface-level diversity are more likely to lead teams to engage in cooperation and coordination (see Figures 2 and 3).

The results also suggest that teams high in perceptions of deep-level diversity are less willing to cooperate and coordinate under the same conditions (see Figures 4 and 5). Instead, teams high in perceptions of deep-level diversity are more willing to cooperate and coordinate when they are geographically dispersed and have low levels of perceived distance. In other words, feelings of being close rather than far from one another created conditions where perceptions of deep-level diversity were more likely to translate to more cooperation and coordination in geographically dispersed teams. This finding calls for a more in-depth discussion, which can be found in the following section.

Two additional findings are worth noting across both hypotheses. One, the type of perceived diversity appears to be crucial in understanding when geographical dispersion and perceived distance can be beneficial. The conditions in which perceptions of surface-level diversity are positively related to cooperation and coordination are the same conditions where perceptions of deep-level diversity are negatively related to cooperation and coordination.

Independent Variables	Team Cooperation					Team Coordination				
	Model 1	Model 2	Model 3	Model 4	R <sup>2</sup>	Model 1	Model 2	Model 3	Model 4	R <sup>2</sup>
Step 1: Control Variables										
Age Diversity	-0.026	0.00	0.01	0.00		-0.01	0.00	0.00	0.00	
Team Age	0.007	0.02	0.02	0.03		0.03 *	0.01	0.01	0.01	
Team GPA	0.66 *	0.35 *	0.37 *	0.31		0.20	0.09	0.17	0.11	
Tenure	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Team Size	-0.30 *	-0.08	-0.10	-0.14 *	0.17 ***	-0.23 **	-0.15	-0.13	-0.16 *	0.20 **
Step 2: Main Effects										
GD		-0.39 *	-0.45 *	-0.55 **			0.28	0.25	0.17 *	
PD		-0.19 **	-0.17	-0.11			-0.11	-0.13	-0.08	
PSLD		0.10 *	0.11	-0.03			0.15	0.11	0.08	
PDL D		-0.60 ***	-0.42 ***	-0.32 **	0.62 ***		-0.28 ***	-0.30 **	-0.24 **	0.36 ***
Change in R <sup>2</sup>					0.45 ***					0.16 ***
Step 3: Interaction Effects										
GD X PD			-0.09	-0.05				0.05	0.09	
GDX PSLD			0.11	0.15				0.04	0.07	
GD X PDL D			-0.20	-0.36 *				0.13	0.01	
PSLD X PD			0.14 *	0.29 **				-0.01	0.11	
PDL D X PD			-0.12	-0.30 **	0.64 ***			-0.15 *	-0.29 ***	0.41 ***
Change in R <sup>2</sup>					0.03					0.05
Step 4: Interaction Effects										
GD X PD X PSLD				-0.34 *					-0.29 *	
GD X PD X PDL D				0.38 **	0.68 ***				0.32 *	0.45 ***
Change in R <sup>2</sup>					0.04 ***					0.05 ***

N = 121; Unstandardized regression coefficients are reported. All continuous variables were standardized. GD = Geographic Dispersion; PD = Perceived Distance; PSLD = Perceived Surface-Level Diversity; PDL D = Perceived Deep-Level Diversity; \*p<.05; \*\*p<.01; \*\*\*p<.001

**Table 3. Results of Multiple Regression Analysis**



Two, geographical dispersion was associated with conditions where perceptions of surface-level and deep-level diversity had strong negative relationships with cooperation and coordination. This implies that geographic dispersion cannot only help create conditions where perceptions of diversity are positively but also negatively related to cooperation and coordination. This, coupled with findings related to the type of perceived diversity, might explain the inconsistent results from previous studies examining the relationship between team diversity and geographic dispersion.

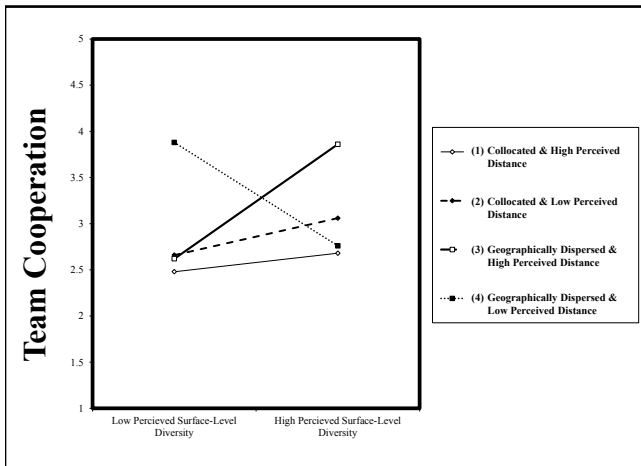


Figure 2. The three-way interaction between perceived surface-level diversity, geographic dispersion and perceived distance on team cooperation.

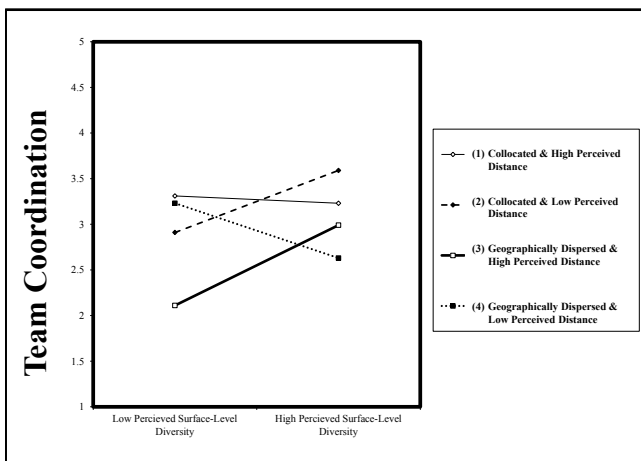


Figure 3. The three-way interaction between perceived surface-level diversity, geographic dispersion and perceived distance on team coordination.

## DISCUSSION

This study examined whether perceived distance could help explain when geographic dispersion creates conditions that benefit teams high in perceived diversity. The results demonstrate that perceived distance helps explain when geographic dispersion can benefit teams high in perceived

diversity. However, this study also found that the impact of both geographic dispersion and perceived distance depends on the type of perceived diversity. Taken together, the results of this study contribute to our understanding of the impacts of diversity in geographically dispersed teams.

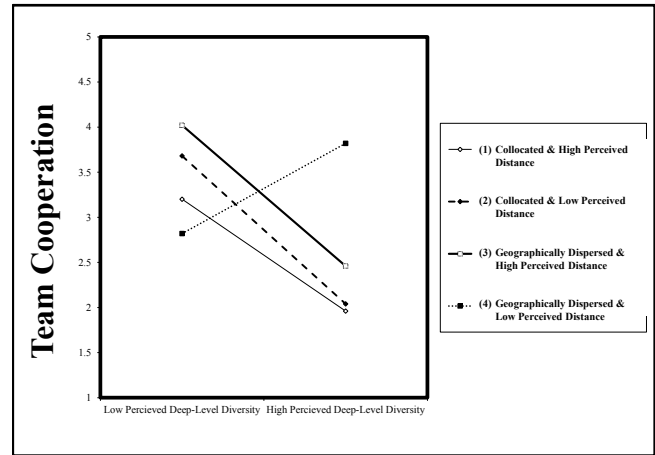


Figure 4. The three-way interaction between perceived deep-level diversity, geographic dispersion and perceived distance on team cooperation.

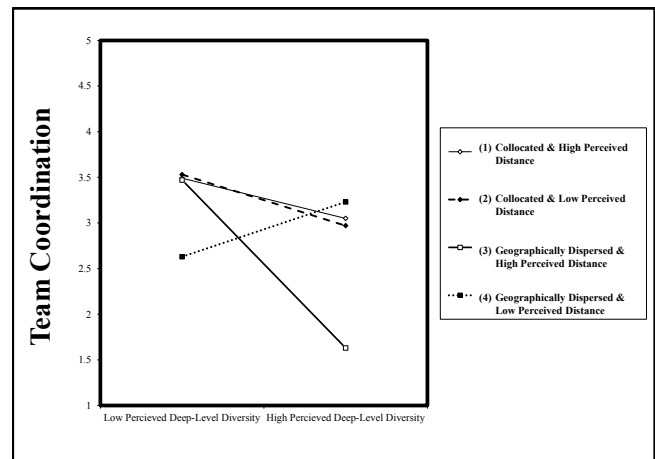


Figure 5. The three-way interaction between perceived surface-level diversity, geographic dispersion and perceived distance on team coordination.

## Limitations

Before discussing the implications of our findings, it is important to acknowledge several limitations of this study. First, scholars should be careful about over-generalizing from one study. Second, the survey items were gathered through self-reports at a single point in time. To address this issue, a Harmon single-factor analysis was conducted. No evidence of common method bias was found. Third, participants in this study were students completing an assigned project as part of their course. Although students typically differ from full-time employees in terms of age

and experience, these participants were of similar age (mean 32) to employees working in many organizations.

### **Contributions**

This study contributes to the literature in several ways. This study contributes to our understanding of diversity in geographically dispersed teams. The results of this study provide an explanation for why geographic dispersion can at times encourage cooperation and coordination in diverse teams and why it may not. The ability of geographic dispersion to alter the impact of perceived diversity on team cooperation and coordination appears to be dependent on perceived distance. Although geographic dispersion is likely to encompass the benefits associated with the use of electronic communication, it may not provide the psychological separation between team members. This highlights the important role that perceived distance plays in determining the effects of geographic dispersion on perceived diversity.

The study also draws attention to the importance of the type of perceived diversity. Geographic and perceived distance created conditions where perceived surface-level diversity was associated with more cooperation and coordination. However, this was not the case for perceived deep-level diversity, which was positively associated with cooperation and coordination when teams were geographic dispersed and had low levels of perceived distance. The current literature on diversity and geographically dispersed does not specifically acknowledge that the type of perceived diversity should matter when determining the effects of geographic dispersion.

However, research in psychology may offer an alternative explanation. The effects of perceived distance are often relative to whether someone sees a particular person or situation as a threat [15]. Threats are potential for conflict. Individuals are more likely to view out-groups as potential threats and perceived such threats as being much closer than in-group members not viewed as threat [15]. Teams in this study may have viewed surface-level diversity as a threat, but not deep-level diversity. However, this interpretation should be taken with caution and be further verified by future studies.

### **Implications for Design and Future Research**

Results of this study provide guidance on when we should design to promote or reduce feelings of distance among collaborators. For teams high in perceptions of surface-level diversity, distance can have benefits. In such cases, we should seek to promote, rather than decrease, feelings of distance among collaborators. Below we list several design implications to promote feelings of distance among these individuals.

Collaborative systems should be designed to reduce direct interactions within teams high in perceptions of surface-level diversity. These systems can be designed to forward team communications directly to knowledge repositories

rather than having them go directly to other teammates. In such systems, team members could log in to check for communications. This would create an intermediary step between team members, facilitating distance. This would also make team communications more asynchronous, which is also associated with increases in distance. In addition, the messages posted in these systems could be depersonalized by removal of any identifiable information, which could also increase feelings of distance.

Systems should also be designed to allow team members to better manage their interactions. Specifically, designers should build systems that allow team members to list their availability by person and communication technology. For example, teammate A could list that she is currently available for contact with teammate B by email only but is available for a phone call from teammate C. This would allow teammate A to manage the distance between herself and her teammates.

Conversely, systems could be designed to reduce distance in teams high in perceived deep-level diversity. First, systems could engage users to employ communication media associated with reductions in feelings of distance, like video over media associated with increases in distance such as email. For example, when a user is writing an email to teammates the system could prompt the user to consider a video call. This prompt could inform the user that teammates are available for a video call now.

Additionally, in these teams high in perceptions of deep-level diversity systems could be designed to prevent communication breakdowns that lead to increases in distance. To accomplish this, systems could be designed to remind users that they have received an email from one of their teammates and have not responded. An example email might state “We have noticed that Jane has emailed you several times over the last month and you have not responded.” The system could also send other reminders regarding the need to communicate with teammates. A system response might state “We noticed that you have not communicated with anyone on your team for 30 days.”

### **CONCLUSION**

Geographic dispersion has been proposed as a means to promote cooperation and coordination when teams are high in perceived diversity. However, research has not consistently supported this proposition. This study suggests that the inclusion of perceived distance can help explain these inconsistent results. In doing so, this study also deepens our understanding of the effects of distance on teamwork. In addition, results of this study provide new insights on how to design systems that better manage the impacts of distance on teamwork.

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