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# A Multi-Level View of the Antecedents and Consequences of Trust in Virtual Leaders

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# **A Multi-Level View of the Antecedents and Consequences of Trust in Virtual Leaders**

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## **ABSTRACT**

Although trust is widely acknowledged as critical to virtual teams, little is known regarding the causes and consequences of trust in leaders of virtual teams. This paper examines the antecedents and consequences of trust in virtual team leaders. Using survey and archival data from a massively multiplayer online game (MMOG), this study's findings show that trust in the leader is affected by team members' use of synchronous communication and breadth of communication with leaders as well as team members' distance from each other. Furthermore, reasoning that team size and culture create a shared context qualifying team members' experiences, we found that team size and collectivistic values diminished the benefits of synchronous communication and breadth of communication, respectively. The findings also revealed that trust in leaders had a positive relationship to team performance. Detailed discussion of the findings is provided in the conclusion of the paper.

## **Keywords**

Communication synchronicity, communication breadth, trust, online games, massively multiplayer, virtual teams, virtual teamwork, virtual leadership, media richness, performance

## **INTRODUCTION**

Virtual team work has become a pervasive component of organizations (Martins, Gilson and Maynard, 2004; Hertel, Geister and Konradt, 2005). Indeed, most organizations and work teams today employ some degree of virtualness (Martins et al., 2004). The features of virtualness enable organizations to utilize diverse knowledge and resources across a wide array of persons and regions, but they also pose significant challenges to teams that may undermine the effective functioning of teams. Primary challenges for virtual teams are trust (Pauleen, 2003; Paul and McDaniel, 2004) and leadership (Zhang and Fjermestad, 2006).

Despite the espoused importance of trust and leadership, research on these issues has been limited in two important ways. First, although the antecedents and consequences of trust in virtual teams have been the subject of considerable investigation (Martins et al., 2004), there is scant empirical research on leadership in virtual teams (e.g., Zhang and Fjermestad, 2006). This oversight is troubling given that research in traditional settings indicates that trust in leaders has a significant impact on the performance of individuals and teams (Dirks, 2000; Dirks and Ferrin, 2002; Korsgaard, Pitariu and Jeong, 2008). Second, trust in virtual teams has focused almost exclusively on the group level, yet theory and research on trust indicates that trust arises both from contextual factors that are common or shared by the groups and by unique experiences of the individuals within the group (Korsgaard et al., 2008). In virtual settings where the physical separation of members may lead them to develop distinct and idiosyncratic patterns of interacting with each other and with leaders, there is likely to be unique, individual-level variation in trust. To understand the nature and effects of trust in virtual settings, it is therefore critical to consider both factors that are shared by the team and factors that are unique to individual team members.

The goal of this investigation is to address these gaps in the understanding of virtual teams by focusing on trust in the virtual team's leadership and adopting a multi-level view of the formation of trust. Specifically, we examine the defining features of virtual teams – dispersion and communication – as individual-level factors and how the effects of these factors are influenced

by the shared context of the team and provide evidence of the importance of trust in leaders to the functioning of virtual teams.

## **THEORY AND HYPOTHESES**

### **Theoretical Background**

Virtual teams can be distinguished from other types of teams by two main features: dispersion and the use of communication technology (Hertel et al., 2005; Kirkman and Mathieu, 2005; Martins et al., 2004). Virtual teams are dispersed or distributed in that members interact across physical, temporal, organizational or social boundaries. Virtual teams also rely on communication technology or virtual communication to interact with one another.

Scholars have argued that the task of leading virtual teams is unique and challenging (e.g., Cascio, 2000; Zigurs, 2002). It is the responsibility of team leaders to define, facilitate, and encourage the team's performance (De Rosa, Hantula, Kock and D'Arcy, 2004). These responsibilities require monitoring performance, providing timely feedback, managing conflicts, and addressing other problems as they arise. Dispersion and technology will constrain how these activities will be performed (De Rosa et al. 2004).

Research in traditional settings suggests that the effectiveness of leaders in motivating employees is contingent upon followers' trust in leaders (Dirks and Ferrin, 2002). Yet, there is a notable deficit of empirical work on the antecedents of trust in virtual leaders (Zhang and Fjermestad, 2006). We therefore focus the present investigation on trust in leaders of virtual teams.

Trust is defined as "...a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another." (Rousseau, Sitkin, Burt and Camerer, 1998, p. 395). Theory and research on trust in leaders suggest that there are three broad categories of determinants of trust: individual attributes, context, and experience (Korsgaard et al., 2008). Given that the defining features of virtual teams are dispersion – a contextual factor – and communication technology – an experiential factor – we focus our discussion of the antecedents of trust on context and experience factors.

Contextual factors are shared features of the task or social environment that provide cues regarding risk, vulnerability and trustworthiness (McKnight, Cummings and Chervany, 1998; Zaheer, McEvily and Perrone, 1998; Kramer, 1999). Team members are apt to trust the leader when there is a shared understanding of the formal rules, norms and expectations for interacting or when they share a common identity or group membership. Cultural values, which we examine in this study, are also an important source of shared norms, expectations and rules (Lee, Pillutla, and Law, 2000) and as a consequence influence trust, a point which we will return to below.

Trust is also affected by direct experience with leaders; that is, the quality of interactions and exchanges between leaders and followers (Lewicki, Tomlinson and Gillespie, 2006). Similarly, leaders who engage in certain behaviors that indicate trustworthiness are more trusted (Colquitt, Scott and LePine, 2007). Included among such behavior is open, two-way communication (Whitener, Brodt, Korsgaard and Werner, 1998).

However, virtual forms of communication may constrain leaders' ability to engage in open, two-way communication. The technology itself may be a hindrance: asynchronous forms of communication that are common to virtual settings may limit leaders' ability to provide two-way communication in a timely and accurate manner. Further, the dynamics of virtual communication may be an impediment. Thus, both the mode and content of communication are critical to instilling trust and motivating collective action (Jarvenpaa and Leidner, 1999; Assmann, Korsgaard and Welp, 2008). Therefore, we will focus on these two facets of communication as antecedents to trust in leaders.<sup>1</sup>

### **Hypotheses Development**

#### *Communication Media and Content in Virtual Teams*

Individual team members have some discretion over the mode and content of communication with leaders. Research indicates that, although shared context may drive common patterns of communication within the team, factors unique to the individual and situation, such as message characteristics or urgency, can influence the ways individuals communicate (Watson-Manheim and Belanger, 2007). Thus, it is important to examine communication at the individual level.

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<sup>1</sup> Due to the limited space of this submission, the literature review is condensed. A more detailed paper can be obtained from the authors upon request.

One important dimension in which communication technology varies is the extent to which the technology is synchronous (Kirkman and Mathieu, 2005). Synchronous forms of communication allow for simultaneous exchange of information to occur in real time (Goel, Sharda and Taniar, 2003; Pinelle, Dyck and Gutwin, 2003). The dynamic and interactive nature of synchronous communication enables individuals to clarify and adapt their messages. Additionally, trust is, in part, an inference that arises from exchanges between parties (Dirks and Ferrin, 2002). Synchronous communication technology can affect both the quality of these exchanges and the subsequent inferences that arise from these exchanges. Research suggests that less rich and interactive media lead to less principled and cooperative behavior (Rockman and Northcraft, 2008). Thus, it follows:

Hypothesis 1: The use of synchronous communication by virtual team members is positively related to trust in team leaders.

The limited range of communication is one potential reason why virtual teams tend to be characterized by lower trust in comparison to face-to-face teams (Alge, Wiethoff and Klein, 2003). Thus, trust in virtual settings is likely to be enhanced when members communicate with leaders across a broad range of topics. Specifically, such broader exchanges should reveal more about leaders' decision making processes and reinforce perceptions of integrity and fairness. Therefore, we hypothesize the following:

Hypothesis 2: The breadth of communication between virtual team members and leaders is positively related to the trust in team leaders.

#### *Dispersion*

The second defining feature of virtual teams is dispersion. Virtual teams can be dispersed across a number of characteristics, including time, geography and relational differences (Kirkman and Mathieu, 2005). Given that important differences in dispersion may exist within teams, we examine dispersion as an individual-level variable in terms of the team member's average distance from other team members. Various forms of dispersion are negatively related to speed of problem solving, coordination, and social integration into the team (O'Leary and Cummings, 2007). It follows that individuals who are more distant from the team are apt to experience a sense of isolation (Kirkman, Rosen, Tesluk, Gibson and McPherson, 2002) and, as a consequence, feel less trusting of other members and the teams' leadership. We therefore hypothesize:

Hypothesis 3: Team member distance from the team is negatively related to trust in the leader.

Dispersion limits the modes of communication teams can employ in that it is costly and logistically challenging to assemble virtual teams with substantial physical dispersion in a face-to-face setting (Kirkman and Mathieu, 2005). Moreover, individuals are less likely to have spontaneous interactions with team members that are physically distant (O'Leary and Cummings, 2007). Thus, it is likely that communication is more constrained and less frequent between leaders and more distant members. We maintain that these problems will be offset by the content of communication. Therefore, we hypothesize the following:

Hypothesis 4: The relationship between team member distance and trust in leaders of virtual teams is moderated by breadth of communication from the team such that the relationship will be weaker for members who communicate more broadly with leaders.

Individuals are embedded in virtual teams and the experiences of the team create a shared context which in turn also shapes trust in virtual team leaders. Such factors can both directly affect trust in virtual leaders and influence the impact of individual-level factors. In the following section we discuss two team-level attributes of particular relevance to virtual teams that are hypothesized to influence trust in leaders.

#### *Shared Context of Virtual Teams: Culture and Team Size*

Theory and research suggest that cultural values influence how teams respond to virtual communication (Bell and Kozlowski, 2002), and research also suggests that cultural values can influence the development of trust (Den Hartog, 2005; Wasti, Tan, Brower and Onder, 2007). Further, reliance on information and communication technology in virtual teams enables such teams to draw on the resources from larger numbers of team members than would be feasible in a face-to-face mode (Kirkman and Mathieu, 2005). In this section, we focus on these two important aspects of the shared context of teams, cultural values and the size of the team, and their implications for trust in the leader.

**Collectivism:** There has been considerable speculation regarding how and why trust may differ across cultures (Den Hartog, 2005; Wasti et al., 2007). Of the various cultural values identified, the one that has arguably received the most attention is individualism-collectivism. Given the emphasis on social relatedness and interdependence, collectivists are sensitive to ingroup-outgroup boundaries (Triandis, 1989). Compared to individualists, collectivists tend to respond more strongly to ingroup cues and favor ingroup members more so than do individualists (Gomez, Shapiro and Kirkman, 2000). Given that

members of collectivist cultures are more attuned to in-group cues, they are more likely to readily place trust in individuals who are part of their in-group, including the team leader (Yamagishi and Yamagishi, 1994; Huff and Kelley, 2003). We therefore hypothesize the following:

Hypothesis 5: Collectivism will be positively related to trust in leaders.

In addition to directly relating to trust in leaders, we propose that collectivism, as an attribute of the team, will shape the way team members react to patterns of communication. Individualists rely more on cues about the disposition of the leader to act in a manner that protects the team member's interest. Team members from individualistic cultures are therefore more likely to base trust on direct experiences with the other party. Thus, in virtual settings where direct contact is limited, teams in more individualistic cultures may be slower to develop trust in the team's leadership than are collectivists. Yet, persons from an individualistic culture should be more sensitive to breadth of communication from leaders. It follows,

Hypothesis 6: The relationship between breadth of communication and trust in the leadership of virtual teams is moderated by individualism-collectivism such that the relationship will be stronger in individualistic teams than in collectivistic teams.

Team Size: The benefits of synchronous communication are limited by the size of the group. For example, increased team size can make it difficult for participants to interact effectively using audio-conferencing (Riopelle, Gluesing, Alcordo, Baba, Britt, McKether, Monplaisir, Ratner, and Wagner, 2003). Similarly, while smaller groups adjust well to richer communication media, larger groups feel overburdened by rich media (Löber, Schwabe and Grimm, 2007). In short, coordination problems with synchronous communication in virtual teams arise as the number of group members increases (Wadley, Gibbs and Benda, 2007). We therefore hypothesize:

Hypothesis 7: The positive relationship between the use of synchronous communication and trust in team leadership is moderated by team size such that the relationship is weaker in larger teams.

#### *Trust in Leaders and Team Performance*

As noted previously, empirical research on leadership of virtual teams in general and trust in leadership in particular are lacking. As a result, we have only a very limited understanding of the causal relationships between trust-inducing conditions, trust in leadership and team performance in virtual contexts. There is, however, previous conceptual and empirical research on the consequences of trust in conventional organizational settings, which strongly suggests that trust in leaders influences virtual team behavior and performance (Colquitt et al., 2007; Korsgaard et al., 2008). We therefore hypothesize:

Hypothesis 8: Trust in virtual team leaders is positively related to team performance.

The multilevel approach of this study, individual-level as well as group-level variables, is summarized in figure 1. Data on trust in leadership, communication breadth, communication synchronicity, and distance was analysed on the individual level while team size, performance and collectivism were analysed the group level.

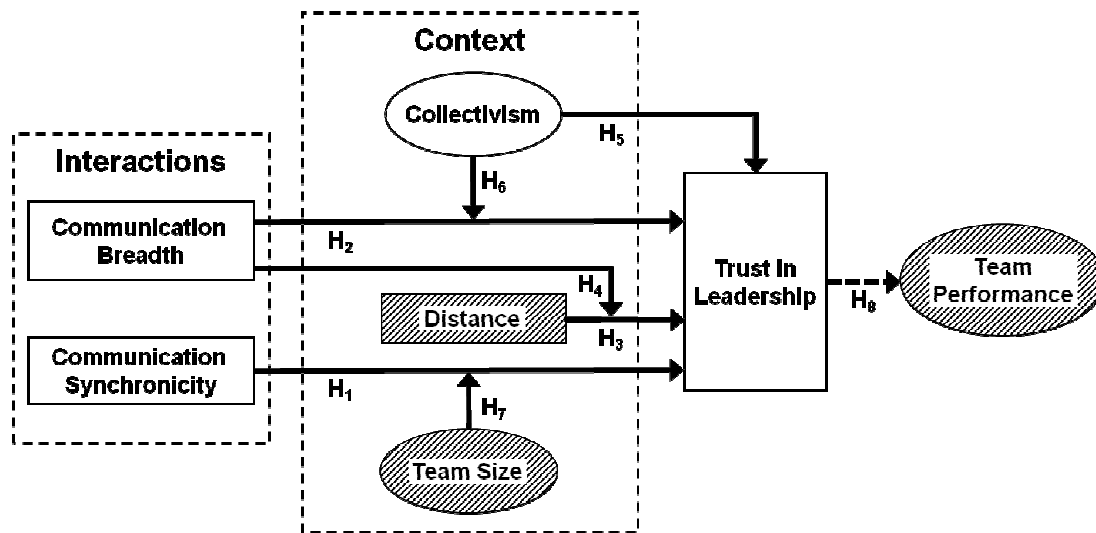


Figure 1. Summary of Hypothesized Relationships<sup>2</sup>

## METHOD

### The Online Game Context

Researching the dynamics of virtual teams creates considerable difficulties. Whereas field studies of virtual teams are typically small in scale and often lack quantitative or objective data (e.g., Kankanhalli, Tan and Wei, 2007), laboratory studies, though allowing for large scale, rigorous quantitative data collecting, involve relatively short-lived simulations with rather small groups in which the participants have little psychological investment (e.g., Hambley, O'Neill and Kline, 2007). In this study, we employed an alternative setting of an online game in which people interact in a realistic manner over an extended period of time in a virtual world. As recently described in an article in *Science* (Bainbridge, 2007), scholars in the social sciences are beginning to discover the potential of such virtual worlds as research context. Although laboratory simulations allow for similar sorts of data collection, this context has advantages over such an approach because online games tend to be highly engaging and psychologically meaningful to participants. Often the relationship between players is compared to the relationship between co-workers in their real job and the activities in such games are increasingly similar to the work performed in business corporations (Williams, Ducheneaut, Xiong, Zhangm, Yee and Nickell, 2006; Yee, 2006). Recent studies indicate that MMOGs could function as online labs for leadership studies providing a glimpse of what team leadership might look like in the future (Reeves, Malone and O'Driscoll, 2008).

The data for this study were derived from a popular browser-based MMOG called *Travian*. The game itself is a real-time strategy game (RTS). Playing with up to 20000 users on one server with scarce resources, actors soon find themselves in a social dilemma (Dawes, 1980), which is typical for organizations, project teams and economies where parties need to both coordinate and compete with one another. In the race to dominate, actors form teams or "alliances" of up to 60 members under a leader or a leadership team (henceforth called the leadership). Teams are equipped with a shared forum, a chat room and an in-game messaging system. Like in virtual teams at work, teamwork and negotiation skills play a crucial role in this context. Given these characteristics of *Travian*, the virtual teams in *Travian* afford an excellent opportunity to study virtual teams at work.

### Sampling and Procedure

Data were obtained from two sources: archival data from the log-files taken directly from the online game servers and an on-line questionnaire administered to subscribed players in virtual teams.

Several sampling criteria were employed leading to a sample of 13,941 participants. The average age of the players was 29 years, ranging from 18 years to 75 years; 18% of the sample was female. The average team size was 41 players ranging from

<sup>2</sup> Variables represented within shaded shapes were derived from the log-files and those without shading from the survey. Variables represented within ovals were measured at the team level and those within rectangles at the individual level. The dotted arrow represents a team-level relationship whose left side was measured by aggregating individual responses.

4 to 60 players. The average percentage of respondents per team was 18%; the number of respondents per team ranged from 3 to 30.

These players came from 1883 different teams and 23 countries, namely Argentina, Austria, Bulgaria, Chile, China, Germany, Greece, Hong Kong, Hungary, Italy, Mexico, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK, and USA.

### Measures

**Dependent variables:** Ratings on trust in leadership was obtained from the team members' survey. It was measured on the individual level by the average of three items (Cronbach's  $\alpha = .91$ ) derived from a measure by Brockner, Siegel, Daly, Tyler and Martin (1997) and adapted to the online game context. Team performance was measured by the in-game scoring system. The in-game scoring system is a transparent and accepted performance measure within the game.

**Independent variables:** Data on culture, communication breadth and communication synchronicity were obtained from the team members' survey. We adopted the approach employed in the GLOBE project wherein culture is assessed at the local (i.e., organizational) level. Individualism-collectivism was assessed using the five-item in-group collectivism scale (Cronbach's  $\alpha = .81$ ) developed in the GLOBE project (House, Hanges, Javidan, Dorfman and Gupta, 2004). Communication breadth was measured on the individual level by using three items (Cronbach's  $\alpha = .70$ ) derived from Parks and Floyd (1996) and adapted to the online game context. Synchronous communication was measured on the individual level by one ten-point Likert-type item (1 = never to 10 = always) assessing how frequently the participant used the in-game chat program to communicate with the alliance leadership. The data on team size and distance were obtained from the log-files of the server. Team size was measured by the number of members belonging to an alliance. Distance was measured at the individual level by calculating the Euclidean distance of each player to the geographic centre of his or her team.

**Control variables:** On the individual level we controlled for age, gender, team members' propensity to trust, and tenure in the team, which were all obtained from the team member survey. We measured propensity to trust on the individual level using an eight-item scale by Mayer and Davis (1999). Cronbach's  $\alpha$  was .60. On a team level, we controlled for team performance (T1), which was measured by the in-game scoring system at the time of the survey.

Table 1 presents descriptive statistics and bivariate correlations for all variables.

	Variable	N	Mean	STD	1	2	3	4				
Level 2	1. Team Size	1883	40.50	14.24	1							
	2. Performance (T1)	1883	146598	173978	0.52*	1						
	3. Performance (T2)	1883	154886	186761	0.51*	0.97*	1					
	4. Collectivism	1883	5.16	0.58	0.11*	0.07*	0.08*					
	Variable	N	Mean	STD	1	2	3	4	5	6	7	
Level 1	1. Member Tenure	13941	3.96	2.65	1							
	2. Age	13941	28.73	8.38	0.04*	1						
	3. Propensity to Trust	13941	2.81	0.50	0.05*	-0.06*	1					
	4. Gender	13941	1.18	0.38	-0.04*	0.02*	-0.08*	1				
	5. Distance	13941	30093	24759	-0.11*	-0.01	0.01	0.02*	1			
	6. Synchronicity	13941	4.26	3.39	0.16*	-0.06*	0.12*	-0.01	-0.06*	1		
	7. Breadth	13941	4.11	1.31	0.12*	-0.04*	0.14*	0.02*	-0.04*	0.31*	1	
	8. Trust in Leadership	13941	3.83	0.80	0.13*	0.05*	0.06*	0.05*	-0.07*	0.17*	0.34*	1

\*  $p < 0.05$

**Table 1. Means, Standard Deviations and Correlations for Study Variables**

### RESULTS

Players play in teams, and teams can be groups within countries. Thus, the players' perception may be affected by grouping effects at both the team and the country level, and therefore not be independent of each other. Moreover, the hypotheses involve predictors measured at two levels of analysis, the team (i.e., the group size) and the individual level (i.e., team member's communication breadth and medium). These nested data structures call for hierarchical linear models (HLM) rather than ordinary least square (OLS) analysis (Hox, 1995; Raudenbush and Bryk, 2002). All predictors were standardized prior to hypotheses testing (Hofmann and Gavin, 1998).



	Trust in Leadership		
	Model 1	Model 2	Model 3
Level 3 Intercept	3.78 (0.03)***	3.79 (0.03)***	3.80 (0.03)***
Level 2 Team Size	0.04 (0.01)***	0.02 (0.01)**	0.02 (0.01)**
Performance (T1)	0.04 (0.01)***	0.01 (0.01)	0.01 (0.01)
Collectivism		0.19 (0.01)***	0.19 (0.01)***
Level 1 Member Tenure	0.07 (0.01)***	0.06 (0.01)***	0.06 (0.01)***
Age	0.03 (0.01)***	0.03 (0.01)***	0.03 (0.01)***
Propensity to Trust	0.05 (0.01)***	0.03 (0.01)***	0.03 (0.01)***
Gender	0.04 (0.01)***	0.03 (0.01)***	0.03 (0.01)***
Synchronicity		0.06 (0.01)***	0.07 (0.01)***
Breadth		0.22 (0.01)***	0.23 (0.01)***
Distance		-0.02 (0.01)**	-0.02 (0.01)**
Distance x Breadth			0.02 (0.01)**
Breadth x Collectivism			-0.02 (0.01)*
Synch. x Team Size			-0.03 (0.01)***

Note. Unstandardized parameter estimates are reported in the body of the table, with standard errors reported in parentheses;

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

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**Table 2. HLM Results for Trust in Leadership**

Table 2 shows the results of HLM analyses for the predictors of trust in leadership. Hypothesis 1 predicted that the use of synchronous communication is positively related to trust in team leadership. As indicated in the column marked Model 3, this hypothesis was supported ( $\gamma = 0.06$ ,  $t = 8.99$ ,  $p < 0.001$ ). Hypotheses 2 stated that the relationship between breadth of communication and trust in team leadership is positive. This hypothesis was supported ( $\gamma = 0.23$ ,  $t = 30.71$ ,  $p < 0.001$ ). Hypothesis 3, regarding the negative relationship between team member distance from the team and trust in leadership, was also supported ( $\gamma = -0.02$ ,  $t = -3.14$ ,  $p < 0.01$ ). Hypothesis 4 stated that the negative relationship between team member distance from the team and trust in leaders of virtual teams is moderated by breadth of communication. The interaction testing of this hypothesis was significant ( $\gamma = 0.02$ ,  $t = 2.60$ ,  $p < 0.01$ ). To interpret this result, we estimated the simple slopes for the relationship between team member distance from the team and trust in team leadership for teams 1 s.d. above and below the mean communication breadth. In support of the hypothesis, the slopes plotted in Figure 2 support the hypothesized relationship: when breadth of communication was relatively high, there was no relationship between distance and trust in leadership, while there was a slight negative relationship between distance and trust when breadth of communication was low. Hypothesis 5 stated that collectivism is positively related to trust in the leadership of virtual teams and was fully supported ( $\gamma = 0.19$ ,  $t = 21.04$ ,  $p < 0.001$ ). Hypothesis 6 stated that the positive relationship of breadth of communication and trust in the leadership is moderated by collectivism. The interaction testing of this hypothesis was significant ( $\gamma = -0.02$ ,  $t = -2.24$ ,  $p < 0.05$ ). The simple slopes for this effect, illustrated in Figure 3, support the hypothesized relationship: breadth of communication had a slightly stronger relationship with trust for teams with an individualist culture as compared to those from a collectivistic culture. Hypothesis 7, regarding the moderation of the positive relationship between the use of synchronous communication and trust in leadership by team size was fully supported by a significant cross-level interaction effect for synchronous communication and team size ( $\gamma = -0.03$ ,  $t = -3.67$ ,  $p < 0.001$ ). In support of the hypothesis, the slopes plotted in Figure 4 suggest that the positive relationship between communication and trust is diminished for larger teams.

<sup>3</sup> An analysis of the influence of level 1 variables on trust before integration of level 2 variables was conducted, but did not reveal different results. Significance levels did not differ from those in table 2.

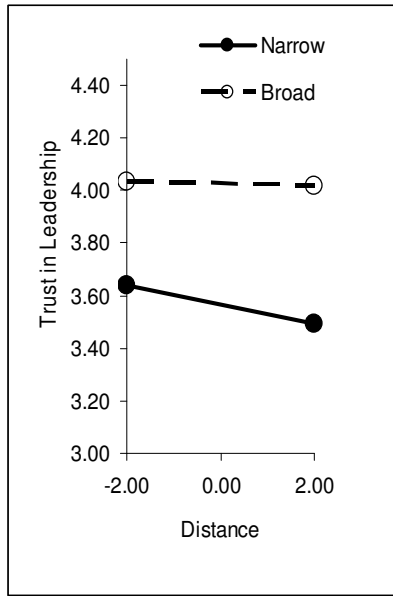


Figure 2. Simple slopes for the Interaction of Breadth and Distance.

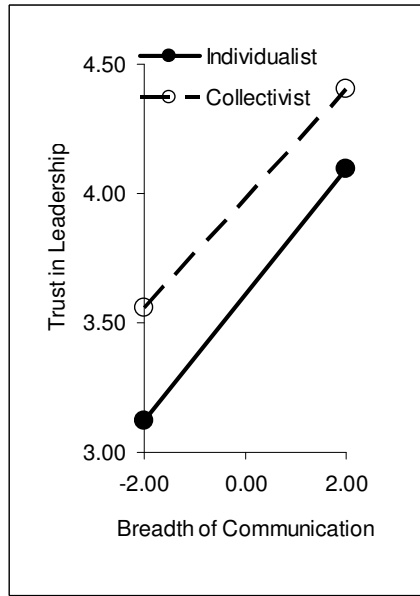


Figure 3. Simple Slopes for the Interaction of Breadth and Collectivism.

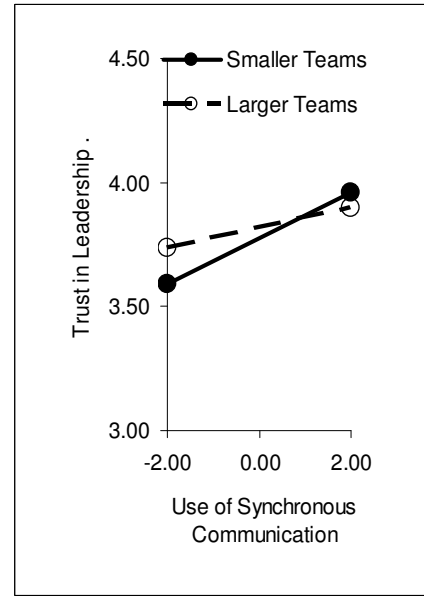


Figure 4. Simple Slopes for the Interaction of Size and Synchronicity.

Hypothesis 8 predicted that trust in leadership is positively related to team performance. The results of the analyses for this hypothesis are reported in Table 3. To rule out confounds associated with the predictors of trust, we controlled for the preceding relationships (a similar effect of trust is obtained if these controls are not included). As indicated in the columns marked Model 4, this hypothesis was supported ( $\gamma = 0.02$ ,  $t = 2.57$ ,  $p < 0.01$ ).

	Team Performance (T2)			
	Model 1	Model 2	Model 3	Model 4
Level 2 Intercept	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Level 1 Team Size	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Performance (T1)	0.97 (0.01)***	0.96 (0.01)***	0.96 (0.01)***	0.97 (0.01)***
Member Tenure	0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Age	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Propensity to Trust	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Gender	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)
Collectivism		0.01 (0.01)	0.01 (0.01)	0.00 (0.01)
Synchronicity		0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Breadth		0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Distance		0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Distance x Breadth			0.00 (0.01)	0.00 (0.01)
Breadth x Collectivism			0.01 (0.01)**	0.01 (0.01)**
Synch. x Team Size			-0.01 (0.01)*	-0.01 (0.01)*
Trust in Leadership				0.02 (0.01)**

Note. Unstandardized parameter estimates are reported in the body of the table, with standard errors reported in parentheses; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

Table 3. HLM Results for Team Performance (T2)

## DISCUSSION

This investigation sought to address two significant gaps in the research on virtual teams and trust. First, although theory and empirical evidence indicates the importance of trust in virtual settings, there is a noted absence of research on trust in leaders of virtual teams. Second, research on trust in both virtual and traditional teams has progressed largely within individual or

team levels, overlooking the potential cross-level effects of unique individual-level experiences and shared context of the team. To address these gaps, we adopted a multi-level view of the antecedents of trust in the leaders of virtual teams.

Specifically, we examined the joint effects of unique contextual factors of dispersion and communication and shared team attributes of culture and team size. We examined these relationships utilizing a unique combination of survey and longitudinal, unobtrusive data in the context of a MMOG. In general, the findings indicate that the exchanges and experience of virtual team members and the team context have significant consequences for the level of trust in the virtual team leadership, and that trust in leaders has consequences for team performance.

A few limitations are worth noting. First, we employed a correlational design, which limits our ability to draw causal inferences. However, this limitation was offset by the use of multiple sources of data and the temporal separation of survey data and performance data, which mitigate against self-report bias and reverse causality. In contrast to teams in actual work settings, this study was conducted in the context of a game, which may pose a limitation to the generalizability of the findings. However, like many MMOGs, this particular game is highly engaging and requires many of the team-related skills and behaviors needed in virtual teams at work. Moreover there are few technical and expertise barriers to playing the game, so the population is likely to be similar to the general population of computer literate adults who would be engaged in virtual teams at work.

Additionally future research may build upon the results of this study in a number of ways. For example, we examined teams that were homogeneous on culture, which provides important insight into transferring virtual team practices across cultures. Moreover, we focused on one aspect of communication mode: synchronicity. Given that virtual teams and leaders often employ multiple modes of communication (Martins et al., 2004) future studies would benefit from examining patterns of modalities as well.

This investigation highlights the importance of the unique experience of individuals and suggests that leaders and team members themselves may proactively shape the trust team members place in leaders. Our findings suggest that to the extent that a range of choices are available, both the leader and team members can initiate exchanges that may enhance trust.

A shortcoming in research on teams and organizations in general is the tendency to adopt a single-level view of the phenomenon (Collquit et al., 2007). Our approach answers the call to incorporate multiple levels into research on teams and groups (Hitt, Beamish, Jackson and Mathieu, 2007).

This study has implications for practice as well. Managers and organizations need to recognize the strategic importance of managing trust in teams that are technology-enabled. Ensuring that the team members have certain communication media available (e.g., those that allow for synchronous communication) and encouraging a certain breadth of communication will increase virtual team collaboration.

In conclusion, the results of this study provide new insights into the antecedents of trust in leaders of virtual teams and the importance of trust in leaders for virtual team performance. The findings hold promise for understanding the role of leadership in virtual teams and for discovering new routes to making virtual teams more effective.

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