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Bringing Employees Closer: The Effect of Proximity on Communication When Teams Function under Time Pressure

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Some studies have assumed close proximity to improve team communication on the premise that reduced physical distance increases the chance of contact and information exchange. However, research showed that the relationship between team proximity and team communication is not always straightforward and may depend on some contextual conditions. Hence, this study was designed with the purpose of examining how a contextual condition like time pressure may influence the relationship between team proximity and team communication. In this study, time pressure was conceptualized as a two-dimensional construct: challenge time pressure and hindrance time pressure, such that each has different moderating effects on the proximity–communication relationship.

The research was conducted with 81 new product development (NPD) teams (437 respondents) in Western Europe (Belgium, England, France, Germany, and the Netherlands). These teams functioned in short-cycled industries and developed innovative products for the consumer, electronic, semiconductor, and medical sectors. The unit of analysis was a team, which could be from a single-team or a multiteam project. Results showed that challenge time pressure moderates the relationship between team proximity and team communication such that this relationship improves for teams that experience high rather than low challenge time pressure. Hindrance time pressure moderates the relationship between team proximity and team communication such that this relationship improves for teams that experience low rather than high hindrance time pressure.

Our findings contribute to theory in two ways. First, this study showed that challenge and hindrance time pressure differently influences the benefits of team proximity toward team communication in a particular work context. We found that teams under high hindrance time pressure do not benefit from close proximity, given the natural tendency for premature cognitive closure and the use of avoidance coping tactics when problems surface. Thus, simply reducing physical distances is unlikely to promote communication if motivational or human factors are neglected. Second, this study demonstrates the strength of the challenge–hindrance stressor framework in advancing theory and explaining inconsistencies. Past studies determined time pressure by considering only its levels without distinguishing the type of time pressure. We suggest that this study might not have been able to uncover the moderating effects of time pressure if we had conceptualized time pressure in the conventional way.

Introduction

Communication is a critical process for innovation teams to achieve their goals successfully (Ancona and Caldwell, 1992; Keller, 2001). Functional experts working in a team require a meeting of minds for information to be effectively exchanged and used for goal achievement. Among the strategies that have thus been deployed to facilitate team communication, colocation is frequently pursued in research and practice (e.g., Allen, 1977; Hoegl and Proserpio, 2004; Keller and Holland, 1983; Te'eni, 2001; Van den Bulte and Moenaert, 1998). Although much work has shown team proximity, which in this study refers to the degree of closeness in terms of physical distance, to enhance team communication and team performance, the outcomes of the studies were at times inconsistent. Importantly, several researchers have found a weak or no relationship between team proximity and team outcomes (Conrath, 1973; Kahn and McDonough, 1997; Keller, 1986; Kessler, 2000; Sethi, 2000; Sethi and Nicholson, 2001). This suggests that the association could be more complex than initially theorized. Because team proximity has been identified as a strategy to improve communication (e.g., Te'eni, 2001), further empirical research is needed to explain those inconsistencies. Furthermore, the increased use of geographically distributed multisite project teams (Victor and Stephens, 1994) also heightens the need for effective colocated teams and hence this line of research, given that success of any multisite project is contingent on the effectiveness of its local-site teams.

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In this study, we suggest the relationship between team proximity and team communication to depend on contextual conditions. Scholars have highlighted some contextual factors, such as project centralization (Kahn and McDonough, 1997), team fault lines (Lau and Murnighan, 2006), and strength of ties (Ganesan, Malter, and Rindfleisch, 2005) to influence the relationship. So far, no work has yet contemplated the role of stress; in particular, stressed caused by time pressure despite its connection with psychological distance (e.g., Chajut and Algom, 2003; Kruglanski and Webster, 1996). In this study, psychological distance refers to cognitive and affective abilities as well as the readiness of actors to exchange information. Although earlier studies on team proximity have generally emphasized its dependence on physical distance between members, we suggest that team proximity is also a function of psychological distance. This is because team members, despite sitting next to one another, are unlikely to share information if they are psychologically distanced, which occurs when people are under intense time pressure (e.g., Hoopes and Postrel, 1999). Furthermore, examining the role of time pressure on the proximity–communication relationship is also timely because escalating market competition over the last decade has made work an increasingly stressful experience (Barczak and Wilemon, 2003). Therefore, considering time pressure potentially sheds further light on the proximity–communication relationship.

BIOGRAPHICAL SKETCHES

Dr. Darrel S. F. Chong holds a position of regional marketing manager (Asia Middle East) of APL Logistics, a wholly owned subsidiary of NOL Group based in Singapore, which specializes in shipping, terminal, and supply chain businesses. He received his joint Ph.D. from the National University of Singapore and Eindhoven University of Technology in 2010, and a bachelor's degree (Hons) in Electrical and Computing Engineering from National University of Singapore in 2003. His research was published in *IEEE Transactions on Engineering Management* and presented at Academy of Management Conference. Darrel was also a recipient of the Keppel Telecommunication and Transportation Scholarship (2000–2003).

Dr. Wendelien van Eerde is an assistant professor of organizational behavior at the University of Amsterdam Business School. She received her Ph.D. in organizational psychology at the University of Amsterdam in 1998. Subsequently, she worked as an assistant professor at the Eindhoven University of Technology until 2007. Her main research interests are work motivation and the use of time at work. More specifically, she studies how people manage multiple goals over time, procrastinate, and deal with time pressure. Her publications appear in several scholarly journals, such as *Journal of Applied Psychology, Journal of Organizational Behaviour*, *IEEE Transactions on Engineering Management*, and *Applied Psychology: An International Review*.

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This study contributes to research in two major ways. First, this study extends the team proximity literature by examining how time pressure moderates the effect of team proximity on team communication. By adopting the challenge–hindrance stressor framework (cf. Podsakoff, LePine, and LePine, 2007) into the existing literature on NPD teams, we theorized and found empirical support that challenge time pressure, and hindrance time pressure improves and deteriorates, respectively, the relationship between team proximity and team communication. The second contribution stems from the conceptualization of the two-dimensional time pressure constructs. This development adds to research by considering the nature of stress, which researchers have argued to advance understanding on the influence of stress on team outcomes (Lazarus and Folkman, 1984; LePine, LePine, and Jackson, 2004; Selye, 1982). In the context of new product development (*NPD*), the distinction between challenge and hindrance time pressure can help to shed light on shortening product development cycle and its effects on team performance (Hoopes and Postrel, 1999; Perlow, Okhuysen, and Repenning, 2002), as we have seen in this study.

Background and Hypotheses

Scholars have posited colocation to improve team communication. In this paper, we focus on three factors through which team proximity was proposed to affect team communication (Hinds and Kiesler, 2002). First is team awareness. Olson, Teasley, Covi, and Olson (2002) highlighted that team members located in close physical proximity tend to have more understanding of one another's strengths, working styles, and moods than of people that are located farther away. Similarly, Covi, Olson, and Rocco (1998) found in an interview study that being aware of one another's job scope helps team members to know when, what, and how to communicate with one another.

The second factor is the reduced amount of effort needed to initiate a conversation. According to Kraut, Fussell, Brennan, and Siegel (2002), the effort to initiate a conversation is lower when team members are in closer physical proximity. This is due to a higher likelihood of chance encounters (Allen, 1977; Porter, 1998) and ease of coordinating planned meetings. The reduced effort also implies that team members can become more efficient in sharing information and in correcting misattribution (e.g., Cramton, 2001).

Third is team identity, which refers to a common perspective of cohesiveness and mutual acceptance among team members (Earley and Mosakowski, 2000). Team identity is developed when team members meet face to face frequently (Sherif and Sherif, 1969) and work together over a period of time (Katz, 1982). Several studies have shown team identity to facilitate team communication (e.g., Hinds and Mortensen, 2005).

Although colocation facilitates information exchange, its influence on communication may not be straightforward. This is because the relationship, as highlighted in the beginning of this paper, also depends on psychological distance between members of a team (Hinds and Kiesler, 2002). Christensen and Shenk (1991) found people who are psychologically distanced to communicate less. And if they do communicate, they are less constructive. Hoopes and Postrel (1999) also observed team members to overlook sharing of critical information because they might be psychologically distanced by difficult deadlines. Therefore, we suggest that time pressure, which is a prominent experience in the NPD environment, is closely related to psychological distance between team members (Kruglanski and Webster, 1996), and can cause people to alter their frequency and pattern of communication even when they are in close proximity.

Before proceeding further on how time pressure may affect the relationship between team proximity and team communication, this paragraph explains the rationale behind conceptualizing challenge time pressure and hindrance time pressure. Studies on time pressure have adopted Yerkes and Dodson's (1908) response-based approach, which focuses on the levels of time pressure to explain its effects on performance (e.g., Amabile et al., 2002; Baer and Oldham, 2006). However, the approach may not sufficiently explain the association between time pressure and performance, given that the stress–performance relationship is also contingent on the nature of stress experienced (cf. Selye, 1982). Lazarus and Folkman (1984) advocated that actors' problem-solving tactics vary with the nature of stressors experienced. For instance, people who appraise stressful events as potentially benefiting tend to take proactive actions to overcome the difficulties imposed by the stressful situations. Conversely, people who appraise stressful events as potentially threatening tend to withdraw from or be passive in stressful situations. Therefore, challenge stress contributes to good performance while hindrance stress leads to bad performance. Recently, research using the challenge–hindrance stressor framework has provided strong evidence for Lazarus and Folkman's proposition (e.g., Cavanaugh, Boswell, Roehling, and Boudreau, 2000; LePine et al., 2004; Podsakoff et al., 2007). Therefore, this study used LePine and colleagues' framework to conceptualize time pressure as challenge or hindrance time pressure. This enables us to better differentiate and to gain stronger insights into the influence of time pressure on the relationship between team proximity and team communication.

Hypotheses

As revealed by some studies, team proximity improves communication because of three underlying factors. People in close proximity tend to experience team awareness, require less effort to initiate conversation, and experience a strong sense of team identification. These factors explain the direct relationship between proximity and communication. However, we also expect the relationship to depend on the time pressure experienced by teams because beyond physical distance, challenge time pressure, and hindrance time pressure appear to affect the three underlying factors by altering team members' cognitive and affective readiness and ability to exchange information. We term this mechanism psychological distance.

Challenge time pressure is associated with fulfillment and a strong proclivity to succeed. These experiences serve as a motivating force in teams (Selye, 1982). Under such circumstances, a person with constrained attentional resources can still engage vigorously in cognitive activities if he or she is stimulated to persist in the course of action (De Dreu and Carnevale, 2003). Pieters and Warlop (1999) conducted a field study to explore the effects of motivation on how people gather purchasing information under time pressure. The authors found the motivated groups to exert more effort in acquiring information than other groups. This indicates that challenge time pressure can facilitate information exchange. Thus, teams that experience challenge time pressure are likely to experience lower psychological distance between one another.

Because challenge time pressure is associated with lower psychological distance, teams that experience high challenge time pressure are cognitively and affectively more ready than low challenge time-pressured teams to take advantage of close physical proximity to exchange information (Hinds and Kiesler, 2002). This is because lower psychological distance encourages people to find opportunities to tap into proximate resources and network to meet deadlines. Hence, we expect challenge time-pressured teams to experience the following. First, such teams will capitalize on their awareness (knowledge) of the teams' capabilities and resources to exchange useful information to fulfill the teams' objectives (Ashford and Cummings, 1985). Second, such teams will be more spontaneous and take seemingly even less effort to engage in constructive conversation because of the lowered psychological distance (Kruglanski and Webster, 1996). Finally, such teams will experience a deeper sense of team identity given the lowered psychological barriers to unite to overcome the challenging tasks ahead (Gittell, 2003). These experiences demonstrate that high challenge time pressure has positive effects on the three underlying factors that govern the relationship between team proximity and team communication, which explains why challenge time pressure teams communicate better than other teams that are located within the same physical proximity but are not challenge by time pressure. Therefore, we propose the following hypothesis:

H1: Challenge time pressure moderates the relationship between team proximity and team communication such that this relationship improves for teams that experience high rather than low challenge time pressure.

In contrast to challenge time pressure, hindrance time pressure is associated with hassles and constraints to goal achievement. Cognitive closure theory suggests time pressure to threaten information exchange if the stress is perceived to be hindering (Kruglanski and Webster, 1996). People in such a situation tend to engage in shallow communication and close their minds to rethink solutions to problems, or even choose not to revisit available information to minimize onerous processing of complex information. This suggests that hindrance time pressure leads people to overlook peripheral information and social cues (Kelly and Loving, 2004). Hence, teams that experience hindrance time pressure are likely to experience higher psychological distance between one another.

Because hindrance time pressure is associated with higher psychological distance, teams that experience high hindrance time pressure are cognitively and affectively less ready and able than low hindrance time pressure teams to take advantage of close physical proximity to exchange information (Hinds and Kiesler, 2002). This is because heightened psychological distance discourages people from seeking additional information, including from proximate resources and networks to meet deadlines (Driskell, Salas, and Johnston, 1999). Thus, we expect hindrance time-pressured teams to experience the following. First, such teams tend not to capitalize on their awareness (knowledge) of the teams' capabilities and resources as they are more concerned about meeting immediate deadlines than exchanging more information, which requires both effort and time (Kruglanski and Webster, 1996). Second, such teams will be more focused on their individual tasks and avoid engaging in conversations despite the physical proximity because of the higher psychological distance (Kruglanski and Webster, 1996). Finally, such teams also tend to experience a weaker sense of team identity as members avoid social cues and are more self-focused in completing their individual tasks (Kelly and Loving, 2004). Thus, high hindrance time pressure has detrimental effects on the three underlying factors that govern the relationship between team proximity and team communication, which explains why teams not affected by hindrance time pressure communicate better than other teams that are located within the same physical proximity but are affected by hindrance time pressure. Therefore, we propose the following hypothesis:

H2: Hindrance time pressure moderates the relationship between team proximity and team communication such that this relationship improves for teams that experience low rather than high hindrance time pressure.

Methods

Research Setting and Procedures

The research was conducted with 81 NPD teams in Western Europe (Belgium, England, France, Germany, and the Netherlands). These teams functioned in short-cycled industries and developed innovative products for the consumer, electronic, semiconductor, and medical sectors. The unit of analysis was a team, which could be from a single-team or a multiteam project. When the survey took place, overall 74 teams were still active: in the design (19%), testing (41%), or initial production (31%) stages. In total, 437 informants contributed data to this study, 356 of whom were team members, and 81 were project managers. The teams consisted of 4–18 core members (x = 7.2, standard deviation [*s.d.*] = 3.8); 94% were male; the average age was 38 years (s.d. = 7.9); the

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average time with the current team was 2.5 years (s.d. = 2.3). Our informants had worked in NPD-related industries on an average of 10 years (s.d. = 7.4), and most of them were highly educated, with 94% having at least a bachelor's degree or a diploma. A large proportion of our sample was natives from Northern or Western Europe (93.6%). The rest were from Eastern Europe (3.7%), Southern Europe (1.6%), and America or Asia (1.1%).

We invited teams for this survey by approaching vice presidents and project managers of organizations developing new products to take part in this study. Contacts who were interested then identified one or more suitable teams from their departments for our follow-up. About 40% of the contacts that we approached recommended teams to participate in the survey. A team was assessed for participation based on a few criteria. The team (1) has at least four members, including the project manager, to take part in the survey; (2) was functioning in short-cycled industries; (3) was developing innovative products; (4) was located in Western Europe; and (4) worked in the same site. In this study, we adopted an informant sampling approach to attract a higher team response rate through reducing the total amount of time needed from each participating team (Van de Ven and Ferry, 1980). The informant sampling approach recognizes that many members of a team are suited to provide good assessment pertaining to their work and team. Hence, we depended on "a limited selective sample of people who are knowledgeable of the global properties of interest" (Van de Ven and Ferry, 1980, p. 72) rather than on all the team members to provide us with the data needed.

The survey was sent electronically in two parts to all informants. The team and project manager's names were printed on introduction emails to ascertain that informants made reference to the correct project while engaging in the survey. Part two was sent to informants a day after they had submitted complete answers to part one. We took the two-part survey design for two reasons: (1) to keep the survey length at each attempt short to facilitate quality response and (2) to introduce a time lag between input to the moderator (challenge and hindrance time pressure) and criterion (team communication) variables because these variables were measured by the same informants. Finally, informants were assured that their input would be used only for research purposes and be kept completely confidential. The response rate for part one was 94%, and 98% of those who completed part one also completed part two.

The approach of the study has made our results less susceptible to common method variance. We shall discuss this from three perspectives. First, this study is team-level research. Research has shown variables measured using multiple informants to be less susceptible to common method bias. This is because aggregating responses provides a more complete measurement of the focal team characteristics, which increases the reliability of the response (Atuahene-Gima and Murray, 2004; Kumar, Stern, and Anderson, 1993). Second, not all our measurements are subjective measures. While the criterion variable (team communication) is a subjective measure, the predictor variable (team proximity) is an objective measure, hence one that is less susceptible to mood state, social desirability, and halo effects. This potentially reduces the chance of main effects inflation and common method variance (Podsakoff, Mackenzie, Lee, and Podsakoff, 2003). Third, the primary interest of this study is related to moderation effects. This reduces the susceptibility of our results to common method variance. Research has found that although common method bias tends to inflate main effects, it also tends to suppress interaction effects (Evans, 1985; McClelland and Judd, 1993). Since we found significance in the moderation analysis (as demonstrated in the Results section), common method bias did not appear to be an issue in this study.

Nonetheless, the data collection process was carefully designed to minimize common method bias by implementing the recommendations put forth by Podsakoff et al. (2003). We did so by separating the measurements temporally and psychologically. Respondents were asked to measure team proximity, challenge time pressure, and hindrance time pressure in the first survey, and to measure team communication in the second survey. This approach introduced a time lag and led respondents to leave short-term memory. The average time lag for receiving the two parts was 16.5 days (s.d. = 13.5). Because the response formats of team proximity and team communication were different, the two measurements were separated methodologically. Such separation reduces the respondents' ability and motivation to use previous answers to infer missing details.

Measures

Prior to data analysis, we established that the answers of the respondents within teams were more similar than those between teams by computing the average interrater agreement coefficient (r_{wg}; James, Demaree, & Wolf, 1993) and the interclass correlation coefficient (ICC(1); Kenny & Lavoie, 1985). Means of the combined ratings of informants belonging to the same team were subsequently computed and used for further analysis.

Team proximity was measured based on the method described by Keller (1986), where the author asked each participant to estimate the walking distance between his or her primary workstation to those of each of three other team members who were the most valuable source of information for the respondent's work in the project. In this study, the distances were measured in meters. We encountered some data (5.6%) where informants indicated the walking distances between them and one or more colleagues to be greater than 200 meters, for example, in the range of 500–1500 meters. This was to be expected, as innovative projects are increasingly using multisite teams to develop new products (Evaristo and Van Fenema, 1999). A team member's valuable sources of information may, therefore, be located in another site. Because data of distance greater than 200 meters occurred almost randomly within any particular team, we approximated these data to 200 meters in our analysis. We suggest that this is a reasonable choice because according to Allen (1977), a walking distance of more than 30 meters between two individuals is usually considered remote. Hence, considering distances greater than 200 meters in the analysis would bring little benefit conceptually. Moreover, given the random nature of these data, computing the actual distances (greater than 200 meters) might undesirably increase the means and variances of proximity for some teams. A factor analysis of the three distances to other team members of each respondent showed these data to load satisfactorily on one factor, explaining 61.5% of variability. Thus, the three data points were averaged (e.g., x meters) for each respondent and reversed coded (200 – x) to compute the proximity for their respective teams.

Team communication was assessed using the ten-item scale developed by Hoegl and Gemuenden (2001). The items asked informants the extent to which members of their team communicated frequently, spontaneously, directly, timely, and openly with one another. Three examples of the scale are "there was frequent communication within the team," "important information was kept away from other team members in certain situations (*reversed coded*)," and "the team members were happy with the timeliness in which they received information from other team members." One item was excluded from the scale because its item-to-total correlation (.14) was far below the acceptable level of .40 (Bennett and Robinson, 2000). The scale was measured with a range from 1 "to little extent" to 7 "to great extent" ($\alpha = .87$; $r_{wg} = .92$; ICC(1) = .12).

Challenge and *hindrance time pressure* were measured using a five-item and an eight-item scale, respectively (see the Appendix). A rigorous process consisting of three phases based on the procedures conducted by Cavanaugh et al. (2000) and LePine et al. (2004) was used to develop the scales. In the first phase, we interviewed 49 practitioners (eight teams) from Western Europe working in NPD industries to gather examples on the causes of time pressure. In total, we gathered 167 examples and classified them into nine categories. Subsequently, these were evaluated with validated time pressure scales (e.g., Amabile et al., 1996) and work stress scales (e.g., Cavanaugh et al., 2000) to generate an initial 20 items for challenge and hindrance time pressure. In the second phase, we invited another 33 NPD practitioners to categorize each item as either a stressor leading to challenge time pressure, leading to hindrance time pressure, or not clearly falling in either of the categories. The classification was conducted using an electronic survey and was based on the construct definitions presented earlier. Based on the feedback from the participants, we reduced the initial number of items to 13; five for challenge time pressure and eight for hindrance time pressure. Importantly, this phase ensured that the items were refined based on perspectives from the field. In the third phase, we recruited two independent academic judges who were unrelated to the research to classify the 13 items into either the challenge or the hindrance category. The judges were allowed to refer to the construct definitions during the task. The categorization of the judges was 88% (23 of 26 items) consistent with the prior categorization, providing evidence that the scales were satisfactory. Finally, we invited the 437 team members from this study to respond to the 13 time pressure items. The responses were required both at the individual level and at the team level on the extent to which each item leads to challenge and hindrance time pressure, respectively, with scales ranging from 1 "not at all" to 7 "a great deal." This step provided added certainty that participants were able to associate the items to challenge and hindrance time pressure. The Cronbach's alpha of the two scales ($\alpha = .86 \mid_{challenge}$, $\alpha = .88 \mid_{hindrance}$) provided good evidence that the scales are acceptable in terms of reliability. Because informants were asked to repeat their ratings of the 13 items for both scales, we were able to validate statistically if any of the challenge time pressure items belong to the hindrance time pressure scale, and vice versa.

An example of the challenge time pressure scale is "the technological complexity that the team needs to overcome to complete this project on time." ($r_{wg} = .83$; $ICC(1) = .10 \mid_{challenge}$). An example of the hindrance time pressure scale is "the lack of time buffer that is planned for this project." ($r_{wg} = .85$; $ICC(1) = .15 \mid_{hindrance}$). A confirmatory factor analysis (CFA) was

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Table 1. Means, Standard Deviations, and Correlations[a]

Variable		M	SD	1	2	3	4	5
1	Team proximity (meter)[b]	167.8	24.0					
2	Team communication	5.10	.50	.10				
3	Challenge time pressure	4.36	.59	.12	.50**			
4	Hindrance time pressure	4.15	.68	−.04	−.37**	−.17		
5	Team size	7.21	3.80	.06	.01	.10	.06	
6	Team tenure (year)[c]	1.40	.99	.02	−.15	.00	.18	.10

[a] $n = 81$ teams; [b] reverse coded and measured in meters; [c] measured in years; ** $p < .01$; * $p < .05$; † $p < .10$.
SD, standard deviation.

also conducted. We found good support for the two-factor model ($\chi^2[64] = 213.9$; comparative fit index [*CFI*] = .94; goodness-of-fit index [*GFI*] = .93; root mean square error of approximation [*RMSEA*] = .072). A one-factor model was also tested ($\chi^2[65] = 3305.0$; CFI = .32; GFI = .47; RMSEA = .33). The chi-square difference between the two-factor model and the one-factor model was significant ($\Delta\chi^2[1] = 3091.1$, $p < .001$). These results support the two-factor structure of time pressure proposed in this study. The ICC(1) of .10 for challenge time pressure indicated that the scale accounted for a reasonable proportion of the variance in individual responses. Although the ICC(1) was not as high as the "hurdle rates" of .12, aggregation is still acceptable if research questions and hypotheses of a study require a particular level of analysis (James, 1982). Following the work of Keller (2001) and Kirkman, Rosen, Tesluk, and Gibson (2004), challenge time pressure was aggregated to team mean.

In addition, we also conducted CFA with the three factors (i.e., two types of time pressure and team communication). The results yielded reasonable support for the three-factor model ($\chi^2[206] = 896.69$; CFI = .93; GFI = .84; RMSEA = .088, normed fit index [*NFI*] = .9, standardized root mean square residual [SRMR] = .067). Although the GFI is on the low side, we suggest that the model is acceptable given the validity of other statistics like CFI, SRMR, and NFI (Kelloway, 1998). In addition, factor loadings for all the items are significant and higher than .5, thus providing support to measurement validity.

Team size and *team tenure* were included as control variables because prior work had suggested them to relate to team communication (e.g., Ancona and Caldwell, 1992; Katz, 1982; Keller, 2001). Team size was measured based on the number of core members in each team. Team tenure was measured with project managers' input on the number of years their members have been working together, including in previous projects.

Results

Table 1 provides the team-level correlations and descriptive statistics for the variables. None of this study's variables had a variable inflation factor above 2.0, indicating that multicollinearity was not a significant problem. In addition, the condition indices for the model were also evaluated. All of the condition indices (<1.77) were far below the 15 mark. This further indicates that our model does not have multicollinearity problem.

The table shows that the correlation between team proximity and team communication is nonsignificant ($r = .10$, $p =$ n.s.). Table 2 presents the results of the moderated hierarchical regression analysis used to test H1 and H2. After centering our independent variables (Aiken and West, 1991), we introduced the control variables and main effects into a regression equation. Next, to test our

Table 2. Hierarchical Regression Analysis of the Moderating Role of Challenge and Hindrance Time Pressure

	Team Communication		
Variables	1	2	3
Control			
Team size	.03	−.01	.00
Team tenure	−.15	−.10	−.08
Main effects			
Team proximity		.04	.10
Challenge time pressure		.45**	.47**
Hindrance time pressure		−.27**	−.25**
Moderation effects			
Team proximity × challenge time pressure			.21*
Team proximity × hindrance time pressure			−.15†
Incremental R^2		.20	.09
R^2	.15	.35	.43
Adjusted R^2	.02	.30	.38

** $p < .01$; * $p < .05$; † $p < .10$; Standardized regression coefficients are reported.
One tailed for hypothesized effects and two tailed for other effects.

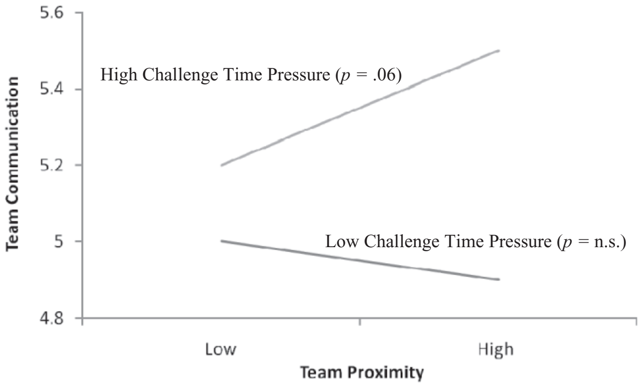

Figure 1. Effects of Challenge Time Pressure on Interaction between Team Proximity and Team Communication

predictions that team proximity is more highly related to team communication (1) when challenge time pressure is high than when it is low (H1) and (2) when hindrance time pressure is low than when it is high (H2), we introduced the interaction term of team proximity and challenge time pressure and the interaction term of team proximity and hindrance time pressure to the model at the same time. As shown in Table 2, the coefficient associated with the interaction term of team proximity and challenge time pressure was significant ($\beta = .21, p < .05$). The coefficient associated with the interaction term of team proximity and hindrance time pressure was significant ($\beta = -.15, p < .10$). An inspection of the interaction plots (Figures 1 and 2) with simple slope tests (Aiken and West, 1991) revealed that only the slopes related to high challenge time pressure and low hindrance time pressure were significant. The plots show that teams communicate more effectively when their members are located proximately when they experienced high challenge time pressure or low hindrance time pressure. The findings are consistent with our hypotheses. As a result, both H1 and H2 were supported. Additionally, the results also suggest that bringing team members closer yields virtually no benefit on team communication in low challenge or high hindrance time pressure situations.

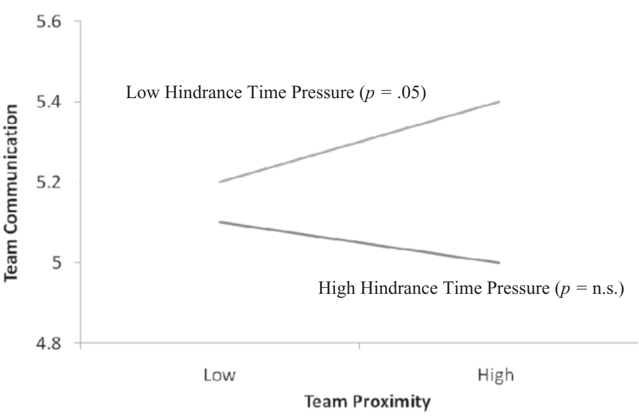

Figure 2. Effects of Hindrance Time Pressure on Interaction between Team Proximity and Team Communication

Discussion

This paper addresses the tenet that team proximity improves team communication. Our findings demonstrate that effective communication in teams depends not only on physical distance (the ease of reach) but also on perceived time pressure, such that high challenge and low hindrance time pressure environments are conducive to team communication. Although team proximity is a well-researched topic, bringing time pressure into the picture enabled us to gather further insight into this area.

Our findings contribute to theory in two ways. First, this study showed that challenge and hindrance time pressure differently influences the benefits of team proximity toward team communication in a particular work context. We found that teams under high hindrance time pressure do not benefit from close proximity, given the natural tendency for premature cognitive closure and the use of avoidance coping tactics when problems surface. Similarly, teams experiencing low challenge time pressure do not gain from close proximity. This is an interesting outcome as it underscores the importance of challenge for teams to function effectively (e.g., Wageman, 2001). Thus, simply reducing physical distances is unlikely to promote communication if motivational or human factors are neglected (cf. King and Majchrzak, 1996).

Importantly, this study demonstrates the strength of the challenge–hindrance stressor framework in advancing theory and explaining inconsistencies. Past studies determined time pressure by considering only its levels without distinguishing the type of time pressure. We suggest that this study might not have been able to uncover the moderating effects of time pressure if we had conceptualized time pressure in the conventional way. For example, if time pressure is measured in the general way, high time pressure may or may not moderate the proximity–communication relationship, depending on whether a team perceives time pressure as highly challenging or highly hindering. In most cases, the outcomes would be masked because of the aggregated effects of challenge and hindrance time pressure. This would possibly lead to insignificant conclusions. In addition, our results have highlighted the advantages of conceptualizing time pressure as a two-dimensional work stress and also served to extend the framework introduced by

LePine and his colleagues. So far, it had been applied to examine individual-level outcomes. In this study, we extended the framework and used it to address inconsistencies at the team level.

On a separate note, we found an insignificant relationship between team proximity and team communication, similar to previous studies (e.g., Conrath, 1973). We explain this finding by suggesting that communication is a matter of heart and mind (Kruglanski, 1996); mere physical distance alone may not have significant effects.

This study is not without limitations, and it is important to indicate them. The first limitation is that we did not collect data concerning team awareness, effort to initiate conversations, or team identity to provide an empirical argument for the nonsignificant relationship between team proximity and team communication. This portion of the study needs to be investigated in the future. Another limitation is the small sample size of 81 teams. The third limitation is that we did not take into account the physical barriers, such as partitions or doors, in the offices while examining the relationship between team proximity and team communication. Hatch (1987) found physical barriers to improve communication, as barriers help a team to define its boundaries and sense of identity. Hatch's findings implied that close proximity does not necessarily improve team communication if there is no landmark to signify a team boundary, and simply placing multiple teams in a huge open hall does not facilitate communication within a team. This could be an alternative explanation for not finding a significant relationship between team proximity and team communication in this study.

The outcomes of this study are important for managers and practitioners. The results showed that simply locating team members close to one another does not guarantee improved communication. This is especially so for teams functioning in short-cycled industries. The effects of close proximity depend on whether team members are willing to make use of the short distances between one another to exchange information. Management with the intent to adopt colocation as a means to facilitate communication should also attempt to cultivate a work environment where employees experience challenge time pressure. Accordingly, we encourage managers to identify and eliminate factors that cause hindrance time pressure. On the one hand, managers could attempt to reduce hindrance time pressure by designing realistic project schedule and deliverables, and by planning downtime in between projects so that teams can recuperate from high strain projects during these intervals. These can be achieved through active engagements with team members. In addition, providing team members with reasonable levels of autonomy for decision making and managing the frequency of status reporting also helps teams to feel that they are trusted.

On the other hand, managers could increase challenge time pressure by underlining the importance of the project. It is fundamental for managers to understand what challenges the team and induces them to work together. Is it the complexity of a particular technology? Or is it the collective desire to advance consumer lifestyles, to develop a sustainable solution, or to see a breakthrough in a medical field? Managers that are able to keep their teams focused on achieving a goal are likely to witness their teams endure time pressure and perceive it as stimulus. In fact, our time pressure scales show that at the team level, dependency and commitment are two team components that induce team members to experience time pressure as a challenge. Based on that finding, we encourage managers to plan activities and training that will help teams to develop a stronger sense of interdependency and team commitment before putting them through high time pressure missions.

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Appendix Construct Measurement

1 = strongly disagree to 7 = strongly agree	Loading
Challenge time pressure ($\alpha = .86$). Source: self-developed	
To what extent do the following cause the team to experience positive time pressure (makes you feel good, joyful, satisfied, stimulated) in the project?	
1. The importance of completing this project on time.	.70
2. The degree to which team members depend on one another to finish this project on time.	.68
3. The urgent need for successful completion of the work the team is doing.	.76
4. The extent to which the team committedly works together to complete the project on time.	.78
5. The technological complexity that the team needs to overcome to complete this project on time.	.63
Hindrance time pressure ($\alpha = .88$). Source: self-developed	
To what extent do the following cause the team to experience negative time pressure (makes you feel annoyed, upset, bothered, discouraged) in the project?	
1. The impossibility to fulfill the project schedule.	.77
2. The lack of time buffer that is planned for this project.	.59
3. The excessive reporting of the project team status required by the management.	.80
4. The number of changes on the team tasks at the late stages of the project.	.72
5. The inability for the team to do more iteration to improve the project deliverables.	.72
6. The amount of constant switching between tasks for the team in a day.	.69
7. The persisting period of high time pressure the team experienced.	.56
8. The imbalance in my team members' personal lives due to the time pressure from this project.	.76
Team communication ($\alpha = .87$). Source: Hoegl and Gemuenden (2001)	
For each statement, use the following scale to indicate which is most descriptive of your team.	
1. There was frequent communication within the team.	.62
2. The team members were happy with the timeliness in which they received information from other team members.	.67
3. The team members were happy with the precision of the information received from other team members.	.77
4. The team members were happy with the usefulness of the information received from other team members.	.79
5. The team members communicated often in spontaneous meetings, phone conversation, etc.	.55
6. The team members communicated mostly directly and personally with each other.	.54
7. Project-relevant information was shared openly by all team members.	.69
8. Important information was kept away from other team members in certain situations (reverse coded).	.59
9. In our team there were conflicts regarding the openness of information flow (reverse coded).	.60

All loadings are significant at $p < .001$ (one tail).