

Does Dormant Faultline Still Matter in Distributed Teams? Extending the Faultline Concept to Distributed Environment

Completed Research Paper

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Abstract

Subgroup divisions based on demographic characteristics such as age, gender, and race (the notion of dormant team faultlines) have been found to influence team processes and outcomes in face-to-face teams. This research extends the faultline concept to distributed environment, by proposing that recognized faultlines, instead of dormant faultline, will have a negative impact on distributed team performance and an important team cognitive process – Transactive Memory Systems (TMS). The research model was tested based on survey data collected from 156 MBA students in 42 distributed teams. Our results show that in distributed teams where each team member locates at a different location and never meet face-to-face, recognized faultlines have a negative relationship to both team performance and TMS, while dormant faultlines only have a negative link to TMS, but no significant relationship to team performance. Implications for research and practice are discussed together with potential avenues for future research.

Keywords: Faultlines, Distributed teams, Transactive memory, Subgroups

Introduction

Distributed teams allow organizations to access diverse expertise distributed across geographic locations without the need to travel between locations, thus reducing travel-related time and expenses (Brown and Eisenhardt 1995; Gorton and Motwani 1996; Madhavan and Grover 1998; Townsend et al. 1998). Distributed teams also help organizations to understand local markets better (Boutellier et al. 1998), get closer to customers (Levenson and Cohen 2003), and increase cycle time and productivity through around-the-clock work pattern (Gorton and Motwani 1996; Levenson and Cohen 2003). Due to these potential benefits, organizations have employed distributed team to performance key functions such as product development, software development and strategic planning (Kotlarsky and Oshri 2005; Majchrak et al. 2000; Maznevski and Chudoba 2000). Thus, distributed teams' performance becomes critical to organizations.

Despite of the proliferation of distributed teams in organizations, evidence has shown that it is inherently challenging to achieve team effectiveness in distributed environments, due to temporal, geographic, and cultural differences (Armstrong and Cole 1995; Espinosa et al. 2007; Griffith and Neale 2001; Kotlarsky and Oshri 2005). While distributed teams utilize a wide range of communication tools such as groupware and codified knowledge management systems, coordination breakdowns still occur (Kotlarsky and Oshri 2005; Oshri et al. 2008). Researchers acknowledge that information technologies alone are not sufficient to bridge temporal, geographic, and cultural differences in distributed teams (Kotlarsky and Oshri 2005; Yoshioka et al. 2002). Besides employing various technology tools, we should also focus on social aspects (e.g., trust, social ties, formal and informal communication) which are crucial to the success of distributed teams (Kotlarsky et al. 2008; Orlikowski 2002). In addition, although it's not surprising to find that the majority of distributed team studies have been focused on team level factors that affect team effectiveness, there is a relative lack of research on how subgroup factors determines distributed team effectiveness and dynamics (Mortensen et al. 2009). To address this gap in distributed team literature, this study examines how subgroup divisions might influence distributed teams by extending the notion of "team faultlines" to the distributed team environment .

The faultline concept was introduced to the teams literature by Lau and Murnighan (Lau and Murnighan 1998). By analogy with the geological concept of faults (i.e., fractures in the earth's crust), Lau and Murnighan defined group faultlines as "hypothetical dividing lines that may split a group into subgroups based on one or more attributes" (Lau and Murnighan 1998, p. 328). They proposed this concept to extend the team diversity literature, which, at that time, mainly focused on team member heterogeneity and homogeneity *among individuals* (either for face-to-face or distributed teams), but such earlier work did not address how patterns of *difference between subgroups within a larger group* might influence team processes and outcomes.

To our knowledge, existing research on team faultlines has focused on traditional face-to-face teams and teams with collocated subgroups, and has measured faultlines based on *objective* demographic characteristics (such as gender, age, or race).¹ In distributed teams where members never meet face-to-face, however, such objective demographic attributes – which are easily visible in face-to-face teams – are much less salient. This raises an interesting research question: do faultlines based on objective demographic characteristics still matter in distributed teams?

To answer this question, we developed a research model that examines the impact of two different types of faultlines on distributed teams: 1) faultlines based on *objective* demographic characteristics (gender, education, race, and functional background) that may (or may not) cause a group to split into subgroups – known as *dormant* faultlines (Jehn and Bezrukova 2010); and 2) faultlines that are actually recognized by team members – which we label as *recognized* faultlines. To test our model of the relative influence of both types of faultlines in distributed teams, we surveyed 159 members in 42 distributed teams from an online MBA course where team members never met face-to-face. As such, our findings shed light on the

¹ Few studies have also considered member location (Polzer et al. 2005) and personality factors such as conscientiousness (Rico, Molleman, Sanchez-Manzanares and Van der Vegt 2007) as the source of the faultline; however the vast majority of research on team faultlines focuses on objective demographic characteristics.

differences between these two types of faultlines and help to extend the faultline concept to the distributed team environment.

Theoretical Background and Hypotheses

Dormant Faultline vs. Recognized Faultline

As introduced earlier, the concept of faultline is defined as hypothetical lines that divide a group into subgroups based on the alignment of multiple attributes (Lau and Murnighan 1998). This concept allows us to consider the *alignment* of various team attributes, thus evaluating team dynamics that are triggered by possible subgroups formation. For example, a team consisting of two accountants in their 20s and two programmers in their 50s has the potential to sub-divide into two subgroups based on the alignment of members' different functional background and age. The faultline model suggests that strong faultlines are more likely to occur when all member characteristics form non-overlapping categories (as in this example, where the two middle-aged programmers are distinct from the two young accountants), compared to teams where the (several) relevant attributes are completely heterogeneous or homogeneous within a given team. The stronger the faultline (which Jehn and Bezrukova 2010 label the dormant faultline), the more likely a given team will split into discrete subgroups, with possible losses in terms of group processes and outcomes.

In Lau and Murnighan's (1998) conceptualization of faultlines, a group may have many potential faultlines based on the variations as well as the salience of group members' attributes, "each of which may activate or increase the potential for particular subgroupings" (p. 328). This indicates that the faultlines based on members' demographic characteristics may or may not be recognized by team members. However, until very recently, most of the empirical faultlines research has only considered faultlines based on objective demographic characteristics –gender, age, race, etc. (Lau and Murnighan 2005; Li and Hambrick 2005; Molleman 2005; Polzer et al. 2006; Thatcher et al. 2003). That is, most researchers have traditionally operationalized the notion of faultlines based just on team members' demographic attributes, without considering whether the team members themselves actually recognize the faultlines that such attributes are assumed to trigger.

One recent study in this research stream has distinguished between dormant faultlines and activated faultlines (Jehn and Bezrukova 2010). Jehn and Bezrukova (2010) define dormant faultlines as the potential faultlines based on demographic attributes, while activated faultlines are internal divisions that team members actually perceive, owing to such demographic attributes. Their empirical studies showed that dormant faultlines do not necessarily lead to activated faultlines – but only under certain conditions (Jehn and Bezrukova 2010).

Acknowledging the differences between dormant faultlines and activated faultlines is a critical advance in the trajectory of faultlines research; however, the notion of activated faultlines is still based on *objective demographic attributes* (e.g., race or gender) which may not be a sufficient condition for actual, recognized faultlines to occur.

For example, in our previous example of a team with two young accountants and two middle-aged programmers, other non-visible attributes may actually override the demographic attributes. For example, consider that one accountant and one programmer may share a similar work style and personality – such as being very spontaneous and extroverted (which differs from the other two team members). In such a scenario, the accountant and programmer may feel that they "belong to the same camp", regardless of the fact that their age and functional background differentiate them. By introducing this example, we suggest that non-visible differences in aspects of behavior – such as work style, personality, or previous life experiences – may matter more in terms of creating or overriding subgroups based on visible, demographic attributes. While this is a hypothetical example at this point, the problem is that if researchers who study faultlines never bother to include non-visible attributes (e.g., work style and personality) as the basis for the creation of faultlines. It is possible that they have overlooked the true source of any faultlines that their research detects; instead, researchers may assume that any such faultlines arise due to any demographic differences that exist within the group. In short, maybe the traditional features of age, race, and gender matter more to faultline researchers than these attributes matter to team members themselves!

In fact, Lau and Murnighan's (1998) original conceptualization of faultlines does not explicitly limit the basis for faultlines to just demographic characteristics – although this is how nearly all empirical researchers have operationalized these faultlines. On the contrary, Lau and Murnighan explicitly stated that "faultlines based on other nondemographic characteristics, such as personal values or personality, may also lead to active subgroups within a larger group" (p. 328). The reason that researchers have only examined faultlines based on objective demographic features may be due to the fact that demographic characteristics "are the most easily noted when a new group forms" (Lau and Murnighan 1998, p. 328). Of course, this is true in traditional face-to-face teams where objective demographic characteristics are readily visible to team members; however, in distributed teams where members never meet face-to-face, demographic characteristics become much less salient. Social equalization research has suggested that in highly distributed settings, few cues are salient to indicate team members' status and position (Siegel et al. 1986). In this case, faultlines based on objective demographic characteristics may be irrelevant. Of course, subgroups may still form within distributed teams, but the trigger to such subgroup formation may be distinct – such as location, personality, workstyle, preference for specific communication media, etc.

This means that a unique challenge in studying faultlines in distributed environments is the practical difficulty of identifying the attributes that actually matter to team members, in terms of causing the team to split into two or more subgroups. Some work in this area is beginning – for example research on how team geographic configuration (the relative number of team members at different sites) impacts team dynamics at the individual, subgroup and team-level (O'Leary and Mortensen 2010). Another study considered how colocated subgroups (i.e., specific team members located at one site, while the rest are located elsewhere) can impair group functioning (Polzer et al. 2006). But in distributed teams where no two members share the same location, this approach to studying geographic configuration does not apply. So what attributes may contribute to faultlines that may emerge in such fully-distributed teams? Or, will such teams completely avoid such faultlines?

To study the potential impact of faultlines on fully-distributed teams, we shift our focus to the faultlines as they are experienced by team members. Taking this approach, we can measure the effect of actual faultlines that are recognized by and thus, influential to team members. Thus, in our research, we define recognized faultline as subgroup divisions that are experienced by team members. In other words, we measure team members' perception of subgroup divisions directly (i.e., by asking if they acknowledge any internal divisions), without assuming that faultlines are due to demographic characteristics.

Our notion of recognized faultline is different from the prior concept of dormant faultlines (Jehn and Bezrukova 2010): instead of focusing on faultlines arising from demographic characteristics and assuming that these faultlines actually occur in teams, we ask team members about their perceptions of any faultlines. This is similar to Jehn's activated faultline concept – with the difference that our recognized faultline is not inherently tied to demographic attributes (which the concept of activated faultlines still assumes). Instead, we measure recognized faultline by asking team members whether they experienced any schism or subdivisions within their teams, without explicitly identifying the underlying basis. Thus, rather than asking "Did the differences in team members' race cause any problems in your group processes or outcomes" – which prior researchers have asked – we instead pose the general question "Did you notice any subdivisions that formed within your group?"

Based on this distinction between our notion of recognized faultlines vs. dormant faultline, we posit that, within distributed teams where team members never meet face-to-face, objective demographic characteristics (such as race, age and gender) will become less salient, and such dormant faultlines will not matter to team members' experiences or to the team's overall performance. Instead, if any faultlines do emerge, team members will state the basis for such recognized faultlines and it is the latter (rather than any observed differences in demographic features) that will affect members' experiences and self-reported team outcomes. In the next section, we review the literature on dormant faultlines and then we develop our research hypotheses.

Faultline's Impact on Team Processes and Outcomes

According to conventional faultlines theory, the stronger the faultlines, the more likely the team will split into factions, leading to potential intergroup conflict (Jehn 1995) and the risk that members will share information only within subgroups rather than among *all* team members (Lau and Murnighan 1998). Both experiments and field research have been conducted to examine the influence of strong faultlines on

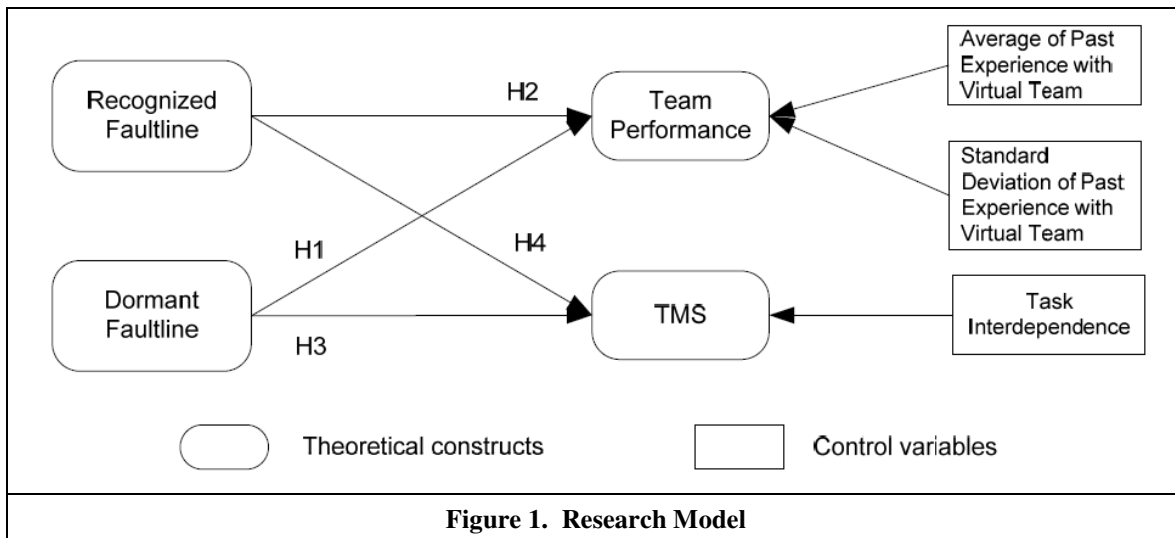
team processes and outcomes. These studies all measure dormant faultlines that are based on demographic characteristics in traditional face-to-face teams (see Table 1 for a brief summary). All except one study (i.e., Lau and Murnighan 2005) reported that strong faultlines harmed team processes (such as intrateam communication, group efficacy and team identity) and outcomes (such as team performance, team satisfaction). However, Lau and Murnighan (2005) uniquely reported that members of strong-faultline teams experienced more psychological safety, more team satisfaction, and less relationship conflict than members of weak-faultline teams. This means that rather than strong faultlines being universally negative, there were some beneficial by-products of such faultlines.

Table 1. Faultline's Impact on Team Processes and Outcomes		
Prior Literature	Faultline Base ^a	Direct Effect of Strong Faultlines (+: positive impact; -: negative impact)
Earley and Mosakowski (2000) (study 2) ^b	Nationality	- worse processes (team identity, group efficacy, role expectations, intrateam communication) worse outcomes (team performance, satisfaction with team's performance)
Lau and Murnighan (2005)	Ethnicity and sex	+ less relationship conflict better group outcomes (psychological safety, group satisfaction)
Molleman (2005)	Gender, age and having a part-time job	- lower group cohesion higher team conflict
Li and Hambrick (2005)	Age, tenure, gender and ethnicity	- higher emotional conflict higher task conflict
Rico et al. (2007)	Educational background and conscientiousness	- worse performance lower level of social integration

a. We define the attribute or set of attributes based on which group faultlines are formed as faultline base.

b. This paper reported results from three studies that examined the effect of heterogeneity in nationality on effective performance. Only one study (study 2) specifically examined the effect of faultlines on performance.

In the next two subsections, we discuss a possible explanation that accounts for the inconsistent results in the prior faultline literature. We then develop hypotheses that establish conceptual linkages between faultlines, team performance and an important team process variable: transactive memory system (TMS). Figure 1 shows our overall research model.



Faultline's Impact on Team Performance in Distributed Teams

We suspect that one reason for the inconsistent results in the faultline literature is that researchers have neglected to distinguish between faultlines that are solely based on demographic characteristics (i.e., dormant faultlines) and the faultlines that are truly recognized by team members (i.e., recognized faultlines). This distinction may be less critical in face-to-face teams, especially in lab experiments², than in distributed teams, where members do not meet face-to-face. We thus propose that dormant faultlines will not affect team outcomes such as performance, since the demographic characteristics that are assumed to underlie dormant faultlines are less salient in distributed teams. Thus, our first hypothesis states:

Hypothesis 1: dormant faultlines are not related to team performance in distributed teams

The prior literature suggests that, once faultlines are recognized by team members, they have negative effects on team processes and outcomes. For example, in Jehn and Bezrukova's (2010) experiments, their notion of activated faultlines incorporates members' perception of whether subgroups occur (although it is still based on objective demographic attributes). They found that teams with stronger activated faultlines have higher levels of conflict, which causes members to avoid communicating and avoid sharing information with members of other subgroups. Based on this logic, we propose that team performance will suffer from the lack of communication and information sharing, once team members recognize the existence of such faultlines in their distributed teams. Therefore, we predict that:

Hypothesis 2: recognized faultlines are negatively related to team performance in distributed teams

Faultline's Impact on TMS in Distributed Teams

Previous faultline research has studied various process variables such as group efficacy, intra-team communication (Earley and Mosakowski 2000), emotional conflict and task conflict (Li and Hambrick 2005; Molleman 2005). In this study, we include transactive memory systems (TMS) as an important team process variable that may be affected by the existence of faultlines because of its role in leveraging team members' diverse expertise (Lewis 2004), which is critical to teams in distributed settings. In the rest of this subsection, we first introduce the concepts of transactive memory and TMS. We then discuss our rationale for examining the effect of faultlines on TMS in distributed teams and develop related hypotheses.

The notion of transactive memory (TM) was conceptualized by Wegner (1987), who first used this concept to explain the behavior of couples in intimate relationships. The memories that exist in one person's mind about what the other person knows and the knowledge resulting from that understanding is called transactive memory (TM).

Borrowing an example from Lewis (2003), suppose that Tom does not remember his Aunt Sara's birthday, but his wife Jane does remember. As a result, Tom knows that he doesn't need to remember Sara's birthday because whenever he needs this information, he can always retrieve it from Jane. Eventually, Tom may associate "remembering birthdays" with Jane and never bother to learn family birthdays by himself. In this example, Tom's belief that "Jane knows family birthdays" and "I need not remember birthdays" is an example of his transactive memory, which results from his knowledge of Jane's memory. Wegner argued that a similar phenomenon also happens in groups. A group's transactive memory consists of members' knowledge about which members possess what specific knowledge as well as the understanding resulting from this knowledge (Wegner 1987).

Transactive memory system (TMS) is a group-level concept, referring to "the operation of the memory systems of the individuals and the processes of communication that occur within the group" (Wegner 1987, p.191). Continuing the above example of Tom and Jane (Lewis 2003), suppose that Jane relies on Tom to remember other types of information, for example, where the postage stamps are stored in their house. When they want to send a birthday card to Aunt Sara, both of them need to retrieve necessary

² In such experiments, a researcher manipulates the formation of faultlines and verifies that this manipulation is successful. Under this scenario, dormant faultlines are very likely to become recognized faultlines. In field settings, however, we cannot assume that actual variation in members' demographic attributes will trigger such faultlines.

information from their own memories and combine this information, before they can finish the task. Tom and Jane are using their transactive memories to accomplish a task; they have created a TMS. In a team, TMS describes the active use of members' transactive memories to complete a team task cooperatively. For example, in a team with a well developed TMS, a member can quickly locate who knows best about a failing system component and then use that other person's knowledge to fix the broken component (Kotlarsky and Oshri 2005).

In this study, we consider TMS as an important construct when studying faultlines in distributed teams because its critical role in leveraging members' diverse expertise may be hurt by the existence of faultlines in distributed settings. Empirical studies have found that TMS enhance team members' ability to integrate knowledge (Faraj and Sproull 2000; Jarvenpaa and Majchrzak 2008; Kanawattanachai and Yoo 2007) and their ability to apply knowledge obtained from a prior task in a new setting (Lewis 2005). These abilities are especially important for members in distributed teams, which, on average, are expected to be more diverse in expertise and background than traditional face-to-face teams (Griffith and Neale 2001). That is, members in distributed teams are usually expected to effectively leverage expertise of members in many different locations. In teams with strong faultlines, however, it might be more challenging to leverage the expertise and skills of other team members because strong faultlines impair team processes, leading to reduced intra-team communication (Earley and Mosakowski 2000) and to greater team conflict (Li and Hambrick 2005; Polzer et al. 2006), which may negatively affect TMS. Since TMS is an especially important mechanism through which knowledge workers can integrate and leverage other members' diverse expertise (Lewis 2004), in this research, we investigate whether the two different types of faultlines – dormant faultlines and recognized faultlines – will have negative effects on these teams' TMS.

Following a similar logic to that of Hypothesis 1, since the demographic characteristics that form dormant faultlines are less salient in distributed settings, we propose that in distributed teams where members do not meet face-to-face, dormant faultlines will no longer impact team processes such as TMS. Thus, we propose that:

Hypothesis 3: dormant faultlines are not related to TMS in distributed teams.

When faultlines are recognized by team members in distributed environments, we believe that they will impact team processes such as TMS. In traditional team studies where only dormant faultlines were measured, researchers found that teams with strong faultlines caused the team to splinter into subgroups – with members communicating and sharing knowledge only within their subgroups, but not to all members (Cramton 2001; Gratton et al. 2007; Polzer et al. 2006). In Jehn and Bezrukova's (2010) experiments where their activated faultline concept asked individuals about their awareness of subgroup formation, they found that teams with stronger activated faultlines have higher levels of conflict, which causes members to avoid communicating and avoid sharing information with other subgroup members. (As we noted above, their study still assumes that demographic attributes are the cause for any such subgroups that emerge.) These dysfunctional team dynamics – higher levels of conflict, combined with decreased communication and information sharing – discourage individual members from sharing information and, in turn, prevent them from knowing what relevant knowledge other team members have regarding the project. These changes in team dynamics are the very definition of TMS, therefore, we posit that:

Hypothesis 4: recognized faultlines are negatively related to TMS in distributed teams.

Research Method

Data Collection

To evaluate our research model, we collected survey data from students registered in an online MBA program in two consecutive semesters in a large university in the U.S. southeast. The course was administrated virtually through Blackboard, with no face to face class meetings. A total of 159 MBA students (97 male, 59 female) participated in the study, of which 156 completed our survey at the end of the course (98% response rate). On average, these students have 6.7 years of working experience. Slightly more than two-third (67.3%) of participants were located in different cities in the state where the

university is located, with the rest located in other U.S. states or in other countries (e.g., one in Italy and one in Japan).

As a major component of the online course, each group was required to submit three case analyses, which accounted for 30% of their final grade. Students were asked to form four-member teams on their own at the beginning of the semester. Because some of the students dropped the course during the semester, we ended up some teams with fewer than four members: out of 42 teams, 34 were four-member teams, seven were three-member teams, and one team had just two members³.

The teams were asked to select three cases to analyze and submit, at approximately four week intervals. To conduct the case analysis, students needed to identify the major issues presented in the cases, use the reading materials to guide their data analysis, make recommendations, and prepare an action plan to implement their recommendations. Because of the different locations and work schedules, teams had to use virtual communication tools, such as email, telephone, and/or team communication tools provided by Blackboard (e.g., discussion board, file exchange and chat), to coordinate their work. This course setting thus provided an ideal opportunity to test our proposed research model. We administrated the survey immediately after students finished their last case analysis.

Instrument Development

We conducted an extensive literature review to identify existing measurement scales for all constructs. Whenever possible, we adapted validated measures from previous studies. The preliminary questionnaire was peer reviewed by a panel of five academic experts who were asked to evaluate content validity, clarity, question formats, response format, appearance, and organization. The questionnaire was modified and re-organized according to their comments. The appendix lists the items for each construct.

Recognized Faultlines. No empirical research has examined the concept of recognized faultline. To our knowledge, the only measure that considered team members' perception of group faultlines is Jehn and Bezrukova's scale for activated faultlines (Bezrukova et al. 2009; Gibson and Cohen 2003; Thatcher et al. 2003). Their measure used three questionnaire items, "My team split into subgroups during exercise", "My team divided into subsets of people during this exercise", and "My team broke into two groups during this exercise". We consider the three items that directly asked about the formation of subgroups to be repetitive, thus not providing sufficiently broad content coverage for our study. Thus, based on the subgroups literature (Cramton 2001; Gratton et al. 2007; Panteli and Davison 2005; Polzer et al. 2006), we created several items to assess whether team members recognized the existence of subgroup format, whether members behaved as subgroups instead of as a full, cohesive group, etc. Respondents rated each item on a seven-point scale (ranging from 1 = strongly disagree to 7 = strongly agree).

Dormant faultline. We calculated a measure of each group's dormant faultline based on five demographic characteristics: gender, education, race, years of working experience and functional background. These demographic characteristics were chosen based on the previous literature (Bezrukova et al. 2009; Gibson and Cohen 2003; Thatcher et al. 2003) and because information about these attributes were available to us through the university's registration data. Please see Table 2 for a summary of the demographic characteristics of the participants. We used the procedure developed by Thatcher et al. (2003) and used by others (Bezrukova et al. 2009; Lau and Murnighan 2005; Molleman 2005) to calculate our measure of dormant faultlines. In this procedure, categorical variables (such as gender, education, race and functional background in this research) are coded as dummy variables. For an n-member team, there are $S = (2^n - 1)$ ways to divide the group into two subgroups. For each possible division, the strength of the faultline, F_{aug} , is the ratio of the variation between subgroups to the total variation in overall member characteristics in that team. This ratio is calculated by dividing the total between group sum of squares to the total sum of squares:

³ The two-member team was later dropped from data analysis because based on the procedure used to calculate dormant faultline (Thatcher et al. 2003), a two-member team will be considered as an extreme case where the team faultline strength is 1.

$$Fau_g = \left(\frac{\sum_{j=1}^5 \sum_{k=1}^2 n_k^g (\bar{x}_{\cdot jk} - \bar{x}_{\cdot j})^2}{\sum_{j=1}^5 \sum_{k=1}^2 \sum_{i=1}^{n_k^g} n_k^g (x_{ijk} - \bar{x}_{\cdot j})^2} \right) \quad g = 1, 2, \dots, S,$$

where x_{ijk} : the value of the i th member of subgroup k on the j th demographic characteristics (in this case $j = 1, 2, 3, 4, 5$ since five demographic characteristics are used);

$\bar{x}_{\cdot j}$: the overall group mean of characteristic j ;

$\bar{x}_{\cdot jk}$: the mean of characteristic j in subgroup k ;

n_k^g : the number of members of the k th ($k = 1, 2$ since we only consider the situations where a team is divided into two subgroups) subgroup under split g .

The strength of the dormant faultline, Fau , is the maximum value of Fau_g over all possible division $g = 1, 2, \dots, S$. Theoretically, the faultline strength can vary between zero and one, with larger values indicating a stronger dormant faultline.

Table 2. Summary of Demographic Characteristics

Gender			Working experience		
Male	100	64.1%	mean value	6.7	
Female	56	35.9%			
Education			Functional background		
Bachelors	131	84.0%	Finance and Accounting	33	21.2%
Graduate	25	16.0%	Sales and Marketing	11	7.1%
Race			IT, MIS, Engineering	26	16.7%
White	123	78.8%	General Management	32	20.5%
Black	8	5.1%	Military officer	14	9.0%
Hispanic	10	6.4%	Others	40	25.6%
Asian	2	1.3%			
Other	9	5.8%	Total N= 156 for each demographic characteristic		

Transactive Memory System. We used Lewis' (Lewis 2003) 15-item scale to measure TMS. Responses were scored on a seven-point scale (ranging from 1 = strongly disagree to 7 = strongly agree).

Team Performance. Team performance was assessed using Henderson and Lee's (Henderson and Lee 1992) 5-item measure. The items ask respondents to evaluate their team's performance on 7-point scales relative to other project teams on which they have served (1 = extremely lower than other teams; 7 = extremely higher than other teams).

Control variables. We include perceived task interdependence as a control variable for TMS in the model, because studies show that *perceived interdependence* among team members triggers the development of transactive memory (Hollingshead 1998a; Hollingshead 1998b; Hollingshead 2001; Levine and Moreland 1999; Moreland 1999; Wegner et al. 1991). In the absence of tasks that require coordination among members, there is little reason for TMS to emerge. We assessed interdependence using Campion et al.'s (1993) 5-item measure, based on a 7-point scale (ranging from 1 = strongly disagree to 7 = strongly agree).

We also included a control variable called *past experience with virtual teams*, since research has shown that students with previous virtual team experience had higher levels of learning about course material and teamwork in virtual context; such experienced subjects had greater confidence for working in a virtual team (Dineen 2005). We suspect that past experience with virtual teams may also affect team performance. Thus, we include this as an additional control variable for team performance in our analysis model. We measured past experience with virtual teams by asking "How would you rate your level of

experience of working in virtual teams before the first group case analysis project began?" In our analysis, we calculated both the average level of members' past experience with virtual teams and also the standard deviation of this past experience⁴, and we included both as control variables for team performance.

Analyses and Results

Measurement Validation

We used Smart PLS (Ringle et al. 2005) to calculate average variance extracted (AVE) to assess discriminant validity. Discriminant validity is established when the square root of each construct's AVE is much larger than its correlation with other constructs (Gefen and Straub 2005; Gefen et al. 2000). The results presented in Table 3 demonstrate that discriminant validity is achieved.

Table 3 also presents internal *reliability* results for all constructs. A Cronbach alpha value of 0.70 or higher (Nunnally 1978) or a composite reliability value of 0.70 or higher (Nunnally and Bernstein 1994) indicates high internal reliability. The scores reported in Table 3 show high reliability for our measures.

Table 3. Means, SD, Composite Reliability, AVE and Inter-Construct Correlations

	Mean (SD)	Cronbach Alpha	Composite Reliability	AVE	1	2	3	4	5
1. Recognized Faultline	2.35 (0.95)	0.94	0.95	0.77	0.88				
2. Dormant Faultline ^a	0.62 (0.14)	NA	NA	NA	-0.01	NA			
3. TMS	5.42 (0.53)	0.93	0.94	0.53	-0.66**	-0.22	0.73		
4. Team Performance	4.78 (0.71)	0.97	0.98	0.90	-0.66**	0.07	0.71**	0.95	
5. Perceived Task Interdependence	4.77 (0.61)	0.84	0.89	0.67	-0.40*	0.20	0.41*	0.40*	0.82

Legend:

*p<0.05, **p<0.01 (2-tailed tests); Bold figures on diagonal are values of square root of the AVE

a. All variables are measured with 7-point scales (with larger numbers indicating higher values) except *dormant faultline*, which is calculated based on five demographic characteristics: gender, education, race, work experience and functional background. Theoretically, the faultline strength can vary between zero and one, with a larger number indicating stronger faultlines.

Common Method Bias

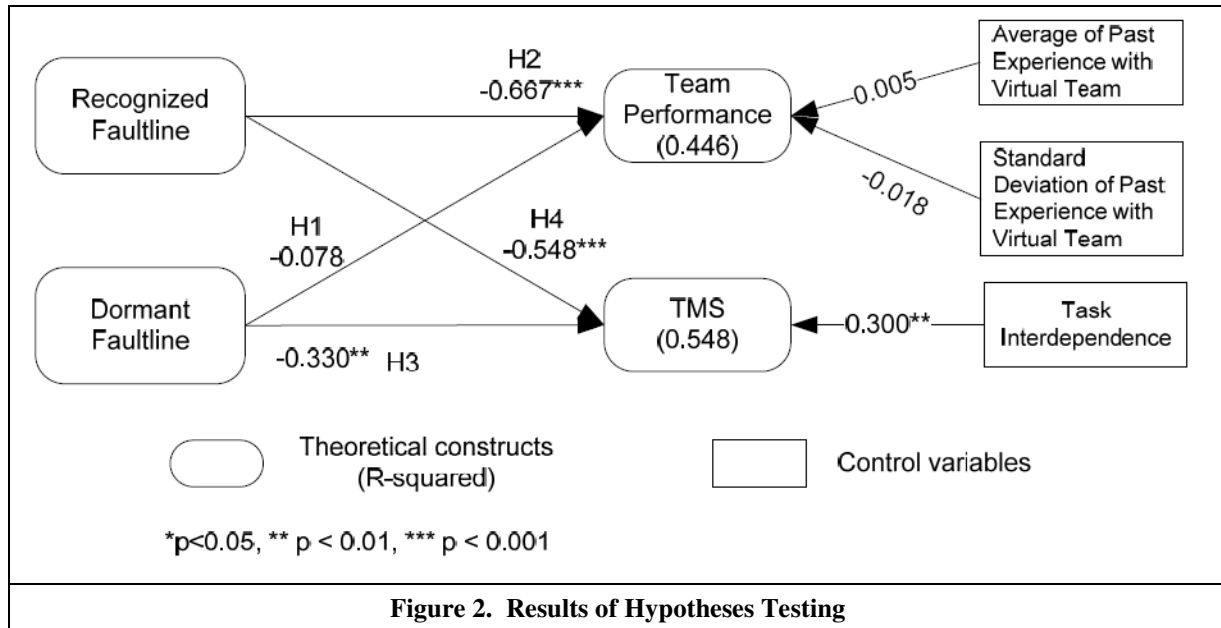
Since the effect of common method bias is generally acknowledged as a potential validity threat in behavioral research (Podsakoff et al. 2003), we paid special attention to assess common method bias throughout the research processes. During questionnaire design, we followed procedural remedies recommended by Podsakoff et al. (Podsakoff et al. 2003), while after data collection, we used Harmon's one factor test to test for common method variance (Podsakoff et al. 2003). Harmon's one factor test showed no evidence of one factor accounting for the majority of variance. Next, following the statistical approach suggested by Podsakoff et al. (2003) and its application in PLS (Liang et al. 2007), we inserted

⁴ We included the standard deviation of past experience with virtual teams within a team as a control variable because we suspect that when members in a team has different levels of past virtual team experience, this variation may affect team performance.

into the analysis a marker variable (personal innovativeness with IT (Agarwal and Prasad 1998)). We chose this construct because it should be uncorrelated with the various constructs in our model. As the average common method-based variance is only 0.032, compared to 0.618 that is explained by the average of the substantive indicators, we can conclude that common method bias is not a major concern in the dataset.

Test of Hypotheses

We used components-based structural equation modeling with Smart PLS (Ringle et al. 2005) to test our research model. We used a total of 500 bootstrapping samples to estimate the statistical significance of structural paths. All constructs are aggregated to group level. Figure 2 shows standardized path coefficients and the explained construct variances. The high R² values for the two dependent variables – 0.446 for team performance and 0.548 for TMS – indicate that the model explains a substantial amount of variance. We also found that the control variable perceived task interdependence is significantly related to TMS (path = 0.300, t = 2.595, p < 0.01); however, past experience with virtual teams is not significantly related to team performance.



Research hypotheses were tested based on the magnitude and significance of paths computed by Smart PLS. Table 4 summarizes the results.

Hypothesized relationship	Predicted link	Result
H1: dormant faultline → team performance	Not related	Supported
H2: recognized faultline → team performance	Negatively related	Supported
H3: dormant faultline → TMS	Not related	Not supported (negatively related)
H4: recognized faultline → TMS	Negatively related	Supported

Hypothesis 1 proposes that dormant faultlines are not related to team performance in distributed teams. Results show that the path from dormant faultlines to team performance (path = -0.078, t = 0.711, p > 0.05) is negative but not significant. Thus, hypothesis 1 is supported.

Hypothesis 2 states that recognized faultlines are negatively related to team performance in distributed teams. This hypothesis is supported since the path from recognized faultlines to team performance (path = -0.667, $t = 9.421$, $p < 0.001$) is negative and statistically significant.

Hypothesis 3 states that dormant faultlines are not related to TMS in distributed teams. However, results show that the path from dormant faultlines to TMS (path = -0.330, $t = 2.801$, $p < 0.01$) is negative and significant. Thus, hypothesis 3 is not supported. While dormant faultlines were not related to team performance (as shown in Hypothesis 1), such dormant faultlines *were* negatively related to TMS (contrary to Hypothesis 3).

Finally, hypothesis 4 states that recognized faultlines are negatively related to TMS in distributed teams. Results show that the path from recognized faultlines to TMS (path = -0.548, $t = 3.962$, $p < 0.001$) is negative and significant. Thus, hypothesis 4 is supported.

Discussion

In this study, we seek answers for the research question: do faultlines based on objective demographic characteristics still matter in distributed teams? In pursuing this question, we distinguish between dormant faultlines and recognized faultlines, with the result that in distributed teams, recognized faultlines have a negative relationship to both team performance and TMS, while dormant faultlines only have a negative link to TMS, but no significant relationship to team performance.

This study contributes to the current faultline literature in three ways. First, we distinguish between recognized faultlines and dormant faultlines. Instead of focusing on dormant faultlines (which are based on objective demographic characteristics), we consider recognized faultlines which actually split teams into subgroups. This is an important distinction because the triggers to faultlines are not limited to demographic characteristics (Lau and Murnighan 1998). We also recognize that dormant faultlines arising from demographic characteristic do not necessarily cause the faultlines that are recognized by team members. Our results support this claim by showing that dormant faultlines have no significant effect on team performance in distributed team. Instead, as we hypothesized, *recognized* faultlines have a negative effect on team performance.

Second, this is the first empirical study that compares the impact of both *dormant* faultlines and *recognized* faultlines on teams in a distributed environment. While most prior research has focused on how face-to-face teams experience the negative consequences of either dormant faultlines or activated faultlines based on demographic characteristics (Jehn and Bezrukova 2010), our study found that in distributed teams where each team member is located in a different location and where members never meet face-to-face, dormant faultlines have no impact on team performance. Instead, *recognized* faultlines have a negative effect on team performance. This indicates that while faultlines based on demographic characteristics (either dormant or activated) are detrimental to team performance in face-to-face teams (Jehn and Bezrukova 2010), such demographic characteristics are less likely to be salient to members of distributed teams.

Third, we examine how the two types of faultlines influence TMS, an important team process variable that has not received attention in the research stream on group faultlines. Since TMS is an especially important mechanism through which knowledge workers can integrate and leverage each other's diverse expertise (Lewis 2004), we investigate whether dormant faultlines and recognized faultlines will have negative effects on teams' TMS, respectively. The results in this area were consistent with our predictions – there is a negative relationship between recognized faultlines and TMS in distributed teams. However, contrary to our hypothesis, we found a negative relationship between dormant faultlines and TMS among the teams we studied. One possible explanation is that some specific subconstructs (Kanawattanachai and Yoo 2007) within the larger TMS construct (such as members' trust and reliance on each other's knowledge) is impaired by the dormant faultlines; then, the overall TMS levels are reduced.

Practical Implications

Our research finding has a few clear implications for managers of distributed teams. First, managers should be aware that the demographic factors that have been widely studied in the teams literature as

impairing performance in face-to-face teams may not be as important in distributed teams anymore. Thus, when they make decisions regarding the composition of a team in a distributed setting to avoid subgroup divisions, they should worry less about demographic factors such as age, gender and race, instead, they should acknowledge other sources of subgroup divisions – such as member location in partially-distributed teams (Polzer et al. 2006).

Second, our findings suggest that managers of distributed teams should pay attention to recognized faultlines that emerge within a team, given their negative association with both team performance and TMS. Distributed employees are inherently difficult for managers to oversee (Cascio 2000; Davenport and Pearlson 1998), and the feeling of isolation from managers or colleagues may allow various triggers for faultlines to become exacerbated over time. By recognizing the existence of faultlines, managers and members of distributed teams will be better prepared. Managers can avoid such faultlines by following suggestions in faultlines literature such as focusing members' attention on performance goals and task performance (instead of dwelling on relationships among members), especially when a team is newly formed. Managers may also create socializing opportunities to resolve tensions among members that may arise once the team has formed and started to produce its work (Gratton et al. 2007).

Future Research Opportunities

As with any empirical study, our approach has certain limitations. However, these limitations offer future research opportunities. First, ours is a cross-sectional study that collected all data at once, without considering temporal effects. It will be valuable to investigate the pattern of impact of different types of faultlines (dormant and recognized) on team performance and TMS over time. Such longitudinal studies will provide insights into research questions such as whether the initial perceptions that team members develop with regard to faultlines at the early stages of the teams' lifecycle differ from those in the middle or at the end of the teams' lifecycle.

Second, we only measured the perceived level of team faultlines as recognized by subjects, without capturing information about specific events, experiences, or beliefs that may have contributed to such faultlines. Future research should examine the factors contributing to such recognized faultlines, which may help managers to avoid the formation of subgroups within the teams they manage. This will be especially insightful for teams in distributed work settings, where temporal, geographic, and other language or cultural differences are more prominent.

Third, the data in this empirical study are limited to the various constructs in the online survey that we administered to students. Thus, we have not explored different teams' actual choices and their usage levels of different coordination mechanisms and technologies that they actually used for collaboration (e.g., email, phone, instant messenger, discussion boards, etc.), and how the use of these specific communication media – or non-use - may have triggered the faultlines that members actually recognized. Future research can explore whether and how use of different communication technologies (e.g., traditional communication tools such as email, instant messenger and video conference systems, versus emerging Web 2.0 tools such as social networking sites, Wikis, and mobile applications) may influence recognized faultlines in distributed teams.

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Appendix: Measurement Items and Factor Loadings

Construct (Source)	Items	Factor loading
Recognized Faultline (New scale)	<ol style="list-style-type: none"> 1. Communications (e.g., emails, phone calls) happened only among part of the group. 2. I found it easier to communicate (e.g., sending emails, talking on the phone) with certain group members than others. 3. I preferred to ask project related information from certain group members over others. 4. One or more group members didn't act like part of our group. 5. I withheld some project related information from certain group members. 6. If one or more group members were omitted from our group, it would have been much easier to finish this project. 	<p>0.702</p> <p>0.726</p> <p>0.714</p> <p>0.769</p> <p>0.700</p> <p>0.746</p>
Transactive Memory System (Lewis 2003)	<ol style="list-style-type: none"> 1. Each group member has specialized knowledge of some aspect of our project. 2. I have knowledge about an aspect of the project that no other group member has. 3. Different group members are responsible for expertise in different areas. 4. The specialized knowledge of several different group members was needed to complete the project deliverable. 5. I know which group members have expertise in specific areas. 6. I was comfortable accepting procedural suggestions from other group members. 7. I trusted that other members' knowledge about the project was credible. 8. I was confident relying on the information that other group members brought to the discussion. 9. When other members gave information, I wanted to double-check it for myself. (reversed) 10. I did not have much faith in other members' "expertise". (reversed) 11. Our group worked together in a well-coordinated fashion. 12. Our group had very few misunderstandings about what to do. 13. Our group needed to backtrack and repeat certain parts of the project a lot. (reversed) 14. We accomplished the task smoothly and efficiently. 15. There was much confusion about how we would accomplish the task. (reversed) 	<p>0.729</p> <p>0.828</p> <p>0.824</p> <p>0.857</p> <p>0.792</p> <p>0.783</p> <p>0.811</p> <p>0.817</p> <p>0.585</p> <p>0.611</p> <p>0.690</p> <p>0.659</p> <p>0.606</p> <p>0.707</p> <p>0.771</p>

Team Performance (Henderson and Lee 1992)	1. efficiency of team operations.	0.815
	2. amount of work the group produced.	0.880
	3. group's adherence to schedules.	0.780
	4. quality of work the group produced.	0.879
	5. ability to meet the goals of the project.	0.823
Task Interdependence Adapted from (Campion et al. 1993)	1. I work closely with other members of my group in doing my project tasks.	0.598
	2. I frequently must coordinate my efforts with others.	0.779
	3. My own performance was dependent on receiving accurate information from others.	0.763
	4. The way I perform my project tasks had a significant impact on other members of my project team.	0.641
	5. My work on the project required me to consult with other members of my project team fairly frequently.	0.830