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Moved by conflict: Exploring the relationship between experienced conflict and individual mobility patterns

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MOVED BY CONFLICT: EXPLORING THE RELATIONSHIP BETWEEN EXPERIENCED CONFLICT AND INDIVIDUAL MOBILITY PATTERNS

Abstract (50 words)

We explore how mobility patterns relate to team processes and states. 39 students in project teams were tracked over 82 days, yielding up to 8 million records. Preliminary analysis of this big dataset and interview data revealed differences in the mobility patterns of individuals based on their experience of conflict.

Keywords: team process, team states, team conflict, big data, location data

In a dynamic and competitive landscape, organizations increasingly structure work around teams to capitalize on the variety of expertise, perspectives, and experience to address more complex problems. However, not only are the gains from teamwork elusive but, in many cases, teamwork can be disruptive as well. To better understand the conditions under which process gains and losses (Steiner, 2007) occur, team processes and states (Marks, Mathieu, & Zaccaro, 2001) have been a central focus in management and groups research. For example, there has been considerable research on conflict in teams, resulting in much progress on how conflict is conceptualized (DeChurch, Mesmer-Magnus, & Doty, 2013; Jehn, 1995; Weingart, Behfar, Bendersky, Todorova, & Jehn, 2015), as well as our understanding of the effects of conflict (De Dreu & Weingart, 2003; De Wit, Greer, & Jehn, 2011). Despite the considerable progress on research into team states and processes, our techniques for measuring these phenomena have not changed much and are still dominated by survey methods.

Measuring team states and processes using surveys have advantages in that it is a widely used method with established techniques for determining the reliability and validity of measures. However, survey methods have their limitations and also restrict how we conceptualize the construct and the questions we ask. The first limitation of surveys is the limited frequency of measurement. Surveys capture phenomena at a single point in time rendering such measures to be highly sensitive to the timing of measurement (Cronin, Weingart, & Todorova, 2011). Although the timing of measurement can be somewhat addressed by taking multiple measurements over time, the obtrusiveness of surveys limits the degree of granularity in measurement. The second limitation, related to the obtrusiveness of surveys, is that surveys are susceptible to respondents' biases especially if administered too

frequently. Third, is the issue of missing data which will be more prevalent when measuring constructs, particularly those associated a strong emotional valence, such as conflict. The missing data problem is exacerbated when measurement frequency increases.

We aim to contribute to research on teams by exploring how team processes and states might manifest in individual mobility patterns. As a first step, we examine how individual differences in experienced conflict relates to the amount of time individuals spent on project-related activities and with their project groups over an 82-day period. These patterns were detected using Wi-Fi based indoor localisation system (Jayarajah et al., 2016) and group-detection system (Sen et al., 2014) deployed in our infrastructure. This is an unobtrusive method for detecting location in 5-minute intervals and could potentially be used as a real-time proxy of team processes, such as conflict states (De Church et al., 2013). Given the emotionality of conflict (Jehn & Mannix, 2001; Todorova, Bear, & Weingart, 2014) it is likely that this emotion will spillover into the time that people spend physically with other team members.

As a first step into exploring how mobility patterns relate to team processes and states, we conducted a semester-long field study at a university with student project teams. Our findings revealed differences in the mobility patterns of individuals who reported being affected by conflict in the teams, compared to those who did not. While our interviews helped to explain some of the differences in these patterns, other questions persist. These differences in mobility patterns provide preliminary support for the potential of using mobility patterns as real-time indicators of team processes and states.

METHOD

Sample and Procedure

Our sample consisted of 39 participants (Male = 19, Female = 20) between the ages of 19 and 25. These students represented part of 22 groups from seven classes. Participants were Sophomore Undergraduate Information Systems (IS) students enrolled in a 13-week core IS module on Software Engineering at a university in Asia. The course placed heavy emphasis on project management for software development. Throughout the 13-week course, students worked on a project to develop software system in pre-assigned teams. These teams comprised of five to six members each, balanced across gender, race and nationality, and academic performance.

This study was part of a broader study on detecting stress through the mobility patterns of students. As part of this broader study, participants also completed surveys measuring their stress levels and teamwork every three days. To identify conflict events, two semi-structured interviews were conducted. The first interview was conducted at the term break in Week 8 and the second interview was conducted at the end of term after project completion in Week 13. In these interviews, students were asked about critical events that occurred within the team and whether they were affected by conflicts in the team.

Participation in the study was completely voluntary. Participants were paid up to US$ 30 based on the number of surveys completed and interviews attended. Those who had completed at least 80% of the surveys were entitled to an additional prize draw of US$ 76.30. Participants received no other material gains or course credit directly from this study.

Location and Group Detection Data

We leveraged on an existing Wi-Fi indoor localisation system (Jayarajah et al., 2016) that obtains room-level location information whenever a device is connected to the campus Wi-Fi. Here, we only considered location data from mobile phones because mobile phones tend to be carried around, perpetuity, wherever we go. The location data is also used as input to the group detection system (Sen et al., 2014) to build group memberships based on devices that 'move together'. An important piece of our study is to characterise location and group detection data into campus-related behaviours. We use everyday knowledge of our student community to assign activity types to various locations on campus such as ‘study’, ‘seminar’, ‘eat’, ‘transition’ and ‘cca’. As an example, the campus concourse is typically an area of transition, but is also utilized after school hours for co-curricular activities (cca) like dance and kickboxing practices. A student who is detected to be at the concourse in the evening over long periods of time, will be recognised as having ‘cca’ instead of making ‘transition’ by the system. We processed approximately five-million location records and eight-million group records of all our participants over the semester. Based on this data, the following variables were measured:

Number of Software Engineering activities, (se_count), are events specific to Software Engineering like pair-programming and team meeting. These events could be held in group-study rooms, campus library, or any study area as reflected on their Software Engineering team schedule.

Time spent in small-sized group, (size_small_group), refers to the number of 5-minute intervals where at least two but no more than seven attendees are detected in the same location as the individual. As students were assigned to project teams of four to five members

and did not work on group projects, there was a high probability that attendees at these sessions were their project team members.

FINDINGS

Our goal in this study is to examine how individual differences in experienced conflict relates to their mobility patterns over an 82-day period, such as the amount of time spent on *Software Engineering* and the total amount of time in groups. To identify these patterns, participants were grouped into "affected" (n = 10) and "unaffected" (n = 29) by team conflict, based on their two interview reports. Values for se_count and size_small_group were averaged within these groups and plotted over time (Figure 1 and 2).

Finding 1: Experienced conflict and time spent on Software Engineering

We observed that students "affected" by conflict generally spent less time on Software Engineering activities than "unaffected" students. Between Day 1 to 10, Figure 1 indicates that affected students spent more time on project activities compared to unaffected students. Between Day 11 to 50, there was a general increase in project activities due to the release of project specifications. The largest peak corresponded to the beginning of recess week (Day 40 onwards), which also was a week before *demo* milestone[1]. Both affected and unaffected students ramped up the number of project activities they were involved in. However, unaffected students demonstrated a higher maximum of 9 activities in Day 45. By contrast, the number of activities for affected students seemed to have peaked at 8 activities in Day 40.

[1] Demo milestone required students to deliver a working prototype of their system

After the *demo* milestone, there was an overall decline in the number of activities for both affected and unaffected students. However, the dip in participation was much steeper for affected students, reaching a minimum of 2 activities in Day 82 compared to 6 activities for unaffected students as the final deliverable milestone approached.

INSERT FIGURE 1 HERE

Finding 2: Experienced conflict and group work on campus

Figure 2 shows that affected and unaffected students displayed a similar trend in time spent with their project teams. However, the amplitude of the trend differed. The maximum time spent in project teams was consistently lower for affected students than for unaffected students. Between Day 11 to 50, where contributions among members were expected to be the most (to meet the *demo* milestone), affected students spent approximately an hour less than others (affected: 25 counts of 5-minute interval; unaffected: 38 counts of 5-minute interval) on Day 35.

The same trend was observed as the *final deliverable* milestone approached in that both affected and unaffected students converged in their time spent with their teams on Day 82. Yet, unaffected students appeared to have continued working on Software Engineering independently, as shown in Figure 1.

INSERT FIGURE 2 HERE

We next report the interview data to gain deeper insights into these patterns. A common theme was that all the affected participants experienced unfairness in the allocation of work. Five participants reported feeling that they should have been more involved. They were aware that minimal tasks were assigned to them due to their lack of technical

competence. As one participant explained, “I was the weak coder, and always sought for advice from my team. They were never responsive and I got frustrated over their passiveness.” Another participant reported being left out because “A-coders[2] preferred to work in isolation” and “there was no coordination in our code”.

The remaining five participants who reported being affected by conflict perceived themselves as lead developers who resorted to working independently due to their distrust in their team members’ quality of work. According to one participant, “I ended up redoing their work all over again [because] they didn’t know how to resolve the bugs. [My team] always had a sense of assurance that I would fix things anyway.” Another participant explained, “I really didn’t appreciate their constant comment that I was the A-coder and [in] Dean’s list. They bought into the idea that they were the weak coders, so I just preferred to work alone.”

The interviews thus reveal that the conflict experienced by individuals led to isolating behaviors for different reasons. For “laggards”, their isolation from the team stemmed from not feeling like they were a valued member of the team. For the “stars”, their isolation from the team stemmed from not wanting to be held back by their less competent members.

CONCLUSION

Big data has been touted as an avenue for management researchers to explore new questions (George et al., 2016). In this paper, we presented our first steps toward the use of big data in asking new questions with respect to team phenomena. Specifically, over an 89-day period, we tracked 39 undergraduate students working in Software Engineering project

[2] A-coders refer to the lead developers

teams using Wi-Fi based indoor localisation data and group detection data to explore how the experience of conflict manifested in individual mobility patterns.

Our preliminary analysis of five-million location records and eight-million group record revealed that mobility patterns corresponded to differences in experienced conflict. Tracing individual's movements and participation in team activities over time revealed that compared to individuals unaffected by conflict, those affected by conflict consistently spent less time with their project teams and engaged in fewer team activities when completing project milestones. Although students were asked about their conflict experiences in Week 8, the mobility patterns reveal that affected individuals displayed their isolating behavior within the first week of the project team. This suggests that the conflict experienced occurred early on in the project and persisted throughout. Being able to see when this pattern manifested demonstrates the potential for mobility patterns to address the issue of measurement timing.

Our findings, while preliminary, thus supports the possibility that mobility patterns could be unobtrusive indicators of team states and processes. Future analysis of our dataset involves examining how mobility patterns correspond to other team phenomena such as group potency, team identification, team satisfaction and team performance. Such work will be a step towards unobtrusive, real-time indicators of team processes and states which leaders and team members can utilize for timely interventions to improve team performance.

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Figure 1. Average number of Software Engineering activities on campus over 82 days. Red (solid) line represents affected students, blue (dashed) line represents unaffected students.

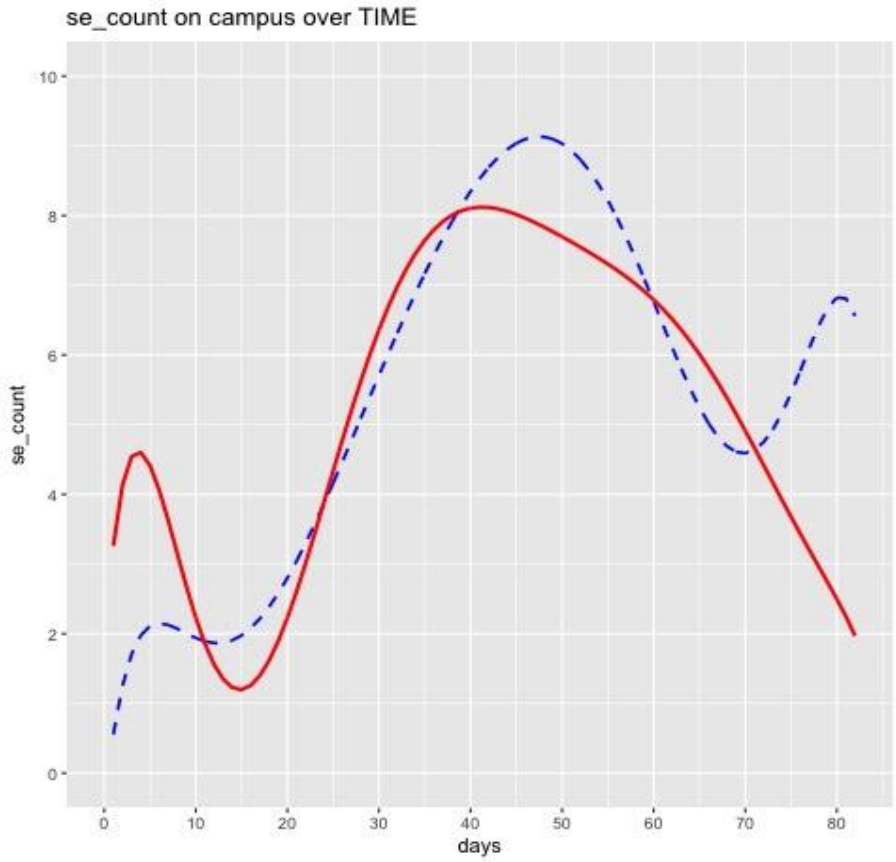

Figure 2. Average time spent in small-sized groups on campus, represented in five-minute intervals over 82 days. Red (solid) line represents affected students, blue (dashed) line represents unaffected students. team.