Temporal Patterns of Cohesiveness in Virtual Groups

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Abstract
Group cohesiveness is a vital social dynamic that is difficult to achieve in virtual teams, but leadership can help groups move past these challenges. We used the Language Style Matching metric to measure group cohesiveness over the course of interaction while groups with either assigned or emerging leaders worked via online chat to complete a collaborative task. We find that overall, successful groups are more cohesive than unsuccessful groups at all times. For groups with assigned leaders, we find this same pattern of cohesiveness. For groups with emerging leaders we find that successful groups and unsuccessful groups are similar in group cohesiveness during the first two-thirds of interaction, but during the final third successful groups are more cohesive than unsuccessful groups.

Keywords
Group cohesion, leadership, virtual groups, computer-mediated communication.

ACM Classification Keywords
H5.3. Information interfaces and presentation (e.g., HCI): Group and Organization Interfaces.

General Terms
Experimentation.

Introduction

Group cohesiveness is an important social dynamic in small groups, as members of high cohesive groups tend to be more satisfied with their group experience and make more of an effort to achieve group goals than members of low cohesive groups [6]. However, virtual teams who are not able to interact face-to-face often have a hard time developing into high cohesive groups [6]. As a result, leaders can be integral in the transition of a group from individuals to a cohesive work unit [4].

Furthermore, leaders can assume their role in different ways. Sometimes they are appointed through organizational structures, while on other occasions they emerge as group work progresses [3]. We expect that groups with assigned and emerging leaders will show different patterns when developing group cohesiveness because individual group members react differently to different types of leaders. For example, [7] found that when a higher status member was identified as such to the group, their higher status behavior was valued, but when a higher status member was introduced to the group as lower status, their higher status behavior was criticized. It follows that emerging leaders must be careful in asserting their leadership as to not draw negative reactions from group members. Understanding how virtual groups with these different types of leaders do or do not develop into cohesive units will help us better support virtual groups through technology.

Drawing on recent techniques for language analysis, this paper is a first step in exploring the temporal patterns of cohesiveness of virtual groups with both assigned and emerging leaders. We use the Language Style Matching (LSM) metric introduced by [2] as a measure for cohesiveness. This metric was developed as an algorithm to calculate verbal mimicry, but has been shown to predict group cohesiveness [2]. For this study, LSM is advantageous relative to commonly used cohesiveness scales because it can be calculated at any point throughout the group's communication without asking participants to complete a self-report measure.

Methods

We recruited 112 participants for a "Murder Mystery Study" (73 female, 39 male, ages 17-26, median age 20). After giving consent, participants were randomly assigned to a four-person group and given 30 minutes to complete the "Wilmore Homicide" task developed by [1] over online chat. The teams' task was to role-play a team of detectives and decide together which suspect to arrest for the Wilmore homicide. Each participant was encouraged to share information freely with their group because they all had different evidence.

Leadership Manipulation

Each group was assigned to one of two conditions. In the *assigned leader* condition, the whole group was told which member was to be the leader. In the *emerging leader* condition, one group member was told to take on the role of leader, but the rest of the group was not aware that they were the leader.

Measures

We measured both whether groups reached consensus on the collaborative task and whether they were successful and came to the correct solution. As mentioned above, we also used the LSM metric to measure group cohesiveness [2]. We calculated LSM scores from the chat logs according to [2] using LIWC [5] to calculate the nine separate dimensions of words that make up the overall group LSM score.

Table 1. Mean LSM scores for successful and unsuccessful groups at time segments one, two, and three.

Time	Successful	Unsucce-ssful	T-score	P-value
1	0.779 (SD=0.060)	0.764 (SD=0.064)	-0.640	0.528
2	0.781 (SD=0.044)	0.757 (SD=0.091)	-0.886	0.384
3	0.771 (SD=0.052)	0.715 (SD=0.115)	-1.681	0.105

Table 2. Mean LSM scores for groups with assigned and emerging leaders who are successful and unsuccessful at time segments one, two, and three.

Time	Success-ful	Unsucce-ssful	T-score	P-value
Assigned Leader Groups				
1	0.790 (SD=0.47)	0.745 (SD=0.079)	-1.294	0.220
2	0.760 (SD=0.036)	0.722 (SD=0.119)	-0.820	0.428
3	0.753 (SD=0.059)	0.669 (SD=0.151)	-1.371	0.196
Emerging Leader Groups				
1	0.769 (SD=0.073)	0.784 (SD=0.040)	0.473	0.645
2	0.802 (SD=0.043)	0.792 (SD=0.033)	-0.467	0.649
3	0.790 (SD=0.038)	0.761 (SD=0.024)	-1.685	0.118

Additionally, we divided each transcript into three equal segments based on number of turns taken, and calculated group LSM scores for these three segments, allowing us to analyze group cohesion over time.

Preliminary Findings

We first compared overall LSM scores of groups who did and did not reach consensus. LSM scores for groups who reached consensus were significantly higher than for those who did not (M=0.86, SD=0.02; M=0.82, SD=0.07; t=-2.48, $p<0.05$). We expect groups reaching consensus to be more cohesive than those who do not, suggesting that LSM corresponds to cohesion in our sample, replicating prior work [2].

Next, we compared LSM scores of successful and unsuccessful groups at time segments one, two, and three. There was no significant difference between LSM scores for successful and unsuccessful groups at time one (see Table 1), suggesting that both groups start at the same level of cohesiveness. At time two, the difference in LSM between successful and unsuccessful groups is still not statistically significant, but the mean LSM score increased for successful groups and decreased for unsuccessful groups from time segment one, resulting in a higher T-score when comparing means for time two than for time one (see Table 1). This shows a divergence of cohesiveness between successful and unsuccessful groups from time one to time two. At time three, LSM scores for successful and unsuccessful groups diverge further, and the difference between these groups approaches significance (see Table 1). Taken together, this shows that successful and unsuccessful groups begin with similar cohesiveness at time one, but as time goes on, successful groups become more cohesive and unsuccessful groups become less cohesive.

Finally, we examine whether temporal patterns of cohesiveness of successful and unsuccessful groups differ between assigned and emerging leader groups. First, we consider groups with assigned leaders. At time one, the difference in LSM between successful and unsuccessful groups is not significant, but it can be observed that the mean of LSM scores for successful groups is higher than that for unsuccessful groups (see Table 2). At time two and three, this difference remains not statistically significant, but still observable as both successful and unsuccessful groups decrease in LSM score over time (see Table 2). This suggests that successful groups with assigned leaders are slightly more cohesive during the first third of their interaction than unsuccessful groups, and both successful and unsuccessful groups become less cohesive as time goes on, but successful groups remain more cohesive than unsuccessful groups for all time segments.

We find a different pattern of cohesiveness for successful and unsuccessful groups with emerging leaders. There is not a statistically significant difference in LSM between successful and unsuccessful groups for times one and two (see Table 2). We can also see that these two groups are closer with respect to mean LSM than were successful and unsuccessful assigned leader groups, as the T-scores are much lower. At time two,

we also see that unsuccessful and successful emerging leader groups increase in LSM from time one, but the increase is much larger for successful groups. Time three is where successful and unsuccessful emerging leader groups differ, as successful groups only see a slight decrease in LSM score while unsuccessful groups see a larger decrease in LSM; at time three, the LSM scores for successful and unsuccessful emerging leader groups are marginally significant (see Table 2). This shows that for emerging leader groups, successful and unsuccessful groups have similar levels of cohesion for the first two-thirds of interaction, but in the final third successful groups are more cohesive than unsuccessful groups. Successful groups become more cohesive between time one and two, while unsuccessful groups decrease in cohesion between time two and three.

Conclusions and Future Work

This paper presents a preliminary analysis of temporal patterns of group cohesiveness when groups with different types of leaders complete a collaborative task over online chat. For groups with assigned leaders, we find that successful groups are more cohesive than unsuccessful groups from the beginning, but both groups become less cohesive over time. For groups with emerging leaders, successful groups show a marked increase in cohesiveness between the first and second thirds of interaction, while unsuccessful groups show a marked decrease in group cohesiveness between the second and third thirds of interaction, resulting in similar cohesiveness during times one and two, but different cohesiveness in time three.

In future work we will collect more data to address our sparse data limitation, and undertake a full statistical analysis of this data. Additionally, we plan to explore the development of group cohesion in groups where a leader is allowed to emerge completely naturally, as is usually done in prior work on emerging leadership. Finally, while LSM provides an overall view of the progression of group cohesion, we plan to hand-code the chat transcripts to deepen our understanding of how groups communicating over online chat develop.

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