

Emergent Leadership in Small Groups Using Computer-Mediated Communication

Ryoko Yamaguchi, Nathan Bos, Judy Olson

University of Michigan
{ryokoy, serp, jsolson} @umich.edu

ABSTRACT

When small groups meet online, the communication channel they use may affect the emergent leadership styles that individuals attempt. We studied 66 three-person groups playing a social dilemma game and communicating via one of four channels: face-to-face, videoconference, audio conference, or Internet chatroom. We found that the narrower the channel, the less likely groups were to use relationship-focused leadership styles. We also found that for mixed-gender groups, lower levels of relationship-focused leadership led to poorer group performance on the cooperation task. The more autocratic task-focused leadership style was not inhibited by communication channel. Additional results are also given linking gender composition to choice of leadership style. The statistical technique used in this research, Hierarchical Linear Modeling is particularly useful for studying group work, and so is explained in some detail.

Keywords Computer-mediated communications, CMC, emergent leadership, collaborative learning, small group work, trust, social dilemma

In the future, it may be common for virtual teams of learners to work together at a distance, and interact exclusively using computer-mediated communications (CMC). This will happen increasingly as distance education, commuter-friendly education, inter-school collaborations, and various other forms of e-learning are explored. Research on computer-supported collaborative learning has identified effective models for using CMC in conjunction with face-to-face classroom interaction (Koschmann, 1996; Hewitt, Scardamalia & Bereiter, 1997). However, new challenges may arise when groups rely on CMC for all communications.

Small groups are very often asked to take on ambiguous tasks without any pre-assigned roles, with often no designated group leader. This is true in both educational and workplace settings (Hackman, 1987). These groups are more effective when leadership functions are performed by one or more members-- that is, when they experience emergent leadership (Morris & Hackman, 1969; Borg, 1957; Bormann, 1990).

Emergent leadership can take several forms. For example, a single dominant individual can emerge to take over the group process. Or, groups can take on a more democratic character, with equitable contribution of ideas and consensus-building processes. Leadership is accomplished in either of these cases, but the styles are quite different. One often-used way of characterizing emergent leadership styles is to contrast 'task-focused' and 'relationship-focused' leadership (Fiedler, 1967; Stodgill and Coons, 1957). Briefly, task-focused leadership refers to focusing exclusively on the task at hand, while relationship-related leadership refers to improving group cohesion. Task-focused leadership is often associated with dominance behavior, such as initiating structure, while relationship-focused leadership is associated with affiliative behavior, such as democratic decision-making (Fiedler, 1967).

Previous research shows that students, even at a young age, may prefer a relationship-focused leadership style. French and Stright (1991) studied fourth and sixth graders engaging in a group picture-rating task. Although one might expect such young students to confuse dominance with leadership, in fact, the behaviors most associated with peer- and teacher-reported leadership were soliciting opinions from others, facilitating the task, and recording outcomes. Level of participation was only weakly correlated with leadership, showing that even young students can distinguish between what we would call task-focused leadership (dominance) and relationship-focused leadership.

The two types of leadership are highly gendered (Eagly & Karau, 1991; Karau & Eagly, 1999; Kolb, 1999). Males tend to emerge as task-focused leaders, while women tend more toward relationship-focused leadership (Eagly & Karau, 1991; Karau & Eagly, 1999). To complicate matters, researchers have found that it may not gender per se, but gender group composition that influences emergent leadership. Specifically, male-majority groups show more task-focused behaviors while female-majority groups show more social and communal behaviors (Berdahl, 1996, 1998).

Regardless of the style, some form of emergent leadership may be necessary for small group effectiveness (Borg, 1957; Hardy, 1971, 1972, 1976; Pryer, Flint, & Bass, 1962). One foundational study by Borg (1957) found that teams of Air Force officer candidates, working on situational problems such as escaping from a simulated prison compound, performed better when a leader emerge. Similarly, Bormann (1990) found that the emergence of leadership improved undergraduate discussion groups.

In online settings, there may be an even greater need for emergent leadership. Jarvenpaa's 1998 study of international project teams documents both difficulties and success stories, and leadership functions were strongly associated with

success. In this study, 29 teams of 4-6 undergraduates were grouped together in such a way that no two students were from the same country. They were assigned to complete an online research project using only email and some chat sessions for group coordination. Based on case studies of high and low-performing groups, Jarvenpaa identified leadership as an important characteristic of the successful groups. These leaders were sometimes single members and sometimes multiple members, but they tended to share these characteristics: leaders took initiative early on in the task, leaders maintained a positive outlook, and group members could count on receiving timely and predictable responses to communications from group leaders. The less-successful groups, in contrast, had no leadership or negative (complaining) leadership, lack of individual initiative, and unpredictable communications between members. Email records from these less-successful efforts portray directionless groups where email questions go unanswered, important process questions are never addressed, and other leadership functions are unfulfilled.

Given the considerable challenges associated with managing group work online, research is needed on how emergent leadership functions tend to occur in different telecommunications conditions. Beyond purely descriptive work, research is needed on what management strategies or teaching interventions are likely to be effective in virtual teams. The study reported here compares emergent leadership in four communication conditions, differentiates between relationship-focused and task-focused leadership styles, and identifies characteristics that may lead to success in these new settings.

RESEARCH QUESTIONS

Our data supports examination of these three questions:

Research Question 1: How do communication media influence emergent leadership?

Research Question 2: How does group gender composition influence emergent leadership?

Research Questions 3: How does emergent leadership influence cooperation in group work?

METHODS

Experimental task

Sixty-six groups of three volunteers played an online social dilemma game called 'Daytrader'. These groups were allowed to discuss the ongoing game periodically using one of four communication conditions: face-to-face meeting, a high-quality videoconference, a standard phone conference, and an Internet chatroom.

The Daytrader game is a social dilemma devised for this research, adapted from previous research by Rocco (1998). Social dilemmas are useful for studying cooperation and trust-building in groups. In Daytrader, participants must decide every round how to divide a 30 token investment between individual and group investment. Giving to the group investment pays a higher overall rate (3x), but entails some risk, because it is dependent on the actions of others. The proceeds of the group investment are divided equally among participants, so that individuals who contribute to the group risk being exploited by those who contribute little or nothing. The alternative to investing with the group is investing as an individual, which pays a guaranteed lower rate (2x) that is not dependent on others. Maximum cooperation (and maximum payoff) are achieved when all three participants contribute all of their funds to the group. Groups differ on whether, and how quickly they are able to reach the maximum cooperation level. The differences in group payoff are therefore a good measure of cooperation, and correlate highly with post-test measures of trust in group members.

As reported in a previous paper (Bos, Gergle, Olson, & Olson, 2001), the communication media does affect groups' cooperation and self-reported trust. Face-to-face groups were the most cooperative, followed by video, audio, and text chat. The three technology mediated conditions all showed slower-developing trust and more frequent opportunistic betrayals among group members.

As part of the experimental post-test, participants reported on their own emergent leadership behavior during group discussions. This data provides a context for studying how emergent leadership arises across the four communications conditions, and examining whether leadership style had an effect on group performance.

Participants

Participants were 197 people recruited through a paid subject list at a large university in the Midwest. There were 49% female participants and the mean age was 23.

Group Gender Composition

Participants were randomly assigned to the following gender group composition: female only (11%), majority female (39%), male only (15%), and majority male (35%).

Group Condition

Groups were randomly assigned to one of the following communication mediums: face-to-face (24%), video conferencing (26%), audio conferencing (26%), and chat (24%).

Measures

The leadership scales, task and relationship-focused leadership, were adapted from Stogdill's Leadership Behavior Descriptor Questionnaire (Stogdill, 1948, 1969; Stogdill & Coons, 1957). One scale measured task-focused leadership (5-item scale, $\alpha=.84$) with items such as "I took charge of what the group should do during the game" and "I gave directions to the other players on how we should play the game." Relationship-focused leadership items focused on individuals' actions promoting group cohesion (4-item scale, $\alpha=.87$) with items including "In the discussions I suggested how we could all work together" and "I made sure that everyone in my group was listening to one another." These items measured subjects' self-perceptions of leadership behaviors. Self-perceptions are used because they best measure the intentions of the actors, rather than observable behaviors or external impressions. Future analysis of this data will examine the degree to which these intentions resulted in observable leadership behaviors.

Cooperation is measured by looking at the total group payoff in the Daytrader game, after discarding the first five rounds before any communication occurred. The more quickly and consistently groups cooperated in the game, the higher the total group payoffs. This measure was used in other research on this data, and correlates highly with self-reports of trust within the group.

Analysis

Because the data for this study has multiple levels (student and group level), hierarchical linear modeling (HLM) is used to answer how emergent leadership is associated with communication media, gender group composition, and cooperation. HLM is a statistical (maximum likelihood) procedure that was developed by Bryk and Raudenbush (1992) to address the unit of analysis problem in multi-level analysis. HLM is a series of regression-like equations that takes into account the interdependence, or nestedness, of the data (Bryk & Raudenbush, 1992; Pollack, 1998).

HLM is a good statistical technique for analyzing small group data because this data is 'nested'—that is, data from individual participants cannot be considered independent of all others, but rather are partly dependent on their small groups. One other way that such group data is sometimes handled is by using only group averages, but this discards much useful information. HLM makes it possible to analyze all the data at hand.

RESULTS

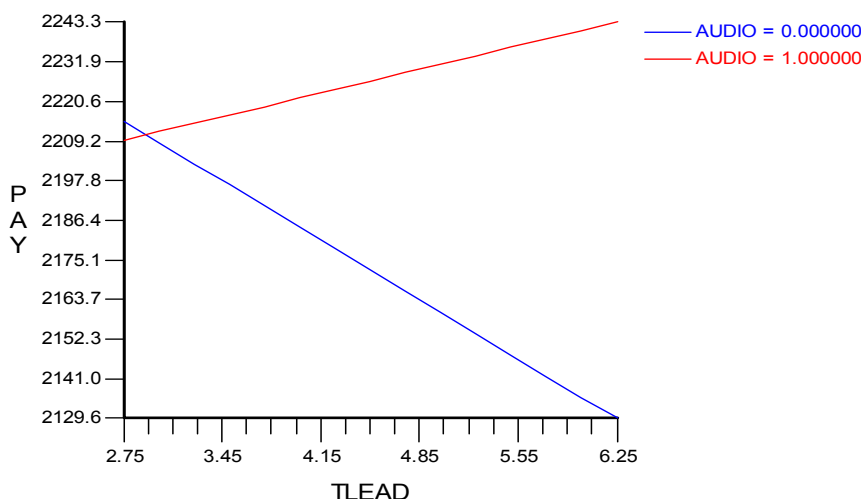
Task-focused Leadership

There were no significant differences in task-focused leadership across the communication mediums. In gender group composition, female-only groups had lower levels of task-focused leadership, as compared to male-only groups ($\beta = -0.696$, $t = -3.713$, $p < .001$).

Effects of Task-focused Leadership on Cooperation

While task-focused leadership was not directly related to cooperation, it improved cooperation in certain communication mediums. Specifically, in the audio condition, task-focused leadership positively influenced cooperation ($\beta = 34.015$, $t = 2.058$, $p < .05$) (See Figure 1).

Figure 1: Task-Focused Leadership in the Audio Condition



Relationship-focused Leadership

There were significant differences in relationship-focused leadership across communication media and gender group composition. In communication mediums, the chat condition had the lowest levels of relationship-focused leadership ($\beta =$

0.530, $t = -2.715$, $p < .01$). The β value for relationship-focused leadership was $-.453$ ($t = -2.567$, $p < .05$) in the audio condition, and $-.344$ ($t = -1.924$, $p < .10$) in the video condition. Hence, perceptions of relationship-focused leadership became progressively lower as the communication medium went from fuller to narrower.

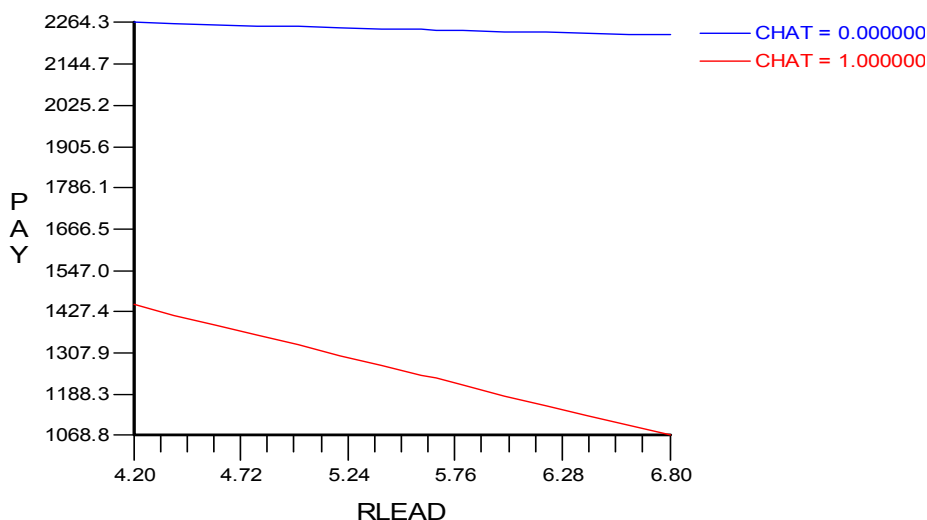
In group gender composition, female-majority groups had lower relationship-focused leadership ($\beta = -.42$, $t = -2.10$, $p < .05$), and were even lower in female-only groups ($\beta = -.51$, $t = -1.91$, $p < .10$).

Effects of Relationship-focused Leadership on Cooperation

While relationship-focused leadership was not directly related to cooperation, it had significant effects in cooperation depending on the gender group composition and the communication medium. Specifically, in female-majority groups, relationship-focused leadership was positively related to cooperation ($\beta = .91548$, $t = 2.733$, $p < .05$). In male-majority groups, relationship-focused leadership was also positively related to cooperation ($\beta = .67514$, $t = 1.784$, $p < .10$).

In the communication medium, relationship-focused leadership negatively influenced cooperation in the chat condition ($\beta = -.131909$, $t = -3.152$, $p < .01$) (See Figure 2).

Figure 2: Relationship-focused Leadership in the Chat Condition as compared to other conditions



DISCUSSION

How does communication medium influence emergent leadership?

Task-focused leadership did not change much across the different communications conditions. Apparently, narrowed communication channels did not hinder this kind of emergent leadership. Relationship-focused leadership was affected by media, however. Levels of relationship-focused leadership were progressively lower as the communication channel narrowed from face-to-face to video, to audio, and to on-line chat. As was previously found with trust, (Bos, et. al. 2001), it seems that this leadership style is inhibited by mediated channels. Why might this be? It could be that participants attempted relationship-focused strategies but found them to be less effective in mediated conditions, and therefore abandoned them early in the task. Or, it could be that because of the feeling of social distance afforded by this technology (Siegel, Dubrovsky, Kiesler, and McGuire, 1986) participants did not even attempt to build up a sense of group cohesion. In either case, this presents an interesting challenge for computer-supported group work settings where instructors would like to foster relationship focused leadership skills.

How does group gender composition influence emergent leadership?

Female-only groups had lower levels of both task-focused and relationship-focused leadership, and female-majority groups also had lower levels of relationship-focused leadership. The first part of this finding (lower task-focused leadership) is consistent with past research on gender differences in emergent leadership. Female-majority groups usually report less task-focused leadership than male-majority groups (Karau & Eagly, 1999; Kolb, 1999). But the second part of this finding, that female-majority and all-female groups showed lower relationship-focused leadership, is unexpected and harder to interpret within our theoretical framework. Female-majority groups did not have lower overall cooperation levels, so if there was less leadership it did greatly inhibit overall team performance. Perhaps the combination of a distancing media and a competitive task dissuaded female-majority groups from using what would have been their preferred leadership styles.

This finding is especially interesting in light of research which shows that female students are less inhibited in computer-mediated conversations and participate on a more equal footing males (Hsi & Hoadley, 1997). Could it be that the same technology which encourages individual female students to speak up also tends to inhibit female-majority groups from forming strong group relationships?

There is one other possible interpretation. Perhaps women only rated their relationship-focused strategies as lower because the measures used were self-reports, and women have a tendency to under-rate themselves in leadership (Owen, 1986). Analyses of the conversation transcripts currently underway should help decide which of the above interpretations is more accurate.

How does emergent leadership influence cooperation in group work?

Was emergent leadership necessary for effective small group interaction in these experiments? In the Daytrader game, there were no overall effects on cooperation success from either leadership style. But there were some interactions with media and gender composition, indicating that emergent leadership did affect success for some types of small groups.

Relationship-focused leadership seemed to benefit both sets of the mixed-gender groups, female-majority and male majority, but failed to have significant impact in the female-only or male-only groups. This could mean that when groups are mixed-gender, there is a greater need for these groups to create and maintain positive group relationships, and greater harm to cooperation if there is no relationship-focused leadership.

Looking at communication conditions, we found that relationship-focused leadership seemed to harm the performance in one media channel, the chat condition. We had already reported that chat led to less relationship-focused leadership; this new finding goes even further, saying that when relationship-focused strategies were attempted in chat they actually backfired, resulting in slightly worse cooperation. There is one alternate explanation, which is that relationship-focused strategies were only attempted after other attempts to cooperate had already failed, and thus were only used when group cooperation was already well below average. Obviously the implications of these two interpretations are very different—one argues that relationship-focused leadership should not even be attempted via text chat, while the other is not prescriptive. The first interpretation seems less consistent with other research, which has found relationship-focused leadership to be beneficial or, at worst, a neutral influence. It is also inconsistent with previous research on chat (Zheng, Bos, Olson and Olson, 2001) which shows that trust can be built via chat communication. The issue of when chat groups attempted relationship-building (before or after cooperation had gone sour) may be settled by further discourse analysis of the current data.

As for task-focused leadership, it was significantly related to cooperation only in the audio condition. Specifically, task-focused leadership improved cooperation in the audio condition. This may indicate that because audio conferencing involves real-time interactions without visual cues, task-focused leadership is critical to the success of these groups.

CONCLUSION

The most important finding of this research is that narrower computer-mediated channels seem to inhibit relationship-focused leadership. Since these authors, and we suspect most educators, prefer relationship-focused leadership as a desirable strategy for learning groups, this finding presents a pedagogical challenge. We do not, however, consider that this challenge is insurmountable. There are many interventions we can imagine that might help virtual teams develop relationship-focused self-management techniques, including team-building exercises, direct instruction on effective leadership. It may also be a good idea for newly-formed groups to get to know each other use a richer communication channels such as videoconferencing for the purpose of relationship-building. Even chatrooms might be useful for this if meeting time is explicitly set aside for socialization. Pre-task chatroom meetings were found to improve trust in Zheng, et al. 2001. Perhaps there are similar, relatively simple interventions that can overcome the leadership-style tendencies described in this paper. Future research should focus both on clarifying why communication channels may affect emergent leadership, and also help identify effective strategies for promoting positive leadership.

ACKNOWLEDGMENTS

This research was funded by National Science Foundation grant IIS 9977923 to Judy and Gary Olson

REFERENCES

- Berdahl, J. L. (1996). Gender and leadership in work groups: Six alternative models. *Leadership Quarterly: Special Issue: Leadership and diversity: I.*, 7(1), 21-40.
- Berdahl, J. L. (1998). The dynamics of composition and socialization in small groups: Insights gained from developing a computational model. *Composition: Research on managing groups and teams*, 1, 209-227.
- Borg, W. R. (1957). The behavior of emergent and designated leaders in situational tasks. *Sociometry*, 20(2), 95-104.
- Bormann, E. G. (1990). *Small Group Communication: Theory and Practice* (Third ed.). New York: Harper and Row.

- Bos, N.D., Gergle, D., Olson, J.S., & Olson, G.M. (2001) Trust without touch: video is (almost) as good as being there. Proceedings of CHI 2001. New York: ACM. [on-line] http://intel.si.umich.edu/crew/technical_reports.htm
- Bryk, A. S., & Raudenbush, S. W. (1992). Hierarchical Linear Models: Applications and Data Analysis Methods. Newbury Park: Sage Publications.
- Eagly, A. H., & Karau, S. J. (1991). Gender and the emergence of leaders: A meta-analysis. *Journal of Personality and Social Psychology*, 60(5), 685-710.
- Fiedler, F. E. (1967). *A Theory of Leadership Effectiveness*. New York: McGraw-Hill.
- French, D. C., & Stright, A. L. (1991). Emergent leadership in children's small groups. *Small Group Research*, 22(2), 187-199.
- Hackman, J.R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of Organizational Behavior* (pp. 315-341). Englewood Cliffs, NJ: Prentice-Hall).
- Hardy, R. C. (1971). Effect of leadership style on the performance of small classroom groups: A test of the contingency model. *Journal of Personality and Social Psychology*, 19(3), 367-374.
- Hardy, R. C. (1972). A developmental study of relationships between birth order and leadership style for two distinctly different American groups. *Journal of Social Psychology*, 87(1), 147-148.
- Hardy, R. C. (1976). A test of the poor leader-member relation cells of the contingency model on elementary school children. *Child Development*, 46(4), 958-964.
- Hewitt, J. (1997). Beyond threaded discourse. Paper presented at *WebNet 97*. [on-line] <http://csile.oise.ca.edu>
- Hsi, S. & Hoadley, C. (1997). Productive discussion in science: gender equity through electronic discourse. *Journal of Science Education and Technology* 6 (1), 23-36.
- Jarvenpaa, S.L., Leidner, D.E. (1998). Communication and trust in global virtual teams. *Journal of Computer-Mediated Communications* 3 (4). [on-line] <http://www.ascusc.org/jcmc/vol3/issue4/jarvenpaa.html>
- Karau, S. J., & Eagly, A. H. (1999). Invited Reaction: Gender, social roles, and the emergence of leaders. *Human Resource Development Quarterly*, 10(4), 321-327.
- Kolb, J. A. (1992). Leadership of creative teams. *Journal of Creative Behavior*, 26(1), 1-9.
- Kolb, J. A. (1999). The effect of gender role, attitude toward leadership and self-confidence on leader emergence: Implications for leadership development. *Human Resource Development Quarterly*, 10(4), 305-320.
- Koschmann, T (1996) *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Erlbaum.
- Morris, C. G., & Hackman, J. R. (1969). Behavioral Correlates of Perceived Leadership. *Journal of Personality and Social Psychology*, 13(4), 350-361.
- Owen, W. F. (1986). Rhetorical themes of emergent female leaders. *Small Group Behavior*, 17(4), 375-486.
- Pollack, B. N. (1998). Hierarchical linear modeling and the "unit of analysis" problem: A solution for analyzing responses of intact group members. *Group Dynamics: Theory, Research, and Practice*, 2(4), 299-312.
- Pryer, M. W., Flint, A. W., & Bass, B. M. (1962). Group effectiveness and consistency of leadership. *Sociometry*, 25(4), 391-397.
- Rocco, E. Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact, *Conference proceedings on human factors in computing systems*, 1998, pp496-502.
- Rothaus, P., Davis, R. T., & Banker, C. A. (1969). Participants in adolescent autonomous groups. *Journal of Genetic Psychology*, 114(1), 135-142.
- Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. (1986). Group processes in computer-mediated communication. *Organizational behavior and human decision processes* 37, 157-187.
- Stogdill, R. M. (1948). Personal factors associated with leadership: A survey of the literature. *Journal of Psychology*, 25, 35-71.
- Stogdill, R. M., & Coons, A. E. (Eds.). (1957). *Leader Behavior: Its Description and Measurement*. Columbus, OH: Ohio State University, Bureau of Business Research.
- Stogdill, R. M. (1969). Validity of leader behavior descriptions. *Personnel Psychology*, 22(2), 153-158.
- Webb, N. M., Nemer, K. M., Chizhik, A. W., & Sugrue, B. (1998). Equity issues in collaborative group assessment: Group composition and performance. *American Educational Research Journal*, 35(4), 607-651.