
Supporting Intercultural Collaboration with Dynamic Feedback Systems: Preliminary Evidence from a Creative Design Task

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Abstract

Intercultural collaboration is often hampered by the manner in which teams communicate, or fail to communicate, their ideas, concerns, and feelings. Computer-mediated communication and the virtual nature of collaboration tend to exacerbate such communication issues into problems of conversation dominance, misattribution, and group conflict. New communication tools have the potential to mitigate some of these problems by augmenting individuals' and team's awareness of their communication inputs and processes. We explore how such feedback affects the communication content, attention distribution, and affective states of Chinese and American collaborators engaged in a creative design task. We describe our tool, present preliminary findings from an ongoing lab experiment, and discuss next steps in our research regarding ways of detecting the impact of real-time conversation feedback in intercultural collaboration environments.

Keywords

Distributed work, feedback mechanisms, cross-cultural communication, computer-mediated communication

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H.5.3 Information Interfaces and Presentation: Group and Organization Interfaces – CSCW.

Introduction

Distributed intercultural collaboration is characterized by persistent challenges that are traceable to the group processes such as different communication styles, difficulty establishing common ground, and divergent interpretations of others' language and intentions [1]. Conversation feedback systems provide real-time dynamic feedback on a team's conversation inputs, such as numbers and types of utterances, with the goal of motivating participation in conversation, and, indirectly, improving team functioning ([6], [2]). However, providing feedback to team members on their use of language could have differing effects depending on their culture.

We explore the potential of providing linguistic feedback to augment virtual intercultural collaboration using an adaptation of GroupMeter. Linguistic feedback is a visualization of a team's conversation content that is generated automatically based on each team member's words and phrases that they use to communicate with others during their teamwork; it is updated dynamically as the team's conversation unfolds during the task, and is displayed visually to all team members (figure below). Originally designed to display conversation feedback for pre-specified linguistic categories, such as emotional vs. task-related words [6], GroupMeter's usability has been tested with American participants in decision-making tasks. However, its appropriateness for intercultural settings and its support for distributed creativity have not been tested yet [6]. Our adaptation of GroupMeter included feedback categories that are

appropriate for distributed creative tasks (such as affect and expression of preferences), and examined Chinese and American participants' cognitive and affective reactions, and changes in their communication content, when such feedback was available to them. In the following sections we discuss our ongoing research and the system design.

Hypotheses*Attention to Conversation*

While conversation feedback can provide useful information to teams and their members, it is an additional stimulus that takes up cognitive resources, and can detract individuals' attention away from the task at hand. Even though the display can be placed in the periphery of a workspace, whether and how much attention individuals pay to it depends in part on mental habits of attention distribution.

The extent to which people tend to focus on central vs. peripheral stimuli, and the direction of their gaze when observing visually ambiguous items, differ depending on the cultural influences they have had while learning how to observe and interpret the world around them [7]. People with an East-Asian background are accustomed to distributing their attention to stimuli both in the center and periphery of a scene, whereas individuals that have been socialized in Western cultures tend to pay less attention to peripheral stimuli.

In order to interfere as little as possible with the main task environment, we chose to present conversation feedback as a peripheral display. We expect that this feedback display would motivate people to pay more attention to the conversation, by drawing their attention to conversational dynamics they might otherwise

not notice. We further expect this effect to be greater for Chinese participants because they are socialized to be more attuned to peripheral information.

H1a: Both American and Chinese participants will pay more attention to the conversation when feedback is displayed vs. when no feedback is displayed.

H1b: Chinese participants will pay more attention to the conversation than Americans when provided with feedback.

Ideas & Preferences Communication

Group creativity depends to a large extent on consideration of diverse information, ideas, and other inputs that group members contribute [3]. People who have been socialized in East-Asian cultures tend to value reflective listening and thinking-in-silence during group tasks rather than thinking-aloud [4]. Expression of opinions and ideas tends to be secondary to reflective listening. This often results in Chinese participants speaking less in group conversations, with members of Western cultures dominating the conversation. The ideas of Chinese members or those that are less outspoken may thus be overlooked or ignored.

Feedback about preference expression can mitigate this problem by making both kinds of participants, those who talk a lot and those who talk less, aware of their expressed views. Those dominating the conversation will be motivated to reduce their talking, indirectly opening the conversational floor for less talkative members to express their preferences (e.g., "what do you think?"). Alternatively, the less talkative people may directly decide to talk more.

We expected that Chinese participants would tend to talk overall less than Americans. Further, when provided with feedback about preference expression, we expected that those who talk more, regardless of their culture, would be motivated to express their preferences less, whereas those talking less would be motivated to express their preferences more (e.g., "I like this option better").

H2: Without feedback, Chinese participants will talk less than American participants.

H3a: Participants who are shown that they express their preferences more than their partner will reduce their expressions of preferences.

H3b: Participants who are shown that they express their preferences less than their partner will increase their expressions of preferences.

Affective Communication

Because the nature of the task is cooperative and interdependent, we expected both American and Chinese participants to be motivated to maintain an overall positive teamwork climate, using phrases that carry positive valence such as, "this [design option] is really nice," "wow, this is great," and "good job". Feedback about positively-valenced expressions can further support this process. When provided with feedback about expression of positive words, we expected that those using fewer positive words would increase them in an attempt to maintain a prosocial climate [3].

H4: Participants who are shown that their positive-affect words are fewer than those of their partners will increase their use of positive words in the discussion.

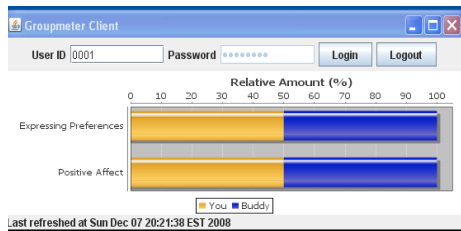


Figure 1. GroupMeter's Feedback Display. Participants use AOL Instant Messenger (AIM) to chat with a bot, which records and forwards the messages to their partner. The client polls the stored chat messages from a database every minute and counts the number of words in the past 5 minutes that satisfy LWIC dictionary categories for Positive Affect, and Expression of Preferences [8]. The feedback bars are updated at regular 1 minute intervals.

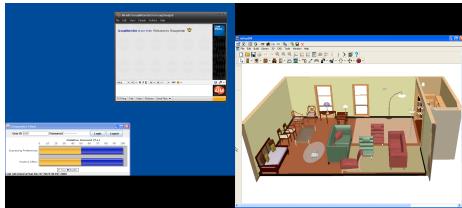


Figure 2: Workspace with GroupMeter on the bottom left.

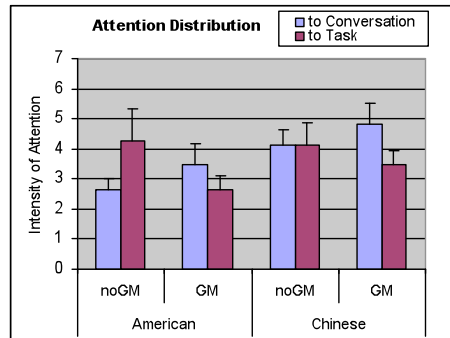


Figure 3. Attention effects.

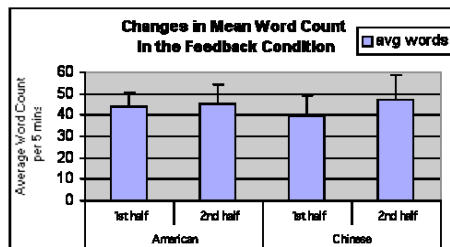


Figure 4. Amount of talk.

Research Platform

We developed a client-server system based on an early version of GroupMeter [6]. Our main design goal was to display feedback in a way that creates a pro-social context supportive of group creativity with an unobtrusive peripheral interface. The literature on group psychology suggests that groups are more creative when all members have opportunities to express their views, when they feel comfortable doing so, and when they experience positive emotions [3]. We translated those ideas into design specifications by displaying feedback about (a) how much each person is expressing their preferences in task-related group decisions, and (b) the extent to which each person's conversation includes positive affect words (Figure 1).

For each feedback dimension, the display shows the relative proportion about oneself vs. one's partner. That is, participants see how much of the preference expression and positive affect feedback was theirs vs. their partner's on a 100% scale. The purpose of this design was to prompt participants to consider their conversation inputs in relation their partners' inputs.

Method

Participants were American and Chinese students (raised in China or Taiwan; competent in English) in a US university. Our pilot results include 8 participants. Participants were randomly assigned to a partner of similar or different cultural background, forming three dyad configurations: American-American (AA), American-Chinese (AC), Chinese-Chinese (CC).

Each dyad completed two creative design tasks using a commercially available interior design software package and communicating over Instant Messaging (IM). The

tasks involved designing a living room and a dining room in a house using room templates. Participants could manipulate, add, or delete furniture. Participants received 10 minutes of training on the software prior to the first task. Participants used dual-monitor desktops, with a shared view of the rooms, and shared control of the mouse and the room templates so that they both could manipulate furniture and visualize the rooms.

During one task, participants received feedback via GroupMeter (FB); during the other task no feedback was displayed (noFB). When present, GroupMeter was placed peripherally (Figure 2). Tasks and FB conditions were counterbalanced across pairs.

Participants were seated in workspaces separated by a large barrier that prevented them from seeing one another and were instructed to communicate only through IM. Each design task lasted 30 mins. At the end of each task, participants filled out questionnaires with items about their cognitive and affective reactions.

Results and Discussion

We present our preliminary results from the pilot study. Ongoing analysis of the extended study is underway.

Attention to Conversation (H1): In the noFB condition, Americans paid more attention to the task, whereas Chinese paid equal attention to task and to conversation. However, attention to the task decreased in the FB condition, more so for Americans than for the Chinese. Both Chinese and Americans paid more attention to their conversation in the FB condition, the Chinese more so than the Americans (Figure 3).

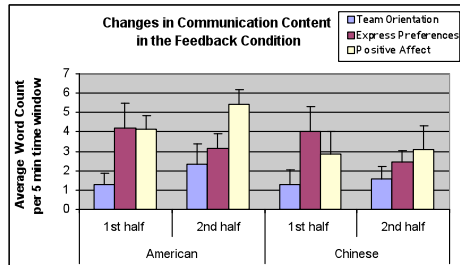


Figure 5. Preferences expressions, affective words and team orientation

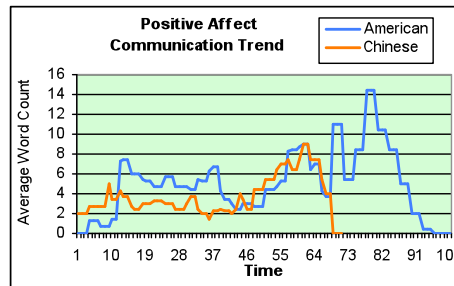
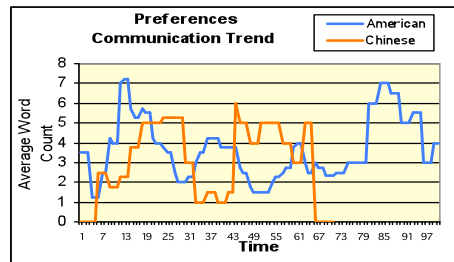


Figure 6: Changes in expressions of preferences and affect over time

Amount of Participation (H2): Overall, Chinese and American participants contributed to a similar extent to the conversation. Chinese participants talked slightly less in the first half of the FB-session but increased the overall amount of their talk slightly more so than did American participants (Figure 4).

Expression of Preferences (H3): Contrary to our hypothesis, participants seemed to decrease their expression of preferences in the second half of the FB session (figures 5 and 6). That might be because of the nature of the task: expressing preferences about what the design should look like and what items should be included could reasonably have happened early in the session, with the second half of the session being devoted to the actual designing of the room. Another possibility is that participants felt less comfortable expressing their preferences over time because of the public aspect of the feedback display (both partners could observe each other’s feedback).

Affective Communication (H4): Consistent with our expectations, participants’ affective state became increasingly positive over the course of the feedback session (Figures 5 and 6). Chinese participants started with lower levels of positive affect words, but increased them in the second half of the session. American participants started with slightly higher positive affect words and increased them in the second half of that session.

Positive affect communication seems to function in a positive loop manner, with positive communication eliciting more positive communication, however the underlying psychological mechanisms might differ. Especially with the 100% scale of the feedback meters, those who

use more positive words may continue or increase their use in a concern to maintain their own positive state stable and not show a decline from an already high positive state. Those who initially use fewer positive affect words might be motivated to improve their communication out of concern for maintaining group harmony or out of a desire to mimic their partner’s positive affect as a worthwhile goal. One of our next steps following from this observation will be to disentangle those possible mechanisms through questionnaire data and analysis of IM conversations.

We also assessed participants’ affect through self-reports using the PANAS scale [9]. Both American and Chinese participants reported overall positive affect in both conditions. Americans reported slightly higher positive affect than the Chinese, similar to what we observed in the conversational data analysis – that Americans increased their use of positive affect words during the FB condition compared to Chinese.

We also examined how many socially inclusive words and phrases participants used (“we” pronouns to refer to group ideas and resources, and references to the team [8]). Being aware of how inclusive/exclusive one’s language is can help one adjust the way they talk and thus build a climate of psychological safety which has been shown to promote expression of ideas and group creativity [3]. Differences between American and Chinese participants seemed to emerge (“Team Orientation” bar in Figure 5).

Next Steps

Extensive data collection on the study reported here is underway. In addition, we plan to include a third feedback category, “team orientation”, which seemed to

differ for Chinese and American participants in the conversation analysis discussed above.

Culturally Appropriate Feedback

GroupMeter's current design displays feedback on each member's conversation inputs to everybody in the group. This public mode of feedback might be inhibitive for individuals who prefer private modes of feedback. We plan to modify GroupMeter's visualization to examine how users from different cultures respond to feedback in private vs. public mode.

Advanced Communication Interventions

In the long run, empirical data from this study can be used to develop an inductive model of real-time conversational interventions to improve teamwork. Using this model, we plan to augment GroupMeter with a machine learning tool that detects communication issues (such as series of questions by a member that remain unaddressed, domination of conversation or long silences) and prompts participants to repair them (e.g., answer a question, request inputs from silent members).

Acknowledgments

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References

[1] Cramton, C.D. & Hinds, P.J. (2005). Subgroup dynamics in internationally distributed teams: Ethnocen-

trism or cross-national learning? *Research in Organizational Behavior*, 26, 231-263.

[2] DiMicco, J.M., Pandolfo, A., & Bender, W. (2004). Influencing group participation with a shared display. *Proc CSCW'04*. Chicago, IL, 614-623.

[3] Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44, 350-383.

[4] Kim, H.S. (2002). We talk, therefore we think? A cultural analysis of the effect of talking on thinking. *Journal of Personality and Social Psychology*, 83(4), 828-842.

[5] Losada M., Sánchez, P., Noble, E.E. (1990). Collaborative technology and group process feedback: Their impact on interactive sequences in meetings. *Proc. CSCW'90*, Los Angeles, CA. 53-64.

[6] Leshed, G., Perez, D., Hancock, J.H., Cosley, D., Birnholtz, J., Lee, S., McLeod, P.L., & Gay, G. (2009). Visualizing real-time language-based feedback on teamwork behavior in computer-mediated groups. To appear in *Proceedings of CHI'09*.

[7] Masuda, T., Gonzalez, R., Kwan, L., & Nisbett, R.E. (2008). Culture and esthetic preference: Comparing the attention to context of East Asians and European Americans. *Personality and Social Psychology Bulletin*, 34, 1260-1275.

[8] Pennebaker, J.W, Francis, M.E., & Booth, R.J. (2001). *Linguistic Inquiry and Word Count LIWC 2001*. Erlbaum.

[9] Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scale. *Journal of Personality and Social Psychology*, 54, 1063-1070