At a Different Tempo: What Goes Wrong in Online Cross-Cultural Group Chat?

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ABSTRACT
Cross-cultural communication has become increasingly prevalent in organizations and education systems. Such communication often takes place in a distributed fashion, and many studies have examined the impact of computer-mediated communication (CMC) on distributed cross-cultural groups. For example the literature points to cultural factors that could cause communication failures, such as individualism vs. collectivism, high context vs. low context, and power distance. We contend that language proficiency, a basic and fundamental difference between people from English speaking countries and other countries, is often neglected by researchers. Therefore, we have begun a detailed investigation of cross-cultural group chat. We chose text chat as a target technology because previous studies reported it as non-native speakers' preferred choice for CMC. Our study revealed that language proficiency played a pivotal role in cross-cultural group chat. When people conversed at different levels of proficiency, turn taking was severely disrupted, causing confusion and neglect of discussion points. We also found that some native speakers hold back ideas to accommodate the non-fluency of non-native speakers, slowing down the group process and outcomes. Working from these findings, we discuss possible designs that could assist both non-native and native speakers in cross-cultural group chat.

Categories and Subject Descriptors
H.5.3 [**Information interfaces and presentation**]: Group and organization interfaces – *Computer-supported cooperative work;* J.4 [**Computer applications**]: Social and behavioral sciences – *Sociology;* H.1.2 [**Models and principles**]: User/machine systems – *Human factors.*

General Terms
Design, Human Factors.

Keywords
Cross-cultural, group chat, language proficiency, text chat, turn taking, communication accommodation.

1. INTRODUCTION
Cross-cultural communication and collaboration has become more and more common in organizations and education systems, as multinational corporations hire local employees in their overseas branches, American companies outsource services to foreign states, and international students take online courses at U.S. universities. As a result, cross-cultural issues in computer-mediated communication (CMC; the primary communication option for cross-cultural communication) have increasingly drawn scientific interest, exemplified by the rising number of published papers in CMC-related research venues.

A central question in this expanding body of research is how technologies shape and are shaped by cross-cultural communication. A full range of synchronous and asynchronous CMC tools have been studied, including email, discussion boards, instant messaging (IM), and audio/video conferencing tools (see [13] and [28] for examples). Most lab studies have investigated cross-cultural communication in dyads (i.e., one American and one foreigner). Wang et al. [34,35] investigated triads' communication of groups consisting either two Americans and one Chinese or two Chinese and one American, finding that both Chinese and American participants' communication styles altered due to the impact of other group members. Like Wang et al. we study cross-cultural communication in small groups, because we believe that cross-cultural communication problems are more likely to occur in multiparty situations in which participants must compete for limited resources (e.g. time, speaking turns, attentions, etc). In such settings people from particular cultures or speaking a particular language may be at an advantage/disadvantage, generating imbalanced relationships in conversations and groups.

In group communication, text chat tools have been widely adopted by non-collocated workplace users [15] and college students [17]. The use of text chat tools is especially prevalent among non-native speakers. Research in second language learning showed that in discussions and planning tasks, foreign students preferred text chat to face-to-face (FTF) communication, because text chat reduced face-threatening pressure by reducing the level of immediacy in interaction that is typically expected by interlocutors in FTF communication [6]. An interview of non-native speakers on their preference of media use also showed that non-native speakers preferred text chat tools for their reduced risk of misunderstandings caused by language problems [28].

Clark and Brennan's framework of eight conversational attributes [2] characterized how communication media support mutual understanding between interlocutors. These attributes are: copresence, visibility, audibility, contemporality, simultaneity, sequentiality, reviewability, and revisability. Although most text chat tools afford reviewability and revisability, they lack many other attributes, such as copresence, visibility, and sequentiality. Many researchers have suggested that the lack of these characteristics could cause communication problems. For example, Smith et al. [29] identified five main flaws in existing chat systems, all directly or indirectly linked to lack of interlocutor visibility. Because people are blindly "talking" to others, by the time they finish

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typing and send out their messages, there could be several messages submitted simultaneously by other interlocutors who are unaware of others' activity. As a result, any given utterance may not be the response to the last utterance but several utterances earlier; conversation topics are intertwined togetherl and parallel sub-conversations take place. This results in an extra cost for people to realign their conversation while it continues. Convertino et al. [5] compared the conversational process of participants finishing a map task in a CMC tool with audio support versus face-to-face communication and found that participants needed significantly more effort for grounding and conversation reorientation. Their study also showed that text-based CMC tools that offer few communication attributes require more communication management.

If text chat tools are to become more widely adopted in cross-cultural communication, then it would be beneficial to understand how their affordances affect both native and non-native speakers more fully. This understanding could provide guidance on designing/redesigning tools for cross-cultural group communication. To develop such an analysis, we conducted a mixed methods study on groups of Chinese and American students brainstorming and making decisions on a given topic in online group chat. Three types of data (surveys, chat logs, and interviews) were analyzed. This allowed us to look at situations from different perspectives, thus resulting in a comprehensive understanding of the problem.

This research complements prior studies of cross-cultural group chat. The most relevant work is that of Wang, Fussell and Setlock [34]. They conducted a lab experiment to study cultural difference and communication accommodation in online group brainstorming through either text chat or video chat. They found that Chinese participants were less talkative in general. However, in the text chat condition, Chinese and American participants were not significantly different in terms of talkativeness and responsiveness. Furthermore, they found that Chinese participants raised their responsiveness to the same level as American participants to accommodate their communication styles in cross-cultural groups. This paper expands the scope of their work by exploring participants' feelings (satisfaction/frustration) and experiences in the conversation. We found that Chinese participants were uncomfortable with the parallel conversation style in text chat, whereas American participants were not bothered by this as much. This suggests one possible reason why Chinese participants were less talkative in our study and in other related studies. We also found that some American participants accommodated their Chinese counterparts by talking less, a phenomenon not observed in the Wang study. Our findings lead to new insights for designing group chat systems that can benefit both native and non-native speakers.

2. BACKGROUND

2.1 Turn-Taking Systems in Text Chat

Systems for turn taking were first proposed by Sacks [24], who used this to describe the dynamics of spoken conversations. The turn taking action is accomplished when interlocutors exchange cues about whether they plan to hold a turn, start or end a turn, or interrupt a turn. Opportunities to talk often occur when the active speaker indicates an end of his or her turn. The next speaker may be self-selected or pre-selected by the last speaker. Under the turn taking rules, there is usually only one speaker at a time. The next speaker is expected to address the previous comment, so that his/her turn "fits into" the conversation. If it deviates from the conversation flow, some expression denoting a topic change may be given (phrases such as 'by the way' or 'now then' can be used to indicate a new topic); if not other speakers may convey confusion, comments or rebukes (see [19] for a detailed analysis of spoken conversation). The turn taking system ensures that a conversation can carry on unambiguously and coherently.

Schegloff noted that turn taking also occurs in text-based conversations but with slightly different dynamics than in FTF conversations [25]. In most text chat systems, people receive a message immediately after the sender posts it. However, the process of producing the language is private to the poster. Before he/she posts the message, conversation partners do not know what is being written or edited; they may even not know that the person is typing. According to Clark and Brennan, text chat systems do not afford simultaneity in this sense. The lack of simultaneity generates two ramifications as pointed out by Smith et al. [29]: first, one can only begin to fit a "next" turn after the last turn has been displayed in its entirety, and second, there is a preference for short turns because one must press the return key in order to secure the floor. Even if people race for the immediate next turn so that their conversation is more coherent, other posts often arrive first, which disrupts the sequential turn-taking system.

Sometimes, a turn may connect to a prior comment several turns before; thus multiple threads can be twisted together, which could make reading and comprehending the conversation hard, especially when reviewing the chat logs later [29]. Several studies have postulated that disrupting sequential turns should generate communication confusions [10,21]. However, when examining the chat logs, researchers [12,20,23] typically find that little confusion actually arose in the chat. Participants use naming, overlapping terms, or utterance repetition to direct a comment when necessary. O'Neill and Martin [23] found that explicit disambiguation is not even used very often, because participants take it as a routine problem and can discern multiple threads very well.

One way to understand these contradictory arguments about text chat is to recognize that participants' experience of text chat may vary by situation. Voida [33] summarized five tensions between conventions of verbal and written communication in online chats and postulated that users' different interpretations of the mixed use of chat conventions may result in communication failure. In the situation of cross-cultural group chat, confusion and frustration might arise more easily, because non-native and native speakers' language proficiency and communication styles could be very different. Researchers [22] of second language learning have suggested that foreign students may feel overwhelmed and even lost in parallel and fast-flowing discussions, especially students who have slow keyboarding skills, slow reading/writing skills, or different cultural backgrounds. Little research has investigated how turn taking in text chat affects a mixed group of people consisting of non-native and native speakers, both how they are affected by the turn taking individually and how their interactions jointly shape the turn-taking system observed in cross-cultural text chat. In this paper, we tried to describe the cross-cultural communication process in order to build an understanding regarding these issues.

2.2 Language Proficiency as a Problem

In the past decade, much of the research in cross-cultural communication and collaboration has tested hypotheses regarding Hofstede's cultural dimensions [14] and Hall's high context/low con-

text culture concept [11]. These cultural factors provided explanations for cultural difference and were successfully used to interpret results in some work in the literature (see [30] and [34] for examples). However, these studies often neglect language proficiency differences between two cultures. For example, Chinese participants are typically described as "fluent or nearly fluent in English". Selection of fluent non-native speakers disguises any impact of language proficiency differences, but no one can deny language proficiency as a pervasive factor in non-native speakers' communication problems. According to Schmidt [26], the meaning of fluency does not have the same application for non-native speakers as it does for native speakers. For native speakers, fluency signifies a fluid speed in language use, and more than that a manifestation of the proficient command of the language, such as demonstrations of control over coherence, complexity and aesthetic functions of the language. For non-native speakers, it is often used as a rough synonym for global ability [18], an ability to make speech understood. In this paper, we show that lack of language proficiency affects non-native speakers, even when they are "fluent" in terms of communication success.

2.3 Communication Adaptation

If people are aware of cultural differences between them and other interlocutors, they may change their communication styles to adapt to other interlocutors. Communication accommodation theory [8] states that styles of communication may converge; speakers may shift their speech patterns toward other interlocutors so that they are more similar to each other. Anawati and Craig [1] describe a similar framework called behavior adaptation, which extends the kinds of accommodation in communication accommodation theory. Giles' communication accommodation theory only covers one aspect of accommodation behavior in cross-cultural communication – speakers may mimic other speakers' language use, so that their communication styles are similar. For example, in cross-cultural communication, a native speaker may speak slowly and keep words and sentences short to make his or her speech similar to a non-native speaker's language pattern.

Anawati and Craig used survey items and open-ended questions to investigate how team members adapt their behavior in spoken and written communication in cross-cultural virtual teams in a multinational company. They found that beyond the sorts of accommodation proposed by Giles [8], native speakers applied more strategies in cross-cultural encounters (see [1] for a complete list). For example, native speakers may list points and confirm understanding by asking questions to ensure that non-native speakers have the same level of understanding with them. They will also allow for "think time" between responses to give non-native speakers more time to digest and express ideas. These behaviors are not aimed at making speech similar but still are important strategies in cross-cultural collaborations. We also found such accommodations in our study, reinforcing the findings of Anawati and Craig. We further discussed how such accommodations affected group outcomes and design implications drawn from the analysis.

3. METHOD

We designed and conducted a mixed methods study [32] to investigate communication processes in distributed cross-cultural groups. In the literature of cross-cultural research in CSCW, researchers have been reporting contradictory results from quantitative studies. For example, Setlock et al. [27] reported that Chinese talked more in spoken conversation than in text chat, whereas Wang and Fussell [35] reported that Chinese talked less in spoken conversation than in text chat. Setlock and Fussell [28] analyzed possible reasons that could lead to these contrasting results, such as types of tasks and familiarity with certain communication tools; their interviews with 22 participants supported their analysis. Drawing from this earlier work, we expected that while we could use quantitative data to track behavioral patterns in conversations, qualitative measures would be important in explaining observed differences and understanding speakers' experiences.

3.1 Participants

We assembled five groups for study, each with two native speakers (Americans) and two non-native speakers (Chinese). After each session and set of interviews we did a preliminary coding of participants' reflections; we concluded the study after reaching the point of theoretical saturation [31], when themes were repeated in the data and no new themes were emerging.

We chose to study Chinese as the representative samples of non-native speakers because both their language and culture are very different from the western world; therefore they are likely to experience communication problems when communicating with people from the western world. We do not expect that our findings will be specific to Chinese non-native speakers, but future work will be needed to determine whether they apply to other non- native speaker populations.

The participants were undergraduate and graduate students from a large university in the Northeast United States; ages ranged from 20 to 43. There were 8 females and 12 males. Because we were not interested in gender effects, and to avoid gender-related social and communication dynamics, we ensured that all groups were of the same gender. Most of the native speakers had some experience collaborating with non-native speakers through group work (two Americans had no such experience). Some of the students had worked with non-native speakers in course projects in the past; some worked closely with non-native speakers.

3.2 Task

We adapted the task used by Freiermuth and Douglas [6], in which they studied non-native speakers' willingness to communicate in chat systems. We changed the theme of the task to a familiar topic for all of our participants. Specifically, we asked each participant to assume the role of a "Go Green" team member; they discussed how to spend $5000 to support environmental sustainability. Four participants formed a group to chat in AIM for 15 minutes. They were asked to come up to at least eight ideas and to decide on the best three. This manipulation was intended to create an intensive group discussion, so that any communication problems would be likely to emerge in 15 minutes.

3.3 Procedure

Upon arrival to the lab, each participant was led to a separate cubicle equipped with a computer. They were told that they were part of a group of four, but not informed of the other group members' nationality (e.g. non-native/native speakers). However, they may be able to infer such information from participants' screen names. After reading the consent form and the instructions, they were asked to fill out a background survey, then were given 15 minutes to chat as a group in AIM. After the task, they were asked to fill out a post-experiment survey. Finally, each of them participated in a follow-up interview separately.

Table 1. Coding scheme for online brainstorming task

Category I	Dialogue Act Codes		Category II
	Proposed solution		**Initiation**
	Questions about the problem *("Is the money for each one of the idea or all the three ideas?")*		
	Questions about solutions	**own –** the owner of the solution solicits opinions or additional information about the solution from others	
		other's – questions about other's solutions	**Response**
	Simple supportive comments *("I like that idea.")*		
	Simple critical comments *("I don't like that idea.")*		
	Acknowledgment – signals receipt of information *("yup")*		
Elaboration	**Supportive arguments** *("I like that because …")*		
	Critical arguments *("It's too expensive …")*		
	Add information – adds information (details, rationales, justifications, etc.) to others' solution		
	Problem clarifications – adds detail or new features to problem statement		
	Solution clarifications – adds information (details, rationales, justifications, etc.) to one's own solutions	**initiated by questions about solutions**	
		self motivated	**Initiation**
	Comments about the group process – positive, negative, or neutral comment about the interpersonal processes of the group		
	Uncodable text		

Notes: "add information", "acknowledgment" and sub-categories of "questions about solutions" and "solution clarifications" were added to the coding scheme. "Comments about the computer system" and "comments off the topic" were eliminated from the coding scheme due to rare occurrence in our data.

3.4 Survey

The post-experiment survey consisted of 10 questions adapted from Convertino's [4] work on quality and satisfaction of communication in virtual teams. (The survey can be found in [3]).

3.5 Interview Protocol

We conducted a semi-structured interview with each participant, spending approximately 30 minutes in discussion. The interview questions were guided by the three general themes below, but were open-ended enough that we could pursue new topics raised by the participant.

1. What was the most difficult thing in terms of communicating with the other group members?

2. What were the dynamics of the group's discussion?

3. What are the advantages and disadvantages of using the IM tool in this task?

Each interview was recorded and transcribed to text. Participants were interviewed in their first language. For interviews with Chinese participants, the transcriptions were translated back to English by the first author. The transcripts were then analyzed informally to discover themes related to cultural differences and communication difficulties.

3.6 Coding Scheme

We coded the chat logs in detail, so that we could carry out a quantitative analysis. We adapted a coding scheme developed for analysis of online brainstorming discussions about on-campus parking [7,16]. Table 1 shows our version of the coding scheme. We generalized the codes in two different ways. Category I distinguishes codes that contain some form of elaboration in the expression. Category II divides codes into initiation and response roles in discussion. We first coded the chat logs according to the dialogue act codes (this includes the elaboration distinction), then reviewed them for initiation and response. This hierarchical coding strategy has enabled us to analyze the data at different levels but with consistent application of a basic set of dialogue acts. Two independent coders performed the coding task. Inter-coder reliability across the coding scheme for a sample log was satisfactory (Cohen's Kappa = 0.63).

4. DATA ANALYSIS

We found three themes from the interview transcripts – language fluency issues, impaired turn-taking system, and a slow down in group process. We used the findings from the interview data guide us to more detailed quantitative analysis when possible. Specifically, if an interesting valuable behavior or pattern was reflected from the interview data, we operationalized the behavior/pattern to consider the issue quantitatively. In the following we combine data from the surveys, interviews and chat logs to introduce and describe cross-cultural issues with respect to fluency, turn taking, and speaker accommodation.

4.1 Language Fluency

The ten non-native speakers are fluent in use of English. All have been living and studying in the U.S. for at least three years. Nine of them rated their English proficiency as advanced in the pre-experiment survey. One non-native speaker rated her English proficiency as intermediate. Advanced proficiency was defined as, "I can carry on a conversation with a native speaker of the

language, although it is highly evident that I am not a native speaker of the language." Intermediate proficiency is defined as, "I can communicate with a native speaker of the language, although I find it difficult to do so; I can carry on a conversation with a native speaker of the language if (s)he speaks very slowly." Most of the non-native speakers also indicated in our interview that they could understand others' utterances without problems. Nonetheless, we learned from our interview data that language fluency affected non-native speakers negatively.

4.1.1 Slow in action

First, non-native speakers were slower in comprehending and expressing ideas, which discouraged their willingness to participate in intensive discussion. As one Chinese student said,

"Sometimes I felt like I couldn't express myself clearly. While I was thinking about how to express it, other people had been talking a lot, so I just listened to them." (Interviewee 7, Chinese)

Another Chinese student shared similar frustrations,

"Sometimes I wasn't sure how to say it in English, especially when many people were discussing, I missed the chance to speak out, after a while, I forgot it myself." (Interviewee 1, Chinese)

Although it seems that in text chat people can "begin new topics fairly much at will in a manner that would not happen in a formal face-to-face group discussion" as O'Neil said [23], this is not always the case. People still try to follow the habitual turn-taking rules from their everyday lives, because injecting new topics into the middle of discussion is thought to interrupt the group process:

"I found that several times when I was going to express my ideas, they already moved to the next topic. In this case, I would hold back my ideas, because I would slow down the discussion process. So I just followed them." (Interviewee 9, Chinese)

In such cases, when participants value group well-being and integrity more important than their fulfillment in the group, text chat may mute their voices because people are actively competing for turns and intensive short discussions can occur one by one.

This phenomenon was underscored by the speaking turns each participant had. For each person, turns was normalized as the number of turns of the person divided by the number of turns of the group, to factor out possible group differences caused by other factors. An independent sample t-test showed that non-native speakers' turns ($M = 21.30$, $SD = 4.40$) were significantly less than native speakers' turns ($M = 28.50$, $SD = 3.34$), $t(18) = -4.12$, $p < 0.001$. This result confirmed the interview data suggesting that non-native speakers were less participatory than native speakers.

4.1.2 Followers in group

Language proficiency enabled native speakers to dominate the chat in all five groups. When asked whether there was a leader in their group, everyone named one of the native speakers in their group. These individuals were able to control the conversation, such as that they "could easily move to the next topic" (Interviewee 10, Chinese) and could also respond more quickly, therefore they could easily hold the floor to talk. Some Chinese participants expressed negative feelings about being followers in the group,

"I couldn't control the conversation. The native speakers led the conversation, for example, what to discuss now, and how to discuss it. I just followed them. Because I needed some time to think about how to express an idea, but they didn't give me the time." (Interviewee 8, Chinese)

This participant also shared her thoughts on why she wouldn't participate as actively as her American counterparts.

"If I were leading the discussion, I would think about how to express myself so that my language is not dry and rude. But if I only follow them, expressing my ideas or commenting theirs. I don't need to think as much."

This suggested that the asymmetric status in the cross-cultural groups could be related to one's proficiency of controlling a conversation. Non-native speakers do not only write or speak more slowly but also are less experienced in handling the coherence, complexity and aesthetic functions of a second language.

The post-experiment survey confirmed that non-native speakers experienced less control of the conversation. For one question participants rated whether they could control the conversation on a scale from 1 to 5 (1 = least level of control and 5 = highest). An independent sample t-test showed that non-native speakers' ratings ($M = 2.60$, $SD = 0.84$) were significantly lower than native speakers' ratings ($M = 4.11$, $SD = 0.60$), $t(17) = -4.45$, $p < 0.001$.

4.1.3 Concise in expression

Non-native speakers often produce less complicated words and shorter expressions than native speakers and we analyzed our data to determine if it was true in the group chat activity. In text chat, one cannot hold the floor for very long, so speakers must type quickly in general. As we discussed earlier, non-native speakers do not generate text as fast as native speakers, therefore they may choose to use efficient expressions, allowing them to quickly share their points. One extreme example of such efficient expression was reflected in an interview,

"I think the native speakers contributed more than us. First, they were faster. My problem was that my English wasn't fluent, so when I expressed an idea, I could only say some nouns. ... My two ideas were water and heating. I only said the two words, which were very vague, because I couldn't keep up in speed with them." (Interviewee 10, Chinese)

However, these ultra-efficient expressions were not received well by other participants. Sometimes, participants would not ask for elaborations; they expected the speaker to provide more information. If the speaker did not grab the chance to do this, his or her idea might not be picked up in the discussion. A native speaker shared what happened in his group,

"Because he (one of the non-native speakers) was not as expressive, if he didn't say much, we probably passed him by as native speakers." (Interviewee 3, American)

When we looked for confirming evidence in the chat logs, we found no significant difference in the frequency of elaborations provided by native and non-native speakers. As with analysis of turns, the likelihood of providing an elaboration was normalized as a person's number of turns coded as elaboration divided by the person's total number of the turns. However, when we examined the word count of individual's elaboration expressions, we found that native speakers were significantly more elaborative than non-native speakers, $t(18) = -4.45$, $p < 0.001$. (Note that we also normalized individual word counts by the word count of the group, to factor out possible group difference caused by other factors).

This result suggested that the problem was not a difference in non-native speakers' communication or thinking style. If they had

preferred to initiate new ideas but not to develop ideas "on the table", the resulting lack of discussion might impair the outcome of the group's decision making. However, this was not the case in our study: non-native speakers allocated a similar percent of their effort in elaboration of ideas. The problem here was that non-native speakers were concise in the elaborations they offered, making their arguments easier to ignore (as the American student observed).

In sum, these examples reinforce the point we made at the beginning of this section, namely that the root of the non-native speakers' participation problems was that they were slower in using English. Our detailed analysis has shown that these language delays produced different types of problems, from perceptions of slowness, to the tendency to follow rather than lead, and to very short elaborations that were easy to pass over.

4.2 Turn-Taking

The chat logs revealed that parallel discussions were prevalent in these cross-cultural groups. Table 2 summarizes the parallel discussion episodes in the five chat logs. The numbers in the middle column refer to the index number of an idea and the parenthesis indicates that initiation or response of one idea was interleaved between responses of another idea. For example, (4 5) refers to a series of utterances during which the discussion of idea #4 and idea #5 crossed over each other.

Table 2. Summary of parallel discussions in chat logs

Group	Parallel Discussion Point	Total Number of Ideas
1	(4 5) (8 9) (11 12)	12
2	(2 3 4 5) (6 7 8 9)	9
3	(1 2 3) (5 6)	11
4	(1 2 3 4 5 6 7 8)	9
5	(1 2 3 4 5 6 7 8)	10

The table shows that a large proportion of ideas were discussed in parallel with other ideas in all group chats. Especially in group 4 and group 5, many ideas were introduced before previous ideas were finished. The participants in these discussions shared their frustrations, causing us to analyze the parallel discussions in more detail. In this, we focused particularly on how language proficiency affected this style of communication, and how native and non-native speakers coped with the associated challenges.

We found two types of disruptions in the chat logs. One case was when people initiated new ideas. People tended to express an idea in several short turns as opposed to saying it all in one turn (e.g., as you might expect in a face-to-face setting). As we discussed earlier, participants were competing for the floor by entering their ideas as fast as they could. In the chat logs, we observed a frequent pattern wherein a proposed solution was closely followed by several solution clarifications. Although this might not generate any confusion in face-to-face conversation because people could tell whether the speaker finished talking from non-verbal cues (eye contact, gestures, tones, etc), it confused interlocutors in text chat, as they don't know whether the speaker is continuously writing more elaborations or is done with the topic. One participant shared his hesitation in joining a discussion,

"It's hard to know who was taking turns speaking while preparing to speak. It's rude to take control of the conversation; it's rude to talk over someone. If there is a clear break, it's kind of hard to figure out whether you should take a pause to be, you know they are done saying something versus they are thinking over a problem." (Interviewee 17, American)

In these cross-cultural groups, people seemed to be more hesitant when taking turns because they were not familiar with the other culture's communication style, thus making it harder for them to take turns at the right time. This may be a common feeling among native speakers communicating with non-native partners. Al-though we did not inform participants about their group members' cultural affiliations, all of them said that they were aware of the cultural difference. Some said that they figured it out by names, and some by "the length of expressions and word choice". A native speaker reflected his feeling about hesitation of communication in their group.

"I think there's a little bit hesitation on everyone's part, because we were aware of the cultural difference." (Interviewee 3, American)

In the chat logs, we found that speakers often initiated new topics before the previous speaker finished his/hers. This caused multiple topics to be active at around the same time. Group members might be drawn to one topic and respond to it, but they might also shift from topic to topic to participate in several. One participant contrasted this to face-to-face turn-taking ,

"In face to face, usually there's only one person talking, so obviously all three other people are listening to that one person. While you are chatting, you can have four different people saying different things in the same time. Then you have to go back and read that. So it's almost like there are four separate conversations going on." (Interviewee 11, American)

Although parallel discussions were prevalent in the text chat, most native speakers seemed to have little problem with this, saying that "it's what text chat is" or "I'm used to it". This finding is consistent with related findings in the literature. In contrast, some of the non-native speakers were bothered by the intertwined, "messy" discussions. Several non-native speakers complained that ideas were neglected in the discussions. They at times attributed this to the disrupted turn-taking system, as in the following comment,

"The most difficult thing in this group discussion was that we didn't know whether others were following the last topic or the newly initiated topic. It happened a lot of times that the three of us were discussing a topic, while the fourth person threw a new topic, which was hard to follow, because we hardly noticed her idea, or even we noticed her idea, we still wanted to finished the last topic, in such case the fourth person's idea was easy to get ignored." (Interviewee 15, Chinese)

The following example illustrates a similar case, although in this case it seemed that the non-native speakers' concise way of stating her points might have interacted with the challenges of an intensive parallel discussion.

"Two of my ideas were ignored, one is growing green plants on roof tops, and the other is coating windows to cool down room temperature. I simply stated my points, but there was another discussion at the same time, so they only noticed that one instead of mine." (Interviewee 9, Chinese)

Another Chinese participant said she did not want her fellow Chinese participant's ideas to be neglected, so she shifted back to these un-

discussed ideas several times during the chat. But this meant that the parallel discussion took place in the context of much later content. This sort of "long distance" disruption occurred quite often in the chat logs, as we discuss below.

A second type of disruption occurred when people responded to an idea posted by someone else. There was always some delay in these responses, simply because one can only respond to a turn after it was posted. While a response is being typed, there might be several other messages posted. So when multiple topics were present, the responses to the different topics could mix up.

Several native speakers mentioned that they missed some points in the multithread discussion, like this participant said,

"There's no immediate feedback, so like someone said something, I want to respond to that, and by the time I typed it and sent it, somebody already posted something else. So I think keeping in step with the conversation can be difficult, I kept looking back who's responding to what line. Sometimes I still respond, sometimes I just let it go." (Interviewee 14, American)

Another native speaker told us how he coped with a point that they missed earlier,

"I know a lot of times five or six messages could go all at once, while I was typing and look up the screen there were already five to six, easy to be mixed up. Like one of the ideas I completely missed, I had to go back and look over it again." (Interviewee 11, American)

The problem of delayed response occurred more often among non-native speakers because of their low competency in language proficiency, as one of the Chinese participants said,

"Our speed was much slower than them (the native speakers). They typed very fast, a lot of times they already sent several messages, while we were still typing a response to the message several lines above." (Interviewee 15, Chinese)

Sometimes the non-native speakers might be so far behind the discussion that they could even drop out of the conversation like we reported at the beginning of section 4.1. To the contrary, the native speakers seemed to be able to manage the turn-taking system although with an extra cost. We observed that native speakers had a number of coping strategies for dealing with out-of-sequence responses. They had techniques for referring to the point they wanted to comment on, for example they might quickly reiterate a point, reuse some key words, use a group member's name to direct their responses, and so on. However, non-native speakers were less likely to exhibit these strategies, perhaps because their command of the language was still rather limited.

To sum it up, multithreaded discussions and disrupted turns were common in the chat logs. Native speakers were not affected much because these patterns occur often in chat systems and they had learned coping strategies from their past experience. Non-native speakers were less competitive in such discussions, because they were generally slower in using the language. This in turn might worsen the situation: the longer they took to finish an idea (e.g., over several turns) or to respond to a previous turn would further disrupt the overall coherence of the conversation.

4.3 Communication Accommodation

Several native speakers who reported that they had closely worked with non-native speakers also indicated that they made changes in communication style to accommodate the non-native group members. In general, they slowed their speed to adopt the same tempo as the non-native speakers. For example,

"In the past when I worked with non-native speakers, there's like a reluctance I see for them to pipe up and bring up their ideas, like talk openly in a group. I don't know, maybe I worked with so many, but I tried to slow things down to make sure they have a chance to talk." (Interviewee 17, American)

Giving non-native speakers more chance to talk and more time to think was one accommodation applied by these native speakers. The following two native speakers of group 1 revealed how they implemented this in their group chat:

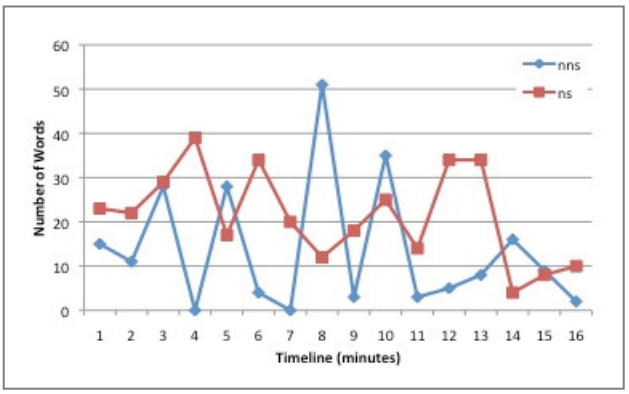
"I would give 20 seconds at least before I start talking. I usually tried to give a pause, everybody could think about it before I keep on typing, especially if it's a new idea, so everybody can think about it." (Interviewee 4, American)

"I think we try to give people a lot more time to express themselves. The native speakers probably would have chatted a lot more and a lot quicker, whereas the non-natives maybe took a little bit more time to make sure that they were expressing their ideas correctly and if their ideas would be accepted in the ways they were expressed." (Interviewee 3, American)

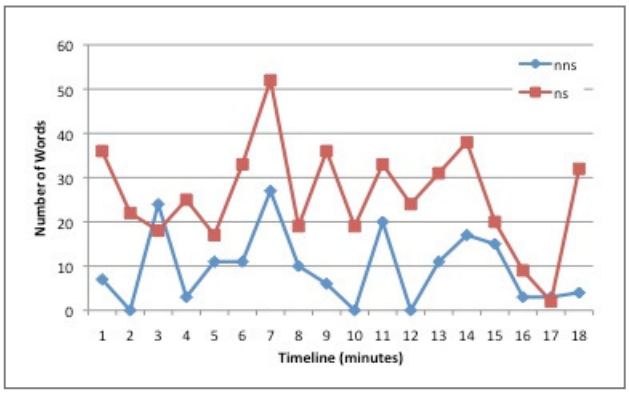
The left side of Figure 1 visualizes conversation patterns consistent with the strategy mentioned by the two native speakers from group 1. It can be contrasted to the conversation of group 3 (right side of figure), in which none of the native speakers mentioned accommodation to the non-native speakers in the chat.

To create these visualizations, we calculated the number of words expressed by each interlocutor per minute (this is analogous to calculating the density of a signal). A higher value means that the interlocutor is intensively talking during that time slot. A lower value means that the interlocutor is relatively inactive in the given time slot. We suggest that the contour of a line connecting these values depicts a "conversational rhythm" for that person. Our intuition was that if the native speakers did accommodate non-native speakers as they said in the interview, we should see a reciprocal pattern such that when non-native speakers were contributing a lot of words, native speakers would be less talkative; when non-native speakers were less talkative, native speakers would return to their normal levels of talkativeness. In our initial analysis, we found similarity within native and non-native pairs but dissimilarities across cultures. This finding is consistent with Wang and Fussell's [35] observation of sub-groups in cross-cultural groups. In their study of a mixed group of Chinese and American participants, members from the same culture were often conversationally close and the two cultural sub-groups within the group were often conversationally far away.

To compare native and non-native speakers' conversational trend, we summed the two non-native speakers' words per minute, and did the same for the two native speakers. Figure 1 (a) shows the conversational trend for group 1. We can see that when the non-native speakers were at their high points, the native speakers were often at their low points. And, whenever the non-native speakers were at their low points, the native speakers' chat density increases. We can also see exceptions to this tendency, for example around minute 10, both non-native and native speakers were engaged in the chat actively; we expect that at times it is normal and reasonable for native speakers to respond fast. However the general trend convinced us that there were communication accommodations in this group, especially in contrast to group 3.



(a) Group 1.



(b) Group 3.

Figure 1. Conversation trend of non-native and native speakers in group chat. Y-axis denotes the number of words in the given time slot (in our analysis is one minute), x-axis denotes the timeline in minutes. Red square trend represents the two native speakers, blue diamond represents the two non-native speakers.

No one in group 3 mentioned any accommodation to group members in their communication. In fact, two ideas from a non-native speaker ideas were neglected, which suggested that the native speakers might not have been as aware of the cultural difference, especially the non-native speakers' language limitations in the communication. Looking at Figure 1 (b), it seems that non-native speakers were in a sense "out-talked" during the discussion. In general the contours have the same shape, but the native speakers' density is almost always greater. Note that the trend of the two lines looked similar at minute 7 and minutes 11 to 15, except that the native speakers' line was much higher than the non-native speakers' line. A review of the chat log showed that the two time slots were just when the two parallel discussions happened. It's when one of the non-native speakers proposed his two solutions and the native speakers were discussing the other three solutions, they just talked passed him. It's worth noting that this non-native speaker's communication satisfaction rate (2.75) was clearly lower than other participants (mean rate was 3.95) and other non-native participants (mean rate was 4.00). This finding suggested that communication accommodation should be encouraged in cross-cultural group chat for the wellbeing of non-native speakers.

Note that despite the interview comments, it is possible that it is the *non-native* speakers who are accommodating to the *native* speakers (e.g., increasing their density when the native speakers pause to think). To better assess whether the accommodation was from the native speakers or from the non-native speakers or both, we used a technique known as the Granger causality test [9], a statistical test of the causal relationship between two time series. The test assesses whether the lagged values of time series X can improve the prediction of time series Y. If the improvement is significant, we can say that X **Granger causes** Y. This differs from a correlation test, in that the causality relationship between X and Y can be asymmetric. That is we might find that X can Granger cause Y, but Y cannot Granger cause X; or vice versa.

To carry out this analysis, we treated a single turn as the series unit; thus the entire set of turns of the conversation composed a time line. For each participant at each turn, if this person did not own the turn, we coded '0'; if this person owned the turn and had an 'initiation' dialogue act code, we coded '1'; if this person owned the turn and had a 'response' dialogue act code, we coded '-1'. By doing so, we converted a participant's dialogue acts into a dialogue time series of 0, 1 or -1. For example, one native speaker from group 1 enacted the dialogue series for the first 5 turns in the discussion. When the Granger causality test is run on such series, an assessment is made for a specified "lag" in the two series being compared; in our series, a lag of 1 would refer to prediction of the very next turn, a lag of 2 would be the turn after next, and so on.

We first tested Granger causality between each possible combination of group members in group 1; we found that the turns of non-native speakers Granger caused those of native speakers but not vice versa; there was also no Granger causality within culture. To simplify – and to make a clearer connection to the chat density visualizations discussed earlier - we merged the series from the two non-native speakers and did the same for the native speakers. Table 3 shows the Granger causality test results of group 1, run with three different lag parameters. It clearly shows that non-native speakers' dialogue acts predicted native speakers' dialogue acts, but not vice versa. This suggested that native speakers did accommodate to non-native speakers in conversation as suggested in the interviews. We also analyzed group 3 for comparison as seen in Table 4. None of the relationships are significant for group 3, suggesting that there was no communication accommodation in this group.

Table 3. Granger causality test results (p-value) of group 1

Lag	Non-native -> Native	Native -> Non-native
1	0.17	0.41
2	**0.01****	0.56
3	**0.05***	0.46

Table 4. Granger causality test results (p-value) of group 3

Lag	Non-native -> Native	Native -> Non-native
1	0.71	0.32
2	0.84	0.65
3	0.90	0.58

Note that while it seems that communication accommodation for non-native speakers should enhance their positive experience in group chat, at the same time it may slow down the group process and thus may impair conversation efficiency, and perhaps even outcomes if time to communicate is restricted. This comment from a native speaker revealed that he would generally try to hold back his ideas when accommodating the non-native speakers:

"I tried not to talk when I can to give everybody a chance, even if it's quiet, I would sit this out and hang around to see whether someone else would pick it. … I had a couple ideas but I tried to only kind of go in turn as much as possible so that everybody had a chance. I know there's always chances later, coz I had them in my head the entire time, so I knew if we had time till the end then I would go for it. But usually I tried to hold back" (Interviewee 4, American)

Given the time limits, which exist for most discussions more or less, a slow group process would produce fewer outcomes. But from the above interview, we can see that at least one native speaker may be willing to accommodate non-native speakers' speed even at a potential cost of reduced group outcomes.

Although several native speakers mentioned the strategy of accommodating to non-native speakers, only group 1 evinced a clear pattern of "holding back." This does not mean that other speakers did not accommodate, but perhaps they did so less pervasively, or perhaps one native speaker accommodated but the other did not. From the interview comments, it seems clear that this is a strategy that is learned by native speakers through experience with non-native conversation partners. It would be interesting to consider whether there are also inverse accommodations by non-native speakers; for example perhaps they would learn to "hold on" to their ideas, then to be opportunistic and jump in as soon as a native speaker pauses and gives up the floor.

5. CAVEATS AND LIMITATIONS

Because studies of cross-cultural communication have provided little detailed analysis of language proficiency and its impacts, we used mixed methods to gather as rich a dataset as possible. However we recognize that our observations come from a relatively small number of groups, and that the configural effects of a group may be very large. Extensive quantitative analyses are not appropriate for small samples such as this, so we have introduced these in only a few cases where they help to make a point suggested by the qualitative data. A more extensive study would be needed for a systematic investigation of the patterns we have described.

We also noted that many of our participants had prior experience with cross-cultural group work; this almost certainly would have affected the ways in which they communicated. Indeed the comments we shared about communication accommodation referred explicitly to prior experience of this sort. On the one hand, this makes it difficult to generalize our findings to groups with less experience. But on the other, it has allowed us in this exploratory study to observe phenomena that might be part of a more stable repertoire of cross-cultural communication practices.

6. DISCUSSION

We conducted a study of cross-cultural group chat that used a mix of qualitative and quantitative data collection and analysis. By combining across data from surveys, interviews, and chat logs, we were able to provide a detailed view of how native and non-native speakers coordinated their conversations, focusing particularly on issues of language proficiency, turn taking, and communication accommodation. As part of this, we have shown how a time series statistical test can be used to assess relationships among different speakers or pairs of speakers. Our primary goal in this paper has been to document communication patterns and experiences, so that we and other researchers can investigate them in more detail in the future. However, we also believe that our findings have implications for the design of tools that might enhance cross-cultural group chat; we now turn to a discussion of these ideas.

One pervasive difference between native and non-native speakers was in the speed and corresponding density of communication. To some extent, this may be impossible to eliminate, as the non-native speakers are simply less fluent. Indeed, one might expect to see similar differences among native speakers who vary in some aspect of fluency (e.g., children versus adults, or skilled versus unskilled typists). However we also reported that at least some native speakers had learned accommodation strategies, and it is interesting to speculate about how such strategies might be encouraged more broadly. Perhaps a simple awareness display of group members' chat density could help individuals to notice the asymmetries; this in turn might encourage them to slow down or reduce the length of their turns – at least until time pressure causes them to shift their focus to group outcomes.

Our data showed that the turn-taking system in cross-cultural group chat was severely disrupted. The disruption was particularly problematic for the non-native speakers. The design implication is that participants need some sort of regulation or new mechanisms to repair these disruptions. For example, O'Neil and Martin [23] suggested use of an access-control rule such that when one interlocutor starts typing, others are blocked from typing. This regulation enforces the sequential turn-taking mechanism in spoken conversation, however it will significantly slow down the communication process. And it will introduce the same kind of time pressure in spoken conversation to text chat; therefore it diminishes the value of text chat being more free and flexible to interlocutors. Smith et al. [29] proposed a threaded chat design, in which a response turn is entered under an existing thread just like posting replies to a thread in forums. However, this would considerably change the natural flow of conversations in text chat. Moreover, people may not know the current topic in discussion like in every conversation. Therefore, they may more easily generate parallel discussions.

We suggest instead some mechanism for thread control that does supports turn taking while minimally affecting the natural flow of the conversation. We envision a side bar of the chat window in which users can enter responses to a turn right besides it. Users' responses can be stacked up in such a side pane, somewhat like a threaded chat. The difference is that the side bar minimizes the interruption to the flow of the conversation; it would be used only when interlocutors see a need to do so. In addition to responses, interlocutors might also note new ideas in such a side bar, especially those they hold back from the main conversation but may still want to talk about them later. We are currently exploring a design for such a mechanism and will be developing and evaluating it in the near future.

7. CONCLUSION

In this paper, we explored the communication process and participants' experience in cross-cultural group chat using IM. We identified a number of problems in this setting. We found that these communication problems were commonly caused by one fundamental problem: non-native and native speakers were conversing at different tempos. We observed that the turn-taking system in

text chat was severely disrupted due to these differences in conversational tempo. Both non-native and native speakers expressed their discomfort with these problems in many ways, such as hesitation of talking, lost in parallel discussions, or simply reduced satisfaction with the group experience.

On the non-native speakers' side, we observed a greater amount of the negative experiences, stemming from their reduced language proficiency. They could not control the conversation and their ideas were at times neglected during parallel discussions. On the native speakers' side, we observed them to be less affected by the language differences and in fact at times evinced positive efforts to accommodate non-native speakers. However, we also noted that such accommodation might impair the performance outcomes of a group. Based on these findings, we analyzed how existing chat systems limit cross-cultural group chat and discussed options for future research or tool design. In our ongoing work, we are designing and evaluating an augmented IM tool aimed at assisting both native and non-native speakers in group chat.

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