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DESIGNING FOR CROSS-CULTURAL GROUP CHAT

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ABSTRACT

Cross-cultural communication is taking place everywhere as the world is getting flat. Research conducted across many disciplines (e.g. education, psycholinguistics, sociology, HCI and CSCW) shows that language fluency plays an important role in communication. Non-native speakers have been suffering from communication problems caused by language fluency issues both in face-to-face (FTF) communication and distributed online communication (Gonzalez, 2003; Neeley, Hinds, & Cramton, 2009). Building upon past studies, I investigated the communication process and outcomes in online cross-cultural group chat, with a particular focus on issues related to language fluency. Based on findings from this work, I proposed and designed a lightweight tool supporting secondary conversation stream. I evaluated and confirmed with a comparison study that group satisfaction and perceived control of the conversation are enhanced for the participants who used the tool. I also discovered new patterns of annotation use and design implications for group chat tools to support cross-cultural communication.
TABLE OF CONTENTS

LIST OF FIGURES .................................................................................................................. vi

LIST OF TABLES .................................................................................................................. vii

ACKNOWLEDGEMENTS ......................................................................................................... viii

Chapter 1 Communication Problems in Cross-cultural Groups .............................................. 1

The Study of Cross-cultural Communication ......................................................................... 1
  The study of social norms, values and beliefs in cross-cultural communication .................. 3
  The study of language in cross-cultural communication ..................................................... 6
  Language Proficiency Matters .......................................................................................... 7

Chapter 2 Computer Mediated Communication in Cross-cultural Communication ............... 12

Conversational perspective ................................................................................................. 13
  HCI perspective ............................................................................................................... 15
  Social perspective ............................................................................................................ 18
  User-centered design of a chat tool for cross-cultural groups ........................................... 22

Chapter 3 Language Problems in Online Cross-cultural Group Text Chat ............................. 24

Participants .......................................................................................................................... 25
  Task .................................................................................................................................. 26
  Procedure ........................................................................................................................ 26
  Instruments ....................................................................................................................... 27
    Survey .......................................................................................................................... 27
    Interview Protocol ....................................................................................................... 27
    Coding scheme ............................................................................................................ 28
  Results ............................................................................................................................. 29
    Language proficiency ................................................................................................. 30
    Disrupted turn-taking ................................................................................................. 34
    Attenuation blocking ................................................................................................. 38
  Discussion ........................................................................................................................ 43

Chapter 4 Designing for Cross-cultural Group Text Chat ....................................................... 45

Collaborative annotation ...................................................................................................... 45
  Threaded chat .................................................................................................................. 50
  Strategies to reduce the blocking effect .......................................................................... 51
  Discussion ........................................................................................................................ 52
  A design concept: Instant Annotation ............................................................................. 53
  Discussion of the design concept .................................................................................... 56
  A use scenario ................................................................................................................. 58

Chapter 5 Evaluating Instant Annotation for Cross-Cultural Communication ..................... 62
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating the Instant Annotation design concept</td>
<td>62</td>
</tr>
<tr>
<td>Method</td>
<td>63</td>
</tr>
<tr>
<td>Results</td>
<td>64</td>
</tr>
<tr>
<td>Design choices</td>
<td>70</td>
</tr>
<tr>
<td>Evaluating Instant Annotation – a comparison study</td>
<td>74</td>
</tr>
<tr>
<td>Participants and task</td>
<td>76</td>
</tr>
<tr>
<td>Measures</td>
<td>77</td>
</tr>
<tr>
<td>Data analysis and results</td>
<td>77</td>
</tr>
<tr>
<td>Chapter 6 Design Implication</td>
<td>86</td>
</tr>
<tr>
<td>Who else might benefit from Instant Annotation?</td>
<td>86</td>
</tr>
<tr>
<td>How might Instant Annotation support chat for larger groups?</td>
<td>88</td>
</tr>
<tr>
<td>Design implications for peripheral design in communication tools</td>
<td>88</td>
</tr>
<tr>
<td>Chapter 7 Conclusion</td>
<td>91</td>
</tr>
<tr>
<td>References</td>
<td>93</td>
</tr>
<tr>
<td>Appendix A Instruction</td>
<td>99</td>
</tr>
<tr>
<td>Appendix B Consent Form</td>
<td>100</td>
</tr>
<tr>
<td>Appendix C Pre-task Survey</td>
<td>104</td>
</tr>
<tr>
<td>Appendix D Post-task Survey (condition 1)</td>
<td>106</td>
</tr>
<tr>
<td>Appendix E Post-task Survey (condition 2)</td>
<td>108</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 3-1: Conversation trend of non-native and native speakers in group chat. .................39

Figure 4-1: A screenshot of CoNote. (Davis & Huttenlocher, 1995, p. 2) .............................46

Figure 4-2: A screenshot of WebAnn. (Marshall & Brush, 2004, p. 2) .................................47

Figure 4-3: An anchored chat prototype. (Churchill et al., 2000, p. 3) .................................48

Figure 4-4: A threaded chat prototype. (M. Smith, Cadiz, & Burkhalter, 2000, p. 100) .........51

Figure 4-5: A mock-up of the Instant Annotation design concept........................................54

Figure 4-6: Another view of Instant Annotation.................................................................56

Figure 5-1: Screen capture of the IA prototype; annotations are in the side bar on the left. ...74
LIST OF TABLES

Table 3-1: Coding scheme for online brainstorming task ........................................................ 29
Table 3-2: Summary of parallel discussions in chat logs ........................................................ 34
Table 3-3: Summary of parallel discussions in chat logs for Group 1 .................................... 42
Table 3-4: Summary of parallel discussions in chat logs ........................................................ 43
Table 5-1: Measures of Discussion Productivity by Condition .......................................... 78
Table 5-2: Five Categories of Annotations ........................................................................... 79
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Chapter 1

Communication Problems in Cross-cultural Groups

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. Compared to intra-cultural communication, communicating with people from other countries requires considerable extra effort, such as more confirmation checks, conversational remedies for misunderstandings, extended time for grounding and so on. Even when extra attention and extended times are allotted for cross-cultural communication, the communication outcomes are often inferior to intra-cultural exchanges. Culture is such a complex construct that it varies among multiple dimensions of language, value, social norm, belief and knowledge. It requires adequate and sometimes sophisticated strategies to reconcile those differences in a successful cross-cultural communication. As such, cross-cultural communication problems continue to be experienced and are a challenge worthy of attention from multiple research disciplines.

The Study of Cross-cultural Communication

Samovar & Porter (Samovar & Porter, 1997) point out that as “cultures differ from one another, the communication practices and behaviors of people will inevitably vary as a result of their different perceptions of the world.” Cross-cultural communication is defined as the study of communication between people whose “cultural perceptions and symbol systems are distinct enough” to alter their communication. Some research shows that messages conveyed by a person
in one culture can be interpreted differently by a person in another culture. For example, studies have frequently found that non-native speakers rely heavily on their first language skills in interpreting English sentences (Koda, 1993). Unfortunately, as Koda points out, the strategies used in one language do not always cross to other languages, because “linguistic features that are essential to sentence comprehension and production vary from one language to another, and, importantly, the specific skills and strategies involved in language processing are developed to capitalize on the essential linguistic information” (Koda, 1994, p. 3). When it is impossible to overcome the incongruities between the two languages, non-native speakers must adjust their strategies, which slows comprehension processes even more.

In addition to varying linguistic experiences, people from different cultures also differ in their knowledge about the world, such as social norms, values, and beliefs. These affect one’s experiences in a society, which in turn impact how words and sentences are interpreted in context. When the context is similar to one of their past experiences, they can quickly retrieve that experience and use the knowledge of that context to understand the current text. When the context is unfamiliar to them, they need to build their understanding purely from imagination or logical inference, which can lead to poor retention or even misunderstanding of the text. For example, Steffensen et al. (Steffensen, Joag-Dev, & Anderson, 1979) found that in a reading task containing a passage of an American wedding and a passage of an Indian wedding, the American participants read the American wedding passage faster and recalled the contents better, while Indian participants read the Indian wedding passage faster and recalled the contents better.
The study of social norms, values and beliefs in cross-cultural communication

**Hofstede’s cultural dimensions**

Hofstede’s (Hofstede, 1980) cultural dimensions – Individualism-Collectivism, Uncertainty Avoidance, Power Distance, and Masculinity-Femininity – suggested some potential sources of conflict and problems in cross-cultural communication. For example, in individualistic cultures, the needs, values, and goals of the individual precede that of the group. In collectivistic cultures, the needs, values, and goals of the group precede that of the individual (Triandis, 1995). When there are conflicts between individual goals and group goals, collectivists will emphasize the attainment of group outcomes and subordinate their personal interests to ensure that group outcomes are attained. They also will perceive themselves as an indispensable part in a group’s success. However, individualists will seek to maximize their self-gain, because they derive satisfaction from performance based on their own achievements (Earley, 1989). Many cross-cultural studies have used individualism-collectivism to explain group work performance. For example, Wagner found that individualists (American) are less apt to engage in cooperative group projects than collectivists (Chinese) (Wagner, 1995).

With respect to cross-cultural communication, the cultural factors directly affect communication styles and behaviors. For example, Gudykunst and Ting-Toomey (Gudykunst, Ting-Toomey, & Chua, 1988) argued that Individualism-Collectivism affected the use of low- and high-context communication, which I will review in detail in the next paragraph. In another large-scale national survey study (P. B. Smith, 2004), Smith found that people from high uncertainty avoidance felt more anxious about interacting with others and had less positive expectations concerning others. Brockner et al. (Brockner et al., 2001) studied the influence of power distance on the magnitude of voice effects. They found that the tendency for people to
respond less favorably to lower levels of voice was greater in low power distance cultures (United States) than in high power distance cultures (China).

**Hall’s emphasis on context**

Hall (Hall, 1976) classified communication patterns in different cultures into low-context and high-context communication. Speakers in low-context cultures tend to express themselves verbally and explicitly. Speakers in high-context cultures are more sensitive to context information such as non-verbal cues and interpersonal relationships. Research has shown that low-context and high-context communication is predominant in individualistic and collectivistic cultures, respectively. People from individualistic cultures are more inclined to talk (Gaetz, Klopf, & Ishii, 1990) and more concerned with clarity in conversations than people from collectivistic cultures (M. S. Kim, 1994).

There is also research showing that people from a high-context culture are more likely to participate in group chat if they are allowed to see each other while chatting (Elizabeth, Judith, Gary, & Xiaolan, 1999; Leslie, Susan, & Christine, 2004). However, the effect of communication patterns is still unclear. There are controversial results showing that people from high context culture are less talkative when they are able to see each other (Wang, Fussell, & Setlock, 2009). Admittedly, there are other confounding factors in this result. For example, in this study the participants from the high-context culture in the study were not from English-speaking countries. Being anonymous and avoiding eye contact while chatting effectively may alleviate their tension when communicating in a foreign language.
Negotiation in Chinese language practices

The negotiation style of Chinese communication partners may be influenced by Chinese cultural values and language usage. Many studies that try to find particular cultural factors related to Chinese negotiation behavior suggest four concepts: power distance, holism, face and guanxi (Graham & Lam, 2003; Kirkbride, Tang, & Westwood, 1991). These four concepts are considered important to Chinese people and therefore have been used widely to explain Chinese negotiation style. Guanxi is the personal connections between people. In a collectivist society, building and maintaining guanxi is very important. In business activities, a good guanxi is a sign of success of two parties’ collaboration. Face is related to guanxi. Chinese’s adoption of mutual-face maintenance is a way to maintain guanxi. Power distance is a mediator of guanxi. In situations where older people or those of higher social status are involved, the other party will take greater attempts to maintain guanxi and protect face. Based on the above discussion, one would expect less open argumentation and debate with Chinese in negotiations. Also, Chinese are reported to be happy to remain at the level of general principles to avoid confrontation related to specific issues, and they tend not to engage in extreme verbal posturing and aggressive position-taking. (Kirkbride et al., 1991) This negotiation style is also considered to be related to Chinese holistic thought processes, which suggests that people will think issues as a whole and are sensitive to context. (Nisbett, Peng, Choi, & Norenzayan, 2001; Redding, 1980)

To the contrary, American negotiation style is known as competitive and confrontational style. Stella Ting-Tommey (Ting-Toomey, 1988) finds that Americans emphasize their self-face maintenance more than their mutual-face maintenance. Therefore, they tend to be aggressive and confrontational when negotiating specific issues. Americans’ negotiation style is analytic, which is the opposite of Chinese negotiation style. Americans usually decompose a negotiation task into a series of logical points or issues and settle the issues one at a time (Graham & Herberger, 1983).
The study of language in cross-cultural communication

People may think language differences will not affect English-based communication as long as all speakers have some working knowledge of English. However, in a survey (Govindarajan & Gupta, 2001) of 58 executives from multinational organizations, the barrier of language differences is rated as the second biggest challenge for effectiveness of global business teams. A qualitative study (Neeley et al., 2009) has shown that uneven English language proficiency in global organizations has degraded meaning making, group collaboration, and individual relationships.

These language problems stem from the fact that cross-cultural communication typically takes place in one language (i.e. English in the context here), thereby requiring that some participants communicate in a non-native language. This generates communication problems in many ways. Research in second language learning has shown that low language proficiency may lead people to feel overwhelmed and even lost in fast-paced conversations (Mynard, 2002). However, most cross-cultural communication studies neglect this language difference. For example, Chinese participants in cross-cultural studies are typically described as fluent or nearly fluent in English, for example, “The Chinese participants were all fluent or nearly fluent in English. Although they were all currently studying at a U.S. university, the majority had been in the U.S. less than 2 years” (Wang et al., 2009) and “Sixteen were nationals of the United States and spoke English as their first language, and 14 were visiting students from the People's Republic of China and had been in the United States for fewer than 2 years and were fluent or nearly fluent in English” (Stewart, Setlock, & Fussell, 2007). The special selection of fluent non-native speakers may mitigate or disguise the impacts of language proficiency differences, but no one can deny language proficiency as a pervasive factor in non-native speakers’ communication problems. The next section will explain in detail why language proficiency matters.
Language Proficiency Matters

“Do you know any jokes?” “...Timing isn't my strong suit.” King George VI embarrassingly stammered out his problem in the movie “The King’s Speech”. Yes, being able to control the rhythm is important when telling a joke. Uttering the same words at different speeds and with different pauses can create a very different listening experience for an audience. In some extreme cases, the utterance could be totally incomprehensible even if the audience hears every individual word clearly. This can be seen in the first public speech by King George VI in the film, where his severe stammer made his message excruciatingly difficult to understand.

Clearly speaking proficiency matters to the sense-making process. But problems in listening proficiency can also incur misunderstandings of a discourse, as can variations in reading and writing proficiency. Many people have such experiences when watching foreign movies; they often feel the dialogue is going by too fast, even if they know the words in that language. While they are trying to work out what the actors just said, or read what the subtitles just displayed, the dialogue is already moving to something else, and they begin to lose their place in the conversation. In general, language proficiency in all four modalities is a common source of problems for non-native speakers, problems that can haunt them in every aspect of their social lives. Therefore understanding language proficiency differences between native and non-native speakers as well as the psycholinguistic processes underlying language proficiency are important to the HCI scholars and designers focusing on non-native speakers as a user group. In the rest of this section, I will overview some common concepts of language fluency across modalities in order to prepare a theoretical common ground for later discussions.

Proficiency or fluency (we will use these two words interchangeably throughout this work) is an often-used term in linguistic research to describe someone’s high-level operational command of a language. It has a number of meanings that vary according to the different facets of a language. First of all, proficiency can vary by modalities: it can be used as a descriptor for
speaking proficiency, listening proficiency, reading proficiency, or writing proficiency. The meaning of fluency as a summary term can also vary by speaker population, for example the operationalization of “fluent native speaker” can be very different from that for “fluent non-native speaker”. For native speakers, fluency implies 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 (Schmidt, 1992). Whereas for non-native speakers, the meaning of fluency does not have the same richness as it does for native speakers and there is much less consistency in how it is used.

Fluency is often used as a rough synonym for global ability (Lennon, 1990). For example when people say someone speaks four languages fluently, they only mean that the person has the ability to communicate well using these different languages, without differentiating the many ways “well” can be operationalized. Given people’s various understandings of perceived fluency, there has never been a unified definition of non-native speakers’ language proficiency. Different researchers take on different definitions according to the need of their studies. For example, Lennon defines speaking proficiency in terms of its temporal aspect, “speech at the tempo of native speakers, unimpeached by silent pauses and hesitations, filled pauses… self-corrections, repetitions, false starts and the like” (Lennon, 1990, p. 390). Brumfit instead emphasizes the communicative outcomes of proficiency, where proficiency is defined as “the maximally effective operation of the language system so far acquired by the [ESL] student” (Brumfit, 1984, p. 543). In his book, he explains fluency in contrast to accuracy. Under his definition, we might say that “He writes fluently, but with many grammatical errors.” or “He speaks fluently, but on occasion chooses odd vocabulary or expressions.” A shared emphasis of Lennon and Brumfit’s definition of proficiency is the speed and flow of language use. It defines proficiency from an information processing perspective that reflects the ongoing status of the brain’s language processing. I will use this definition of proficiency throughout my proposal, except otherwise noted. In fact, native and non-native speakers’ difference in language proficiency reflects a
difference in their language processing and constructing process. This contrasting relationship is also true for adult and adolescent language users, or for that matter, any people with high versus low language skills.

We can think of a language user with high proficiency and a language user with low proficiency as a chess master and an amateur. A chess master is faster than an amateur in terms of planning a move or remembering a mid-game composition. The processes underlying these actions are “controlled” in the amateur’s mind in a way that he is aware of the rules of moving, the consequence of a move, and a particular position of a chess, etc. For the chess master, these processes have been automated so that he can free his mind for some higher-order processes, such as planning for several steps and reconstructing a mid-game composition. Psychologists have been studying this phenomenon for decades, and have described its relationship to working memory capacity (Baddeley, 1986). Working memory is described as “immediate memory processes involved in the simultaneous storage and processing of information in real-time” (Harrington & Sawyer, 1992, p. 25). Chess masters are found to have more efficient processing skills (the automated processing ability), thus allowing more capacity to be devoted to the storage of other tasks (Degroot, 1965). For example in a think aloud reading experiment (Horiba, 1990), researchers found that the non-native speakers paid heavy attention to language mechanics but mostly failed to infer meanings from their knowledge. This suggested that their minds were busy recognizing words and syntax, while higher-level comprehension was left untouched or addressed only to a limited degree. In contrast the native speakers mostly ignored language mechanics and devoted considerable attention to inferring the meaning of a text. This suggested that native speakers were able to automatically extract linguistic information from a text, and thus were more efficient in elaborating and comprehending the semantic content it conveyed.

The notion that a high working memory capacity leads to greater memory storage space in turn rests on the scientific consensus that human memory is limited. This is well documented in Miller’s (1969) book chapter, “The Magical Number Seven, Plus or Minus Two: Some Limits
on Our Capacity for Processing Information.” Seven is approximately the number of items (whether numbers, words representing complex concepts, or any partial products of a process) that you can hold in your conscious mind at one time before the information begins to dissipate. Chess masters are able to connect mid-game chess positions in a current game with similar matches they have played in the past; therefore they only need to remember that past game as one item along with the relevant chess positions from the past game. The amateurs, not having a lot of game experience, can only remember approximately seven chess positions.

Language users with high proficiency have an ability similar to chess masters, but with respect to language use. They use their proficient experience to process basic information quickly, so that their processing capacity is left free for thinking about what a text means, how a paragraph can be organized, or what implications are suggested by content they have just read or heard. To the contrary, language users with low proficiency do not have similar processing of the language, leaving their minds more occupied by words instead of phrases or concepts. Because of having to focus on spelling, or meaning, or sounds of these words, their cognitive processes give lower priority to comprehending and organizing words and phrases at a sentence level. Often, the processes is too slow to be maintained within the limit of seven items; this means that content will disappear from their mind before they have a chance to make sense of a sentence, draw connections between sentences, or synthesize the meaning of a group of sentences. This is why language proficiency is important.

During group text chats, non-native speakers receive and understand information more slowly than native speakers; as a result, they need more time to organize expressions and they frequently make grammatical mistakes. The imbalanced language proficiency between non-native and native speakers could affect the dynamic of group conversation. For example, it can lead to asymmetrical relationships. When a native speaker perceives that a non-native speaker has language deficiencies that interfere with communication, the native speaker may assume control of the conversation (Gaies, 1982). Native speakers also demonstrate more cognitive and
metacognitive skills for comprehending conversations, due to their higher language proficiency (Horiba, 1990).

Because of the prevalence of communication problems in cross-cultural groups, professional communication research has a body of work to develop strategies for these problems. For example, some research has suggested that we should increase native-speaking employees’ cultural awareness and train them to adapt their communication strategies. Communication adaptation strategies include speaking slowly, avoiding jargon, writing clear and structured text, allowing wait time, and so on (for a full list, refer to (Anawati & Craig, 2006)).

Following the cultural and language studies, there is a growing body of research investigating how cultural and language factors influence people’s use of computer-mediated communication (CMC) tools, which in turn influence their computer-mediated cross-cultural communication experiences and outcomes. Chapter 2 will review relevant literature considering the roles and impacts of CMC in cross-cultural communication.
Chapter 2

Computer Mediated Communication in Cross-cultural Communication

Increasingly, text-based computer-mediated communication (CMC) has gained tremendous popularity as an element of distributed collaborative work, online education, and social networks. It has a number of advantages over traditional face-to-face (FTF) communication and audio- or video-based communication due to its unique features shaped by text. Therefore, activities that are closely associated with text communication play important roles in text-based CMC; this is in contrast to the listening and speaking activities that support FTF communication.

A considerable amount work has investigated reading and writing in CMC, across disciplines and with different focuses and scopes. It is neither possible nor necessary to cover all branches of this multi-faceted literature in this chapter. Instead I will address three aspects that are most relevant to the issue of non-native speakers’ communication in text-based CMC. First and foremost I will discuss the conversational aspect of reading and writing. Second, I will discuss features of text chatting from an HCI perspective, contrasting the support provided by different text-based CMC tools. This perspective complements the conversational perspective to provide an integrated view of the reading and writing that occurs when interacting with CMC tools. Third, I will review past work that has investigated social factors of text-based CMC, especially those that may be important for non-native speakers. By the end of the chapter, I hope to have clearly illustrated a comprehensive and solid analysis of research in text-based CMC.
Conversational perspective

In a text-based interactive environment, people read to understand others and write to communicate ideas. Werry (Werry, 1996, p. 61) described the conversational perspective of reading and writing as “simulating the discursive style of face-to-face spoken language. From conveying patterns of intonation, to supplying paralinguistic cues, to the collaborative construction of a shared contextual frame, … [the written language] is crucially inflected by the practice of naturalistic interpersonal exchange, and the tendency to create forms of expression that enable or are appropriate to such exchange”.

Working from Werry’s perspective, I have summarized three features that distinguish conversational reading and writing from their traditional forms: (1) Particular audiences. The audiences in an interactive environment are the interlocutors involved in the particular conversation. (2) Time constraints. Chatting that is time-limited is a common in highly interactive contexts, where efficient and effective communication is often a desire. (3) Turn taking. There is usually a rhythm of when to write and when to stop to read in a text-based conversation. This is similar to the turn taking system in oral conversations, in which interlocutors take turns to talk.

Turn taking has been studied for many years in oral conversations; it is seen as a vital component in the construction of any spoken interaction (Sacks, Schegloff, & Jefferson, 1974). Turn taking is accomplished through a dynamic collaboration of interlocutors, who 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. If one is willing to speak, he or she may indicate a start of his or her turn. Therefore, a speaker’s action of taking turns is a manifestation of his or her efforts of participating in a conversation. The more turns a speaker takes and the longer a speaker hold a turn, the more this speaker participates in a conversation.
Schegloff noted that turn taking also occurs in text-based conversations but with slightly different dynamics than FTF conversations (Schegloff, 1982). Due to the common lack of social cues (e.g., that someone is about to “speak”), several interlocutors may enter a conversation at the same time. Although utterances appear one at a time on the screen, and thus may appear to be sequential (Werry, 1996), there may be no communication logic that creates linkages between the turns. In addition, in contrast to spoken conversations where utterances are produced and heard at the same time, an utterance in most CMC tools is normally read by others only after the interlocutor finishes typing all the words and sends it to the system. Therefore, a given conversational turn may actually respond to a turn several turns before it. This difference disrupts the sequential nature inherent in face-to-face conversation (Herring, 1999), which may worsen the communication. However, several empirical works [23-25] showed that people appear not to be affected by the disrupted turn taking in text chats. Specifically, examination of chat logs showed little confusion associated with the disrupted turns. Participants were good at handling parallel conversations by using names, overlapping terms, or utterance repetition to direct a comment when necessary. However, most of this research has only considered native speakers’ behavior of handling parallel conversations; whether non-native speakers who are likely to have lower language proficiency can perform as well as native speakers remains a question. For example, we do not know whether disruptions in turns or conversation “flow” in text chat is problematic for non-native speakers in cross-cultural group chats; and if they are affected, in what ways.

Language fluency can also affect efforts to take a conversational turn. A less fluent participant may find it difficult to “jump into” a conversation; for example, he or she may feel that the turns move so quickly that by the time he or she understand others’ words, the conversation has moved to another point. This problem may occur more often in groups than in one on one conversation, simply because there are more interlocutors competing for a turn. In addition, asymmetrical relationships among members of a group may emerge on the basis of
language fluency; such contrasts may be similar to the asymmetrical relationships that arise from differences in expertise or authority (Woken & Swales, 1989). When a native speaker perceives that a non-native speaker has language deficiencies that interfere with communication, the native speaker may then assume control of the conversation (Gaies, 1982). The language proficiency imbalance is likely to affect turn taking: Native speakers will take a majority of the turns, with non-native speakers afforded fewer opportunities. When the imbalance barrier is too severe to overcome, non-native speakers may choose to refrain from the conversation, even if they began the conversation with great ideas and willingness to participate.

**HCI perspective**

Monk has argued that analyzing human-human communication as a language production and comprehension process is not enough (Monk & John, 2003). To fully understand communication, we need to study both the social and cognitive processes involved. Clark (1996) proposed a grounding theory that described the communication process as a collaborative interaction of interlocutors to understand each other. According to Clark, to understand each other, interlocutors need to incrementally build common ground in an iterative interactive manner. This grounding process is shaped by both purpose (what people are trying to accomplish in their communication) and medium (the techniques available in the medium for accomplishing this purpose) (Clark & Brennan, 1991). Clark and Brennan defined eight medium-related constraints on grounding: copresence, visibility, audibility, contemporality, simultaneity, sequentiality, reviewability, and revisability. This set of constraints has become an important guide for researchers who study the costs and affordances of CMC tools (Birnholtz, Finholt, Horn, & Bae, 2005; Yamashita, Inaba, Kuzuoka, & Ishida, 2009; Yamashita & Ishida, 2006).
Although text-based chatting episodes may inherit language features from spoken communication, they also introduce unique features emanating from their text-based communication modality. It is this set of features that lead to affordances for text-based CMC tools that are different from affordances of audio/video-based tools. For example, most text-based CMC tools have the attributes of reviewability and revisability. Interlocutors type their utterances before sharing them, and as a result have the freedom to review and revise the content. They can also review previous utterances if desired, as there is generally a log or some other history.

In previous studies, people have expressed mixed feelings about the extra time for editing and reflection before sending messages out (M. Freiermuth & Jarrell, 2006; Setlock & Fussell, 2010). On one hand, it helps interlocutors, especially those with low language skills, by alleviating the cognitive burden of instantaneous writing and reading, thus improving the quality of their communication. For example, Setlock and Fussell (2010) interviewed 15 non-native speakers about their media preferences in a variety of situations. One of their Chinese participants shared concerns about communication through an audio versus text-based channel, “… if one of my friends really likes arguing something, like something philosophical and stuff. I’m better at organizing my thoughts when I’m writing, rather than talking” (Setlock & Fussell, 2010, p. 345). On the other hand, the lag time interrupts the sequential ordering of a conversation, which may result in communication confusion. As shown in Freiermuth’s summary of participants’ experience with online discussion, “The conversation gets messed up. Sometimes it comes back to the beginning, but it seems more like people saying what they want to do rather than a discussion. Things were decided according to the flow of the conversation (rather than by mutual agreement)” (M. Freiermuth & Jarrell, 2006, p. 203).

In addition to reviewability and revisability, some text-based CMC tools afford contemporality and/or simultaneity. According to Clark and Brennan, contemporality is defined as “B receives at roughly the same time as A produces”. Email and online discussion boards do
not possess contemporality, whereas online chatting tools such as IM are closer to the FTF experience. In a chat window, you can see what I have just written, but if we are communicating by email, you must wait until the email arrives, then open the message to view it. Simultaneity is defined as “A and B can send and receive at once and simultaneously”. This is common in FTF communication; I can smile while you are telling a joke. It’s also possible in text-based communication, although it is not very practical. Imagine that there is a chatting tool for two interlocutors only, where each interlocutor has a space to type. Both of the spaces are shown on the screen, and the interlocutors’ typing appears letter by letter in their own space. One interlocutor could then respond to the other’s utterances while he or she is writing.

Garcia and Jacobs (1999) used the set of terms synchronous, asynchronous and quasi-synchronous to describe an idea similar to Clark and Brennan’s notions of contemporality and simultaneity. According to these researchers, if the message production process and the posted messages are both available to other interlocutors, it is a synchronous communication. If only the posted messages are available to other interlocutors while message production is private to the person composing the message, it is a quasi-synchronous communication. If neither message production process nor posted messages are immediately available to other interlocutors, it is an asynchronous communication. I prefer the distinctions made by Garcia and Jacobs, because it clearly points out the two factors of message production and message viewing that differentiate three variants of communication, whereas Clark and Brennan’s definition is more ambiguous.

In many cases, contemporarily and simultaneity can be used interchangeably. In the Clark and Brennan argument, we can grasp the difference from the examples they provided, but the contrast they intend is never defined clearly. In fact, the definitions may even be misused in some circumstances. For example, if two interlocutors send two messages at the same time and the two messages appear almost simultaneously in the chatting window, according to Clark and Brennan, the tool affords simultaneity. However, it may not be a simultaneous conversation, because
utterance one may not be a simultaneous response to utterance two; even Clark and Brennan would agree to this point. Using Garcia’s definition, it is easy to recognize that this is a quasi-synchronous tool, because the message production process is still privately owned by the person who writes the message.

Besides Clark and Brennan’s eight constraints, some researchers have also studied other design features related to their research questions. For example, designing support for face management implies features that aid interlocutor goals such as retaining ones’ own dignity and autonomy (face management for the self) and reducing threatening face expressions towards others (face management for others) (Brown & Levinson, 1987). Freiermuth and Jarrell found that text-based CMC tools reduced face-threatening pressure through requiring less immediate interaction than is usually expected by interlocutors in FTF communication (M. Freiermuth & Jarrell, 2006). Hancock et al. (2009) described how IM enabled face saving by interlocutors because it allowed them to mask their activity behind the screen. The discussion of affordances of CMC tools in this section will be used later to evaluate my proposed tool, which will be introduced in chapter 3.

Social perspective

Social factors affect and are affected by CMC interactions. There is a plethora of literature studying social factors varying across a range of participants’ communication experiences. Studies of non-native speakers’ communication experiences with CMC are especially multidisciplinary, comprised of studies from psychology, education, second language acquisition, sociology, HCI and CSCW. A major theme shared by this diverse research is to understand how non-native speakers’ willingness to communicate is promoted or reduced by CMC. This research question has been studied in a range of tasks, participants, and CMC tools.
One common example comes from education researchers studying non-native students’ willingness to communicate in classroom settings and small group discussions using online discussion forums and chatting tools (M. Freiermuth & Jarrell, 2006; M. R. Freiermuth, 2001; Lee, 2004; Murphy & Coleman, 2008). In other cases, HCI and CSCW researchers have studied non-native speakers’ willingness to communicate in decision making tasks and brainstorming tasks that mimic the routine activities in work settings (Convertino et al., 2008; Diamant, Fussell, & Lo, 2008; Setlock & Fussell, 2010; Setlock, Fussell, & Neuwirth, 2004; Stewart et al., 2007; Wang et al., 2009). The varied and even controversial findings from these studies exemplify that willingness to communicate is dependent upon both the specific situation and the specific people involved in the conversation (Macintyre, Dornyei, Clement, & Noels, 1998). Of particular interest for this proposal is how non-native speakers’ willingness to communicate in text-based CMC is different from audio-based CMC or FTF; this issue will be reviewed in the following paragraphs.

Willingness to communicate is a key component to successful communication, because it is a direct predictor of participation, which in turn is essential for successful communication and collaboration. Originally, this construct was operationalized as the probability that an individual will choose to initiate communication when free to do so (McCroskey, 1992; McCroskey & Baer, 1985). For example, Freiermuth and Jarrell (2006) asked their Japanese participants to choose whether they would use a text-based chatting tool or FTF communication in the future after they finished a planning task. They found that participants were more likely to choose text-based chat communication than FTF communication, which suggested to these researchers that the participants were more willing to communicate via text than FTF. In recent CMC research, researchers often use language production as an implicit measurement of participation willingness; this less direct measure offers a converging measure for probing the construct. For example, Wang (2009) counted the total number of words produced by his Chinese participants in
a brainstorming task that had been conducted in either a FTF or an online chatting condition. He came to the same conclusion as Freiermuth and Jarrell, but using different measurements.

Many factors affect participants’ willingness to converse. Communication anxiety and self-confidence in language use have been shown to predict willingness to talk for both native and non-native speakers (Clement, 1986; McCroskey & Richmond, 1990). These two factors are also often found in non-native speakers’ reflections concerning their reticence in communication, providing further evidence that the social barriers of communication anxiety and self-perceived competency inhibit non-native speakers’ willingness to talk.

There are several types of anxiety that less fluent interlocutors may encounter in a communication. They may be anxious about the time pressure in a conversation, especially an intensively interactive one. They may also be anxious about losing face in a public conversation (i.e., if they come from a culture in which maintaining face is important). Many non-native students have attributed their reticence in classrooms to the fear of making mistakes in front of others (White, 1989). Interlocutors may also be anxious about talking to a person who has higher status, for example, a teacher, group leader, or even a native speaker (from a non-native speaker’s view).

Self-confidence is also a feeling that may be tied to self-perceived competence in communication. Non-native speakers may perceive themselves to have less language competence than native speakers, causing them to restrain from an intensive conversation (Ryan, 1983). Other than self-confidence about language use, there may also be other individual factors that inhibit self-confidence and affect willingness to talk. A novice may perceive herself to have less knowledge and experience than experts, therefore choosing to talk less in a knowledge-intensive problem-solving task. An introverted person often has lower social self-confidence than an outgoing person and may be less engaged in any communication activities. Many studies have shown that text-based CMC tools are better for non-native speakers than audio/video CMC tools.
or FTF communication, because they promote willingness to talk. They talk more in online chatting tools, because these tools “tend to underplay the social cues of participants by focusing on the content of the messages rather than on the attributes of senders and receivers” (Garton, Haythornthwaite, & Wellman, 1997, p. 81).

Although there have been many studies comparing text-based CMC tools with audio/video CMC tools or FTF communication, with corresponding findings that document the advantages of text-based CMC tools over communication through other channels, there are disadvantages of text-based CMC tools naturally rooted in their designs and features. Several qualitative studies have reported participants’ frustrations in online group discussion; in these cases the frustration seems to be directly linked to the overwhelming and flexible turn-taking systems of text-based CMC tools (Hara & Kling, 1999). For example, in Hara and Kling’s (1999) observation in a virtual class discussion, a student complained that, “… conversation on the screen went very quickly. It was very hard to catch up with what was happening” (p. 11). And another student complained that, “By the time I type in my response, the conversation is gone” (p. 11). Gonzalez (2003) found that people often introduce new topics without finishing previous ones and they only selectively attend to the topic that is of their interest. Therefore, some participants may feel overwhelmed and even lost in the parallel and fast-flowing discussions, especially student who have slow keyboarding skills, slow reading/writing skills, and different cultural backgrounds (Mynard, 2002).

Finally, there is the well-known disadvantage that text-based communication tools have with respect to emotional or other non-verbal elements in communication. Research has found that emotion detection is subtler in text-based communication than face-to-face. Because “there are no online channels for the multiple signals the brain uses to calibrate emotions” (Goleman, 2007), it is generally hard for people to act emotions. Hancock et al. (Jeffrey, Kailyn, Kevin, & Jennifer Mae-Hwah, 2008) did a set of experiments to test if participants could still detect their
partner’s emotions in text-based chats. They found that participants could still sense their partners’ negative emotions when their partners were enduring some stress. They gave two possible reasons for the results, one being that participants could sense the negative emotion words used by their partners, the other reason being that participants had to wait longer for a response, a possible signal of something going wrong with their partners. Because the detection of the subtle meaning in the emotion words and time delay that could indicates emotion are related to people’s past experience communicating with others, we can imagine that such detection can be harder for people with different cultural experience.

**User-centered design of a chat tool for cross-cultural groups**

Although we have adequate understandings of current technologies’ impact on cross-cultural communication and non-native speakers’ media choice in different situations, we do not know the design space for future communication technologies that non-native speakers and possibly also native speakers can benefit from. None of the current technology solves existing communication problems perfectly. For example, we know that text chat can alleviate the cognitive burdens of non-native speakers due to less immediacy in response than face-to-face communication. But studies show that there are still communication problems caused by non-matching levels of language competence in text-based CMC, such as lost control of conversation, confusion and frustration (Hara & Kling, 1999). Many such problems have been reported in classroom or group studies (M. R. Freiermuth, 2001; Gonzalez, 2003; Hara & Kling, 1999), perhaps indicating that they are particularly prominent in multi-person communication settings. In previous CMC studies of cross-cultural communication, dyads and triads were mostly used. A less complex conversational setting might explain why those communication problems have not bee reported or well studied. In my research, I chose to use 4-person groups, which though not as
large as a typical class, does place significant strain on a multi-way communication activity. (See (Convertino, Mentis, Slavkovic, Rosson, & Carroll, 2011) for similar arguments for using larger groups in the study of common ground in CMC)

Based on the understanding of cross-cultural communication practice in the current technologies, I took on the goal of exploring new technologies that could better support cross-cultural communication. I am especially interested in designing text-based chat tools for multi-party mono-language communication situations, because it appears that this will be a common mode of communication for cross-cultural conversations in both education and business settings. Therefore, I have not considered the role of text-based chat tools that use machine translators.

My work extends previous work in several ways. First, my work systematically studies the impact of language proficiency on the process and outcomes of cross-cultural communication, which most previous CMC research ignored. Second, I studied cross-cultural communication in a distributed group of four people, creating a communication setting that is complex enough to provide salient examples of communication issues caused by unmatched language proficiency issues in cross-cultural teams. Third, I designed and evaluated a lightweight peripheral interface, which shed some light on how cross-cultural communication tools might be changed to better support communication.

In the balance of this dissertation, I present an empirical study of distributed teams of four people (two American speakers, two Chinese) communicating in text chat. The first part of the study (chapter 3) investigated the effect of language proficiency difference on team and individuals with regards to performance, participation, and user experience. The findings of the first study guided the design of a new technology (chapter 4) to address the problems. The second part of the study (chapter 5) investigated how the new technology changed team outcomes and team members’ experiences. Finally, I discuss design implications and limitations of this work (chapter 6).
Chapter 3

Language Problems in Online Cross-cultural Group Text Chat

I conducted a study to develop an in-depth understanding of how language proficiency differences affect people participating in a text-based conversation. My work is different from previous work in several ways. First, my work systematically studies the impact of language proficiency on the process and outcomes of cross-cultural communication, which most previous CMC research ignored. Second, I study cross-cultural communication in distributed group of four people, which provides salient examples of communication issues caused by unmatched language proficiency issues in cross-cultural teams. Often such study is conducted through fieldwork, with the goal of learning about users’ needs in the real world. However, because my focus is on language proficiency issues in distributed cross-cultural teams, fieldwork was not a practical option. Instead I sought to engage participants in a familiar usage experience in a lab setting (a group chat) where I could closely observe their behavior; with the group chat experience fresh in their minds, I asked participants to fill out a questionnaire and then interviewed them about their communication process. Problems and requirements were then carefully analyzed from the chat logs, post-task questionnaires and interviews. I used a mix of methods in data collection and analysis. Specifically I used quantitative data to track behavioral patterns in conversations while I use qualitative data to characterize the observed differences and understand participants’ experiences.

This study is guided by the following two research questions:

RQ1. Whether and how does language proficiency affect non-native and native speakers in cross-cultural group chats? What strategies do they use to overcome the problem?
RQ2. Whether and how does interrupted turn taking affect non-native and native speakers in cross-cultural group chats? What strategies do they use to overcome the problem?

Participants

I assembled five groups for this study, each with two native speakers (Americans) and two non-native speakers (Chinese). After each session and set of interviews I did a preliminary coding of participants’ interviews; I concluded the study after reaching the point of theoretical saturation (Strauss & Corbin, 2008), when themes were repeated in the data and no new themes were emerging.

The participants were undergraduate and graduate students from a large university in the Northeastern United States; ages ranged from 20 to 43. There were 8 females and 12 males. Because I was not interested in gender effects, and to avoid gender-related social and communication dynamics, I 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.

For the Chinese participants in our study, all had been living in the U.S. for less than four years, and all reported an advanced English proficiency (indicated in their pre-task survey). Advanced English proficiency was described 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.” Thus any difficulties observed should be seen as persisting even once a non-native feels relatively comfortable conversing in a new language.
Task

I adapted the task used by Freiermuth and Douglas (M. Freiermuth & Jarrell, 2006), in which they studied non-native speakers’ willingness to communicate in chat systems. I changed the theme of the task to a familiar topic for all of our participants. Specifically, I 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 using the AIM tool 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. (The task instruction is in Appendix A)

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 (see Appendix B) and the instructions, they were asked to fill out a background survey (the survey is in Appendix C), 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, scheduled at their own convenience.
Instruments

Survey

The post-experiment survey consisted of 10 questions adapted from the work of Convertino et al. (Convertino, Asti, Zhang, Rosson, & Mohammed, 2006) on quality and satisfaction of communication in virtual teams. (The survey is in Appendix D)

Interview Protocol

I also 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 AIM 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 the research questions.
Coding scheme

I coded the chat logs in detail, so that I could carry out a quantitative analysis. I adapted a coding scheme developed for analysis of online brainstorming discussions about on-campus parking (Gettys, Pliske, Manning, & Casey, 1987; Jessup, Connolly, & Galegher, 1990). Table 3-1 shows my version of the coding scheme. I 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. I 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 me 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).
Table 3-1: Coding scheme for online brainstorming task

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

**Results**

I found three themes from the interview transcripts – language proficiency issues, impaired turn-taking system, and a slowing of the group process. In the following I combine data from the surveys, interviews and chat logs to introduce communication issues related to language proficiency as well as remediation strategies.
Language proficiency

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 proficiency affected non-native speakers negatively.

Problem 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 (O'Neill
& Martin, 2003), 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)

The above examples are representative among Chinese participants. Lacking in language competency, they did not have many strategies to remedy the situation. It is hard for them to jump right into the discussions, but it is also hard for them to raise their unshared ideas later, because this would require considerable foregrounding and rephrasing skills. As a result, most of them chose to shun away from the conversation.

This phenomenon was underscored by the speaking turns each participant had. For each person, turns was normalized across groups, using 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.

_Problem 2: followers in group_

Language proficiency enabled native speakers to dominate the chat in all five groups. When asked about leadership 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 having to be 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
chose to follow others, despite that she had a negative feeling about it. “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 participant also commented that she would lead the discussion if she were
communicating in Chinese.

The above examples suggested that an inability to control of a conversation is associated
with an imbalance in how much people contribute; native speakers dominate the conversation by
controlling the flow and direction of the conversation. Although non-native speakers had negative
feelings about it, they still chose a conservative strategy – following others. Non-native speakers
not only write or speak more slowly but also they 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. One question asked whether participants 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.

**Short 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 we
studies. In text chat, one cannot hold the floor for very long, so speakers must type quickly in general. As discussed earlier, non-native speakers do not generate text as fast as native speakers; therefore they may prefer more efficient expressions, allowing them to quickly share their points. One extreme example of 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)

Unfortunately, these ultra-efficient expressions were not received well by other participants. Sometimes participants would not even ask for elaborations; they seemed to expect that the speaker would 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 I looked for confirming evidence in the chat logs, I 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 that had been coded as elaboration divided by the person’s total number of turns. However, when I investigated more closely and examined the word count of individual’s elaboration expressions, I found that native speakers’ elaborations contained significantly more words than those of non-native speakers, t(18) = -4.45, p < 0.001. (Note that I 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 less verbal in the elaborations they offered, making their arguments easier to ignore (as the American student observed).

In sum, these examples reinforce the point I made at the beginning of this section, namely that one important cause of non-native speakers’ participation problems is that they are slower in using English. The detailed analysis has shown that these language delays produced different types of problems, from perceptions of slowness to a tendency to follow rather than lead, and to very short elaborations that were easy to pass over.

**Disrupted turn-taking**

The chat logs revealed that parallel discussions were prevalent in these cross-cultural groups. Table 3-2 summarizes the parallel discussion episodes in the five chat logs. The numbers in the middle column refer to the index number of an idea. A new idea is defined as an idea that did not appear in the discussion before it. An idea that extends another idea is considered an extension of the original idea, not a new idea. The length of the discussion of an idea is defined as from the turn of the first mention of the idea to the turn of the last mention of the idea. The parentheses in the middle column 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 3-2: Summary of parallel discussions in chat logs.
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. In the following analysis, we focused particularly on how language proficiency affected this style of communication, and how native and non-native speakers coped with the associated challenges.

I 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 taking turns in FTF conversations, “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 “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

<table>
<thead>
<tr>
<th>Group</th>
<th>Parallel Discussion Point</th>
<th>Total Number of Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(4 5) (8 9) (11 12)</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>(2 3 4 5) (6 7 8 9)</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>(1 2 3) (5 6)</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>(1 2 3 4 5 6 7 8)</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>(1 2 3 4 5 6 7 8)</td>
<td>10</td>
</tr>
</tbody>
</table>
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 when 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, “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 followed that one instead of
mine.” (Interviewee 9, Chinese)

Another Chinese participant said that 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.

There was always some delay in responding to others’ turns, simply because the group
members could 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 raised at about the same
time, the responses to the different topics could mix up.

Several native speakers also mentioned that they missed some points in the multithreaded
discussion, for example,

“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 me 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. To the contrary, the native speakers seemed to be able to manage the turn-taking system although with an extra cost. I 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 could quickly reiterate a point, reuse some key words, use a group member’s name to direct their responses, and so on. All of these strategies were observed in the chat logs. 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 participative 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.
Attenuation blocking

The “attenuation blocking” problem was discussed in the seminal work of Nunamaker [8], who emphasized the downsides of participants not being able to contribute comments at the time they felt to be most relevant. I have presented several non-native speakers’ attenuation blocking examples in the above sections. Some of the participants’ ideas were never brought up during the group chats because of the language proficiency issues. Interestingly, I also observed attenuation blocking by native speakers in one group.

A native speaker from this group revealed that he would generally try to hold back his ideas to give non-native speakers more opportunity to talk, “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, 'cuz 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)

Although communication adaptation is good for cross-cultural communication, it could result in attenuation blocking, a negative consequence on team outcomes. In the above example, a native speaker held back his ideas several times, and he never brought them into the conversation, resulting in a smaller number of ideas than this team could have produced.

Because attenuation blocking is associated with communication adaptation in our study, I further analyzed how communication adaptation occurred in the group conversations. The following two native speakers of group 1 revealed how they implemented adaptation 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)

In Figure 3-1, Y-axis denotes the number of words in the given time slot (in our analysis this 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. The left side of Figure 3-1 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, I 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. I suggest that the contour of a line connecting these values depicts a “conversational rhythm” for that person. My 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, I found similarity within native and non-native pairs but dissimilarities across cultures. This finding is consistent with Wang and Fussell’s (Wang & Fussell, 2010) 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, I summed the two non-native speakers’ words per minute, and did the same for the two native speakers. Figure 3-1 (a) shows the conversational trend for group 1. I 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; I 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.

No members of 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 3-1 (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. When one of the non-native speakers proposed his two solutions and the native speakers were discussing the other three solutions, they just talked “over” his ideas. While this is just one group and one person within that group, it is 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, I used a technique known as the Granger causality test (Granger, 1969), 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 \textit{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, I 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.

I first tested Granger causality between each possible combination of group members in group 1; I 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 - I merged the series from the two non-native speakers and did the same for the native speakers. Table 3-3 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 suggests that native speakers did accommodate to non-native speakers in conversation as suggested in the interviews. I also analyzed group 3 for comparison as seen in Table 3-4. None of the relationships are significant for group 3, suggesting that there was no communication accommodation in either direction for this group.

Table 3-3: Summary of parallel discussions in chat logs for Group 1.

<table>
<thead>
<tr>
<th>Lag</th>
<th>Non-native -&gt; Native</th>
<th>Native -&gt; Non-native</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td>2</td>
<td><strong>0.01</strong></td>
<td>0.56</td>
</tr>
<tr>
<td>3</td>
<td><strong>0.05</strong></td>
<td>0.46</td>
</tr>
</tbody>
</table>
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 some native speakers through experience with non-native conversation partners.

<table>
<thead>
<tr>
<th>Lag</th>
<th>Non-native -&gt; Native</th>
<th>Native -&gt; Non-native</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.17</td>
<td>0.41</td>
</tr>
<tr>
<td>2</td>
<td>0.01**</td>
<td>0.56</td>
</tr>
<tr>
<td>3</td>
<td>0.05*</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Table 3-4: Summary of parallel discussions in chat logs.

Discussion

Because studies of cross-cultural communication have provided little detailed analysis of language proficiency and its impacts, I used mixed methods to gather as rich a dataset as possible. However I recognize that the 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 I 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 I have described in this dissertation.

I 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 I shared about communication accommodation referred explicitly to prior experience of this sort. On the one hand, this makes it difficult to generalize the findings to groups with less experience. But on the other, it has allowed me in this exploratory study to observe phenomena that might be part of a more stable repertoire of cross-cultural communication practices.

To conclude, I 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, I was 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, I have shown how a time series statistical test can be used to assess relationships among different speakers or pairs of speakers. My primary goal in this study has been to document communication patterns and experiences, so that I and other researchers can investigate these issues in more detail in the future. However, I also believe that my findings have implications for the design of tools that might enhance cross-cultural group chat; Chapter 4 will present a design concept for cross-cultural group chat.

The work reported in this chapter is published in GROUP ’12, see Curriculum Vitae publication C5.
Chapter 4

Designing for Cross-cultural Group Text Chat

After building an understanding of cross-cultural communication practices when using current CMC technologies, my next research objective is to explore new technologies to better support cross-cultural communication. I am especially interested in designing text-based chat tools for multi-party mono-language communication situations. Therefore, I will not cover text-based chat tools using machine translators.

Based on my observations of unmatched language proficiency, disrupted turn taking and attenuation blocking in cross-cultural group chats, I started exploring the design space to solve these problems. My design goals are twofold: first, I want to preserve the positive design features in current text chat tools; second, I want to integrate new design concepts into current text chat tools to solve the emerging requirements I have gathered by observing cross-cultural collaborators. To support these goals, I reviewed and explored technologies that were designed for improving reading or learning comprehensions, mitigating disrupted turn taking and mitigating attenuation blocking.

Collaborative annotation

Note taking or annotation is often used in reading and learning activities to help externalize the learner’s cognitive thinking. In online learning environment, technologies can be provided that allow people to make notes in a collaborative fashion, with the intention of maximizing their learning ability. One such technology category is collaborative annotation tools. Such tools share features with social tagging, for example the annotations are publicly available to others, so as to support information sharing and exchange. However, a fundamental difference
between collaborative annotation and social tagging is the communicative immediacy that the tools enable. While most social tagging is static and asynchronous between users, collaborative annotations are interactive and synchronous. A user can see other users’ annotations on a document immediately and can annotate others’ annotations as well.

A pioneering design in this category is CoNote (Davis & Huttenlocher, 1995). CoNote is a browser plug-in that allows people to annotate using a special document format. The CoNote documents are formatted with specific “annotation points”, where users can insert annotations or view and respond to others’ annotations. Figure 4-1 shows an example of how annotations are embedded within a CoNote document. In this early design experiment, the communication style is still asynchronous, somewhat like an integrated online discussion board.

---

**Problem 1**

There are 7 annotations

*Primitive Function returned from call to conference* Student 1 Thu, 22 Sep 94 17:07:04 EDT

*BUG IN ps3 SOURCE CODE??????* Student 1 Thu, 22 Sep 94 22:47:46 EDT

*Defining cs-advisor* TA Fri, 23 Sep 94 11:32:42 EDT

*strategies* Student 2 Sun, 25 Sep 94 16:45:39 EDT

*BUG WITH POWERMAC* Professor Sun, 25 Sep 94 18:43:03 EDT

*My stupidity hasn't improved.* Student 3 Mon, 26 Sep 94 17:42:19 EDT

*Don't use.* Student 4 Mon, 26 Sep 94 18:16:30 EDT

You may add an annotation

---

Figure 4-1: A screenshot of CoNote. (Davis & Huttenlocher, 1995, p. 2)

---

Marshall and Brush used WebAnn in their comparison study, another browser plug-in. Different from CoNote, WebAnn allows annotation anywhere in a document. As displayed in
Figure 4-2, the web page being annotated is in the right pane of the browser and the annotations and replies to annotations are in a separate index pane on the left. To create an annotation in WebAnn, a user selects text in the web page to annotate, a new annotation is created in the index pane, and the user edits the content of the annotation in the index pane. The selected text becomes the annotation’s anchor and is outlined in the student’s unique color. However, the communication is still asynchronous. Although students may see another user’s annotation immediately, this experience depends on whether and when they open their browser and log in the system. General awareness of others’ annotation activity is still low. Also see (Cadiz, Gupta, & Grudin, 2000) for a similar design in work settings.

Churchill et al. (2000) presented a synchronous collaborative annotation prototype, which can be used to integrate documents with IM. As seen in Figure 4-3, users share a document space, where they collaborate. To create an annotation, a user inserts a “pin”, and an annotation box is created around the document. Every user can see the annotation box immediately after it is created, and can comment on the annotation in the same box. This tool works like an IM chat.
window, where online users can send and receive messages on the go. Virtually, a document can have unlimited number of annotation boxes, which means there will be as many chat windows as the annotation pinpoints. One consequence is that the display could easily become quite complex.

A common feature of the collaborative annotation tools described here is that the central piece of work underlying the collaboration is static – either a web page or a document. But in the real world, collaboration often takes place without a central static artifact; users in such settings still need tools to enrich their collaboration. For example, in group meetings, people often take notes so as not to “forget key decisions or repeat prior discussions” (Whittaker, Tucker, Swampillai, & Laban, 2008). With collaborative annotation tools, people will not only recall important discussion better, but also may become aware of different interpretations of important information (Shoou-Jong & Ted, 2011).

Figure 4-3: An anchored chat prototype. (Churchill et al., 2000, p. 3)

Although researchers have recognized the need for meeting annotation tools, few designs have been proposed to fulfill the need. Instead researchers have offered solutions that involve collaborative annotation tools that can be used after a meeting (Chiu, Kapuskar, Reitmeier, & Wilcox, 1999; Renduchintala, Kelkar, John, & Seligmann, 2007). For instance, such a tool might
record the audio of a meeting, then provide the recordings to users for collaborative annotation. Recently, Kelkar et al. (Kelkar, John, & Seligmann, 2011) proposed a “live” collaborative tagging system for online audio meetings. Their system allows users to tag utterances that are indexed by a timeline. Kelkar et al.’s tagging system and a similar design by Kalnikaite and Whittaker (2008) are two pioneer designs that have added support for collaborative annotation to real-time communication and collaboration, a direction often recommended by researchers.

Early findings from the two pieces of work provide valuable design implications for future real-time collaborative annotation tools. For example, one interesting finding from Kelkar et al.’s observations was that users engaged in tagging intensively while they were holding an audio meeting. Although participating in a group discussion is an intensive activity by itself, participants were still able and willing to use tags as a side communication channel. Kelkar et al. identified six themes grouping the tags that were created: topic, description, turn taking, commentary, play, and summary. Topic and description provide conceptual level understandings of an audio segment with various generality. Turn taking identifies the interlocutor of an audio segment. Commentary, play, and summary are more extended tags (more like annotations or notes) that serve different communicative functions as their names suggest.

Kelkar et al. also found that the collaborative tagging raised participants’ awareness of others. Participants seemed to become motivated to tag by observing others’ tagging activity. However, they rated the information added by the tags to the major conversation as peripheral. Another important finding in Kelkar et al.’s observation was that collaborative tagging imposed an extra cognitive load on users. Some users found it difficult to tag while listening to others. When a conflict occurred, they chose the spoken conversation, because there was no way to track back to what others had said. Therefore, the opportunity to make meaningful tags may be lost if a conversation is fast flowing.
Threaded chat

Threaded chat helps people to organize their chat logs into threads. This design feature can be integrated into chat systems or other tools for different purposes, such as managing conversation structure or supporting side chat. Smith et al. [28] proposed an IM tool that supports threaded chat, in which the threaded structure is integrated in the main chatting window, thus making it a primary element in such communication. Figure 4-4 gives a snapshot of their tool. To initiate a new topic, a speaker clicks the “root” of the conversation tree to create a new thread. To respond to an existing thread instead, the speaker clicks on that thread to create a turn placeholder for editing. Although this method makes the relationships between turns clear, it interrupts the flow of the conversation quite a bit, such that it “hops around” and feels unnatural.

Sellen (Abigail, 1995) found that, interruption was a good indicator of speakers’ interaction level in face-to-face communication, however, the interruption seems to be problematic in text-based chat, evidenced by the low satisfaction ratings and negative feelings of the conversations observed in Smith’s study. This discrepancy could possibly due to the scales of the interruption. Specifically, in face-to-face chat, one can only interrupt the current discussion, resulting in new discussion points under the current topic. And the interruption can be seen as a way of diversifying the current discussion topic. Therefore, the interruption only affects a local scale of the whole conversation. However, in Smith’s conversation tree, the interruption can occur anywhere, for example, it can be a new discussion thread of an earlier discussion topic. Because the several interruptions can occur at the same time, they effectively affect the whole conversation and make tracking the conversation flow hard for group members.
Strategies to reduce the blocking effect

The blocking effect occurs because group members have to share limited speaking times and to attend to others’ speaking. Diehl and Stroebe, who documented a blocking effect in brainstorming groups, studied strategies to weaken the problem. They (Diehl & Stroebe, 1991) found that assigning a fixed turn-taking order or providing people with notepads in face-to-face communication could not prevent ideas to slip away from minds. As we discussed earlier, people
tend to keep the turn-taking rule, therefore they need to be attentive to the group’s discussion in
order to “jump in” when that is possible. This extra cognitive load may interfere with idea
generation. However, distributed chatting tools could alleviate this cognitive load by affording
reviewability and anonymity so that people don’t have to attend to the conversation all the time,
leaving extra time for thinking. In fact, several studies have reported that when people can write
ideas in a virtual notepad while chatting in distributed fashion, there is no blocking effect
(Gallupe, Bastianutti, & Cooper, 1991; Hymes & Olson, 1992).

Discussion

Collaborative annotation tools have been shown to improve retention of content, and to
promote mutual awareness and facilitate communication for people in distributed learning or
working settings. A few researchers have investigated tools that support collaborative annotations
during online audio meetings. Threaded chat tools have been shown to regulate the vulnerable
turn-taking system in text chat. And access to a virtual notepad has been shown to reduce
production blocking. However, non-native speakers may not be able to take advantage of the
benefits shown across these tools, because their normal cognitive load during real-time
conversations are so heavy. The addition of tagging, side chat and threaded chats, while it may be
of great benefit, may be simply skipped by non-native speakers, with the result that they may feel
even more frustrated in their conversations with native speakers.

Based on prior studies that showed non-native speakers’ preference for text-based
chatting tools (see chapter 2), I propose that it will be beneficial for non-native speakers to use
collaborative annotation tools in text-based chat systems. In fact, this general concept goes well
beyond non-native speakers – any person using a text-based chat system, especially someone with
low language skills (e.g., children or adolescents), can benefit from such a design. Instant
Annotation is different from previous collaborative annotation tools. Previous collaborative annotation tools, such as WebAnn, only provide anchor points to static documents, whereas Instant Annotation can provide anchor points to synchronous chat. Instant Annotation is different from previous structured chat tools, such as conversation trees. Conversation trees add too much structure to the main chat stream, whereas Instant Annotation only adds structure flexibly on the side. Besides serving as a chat structure tool, Instant Annotation can also provide higher level structuring, for example, abstracting conversation contents, which does not belong to the conversation flow. In the following, I describe a design concept for such an approach, in an attempt to fill the gap in this design space. After presenting the concept, I will discuss its possible benefits and problems. Finally, to help understand the use case of this tool, I conclude with an illustrative use scenario.

Inspired by the rich design space in collaborative annotation, threaded chat, and digital notepad, I started to design software that integrates good features in each of them to benefit cross-cultural online chats. When selecting features from a design space, there are always some tradeoffs to consider, for example, functionality and complexity, representation and flexibility. My guide in making a design choice is to only choose a small set of functions and features that are most relevant to my target users (members in cross-cultural teams) and are most likely to benefit these target users. I will evaluate if a prototype design is used as expected and how much it benefits the target users. In the rest of this chapter, I will introduce the design concept, Instant Annotation. In chapter 5, I will report evaluations of the design concept and a real prototype.

**A design concept: Instant Annotation**

The most distinctive feature of the design concept I propose is its support of synchronous communication through annotations; thus I have named it Instant Annotation. In a nutshell, it is a
para-communication channel embedded in a conventional IM tool. The term “para-communication” is a composite word of “para” and “communication”. Para is a Greek word meaning at one side of. Para-communication means an auxiliary communication mode to the major communication channel.

Figure 4-5 shows a potential user interface for a text chat that uses Instant Annotation. The right pane serves as the major chatting window, where users can type and send messages. As for other chat clients (e.g., AIM) the interlocutors’ name or screen handle appears before his/her utterance, and the name is colored for easy identification. The left pane is a secondary window, where users can instantly annotate any chat post viewable on the right (the chat record is scrollable to allow annotation of earlier messages). For convenience, I will refer to the right window as the “IM” window, and the left as the “IA” window (IA stands for Instant Annotation).

![Figure 4-5: A mock-up of the Instant Annotation design concept.](image-url)
To create an annotation, a user selects a text segment in the IM window, right clicks to open the context menu, and chooses “create new annotation”. This causes a new annotation “tab” to be created in the IA window; the tab is given the same width as the IA window and the same height as the selected text in the IM window. After the annotation tab appears, a user can insert annotation text. The user clicks the “pop” button at the left bottom to send the annotation. Other interlocutors will see the annotation as soon as a user sends it. The annotation tabs are tied to the text and will scroll up with the anchored text. If more than one annotation is created for the same piece of chat text, they will be collapsed within the same screen space, as seen in Figure 4-4. Users can click on any annotation to expand it to its full extent.

To reply to an annotation, a user clicks on the annotation tab, right clicks to open the context menu, and chooses “reply”. At this point a reply tab is created next to the annotation tab at the bottom. After a new reply tab is created, a user can reply in the tab. As before, the user clicks the “pop” button at the left bottom to send the reply. Other interlocutors will see the reply after the user sends it. In the default status, the replies of an annotation are hidden, indicated by a gray arrow on the annotation tab that can be used to open and view a reply. If the arrow is dark, it indicates there are new replies. If the arrow is light, it indicates no new replies since a user last opened it. Figure 3-6 shows what a screen would look like when the replies are opened.
Discussion of the design concept

The Instant Annotation tool serves both as a language facilitating tool and a side communication (para-communication) tool for non-native speakers. From a language comprehension perspective, I hope that it will help to increase comprehension speed, resolve different interpretations and facilitate retention of the discussion contents. In chapter 1, we have noted that non-native speakers are slow in expressing their ideas. One reason for that is that these individuals have low working memory capacity, which leads them to inefficient information processing and knowledge reconstruction. Instant annotations that list topics or other descriptive tags may help them overcome this limitation.

Figure 4-6: Another view of Instant Annotation.
When non-native speakers need to retrieve prior discussion points, the instant annotations might help them locate and recall the content of the text chat more quickly. Psycholinguists have confirmed the positive priming effect of providing conceptual words before reading on comprehension (Kintsch, 1988). When people reread a piece of text, they do not need to go through the whole reading process again, i.e. read each word, activate the semantic meaning of the word, infer the meaning at the sentence level, conceptualize the meaning and link it with past experience or knowledge. If there are conceptual annotations, they can instead go through the first few steps quickly and jump to the final steps of reading comprehension as language experts. In addition, difficult vocabulary items that are annotated by native speakers can be used to serve as a glossing tool.

Instant annotations may also help to promote awareness of different interpretations of an utterance. The different interpretations implied by different annotations on the same text may arise from misunderstandings of the text or the interlocutor’s intended meaning, or it may result from different understandings by people from different backgrounds. In the first case, the different annotations can help people resolve misunderstandings. By seeing and comparing other annotations, users can easily identify their misunderstandings. They may even receive alerting replies from other users who have noticed the misunderstandings. In the second case, the different annotations can help people broaden their perspectives and deepen their understandings on the discussed topic.

From a social perspective, I expect the Instant Annotation tool to promote non-native speakers’ participation in group discussions. If the tools does increase in participation of non-native speakers, it should also increase their satisfaction with their group’s activities. A native speaker is not only able to speak English fast and coherently, but also knows when to take a turn and when to pause or stop appropriately. However, non-native speakers often have a hard time grabbing opportunities to talk in a conversation. It could be harder for them when participating in
online group discussions where regular turn-taking is interrupted by parallel discussions. It also increases their writing effort, because they have to foreground a prior discussion to respond to it.

The feature of Instant Annotation to anchor a piece of text and annotate and reply to it adjacent to the text provides an alternative path for interlocutors to communicate, especially around a discussion point. It is as if the turn-taking system is repaired in this manner. The design also provides more opportunities for interlocutors to jump into a discussion. The commentary and play types of instant annotations may be particularly preferred by non-native speakers from high-context culture, enabling them to achieve richer set of communicative goals, such as building relationships. These communicative purposes may not be a normal aspect of group discussion in a low-context communication culture (e.g. the U.S.), but the Instant Annotation as a side communication tool provides more freedom and comfort for non-native speakers to communicate in ways that are comfortable for them. The annotations may also increase mutual awareness between interlocutors. Native speakers may be motivated to annotate and reply if they see non-native speakers annotating. Therefore, if they recognize that they are dominating the major discussion thread, they may slow down their speed so that they can engage in the side communication, which in turn will lead to more balanced communication.

A use scenario

To provide a better sense of how Instant Annotation might be used in online group discussions, I present a hypothetical usage scenario in this section. It will illustrate several features of the design concept I have presented; however the concept is not restricted to the examples included in the scenario.

Tracy Bale, Addison Ray, and Sue Wong are three IST graduate students. Sue Wong is a Chinese student who has been studying in the U.S. for two years.
Recently, the three students have been raising funds to support a “Go Green”
project. The money collected for the project will be used to support
environmental sustainability in the IST building. They have collected $5000 this
semester, and they decide to start implementing some ideas with the funds.
Because two of them are out of town, they decide to hold an online meeting using
Instant Annotation tonight. They have played with Instant Annotation once
before. Figure 4-5 shows a screenshot of their discussion. Tracy initiates the
conversation, she proposes to use the money to buy more classified trash bins.
Addison thinks the critical issue is not insufficient amount of bins but insufficient
labor to classify trash. She doesn’t think people can classify trash correctly, so a
special cleaning staff would be needed to classify those trashes. Whereas Tracy
thinks people can do it very well, and the reason they don’t do it is because there
is only one classified trash bin on each floor. It is so far from them, comparing
with the trashcan in each office. Their discussion then quickly moves to the
instruction of how to classify trash posted on the wall besides the classified trash
bins. Tracy thinks the instruction is not well-written, which leads to people’s
incorrect classification.

Sue is in the chat room too, however she doesn’t have a chance to join their
discussion because everything goes so quickly. “They type so fast.” She
murmured. She wants to support Tracy’s idea, but as she is typing, Addison has
led the discussion to hiring cleaning staff and the problem of the recycle
instruction. The idea of revising the recycle instruction inspires Sue. She thinks
IST residents indeed need some targeted education on environmental
sustainability, for example training them to classify trash, etc. But she still feel
she isn’t prepared to speak up. She decides to express her supports for Tracy in
the IA window. She selects Tracy’s first utterance, right clicks and chooses “create a new annotation”. She types in “Nice idea!” and clicks the pop button at the bottom. Then she scrolls down to Addison’s arguments on revising the recycle instruction. She selects six lines of Addison’s utterances and creates an annotation “Revise instruction”. She thinks this will remind her of her idea.

Tracy notices Sue’s instant annotations in the IA window, which makes her realize that Sue hasn’t yet contributed to the IM window. So she asks, “Sue, what do you think?” (They are discussing revising the recycle instruction.) Sue is happy that finally someone invites her to join the conversation. She replies, “I agree with all you said. I added some comments on your suggestions.” She continues typing, “I think we should use a part of the money for advertisement for example, making flyers or holding a Go Green lunch seminar.” Tracy confirms her idea of making flyers but says she is concerned about the spending of a lunch seminar. Addison disagrees with Sue’s idea of holding a seminar, because she thinks it will use up too much of the $5000. As Addison is typing, Sue quickly adds two more annotations for her two ideas in the IA window.

It is almost midnight, so Addison suggests they finish the discussion. Before that, she suggests they reduce the possible options for spending the $5000 to three best ones. Sue quickly adds two more annotations for Tracy’s idea “More trash bins” and for Addison’s idea “Hiring cleaning staff”. She also replies to the annotations of “Flyer”, “Seminar”, and “More trash bins”. “I labeled my three preferred options on the left.” Sue says in the IM window. Tracy thinks it’s smart to use the annotations as a simple voting system, so she also replies to three of her favorite ideas, “More trash bins”, “Revising instructions”, and “Flyer”.

Addison replies to “More trash bins”, “Hiring cleaning staff” and “Revising
instructions”. Addison thinks it’s smart too, she almost forget her proposal of hiring cleaning staff at the very beginning of the discussion. Now, she can remember and vote for it. Finally, “More trash bins” gets three votes, “Revising instructions” and “Flyer” gets two votes each. They are pleased with their discussion and final ranking and decide to hold another meeting using Instant Annotation to work out the details for the three plans.

This scenario vividly illustrated several use cases of Instant Annotation. First, people could leverage the anchored context to jump in earlier discussions. Because the response was placed right beside the context, foregrounding was effectively eliminated. Second, people could manage the side conversations as stacked lists of annotations, each stack corresponding to one discussion point. This conversation management is similar to the conversation trees without interrupting the main chat too much. Third, people could contribute at different places, which made the conversation stream more diversified. As shown in the scenario, some team member felt more comfortable making notes of the discussion, while some member led the conversation in the main chat. This has provided opportunity for more balanced collaboration. In chapter 5, I will evaluate a prototype, which is implemented based on the design concept above. I will evaluate the usability of the prototype, specifically how users use the prototype and if they use it in the expected ways. I will also evaluate the user experience of using the prototype, specifically how users’ experience in using the prototype differ from their experience in standard chatting tool.
Chapter 5

Evaluating Instant Annotation for Cross-Cultural Communication

The design concept Instant Annotation is inspired by collaborative annotation, threaded chat, digital notepad and the observations in cross-cultural communication, however it needs to be validated by the targeted users. To validate the Instant Annotation design concept and evaluate its impact on cross-cultural group chat, I conducted two types of studies. The first study gathers user feedback about the design concept prior to its implementation, so that I can use these comments to enhance the design work. It is important to validate design concepts like this at an early stage, because the cost of such an investigation is generally less expensive than developing and evaluating multiple implementations. Instead I can identify design flaws and user requirements early so as to avoid unnecessary overhaul in the implementation.

A second study provides an empirical evaluation of the Instant Annotation design once it has been implemented as a functioning prototype. At this later design stage, it is important to evaluate whether the design has met the research goal, as well as to discover any limitations or generalizations one can infer from users’ experiences with the system. In this chapter, I will report the two studies in detail; this completes the design phase of my dissertation project.

Evaluating the Instant Annotation design concept

My goal in this initial study was to gain a preliminary understanding of how the Instant Annotation design concept might be used and experienced by native and non-native speakers. This includes gathering users’ first impression of the design, eliciting users’ feedbacks and suggestions and detecting limitations. Because my research questions are exploratory, I chose a participatory design approach, which is often used in exploring these types of questions. In
participatory design, designers work with end users to make new designs. It can take many forms, but the end users are always prompted to imagine using a tool or designing a tool. In parallel with or after this activity, participants are asked to state their rationale and feelings about particular features.

Method

This study was conducted in coordination with the study of group chat reported in chapter 3. Thus the participants were the same as those in that study. After the chat session and post-session survey, I conducted a semi-structured interview with each participant, spending approximately 30 minutes in discussion. During the interview, I first explored the participant’s experiences in the chat as summarized earlier; after this however, I also presented an IA design concept: I showed two mock-up images to participants, one with simple annotation tabs on the IA pane (see Figure 4-5), and one with annotation tabs and replies folded or unfolded on the IA pane (see Figure 4-6). Using the two images I did a walkthrough to “demo” basic functions the IA could provide. I then asked several open-ended questions as described below. The open-ended question format allowed me to pursue other points that came up in each participant’s response.

1. Will a chat client featuring Instant Annotation help him/her in cross-cultural group discussions and if so how? Provide use cases if possible.

2. What are the limitations of Instant Annotation? Or, what other features can he/she imagine to assist cross-cultural group discussions?

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 analyzed informally to discover themes related to use cases. Specifically, we informally coded the transcripts with descriptive words, such as “tagging topics”, “taking notes of important contents”, and “side chat”, etc. And then we sort through similar codes and merge them into higher-level concepts. We searched for themes that could cover the full range of concepts.

Results

In general, I found that most participants (18 out of 20) expressed an interest in using an IM tool that included an IA space, and they were able to voice many ideas about how they would use it based on the experiences they had just had in a group chat, as well as their more general experiences using group chat tools and interacting with speakers from different cultures. Collapsing across the many ideas that were shared, I have organized the proposals into three high-level categories: tagging, side chatting, and other concepts.

Tagging

Many participants envisioned that they could use an IA space for tagging; that is, to provide a conceptual level description of a piece of text. They also suggested what they would use the tags for; these more specific ideas led to three sub-themes in our discussion of tagging as a design direction. I will refer to these subthemes as use cases by analogy to the hypothetical uses that are often generated during requirements engineering (Kulak & Guiney, 2000). Of interest to my general research project, these use cases suggested that the non-native and native speakers differed in how and why they would incorporate tagging into their cross-cultural communication.
One common use case for tagging in the IA space was to quickly retrieve earlier discussion points. Participants indicated a need to remember these discussion points when a discussion went for a long time or when it became complex with a number of rich ideas. I noticed that one participant had noted his group’s ideas on a piece of paper, and all five groups had at least one member who summarized the emerging ideas in the chat window during the chats.

Going beyond the general need to manage a long and complicated discussion, two of the non-native speakers envisioned a more specific scenario: They would use the tags to help reveal the structure of a conversation. In these cases, they said they needed a clearer view of the flow of a conversation because of disruptions in turn-taking. As one interviewee said:

“The discussion of a topic may be disrupted by other discussions, the tags will help you to follow a topic more easily. When a conversation goes really long, discussions of several topics may be mingled together, the tags will make the structure of the conversation clearer.”

(Interviewee 1, Chinese)

Only non-native speakers suggested the use of tags for capturing conversation structure. In this sample at least, native speakers seemed not to have comprehension problems caused by disruptions in turn-taking, perhaps because they are quite familiar with this from their everyday online chatting activities.

A second use case for tagging was to make a note of points that have not yet been shared, so that they can be discussed later. One surprise was that it was native speakers who repeatedly mentioned this possible use, not the non-native speakers. Remember that some native speakers tended to adjust their communication rate to accommodate their non-native speaking team members. Interestingly for this design project, this use case could be supported by the same IA affordance as the more general tagging goal (i.e., a place to hold “extra” ideas). In this case though, we can hypothesize that a side conversation space might be at least as important to native
speakers who are being considerate as to non-native speakers who are feeling stressed by the pace of the conversation.

Two native speakers also suggested the use of tags as a temporary reminder for ideas that they wanted to express but that would not have let them “keep up with the flow of the current chat” (Interviewee 13, American). In this case, it was not so much that they wanted to give their non-native counterparts a chance to contribute but rather than they judged that this was not the right time to change a topic. Thus they elected to wait for the next turn because they did not want to “completely ruin someone’s thought” (Interviewee 4, American). When asked to compare using tags as a reminder versus paper and pencil, they said the tags would be used as “visual markers” that were easy and convenient to access, whereas paper and pencil might not be always available.

The third use case of tagging was to promote awareness of a discussion point. In two different groups, the two Chinese participants’ ideas were at times ignored, apparently due to the overwhelming and parallel discussions taking place. These two Chinese speakers were significantly less talkative than the other three participants in their groups and their expressions tended to be short and simple, making them easy to miss.

One of the Chinese participants made several efforts to re-raise or re-address the ignored ideas from her Chinese group member. This caused her to be seen as a coordinator who organized and shifted topics back and forth in her group. She later provided a compelling scenario of using collaborative tagging to replace her role: “If we missed an idea and we all wanted to catch it up, we would all annotate that idea. Then we would easily shift back to that idea and further discuss on it.” (Interviewee 15, Chinese)

Another Chinese participant expressed similar ideas about collaborative tagging as a way to raise awareness of others’ contributions. However, none of the native speakers voiced concerns
about the highly parallel and disrupted communication style, taking it as “a common feature that all chatting systems have”.

**Side chatting**

Another general design scenario that many participants envisioned was using the IA space for a side conversation. A common need recognized by both native and non-native speakers was to easily comment about earlier discussion points. As stated by the interviewees below,

“*Because each tab corresponds to a topic, if I comment there, they can easily see it. If I respond to an earlier point in the main window, then you have to search above to anchor the point. With the IA window and maybe a bright alert sign when new comments are added, it's easily for people to see what they say, what others respond, and what others respond to those response.*” (Interviewee 16, Chinese)

“*Sometimes I don't know how to say it in English, especially when many people are discussing, I miss the chance to speak out, after a while, I forget it myself. … With the IA space, I can make up the discussion points I missed.*” (Interviewee 1, Chinese)

The side chat feature provides users an alternative way to communicate, one that requires little extra effort to foreground an earlier discussion point before commenting on it. Furthermore, other users do not need to search through the complex chat record to access the point. It is as easy as going right to the point, clicking to expand the comments and reading them. Non-native speakers saw this as a chance for them to jump into a conversation at a later point, for example after they had a chance to process and reflect on what others were saying. Interestingly, they felt that they would only respond to ideas in the IA space when a discussion of the idea was over, because responding while a topic was still in discussion “would interrupt the flow of the main chat too much” (Interviewee 8, Chinese).
The only time that the interviewees predicted that they might respond to currently active ideas in the IA space is when several parallel discussions were taking place. In this case, the rationale for responding next to a piece of text was similar to the one above, in that it would save effort to foreground which point was the target of the new response.

As an example, this functionality was achieved in a different way in group 5’s discussion. The conversation of Group 5 had many cases of disruption, for example one parallel discussion that involved eight out of the ten ideas proposed through the whole discussion process. However, group 5’s members thought their conversation was clear, because they successfully developed a communication protocol within the group: Adopting a practice often seen in microblogs, they used @groupmember’s name to direct responses to the right person. The following snippet from their chat log showed how this worked for them (participants’ screen names have been replaced by letters).

A: I have one idea.

B: @A: yes?

C: We can set up a group to collect student, staff, and faculty’s address and then make the carpool assignment.

D: Note to all: we are at 12 minutes of discussion so far.

B: @C: We kind of already have that.

A: We can purchase some cloth bags and distribute them among the students.

This spontaneous practice is similar to making a comment to the side of a piece of text, which is also able to direct attention of the right person to the right place. One of the participants of group 5 also offered a compelling scenario that uses the IA space to organize a major discussion and a sub-discussion in his lab meeting: “If you are on a task where some people are worrying about when we are gonna schedule things versus how do we organize logistics for
something else, people who are scheduling things can have their own discussion about something versus this general conversation about logistics.” (Interviewee 17, American)

This scenario also applies to the case of native speakers placing tags as reminders for ideas to discuss later. They could chat on these ideas while waiting for the non-native speakers to input their ideas in the main chatting window.

Some interviewees suggested that the IA space could serve as a convenient mechanism to express agreement/disagreement (e.g. Nice idea!) and other quick opinions for that matter. For example, one interviewee said, “Because the normal chat does not hold a lot of ways for you to kind of make different expressions unless you use the happy faces or those kind of things. But I think this is a much better way to do it.” (Interviewee 3, American)

Other use cases

Besides tagging and side chatting, interviewees offered several other use cases of the IA space. They could use it to note down important facts, such as phone numbers, people’s names, and addresses, etc. This is similar to Micronote (Lin, Lutters, & Kim, 2004), which provides a temporary note for fast retrieval. Inspired by the decision making task, participants also mentioned that they might use the IA space to vote for the three best ideas. Although this use case is specific to the task they were given, it might generalize to other decision-making tasks, especially those tasks requiring majority vote of ideas for the final decision.

One participant suggested adding the IA feature to chat tools used for larger groups. He provided an example of annotating in a chat room: Many online live sportscasts provide a chat channel next to the video, so that fans can express opinions, reactions or converse with other fans. Fans from the two sides often debate for their team, which generates some discussion points.
Because there are hundreds of fans in the room, the screen updates very rapidly, which makes these conversations severely disrupted.

In this situation the IA space could help to organize discussions by allowing responses next to a piece of text. It also helps to remind people of important contents. In fact, this scenario also incorporates tagging and side chatting. However, an interesting point raised by this scenario was the scale of the chatting activity. The IA feature may be even more useful in chatting contexts that involve many people as opposed to the small groups we studied.

Design choices

I turn now to the discussion of design implications that are entrained by the range of usage ideas gathered in the participatory design interviews; I discuss also how the ideas helped me to elaborate and realize the IA design concept.

Tag access control

The interviewees were sensitive to the tags’ access rights, though they differed in whether they believed tags should be used for private or public purposes. Although their interview comments did not elaborate this issue enough to clarify the distinction, they asked questions like “Who will see my tags?” and “What does others’ IA space look like?”

When talking about use cases for the IA space, at times participants distinguished between personal versus others’ chat content. For example, “I will definitely tag others' ideas, so that I can review them easily.” (Interviewee 2, Chinese) This participant also said that he would not tag his own ideas. Another participant also saw tagging as a communication tool with public access, “I will tag something when I want to emphasize it to others.” (Interviewee 10, Chinese)
contrast, interviewee 3 only thought about tagging his own content, “If you don't want to express yourself in this group chat, so if you want to hold something and send it as a sidebar to somebody outside the chat. You could take that idea offline and hold it there for yourself for later.” (Interviewee 3, American)

These different views of the tags lead to the general design question, “Who will see what in the IA space?” The simplest option is to make the side pane entirely public or entirely private. However, such a design might only satisfy one portion of users’ needs. A second option is to give users the right to decide what access mode they want for each tag. However, this extra operational cost may add considerable burden to users who do not want to worry about access for each comment. A better compromise might be to make the IA window entirely public but give users the opportunity to “hide” any tags they wish. Yet another option is to have two side panes, one private and one public. The worry there is that users might be more distracted by a two-part IA display, or by navigating between them if they were layered using tabs. In the real prototype, I chose the simplest solution, which is to make the side pane entirely public. Technically, this is the easiest to implement. In the evaluation, users are asked about their experience with sharing annotations in this mode and are asked for their thoughts on having private mode.

Notifications

While sharing their thoughts about using a side chat to raise awareness of a discussion point, several interviewees asked how other users would be notified of new contents. Because the annotations are anchored by a piece of text, a natural design is to display annotations next to the text as the main chat proceeds. But will users notice a new annotation or a response to an annotation if it is not shown in the current window to which they are attending? As the chat
continues, earlier comments scroll up out of sight; this means that a new annotation intended for public viewing might be missed by other users.

With this concern in mind, one participant proposed to include a dashboard at the top of the IA pane. When new content is added, the dashboard could display a hyperlink that other users can click on to go to the content, somewhat like the function of an anchor link in an html page. The dashboard would be updated whenever new annotations are posted. An alternative design would be to have a pop up window at the right bottom corner (i.e., in the IM window). When new content is added, it could pop up for a few seconds and then provide a hyperlink at the corner until the user clicks it. I think that both of these designs could have a positive effect on raising awareness. If new contents about the same discussion point occur often, it indicates a general interest of that discussion point; people may be attracted to see what others say in this hot topic. A history pane containing the recent annotations the user visited may also be useful for the user to quickly revisit the tags or side conversations that are emerging. In the real prototype, again I implemented the easiest notification – a notification sound when an annotation is created. And in the evaluation, users are asked about their experience with the notification sound and their thoughts on these other design ideas.

**Annotation ownership**

In the side chatting scenarios described earlier, users communicate under an annotation tab. One issue that arose was how to distinguish among different annotation contributors, so that the participants can communicate unambiguously. One simple design is to color-code each annotation, so that they represent the color of the user. However, when many users are participating in a chat, there may be too few colors to be distinctive. Another design is to automatically add users’ names or icons as a prefix to an annotation. However, because the IA
space may be small relative to the main chat window (implying that it should be used for short expressions), the addition of user information may overfill the space. This may be an issue that is best left to a group, for example depending on how many participants it includes. In the real prototype, I didn’t display annotation creator information in any form, whereas I left the freedom to the users to disclose themselves. In analyzing the annotation contents, I analyzed the number of annotations with creator information. I also probed users’ preference of the ownership information in the follow-up interview.

**Operational cost**

Finally, two interviewees expressed concerns about the extra cognitive costs of the IA features. Reading and contributing to an online group chat is already demanding; they wondered about the effort required to also attend to and contribute to an IA pane. I also have had this concern from the beginning of this research program. While I have proposed a mechanism for annotation creation in our design scenario, I admit that it may not be a good solution. For example, we may replace the action of right clicking on a text line with a hot key, to see whether it reduces the interaction costs, and there may be other keyboard shortcuts that could simplify navigation among lines of text in the chat log as well as navigation to and from the IA window. In evaluation of the real prototype, users are asked to comment on any stress they experienced in using the software.

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Evaluating Instant Annotation – a comparison study

Following the design concept in chapter 4 and the participatory design brainstorming summarized in the previous section of this chapter, I built a working version of Instant Annotation (IA). The design is slightly different from the design concept presented in chapter 4. The design choices and rationales have been explained at the end of chapter 4. (see Figure 5-1 the “tabs” with red underlines in the left subpane hold annotations related to the text chat in the right). For convenience, in the paper we will refer to the right subpane as the “IM” window, and the left as the “IA” window.

Figure 5-1: Screen capture of the IA prototype; annotations are in the side bar on the left.

To start a new annotation, a user simply clicks on a tab in the IA window; this will activate the tab to allow input. The user can then add text to that tab. Other interlocutors will see the annotation as soon as the user types the ‘Enter’ key. The annotation tabs are tied to their
anchoring line(s) of the chat log and will scroll up with that content. If more than one annotation is created for the same line(s) of text chat, they will appear in a stack. To reply to an annotation, a user simply activates the tab; when this happens the annotation stack is extended and a text area is created under the last annotation. To review stacked annotation lists, the user simply mouses over the tab to expand it and show the full listing.

This design differs in important ways from prior work that has attempted to support collaborative annotation. For example, it is the first to apply annotation tools to real-time text chat. In addition, I have as a primary design goal to display and support the sidebar communication in as non-invasive a fashion as possible, so as to minimally disrupt the flow of the main conversation; this is important from the perspective of cognitive processing as discussed earlier and was raised as a significant issue during the participatory design sessions. I expect that users will only employ the IA space when they have a particular need in managing their conversations.

I will now turn to a report and discussion of a comparison study of text chat that was designed to assess the experiences of cross-cultural groups carrying out the same task as that studied earlier but with the availability of the IA prototype. My goal is to examine whether IA affects team outcomes and team members’ behavior. More specifically, I am guided by four research questions:

RQ1. Are group outcomes affected by the IA tool?
RQ2. How do individuals in a cross-cultural chat use the IA tool?
RQ3. How is the user experience affected by the IA tool?
RQ4. What if there are any costs of the IA tool?

Answering these questions will help us to evaluate the IA tool against the standard chat tool as well as to understand whether and how the IA tool might address communication
problems observed for cross-cultural group chat. To answer the four research questions, I created a comparison design that leveraged the earlier study, so that I could compare both group outcomes and individual user experience with the IA tool absent (as before) an present (the new study). Because the lab study of cross-cultural chat using a standard chat tool (condition 1) was conducted earlier, I simply conducted the same study but now using the IA tool (condition 2). That is, in condition 2 I collected data from an additional five groups having the same composition as condition 1 and performing the same task. However in this case all groups completed their tasks using the IA tool instead of AIM. Note that the basic chat functions of the new tool are the same as AIM. In both tools, chat messages are ordered by time vertically, and are only visible to others once a user clicks ‘send’ button. Both the AIM and the IA chats used 10pt Times New Roman, so that their viewports are almost identical (i.e. allowing for the same number of lines, words, and so on).

**Participants and task**

I carefully constructed the groups in condition 2 to be equivalent to those in condition 1 so that I could compare the experiences of participants who chatted under the two different conditions (i.e., non-IA or NIA versus IA); tool condition thus becomes a between-subjects factor. Nonetheless because the data were collected at different times, I conducted two 2x2 chi-square tests examining Education level and Gender by Condition (NIA versus IA) to ensure that I had successfully recruited similar samples. Neither test found a statistically significant difference, \(\chi^2(1, N=40) = 2.13, p = 0.14\) for Education by Condition; \(\chi^2(1, 40) = 1.6, p = 0.21\) for Gender by Condition. Thus in the data analysis I combined data from the two conditions to analyze the effects of Condition (NIA, IA), Speaker-type (native or N, non-native or NN) and their interaction.
As indicated, the task instructions and activities were identical to those in the earlier study (for details, refer to Chapter 3, page 26). Participants were recruited using the same mechanisms and on arrival to the study completed the same pre-experiment survey. They then participated in the group chat under the same instructions and afterward they completed the same post-experiment survey, except that it had been slightly extended to probe reactions to the IA tool (see Appendix E). All participants also participated in a 1:1 interview using the same semi-structured format as in the earlier study, but again extended to probe experiences with the IA tool. However there were no participatory design sessions with a design mock-up.

**Measures**

As in the earlier study, I collected a mix of dependent measures, including the types of annotations made, ratings of discussion quality and satisfaction, and comments from a post-task interview. In the post-task questionnaire, in addition to the 10 items used in condition 1, an additional 5 items were used to investigate the design of the IA tool.

**Data analysis and results**

I examined impacts of IA on both groups and individuals quantitatively. For qualitative data, I did open coding on annotations and interview transcripts to find common themes. A second pass over the interview transcripts’ open codes was performed using axial coding to look for data that could help to explain interesting results in the quantitative analysis.
Are group outcomes affected by the IA tool?

As a measure of how successful the group conversations were, I contrasted the “discussion productivity” of groups in the two conditions. Specifically, I calculated the number of ideas each group generated (including ideas in the IA panel). I also calculated the number of turns, words, and words per turn for each group (does not apply to annotations). These descriptive statistics offer a general view of the groups’ productivity with respect to amount of content contributed per unit of time (all groups were given 15 minutes). As the summary in Table 5-1 suggests, there was considerable variability across groups, with one group taking only 35 turns and another taking 94. Of interest was whether one or more of these measures would reveal any advantage or disadvantage for the IA groups. However, independent sample t-tests revealed no trends for any of the measures.

Table 5-1: Measures of Discussion Productivity by Condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideas</td>
<td>12</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Turns</td>
<td>68</td>
<td>35</td>
<td>80</td>
<td>81</td>
<td>54</td>
</tr>
<tr>
<td>Words</td>
<td>577</td>
<td>479</td>
<td>656</td>
<td>1070</td>
<td>590</td>
</tr>
<tr>
<td>Words/turn</td>
<td>8.49</td>
<td>13.69</td>
<td>8.20</td>
<td>13.21</td>
<td>10.93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideas</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Turns</td>
<td>64</td>
<td>76</td>
<td>66</td>
<td>46</td>
<td>94</td>
</tr>
<tr>
<td>Words</td>
<td>653</td>
<td>628</td>
<td>789</td>
<td>351</td>
<td>1342</td>
</tr>
<tr>
<td>Words/turn</td>
<td>10.37</td>
<td>8.26</td>
<td>11.95</td>
<td>7.31</td>
<td>14.28</td>
</tr>
</tbody>
</table>

These results suggest that the IA tool neither enhanced nor degraded group-level productivity. However it did seem to influence individuals’ subjective experiences during the chat activity, which I discuss below in three subsections, working from a mix of qualitative (annotations and interviews) and quantitative data (frequencies and rating scales).
How do individuals in a cross-cultural chat use the IA tool?

The number of annotations generated by the five IA groups varied from 12 to 23, for a total of 90. Thus participants did indeed use the IA function, but there was also considerable variability in how much groups employed the feature. Table 5-2 summarizes the ways in which annotations were used, organized into five major use patterns.

Table 5-2: Five Categories of Annotations

<table>
<thead>
<tr>
<th>Category</th>
<th>Definitions and Examples</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summarize</td>
<td>Summarize ideas (&quot;idea 3: awareness competition to reduce energy&quot;); Categorize ideas (&quot;Idea 3.1&quot;); Summarize decisions (&quot;Top3 Ideas: recycling competition, PSU Green Week, Interesting Green activities&quot;)</td>
<td>64</td>
</tr>
<tr>
<td>Communicate</td>
<td>Ask questions (&quot;Can anyone price this for us?&quot;); Reply (&quot;i'm not sure about the cost of monitor reporting, but i would think so - facilities usually has that info&quot;); Express support (&quot;Nice idea!&quot;)</td>
<td>13</td>
</tr>
<tr>
<td>Vote</td>
<td>Vote for preferred ideas (&quot;vote from winston&quot;)</td>
<td>5</td>
</tr>
<tr>
<td>To do</td>
<td>Reminder of things to consider or check later (&quot;ToDo: check how many dryers are in the building&quot;)</td>
<td>3</td>
</tr>
<tr>
<td>Add Information</td>
<td>Extend an idea (&quot;Competition for greenest lab on campus&quot;); Propose an idea (&quot;Temperature should be able to adjusted in each room....I hope...&quot;)</td>
<td>5</td>
</tr>
</tbody>
</table>
Note that even though IA was designed as a side channel next to the main chat, people sometimes used the space to expand on an idea or propose a new idea. To better understand why users might add information in the IA space rather than in the main chatting window, I carefully examined the five cases of Add Information. In one case, a new idea was proposed in the side bar. The new idea pertained to the planning theme that was under discussion at that point in the main chatting window. In this group, group members had first identified several themes, then went back to develop ideas within each theme. The annotation was one such idea, suggesting that it was a convenient place to inject new ideas into what was already in the chat.

In other cases, Add Information annotations extended an idea that appeared in the chat; they were positioned right next to the original idea. These examples suggest that users’ motivation for adding information in the IA space was to organize discussion content by topics or themes, similar to threaded chat.

Looking more generally at the kinds of annotations produced it is clear that the most popular use was Summarize, which accounted for 71% of the annotations. This use might be seen as a way to rephrase a concept, or it might simply be used as a visual tag of content that was deemed interesting to the annotator. Several participants shared thoughts on why they chose to summarize something, for example, “You have one stream of things going on and then you want to kind of distill things from that. For example, if we went back and looked our chat, we would have had to search through, and like oh there's that idea, but with the annotations, it's clear, you know, the things we want to keep we put on the side.” (Interviewee 21, American) From the example, we can infer that participants wanted to summarize important information so that the it could be separated from the “mess” of the chat log, so that it would be easier to find later.
How is the user experience affected by the IA tool?

To explore user experience impacts of the IA tool, we analyzed participants’ ratings of their discussion experiences, focusing particularly on judgments of perceived quality of the communication process and their satisfaction with the discussion. To better understand differences in these ratings we also draw from the individual post-task interviews.

Quality of communication (QC)

After confirming satisfactory internal reliability (Cronbach $\alpha = .73$), I aggregated the six rating scales assessing quality of communication into the QC construct. A two-way ANOVA with Technology and Speaker-type as between-subject factors revealed a main effect of Speaker ($F(1,36)=6.11, p<.02$), but no effect of Technology or interaction of Technology and Speaker. Native speakers provided generally higher QC ratings (overall mean 3.94) than non-native speakers (overall mean 3.41).

Although there was no main effect of Tool on overall quality of communication, inspection of the individual items comprising the QC scale suggested that the one item focused on conversation control (“I was able to take control of the conversation when I wanted to”) was sensitive to the presence of the IA feature. For the standard condition, the mean ratings for native and non-native speakers were 4.11 and 2.60; when using IA, the means for both speaker types were higher (4.30 and 3.30). An ANOVA on this item revealed main effects of both Technology ($F(1,36)=4.34, p<.05$) and Speaker ($F(1,36)=34.66, p<0.001$), suggesting that both the IA tool and language fluency may have influenced perceptions of conversation control. Even though non-native speakers felt less control in general, speakers who used the IA tool felt that they could control the conversation more than those who did not use the IA tool. Given this pattern, we re-examined the interview transcripts, which provided three explanations about how and why the IA feature may have enhanced conversation control.
Mitigating attenuation blocking

The interviews suggest that IA may mitigate the “attenuation blocking” problem. One of our participants shared her frustration in traditional online chatting and how she used IA to overcome it, “I ended up, you know, I started typing something, and then I wiped it out, because somebody else already raised the issue. ... That's why I like the annotation, because you can annotate your comment that pertains to that person’s chat comment by their side and it makes more sense because if you put it into the conversation then you had these two or three conversations going on at the same time, and you were technically commenting something that was chatted on three minutes ago.” (Interviewee 12, American)

This participant had difficulty taking turns in traditional chats because she is not fast enough to contribute to rapidly moving discussion points. Using the IA space, she could add to any point at any time, even after the group moved on to other topics. When other people saw her annotation, they might move back to the discussion point she commented on. This happened twice in one group, where a participant suggested that the intent of a comment like ‘Nice idea!’ would not be clear in a regular chat. However, in the IA space, such a comment could be posted next to an idea, causing the group to further discuss the idea that had been called out as a good one.

Supporting distributed cognition

IA can be seen as a support for distributed cognition among team members via collective annotations of ideas and reactions during chat. For example, one participant stated that she put complementary information in the IA space with the goal of keeping side points on the side, “I want to comment on that one point, and I felt that was a better place in the annotation than in the chat sequence. Because it’s more of a supporting statement, I wanted to put in like ‘To do:’ what need to be done to get that idea going. And I just didn't feel that it wants itself to be in the
discussion, it's more like a side note of ok heads up, we need to do this for this idea.”

(Interviewee 10, study 2)

This participant described an example of cognitive reading skill (Sheorey & Mokhtari, 2001), which is automatically shared with other team members in this case. Hutchins [3] argues that sharing and coordinating the distributed cognition is critical for complex collaborative behavior. In fact, Summarize, Communicate, Vote, To Do, and Add Information annotations are five different instruments for supporting group members’ distributed cognition. With the IA space, it is easy to externalize and share one’s understanding of or reactions to the conversation, thereby sharing it with other team members. The expectation is that the group as a result might enjoy a richer shared understanding; this in turn can explain why participants using IA felt more control over the conversations.

Balancing conversation participation

Wooley et al. [9] found that ‘equitable talk’ predicts better group problem solving. Although IA did not change performance, it seems to promote perceptions of a better balance in conversations, which helps to address issues stemming from differences in language fluency. In the standard condition, when asked whether there was a leader in their group, all groups reported that native speakers assumed leader roles in their multilingual groups. However, in the IA condition, no groups reported having a leader. It may be that the IA feature reduced the tendency for groups to have dominant individuals controlling the conversation. In fact, all of the IA groups emphasized that the member contributions of ideas and annotations were well balanced. Even talkative people who tend to dominate conversations found a way to balance their input. They waited a bit before talking, and spent time instead doing annotations for their group. One native speaker shared this strategy of balancing the conversation in his group, “I was the one who was doing all the annotations. I had a couple of ideas, but I kind of slipped and let other people talk,
while I was annotating. And once it slowed down, I added my own ideas." (Interviewee 13, American)

Group satisfaction (SAT)

The post-task questionnaire also included four rating scales that assessed satisfaction with the group. After confirming satisfactory internal reliability (Cronbach $\alpha = .89$), I aggregated the scales to form the SAT construct. A two-way ANOVA on SAT revealed a main effect of Technology ($F(1,36)= 5.92, p<0.05$), but no effect of Speaker and no interaction, suggesting that satisfaction with one’s group differs in the two conditions. Specifically, participants who chatted using the IA tool were more satisfied with their group (overall mean = 4.43) than participants who chatted in AIM (M=3.95). This might be due at least partially to their increased perceptions of conversation control.

What cost if any are there for using the IA tool?

Finally, the post-task questionnaire included two subconstructs designed to evaluate the cost of using the IA tool. Two 5-point rating scales assessed ease of using IA (EIA); three others probed the perceived cognitive cost of IA (CIA). The average values for both constructs were moderately positive, with a mean of 4.0 for EIA and 3.93 for CIA. I also conducted independent t-tests to contrast the perceptions of native and non-native speakers with respect to these measures but found no significant differences. This suggests that even for users with relatively high cognitive loads (e.g., non-native speakers), annotations combine well with chatting. My interviews also probed perceptions of difficulty in using the IA tool. Users’ comments were consistent with the rating scale data, suggesting that people can multitask between annotations
and the main chatting task. Combining with the null results in the group outcome evaluation, I’m assured that there is no extra cost of annotations in text chats.

This work is published in CHI ’14, see Curriculum Vitae publication C6.
Chapter 6

Design Implication

Although most of my work in chapter 3 and 5 are grounded in lab settings, it represents a miniature scenario in the real world. In this chapter, we discuss the generalization of this work, synthesizing the patterns and themes to develop design implications for group text chat involving the language-disadvantaged. I will also discuss possible ways of specializing the design features to support similar tasks in larger scale. Finally, I provide a discussion of general implications for peripheral design in communication tools.

Who else might benefit from Instant Annotation?

From a mix of methods, I have shown that the root of the cross-cultural groups’ problems is the unmatched language proficiency. Detailed analysis has shown that this unmatched language proficiency issue causes more severed turn taking disruption and attenuation blocking, resulted in negative experience and outcomes. I extract the low language skill characteristic from non-native speakers, emphasizing instead a more general group of people who share this characteristic, such as children, adolescents, or people with language disorders. When they communicate with people who have advanced language skills, will they have the same issues as non-native speakers?

Communication problems of these people with special needs are already under investigation by researchers from adolescent research and autism research. Research showed that these people had similar media choice and online communication issues to what I found with non-native speakers. For example, autistic people often have a great difficulty of speaking, comprehending and reading nonverbal cues. An interview study (Burke, Kraut, & Williams,
2010) of autistic adults about their media choice and communication experience revealed that these people would prefer online chat to face-to-face. Because of the affordances of less immediacy and anonymity of online chatting, this communication method allows for a less stressful experience than face-to-face, an important factor to autism. However, they also reported problems related to spelling and comprehending difficulties in online chats. Similarly, a qualitative study (I.-H. Kim, Anderson, Nguyen-Jahiel, & Archodidou, 2007) of fourth and fifth grade children’s online chats showed similar trends. Small groups of children were assigned to a 15 minutes discussion about a story either in online chat rooms or face-to-face. Children who were chatting in online chat rooms were more engaged in discussion. Reflective essays showed that less immediacy and anonymity were attributed to favor online chatting environment.

However, these children also experienced problems with online chatting. Some need more time to spell words, while some need more time to read and respond to messages. Interestingly, a few children took advantage of a feature of asynchronous communication, with the ability to reread and revise their messages.

Given that children and autistic people share some of the same characteristics with non-native speakers in terms of language skills and they experience similar situations in online chatting, I infer that they can also benefit from designs such as Instant Annotation. For example, the asynchronous feature of Instant Annotation allows users to respond to an earlier discussion point at a later time, requiring even less immediacy than text chat. As shown in my study reported in chapter 5, the participant who was usually slow in online discussion found new ways to contribute to earlier discussion points, even after the discussion had moved to other topics. IA raises opportunities for engagement that might never have been provided without this support. Besides engagement, it also comes along with higher productivity or less attenuation blocking and more control of the conversation.
How might Instant Annotation support chat for larger groups?

My empirical study shows that adding instant annotations during real-time collaboration is both possible and has promising consequences for chat participants, particularly those who have less language proficiency. The annotations were used to distill important information, support side chat, and vote about ideas in a brainstorming/decision-making task. The IA side bar seemed to provide a visually salient space to hold the annotations that were anchored to points in the ongoing chat. A limitation of this work is that it only has been evaluated in short conversations of small group settings. Will Instant Annotation support group chat with large group size? It is easy to imagine situations where Instant Annotation might be useful in large group chats. For example, in a team project meeting with people of different roles, Instant Annotation can be used for collaborative annotation. However, the features need to be more sophisticated to support roles and the increasing number of annotations. To support roles, each annotation needs to add a creator. The creator object can be color-coded to enhance people’s awareness of roles. To better manage the increasing number of annotations, instead of the linear presentation of the stacked annotations, the system can have nested annotations organized by topic. We also imagine that, in large groups, making decisions will rely on voting. Therefore, making voting more salient, such as adding a ‘Like’ function to each annotation will benefit users in this situation. These possibilities have been discussed in the first study in chapter 5.

Design implications for peripheral design in communication tools

Several other researchers also explored the design idea of adding a peripheral communication channel besides primary communications. For example, Kelkar et al. (Kelkar et al., 2011) designed a real-time annotation system “Echoes” for reflections about audio meetings.
Du et al. (Du, Rosson, & Carroll, 2012) designed a live posting system “ClassCommons” that leverages a large public display; it is used as a back channeling tool for students to communicate with one another and with instructors during class lectures, discussions and other activities. I find three common use cases from these two systems and Instant Annotation, which are anchoring context, back channeling, and taking notes. Although the application domains range from small group conversation to large group meeting and to classroom setting, the three use cases show us users’ common requirements for peripheral design in communication tools.

Users of all three systems adapted to the anchoring context concept well. Almost all the annotations created in Instant Annotation and Echoes were directly related to the discussion context at the anchor points. ClassCommons does not include a persistent record of the lecture. Instead, teaching assistants interrupted instructors when questions related to the ongoing lecture occurred. In this sense, the teaching assistants functioned as an analog to a moving anchor point that linked the current context with the peripheral communication channel. In situations where no moderators are available, for example, in MOOC, designs such as ClassCommons need to implement anchor points, so that the discussion in the peripheral channel doesn’t lose the original context.

Users in all three systems used the peripheral interface as a back channel to provide feedback to speakers, although the percentage of such uses varied across systems. In the small group chats using Instant Annotation, 15% of the annotations were used for asking questions, responding to questions, and making comments. In larger group meetings using Echoes, the percentage was 18% for acknowledging to speakers and making comments. In classroom settings using ClassCommons, the percentage was approximately 55% for asking questions, responding to questions, and reporting problems. The difference in using back channeling versus other usage reveals different requirements for the peripheral communication channel. In group meetings, people do not need a second channel to provide their feedback, probably because they can all
equally, or somewhat equally, provide feedback in the primary communication channel. However, in classroom settings, most students cannot freely communicate with their instructors, therefore it is likely that they are motivated to use the peripheral communication channel to fulfill this need. Besides, because students are not expected to engage in communication as intensively as people in group meetings, giving them more time to provide back channel comments than group members. Therefore, for peripheral designs used in large less intensive communications, there should be features to effectively support back channeling. For example, annotations that contain questions or reporting problems can issue sound notifications.

To the contrary, users using Instant Annotation and Echoes often used annotations as a way of note taking, such as summarizing important information and discussion points. The percentage of such annotations among all annotations was 71% in Instant Annotation and 79% in Echoes. Note taking type was not observed as an annotation type in ClassCommons contributions. One possible reason is that ClassCommons does not record or archive the lectures or the posts. Therefore, the value of note taking is diminished. These patterns suggest that peripheral interfaces should make a persistent record of both the primary and annotation content, so that users can enjoy add-on values from their communications.
Chapter 7

Conclusion

Cross-cultural communication is a complicated process, constituting many parts of sociocultural aspects as well as interaction of characteristic discourses. Among the many aspects, language difference plays a fundamental role in cross-cultural communication. It provides a unique scope to understand problems in cross-cultural communication of contemporary people. It also raises challenges and opportunities for technological tools to support cross-cultural communication.

I began with a lab study to probe the language proficiency problems. Participants from two different cultures (Chinese and American) formed small groups to finish a brainstorming and decision making task using AIM in 15 minutes. I triangulated the chat logs, post task surveys, and interview data in order to discover issues related to language differences. I found that unmatched language proficiency was the major theme in the interview data, causing a number of problems identified from chat logs and participants’ reflections. Specifically, I observed that the turn-taking system in text chat was severely disrupted due to the differences in conversational fluency. 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, I 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, I observed them to be less affected by the language differences and in fact at times they evinced positive efforts to accommodate non-native speakers. However, I also noted that such accommodation might impair the performance outcomes of a group.
Based on these findings, I designed a lightweight secondary communication stream called ‘Instant Annotation’. I conducted two studies to evaluate develop and evaluate the design concept. My evaluation has shown that adding instant annotations could help alleviate unmatched language proficiency issues in several ways. Participants not only used instant annotation as a memory aid in summarizing, they also used it to interact with others. Their satisfaction scores as well as perceived capability of controlling the conversation were higher. The qualitative interview data suggested that IA might enhance feelings of controllability by mitigating attenuation blocking, supporting distributed cognition and helping to balance conversations.

Finally, I generalized my design concept in three aspects. First, I generalized the application of IA from non-native speakers to people with low language skills. We know from the literature that children and autistic adults share similar media preferences and communication problems in those media. I expect that IA may assist them in online group chat in similar ways. Second, I envisioned how might IA be used in large group meetings. Richer and more flexible representations of the secondary channel may be needed, such as nested replies for more complex concepts and annotations. Third, I synthesized findings from three designs offering a peripheral channel for group communication, including IA. I found that all three tools share several common use cases, although they are designed for communication in different setting and at different scales. I also found variations of usage in designs for intensive communication and designs for less intensive communication. Based on the discussions, I generated three implications for designing peripheral interface for communication tools.
References


Appendix A

Instruction

This is a group exercise in decision-making. Please read the task instruction carefully and discuss it. Please use the provided chat system to communicate with your group members. Relax and discuss freely.

Task:

Your group has raised $5,000 for a “Go Green” project. As a group, come up with at least 8 possible things that your group can spend the money on. Discuss each possibility and choose three things that your group decides to be the best thing to do.

Background of the hypothetical “Go Green” project:

The “Go Green” project is proposed to help Penn State organizations (college, department, building, etc.) to operate in a more efficient, innovative, and healthy way. It promotes the importance of energy and natural resource conservation and sustainability.

Note:

You will be given 15 minutes to come up with ideas and choose the 3 best ways to spend the money raised by your group. At the end of the task, your group will need to provide the 3 best ways you have decided in the chat window. Please DO NOT close the chatting window.
Appendix B

Consent Form

Informed Consent Form for Social Science Research

The Pennsylvania State University

Title of Project: Study of group dynamics in online chatting

Principal Investigator:
Na Li, Graduate Student
329B IST Building
University Park, PA 16802
(814) 321-4896; nzl116@psu.edu

Advisor: Dr. Mary Beth Rosson
307H IST Building
University Park, PA 16802
(814) 863-2476; mur13@psu.edu

1. Purpose of the Study*: The purpose of this study is to understand the decision-making process in an online chatting environment.

2. Procedures to be followed: You will be asked to log onto an online chat system while the experimenter explains the task, a four-person discussion (using the chat system) of how
to spend a modest sum of money. You will have 15 minutes for this discussion. Afterwards you will complete a post-task survey. The entire session should take approximately 30 minutes. Then you will be asked to complete a follow-up interview. The interview can be conducted right after the previous procedures, or at another time of the day at your choice. The interview will take approximately 30 minutes and will be audio recorded.

Note: During the 15 minutes chat session, your chat will be stored.

3. **Discomforts and Risks:** There are no risks in participating in this research beyond those experienced in everyday life.

4. **Benefits:** You might learn more about working distributed and solve problems with colleagues online. The research findings of this experiment will impact the development of software that may help this process to take place more efficiently and effectively.

5. **Duration:** It will take about 30 minutes to complete the task and the post-task survey. It will take another 30 minutes to complete an individual interview. The details of the time distribution are described above in item 2.

6. **Statement of Confidentiality:** Your participation in this research is confidential. The data collected in the surveys will be kept private and secure. The recordings will be stored in a locked cabinet in the CSCL laboratory, 315 IST Building, School of Information Sciences and Technology, Penn State. Only the investigators of this study will have access to the data. The data will be destroyed 3 years after the close of the study. Regarding your online chat, your confidentiality will be kept to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet by any third parties. The Pennsylvania State University’s Office for Research Protections, the Institutional Review Board and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study. The focus throughout the analysis will be on
group trends, not on individual performance or characteristics. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared.

7. **Right to Ask Questions:** Please contact Na Li at (814) 321-4896 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. If you have any questions, concerns, problems about your rights as a research participant or would like to offer input, please contact The Pennsylvania State University’s Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

8. **Payment for participation:** You will receive $10 at the end of the experiment.

9. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.

Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

*Note: Because the results of the study could be affected if the full purpose is known prior to your participation, the full purpose of the study cannot be explained to you at this time. You will have an opportunity to receive a complete explanation purpose following completion of the study.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and the information outlined above, and if you agree to have your task activities recorded, please sign your name and indicate the date below. You will receive a copy of this consent form for your records.

I agree to be audio recorded during the interview (circle one). 

YES

NO
Please note that the recordings will be transcribed by researchers of the study. The recordings, transcriptions and the chat logs will be destroyed three years after the close of the study.

______________________________________________  ______________________
Participant Signature                        Date

______________________________________________  ______________________
Investigator Obtaining Consent              Date
Appendix C

Pre-task Survey

This survey is confidential. But we need to know your personal information for analysis of the data. Your identity and response will never be disclosed to any one other than the investigators of the research.

1. Name:

2. Gender:

3. Age:

4. I would rate my proficiency in English as the following:
   - Not proficient: I cannot communicate at all with a native speaker of the language
   - Somewhat proficient: I can communicate with a native speaker of the language to a very limited degree (i.e., using broken words or phrases), but cannot carry on a conversation with a native speaker.
   - Intermediate proficiency: 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.
   - Advanced proficiency: 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.
   - Near-native proficiency: I can carry on a conversation with a native speaker of the language with very little difficulty. Sometimes I am mistaken as a native speaker of the language.
• Native proficiency: I am considered by other speakers of the language as a native speaker.

Please rate your typing speed in general chatting circumstances:

- Fast
- Moderate
- Slow
Appendix D

Post-task Survey (condition 1)

Scales:

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Questionnaire items</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of communication</td>
<td>1. There were too many parallel discussions of different topics.</td>
<td>item 1-2 are item 3-6 are new</td>
</tr>
<tr>
<td></td>
<td>2. Many discussions points were unaddressed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. This was an unnatural conversation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. The conversation seemed highly interactive.</td>
<td>adapted from (Sellen, 1992)</td>
</tr>
<tr>
<td></td>
<td>5. I found it difficult to keep track of the conversation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. I was able to take control of the conversation when I wanted to.</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>1. Working with my group members was an enjoyable experience.</td>
<td>(Convertino, Neale, Hobby, Carroll, &amp; Rosson, 2004)</td>
</tr>
<tr>
<td></td>
<td>2. I would enjoy working with my group members again if there are future issues regarding the funds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. I enjoyed communicating with my group members.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. I am satisfied with the group decisions that were reached.</td>
<td></td>
</tr>
</tbody>
</table>
Questions:

1. If you could choose the 3 best ways to spend your money again, which of the three would you choose?
### Appendix E

#### Post-task Survey (condition 2)

**Scales:**

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Questionnaire items</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality of communication</strong></td>
<td>1. There were too many parallel discussions of different topics.</td>
<td>item 1-2 are</td>
</tr>
<tr>
<td></td>
<td>2. Many discussions points were unaddressed.</td>
<td>new</td>
</tr>
<tr>
<td></td>
<td>3. This was an unnatural conversation.</td>
<td>item 3-6 are</td>
</tr>
<tr>
<td></td>
<td>4. The conversation seemed highly interactive.</td>
<td>adapted</td>
</tr>
<tr>
<td></td>
<td>5. I found it difficult to keep track of the conversation when I wanted to.</td>
<td>from (Sellen, 1992)</td>
</tr>
<tr>
<td></td>
<td>6. I was able to take control of the conversation</td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>1. Working with my group members was an enjoyable experience.</td>
<td>(Convertino et al., 2004)</td>
</tr>
<tr>
<td></td>
<td>2. I would enjoy working with my group members again if there are future issues regarding the funds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. I enjoyed communicating with my group members.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. I am satisfied with the group decisions that were reached.</td>
<td></td>
</tr>
</tbody>
</table>
Usability

1. I could easily post messages using this chat tool like using any other chat tools. (Messages include texts in the main chatting window and in the annotation side bar.)

2. I could easily review messages using this chat tool like using any other chat tools. (Messages include texts in the main chatting window and in the annotation side bar.)

3. I am distracted by the annotations in the side bar.

4. I can’t send annotation; it’s too much burden for me.

5. I managed to use both the main chatting window and the annotation side bar well.

Questions:

1. If you could choose the 3 best ways to spend your money again, which of the three would you choose?
Na Li

Education

2008.08 – 2014.12 Pennsylvania State University, University Park, USA
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Conference publications


