1. Introduction

Since the network environments began expanding globally in the 1990s, computer-mediated communication between people in different countries has been increasing rapidly. The scale involves in both international technical collaborations and non-technical communication. Normally, a common language, English is used in most communication cases. However, although the Internet was first established in the English language, roughly two-thirds (470 million) of all the Internet users today are non-English speaking users [1] [2]. Most of non-English speakers mainly from Asia feel that they cannot express themselves accurately in English and are apt to use their mother languages.

Asia is a continent of various cultures and languages. Since Al Gore defined the concept of digital earth in the year 1998, the research of digital Asia has been carried out. However, information on the Internet is described in all kinds of languages with diverse senses of values, so information can hardly be shared by people from different countries in Asia, which leads to the emergence of numerous isolated information islands. Therefore, it is necessary to build the cross-cultural support system, which can support multilingual technical collaboration and intercultural non-technical communication among Asian
countries. In building such systems, the machine translation services are expected to overcome the language handicap.

This paper is based on the technical Intercultural Collaboration Experiment (ICE) [3] [4] and the non-technical China-Japan-Korea Virtual Community Experiment (3ASIAN) [5]. The two experiments were carried out among Asian countries, so they could be good examples of practices in digital Asia. Machine translation services are used in both experiments. We analyze the communication modes, usage of machine translation in the two experiments and describe some conclusions drawn from the analysis.

2. Intercultural Collaboration Experiment

Inter-cultural Collaboration Experiment (ICE) is an experiment among Asian universities from the year 2002 headed by the Department of Social Informatics, Kyoto University, Japan. The experiment is to support intercultural and multilingual collaborations using machine translation technologies. In this experiment, about 40 students majoring in computer science or informatics from Kyoto University, Japan, Shanghai Jiaotong University, China, Seoul National University and Handong University, Korea and University of Malaya, Malaysia made up an international team. The participants conducted an experiment on open source software development over the Internet, never seeing each other. They were required to communicate only in their mother languages. One of the objectives of the experiment is to see if the participants can break language barriers by using machine translation tools.

ICE2002 was carried out in two tracks with two months for each. Each track was divided into two four-week-phases, the Software Design Phase and the Software Implementation Phase. During the two phases, each sub team (one for each country) was required to design and complete an intercultural collaboration tool. These tools included search engine (China), Web-based email system (Japan), SMS (Malaysia) and Web-based chat system (Korea).

In Intercultural Collaboration Experiment 2002 (ICE2002), machine translation tools named TransBBS and TransWEB were provided to the participants. In both tools, machine translation services provided by arcnetsangenjaya [6] and J-server [7] are integrated.

TransBBS is a multilingual Bulletin Board System, which provides support for Chinese, English, Japanese, Korean and Malay. When a participant posts a message written in his or her own language, the system will translate the original message into the other four languages and then submit to the TransBBS. TransWEB is a WWW page translation system, which can translate web pages among the above five languages. In ICE, participants were required to write
development documents in their mother language and upload them to some websites, and then participants from other countries can read the documents in their own languages by using TransWEB.

TransWEB and TransBBS were used as the only communication tools among the participants during the whole experiment and other communication methods like e-mail and chat systems were not allowed.

2.1 Communication Among Participants In ICE

Six rooms were established on TransBBS for communication. The room of “lobby” is about all kinds of topics for all the participants. The rooms of “China”, “Japan”, “Korea” and “Malaysia” is about discussion on software development for the sub teams. The room of “integration” is about integration of tools developed by the four sub teams.

By analyzing the log data on TransBBS in ICE2002, we found that, in the first phase of the first track, the topics on TransBBS were mainly about social cues and machine translation quality although topics of software development were on increase. In the second phase of the first track and in the second track, most of the topics were about software development and integration. However, topics about social cues and machine translation quality had never faded away.

We also found that, communication in the Software Design (first) Phase was more active than in the Software Implementation (second) phase in both tracks. In the first track, the total post number was 320 in the first phase and 208 in the second phase. The corresponding numbers in the second track were 471 and 271.

| Table1: Post number on TransBBS in the second track of ICE2002 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Track & Phase   | Lobby | China | Japan | Korea | Malaysia | Integration | Total |
| 2-1             | 215   | 31(12) | 110(20) | 49(21) | 35(7)    | 31           | 471          |
| 2-2             | 164   | 18(8)  | 59(1)  | 8(2)  | 3(1)     | 19           | 271          |

Table1 shows the post number in the second track in details. The numbers in the brackets in the rooms for the four sub teams indicate post numbers by participants from the other three sub teams. We see that the total post number in the four rooms for sub teams decreased remarkably from 225 in the first phase to 88 in the second phase. Meanwhile, the total post number of participation by other sub teams in the four rooms also decreased from 60 to 12. The reason is that both members in a same sub team and participants among different sub
teams needed more discussion on software in the Software Design Phase than in the Software Implementation phase when they concentrated on coding separately instead of communicating.

2.2 Adaptation To Machine Translation Using Artificial Interference

By the end of the second track of ICE2002, all of the sub teams succeeded in developing their tools. We found that, despite the noise brought by machine translation, participants from the four countries managed to communicate with each other successfully, which had resulted from, to some extent, the efforts of adaptations to machine translation by artificial interferences. Two types of artificial interference were observed in the experiment, soft interference and hard interference.

Soft interference is a method of repeating to repair the original post by oneself to get good machine translation result (English as reference). This can be described as a process of human-to-machine adaptation. The method was not used at the beginning of the experiment. However, the participants found it necessary to improve the translation result and made use of it during the second track in ICE. Table 2 shows the efforts of soft interference by the participants in the first phase of Track 2.

<table>
<thead>
<tr>
<th>Item</th>
<th>China</th>
<th>Japan</th>
<th>Korea</th>
<th>Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Repair</td>
<td>148</td>
<td>1019</td>
<td>117</td>
<td>158</td>
</tr>
<tr>
<td>Total Post</td>
<td>62</td>
<td>206</td>
<td>57</td>
<td>92</td>
</tr>
<tr>
<td>Repair Per Post</td>
<td>2.39</td>
<td>4.95</td>
<td>2.05</td>
<td>1.72</td>
</tr>
</tbody>
</table>

The difference between soft interference and hard interference is that in the latter way the repairs of original post was not by oneself but by the Translation Guerrilla Group (one member from each sub team), which emerged in the second track of ICE2002 to improve the quality of communication. The translation guerrillas used hard interference when they found that the English translation result could hardly be understood or when the vote of translation quality of a message by the participants was shown “poor”. In repairing the original messages, they at first copied the messages into Microsoft Word for grammar advice and then rewrote the messages to adapt the translation machine for better translation result.
Figure 1 shows the usage of hard interference in the second track in details. We found that, times of hard interference of all the languages almost decreased week by week, which means that participants achieved to communicate with each other gradually even in the condition of high noise of translation. We also found that, the times of hard interference of Korean was several times of that of other sub teams. That might result from the poor translation quality. Another reason is that the Korean guerrilla, who can speak good Korean, English and also Japanese, managed to use two reference languages while judging the translation quality.

We also observed from Table 2 and Figure 1 that, the Japan Team, which was the most active sub team in using soft interference, needed the least times of hard interference.

3. China-Japan-Korea Virtual Community Experiment

China-Japan-Korea Virtual Community Experiment (3ASIAN) is conducted by Korea Institute for Regional Advancement (in Daegu) and Department of Computer Science and Engineering, Shanghai Jiaotong University from the end of the year 2002. The objective of this experiment is to develop the international communication among people from North-east Asia for a better understanding among them and to testify the feasibility of intercultural communication using the network environments and the machine translation technologies. The method
of the 3ASIAN experiment is to build a China-Japan-Korea oriented virtual communication community.

Unlike the experiment of ICE, 3ASIAN is non-technical and totally open to the public on the Internet. The participants of this experiment are people of various backgrounds mainly from China, Japan and Korea. Till the end of the year 2003, about 30,000 people had taken part in 3ASIAN. About 35 percent of all those people are from Japan, 40 percent are from Korea and 25 percent are from China.

In 3ASIAN, usage of machine translation is quite different with that in ICE. No machine translation embedded tools like TransBBS and TransWEB are provided and only links of machine translation services provided by Amikai [8] and Infoseek [9] are available. Therefore, it is up to the participants to decide whether they use the translation services or not. Amikai provided the machine translation services between Japanese and Korean, Japanese and English, while Infoseek provided services between Japanese and Korean, Japanese and Chinese, Japanese and English. We can see that no direct translation services were available between Chinese and Korean.

3.1 Communication in 3ASIAN and Usage of Machine Translation

The 3ASIAN community can be mainly divided into three parts: public information, personal BBS and Clubs. Public information includes notices, news, Q&A and so on. Personal BBS is for individuals to own BBS of certain subjects while clubs gather people who have similar backgrounds or same interests. We can analyze the effectiveness of communication in 3ASIAN mainly by analyzing the log data in the most typical clubs, Club of Housewives and Club of Wonbin (name of a Korean male movie star) Fans.

The members in the Club of Housewives are housewives from Korea (23 people) and Japan (30 people) while the members in the Club of Wonbin Fans are from three countries and 15 of the most active 100 members are Chinese, 35 are Korean and 50 are Japanese. The number of average new topics per day is 12.89 in the Club of Housewives and 9.47 in the Club of Wonbin Fans.

Table 3 shows the Average Conversation Chain Length (ACCL) of all the post in each room in the two clubs. The longer the average conversation chain is, the more effective the communication will be. ACCL is defined as follows:

\[
(ACCL) = \frac{\text{Total Replies (TR)}}{\text{Total Topics (TT)}} + 1 
\]

From table 3, we can see that, the value of ACCL in every room is greater than four except that in the room of Chinese Fans in Club of Wonbin Fans. The high convention chain length indicates that members in the clubs managed to overcome language barriers by using translation services. In fact, in the Club of
Housewives, we found that all the members made use of the translation services consciously and translated the original messages before posting, even if some communication was among members of the same country. In 3ASIAN, most of the participants were satisfied with translation quality between Japanese and Korean provided by Amikai.

<table>
<thead>
<tr>
<th>Room</th>
<th>TT</th>
<th>TR</th>
<th>ACCL</th>
<th>Room</th>
<th>TT</th>
<th>TR</th>
<th>ACCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Topics</td>
<td>1577</td>
<td>10708</td>
<td>7.79</td>
<td>Wonbin</td>
<td>1210</td>
<td>8252</td>
<td>7.82</td>
</tr>
<tr>
<td>About Food</td>
<td>625</td>
<td>3875</td>
<td>7.20</td>
<td>Language</td>
<td>26</td>
<td>140</td>
<td>6.38</td>
</tr>
<tr>
<td>Ideas of Life</td>
<td>185</td>
<td>962</td>
<td>6.20</td>
<td>Japanese Fans</td>
<td>93</td>
<td>331</td>
<td>4.56</td>
</tr>
<tr>
<td>Hobbies</td>
<td>310</td>
<td>1593</td>
<td>6.14</td>
<td>Free Topics</td>
<td>353</td>
<td>1062</td>
<td>4.01</td>
</tr>
<tr>
<td>Children</td>
<td>310</td>
<td>1562</td>
<td>6.04</td>
<td>Chinese Fans</td>
<td>147</td>
<td>283</td>
<td>2.93</td>
</tr>
<tr>
<td>Cultures</td>
<td>199</td>
<td>796</td>
<td>5.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All Rooms</strong></td>
<td>3206</td>
<td>19496</td>
<td>7.08</td>
<td><strong>All Rooms</strong></td>
<td>1829</td>
<td>10068</td>
<td>6.50</td>
</tr>
</tbody>
</table>

Successful communication, to a great extent, results from the quality of translation services and so does unsuccessful communication. The reason of low participation of Chinese lies in the poor machine translation quality between Chinese and Japanese, not to mention that between Chinese and Korean without direct translation services available. The fact also explains why the value of ACCL of the Chinese Fans room is the smallest in Table 3. In 3ASIAN, most of the participants from Japan and Korea had a continuous complaint about the poor translation quality between Chinese and their languages. However, on the other hand, they believed that communication with Chinese could also be successful given good quality of machine translation.

Translation is not everything in 3ASIAN. What matters indeed is how to use machine translation and how to adapt to it. We found that, participants achieved to communicate with each other using machine translation by two means: translation amending and translation returning.

Translation amending is a method used among those who master two or three languages of Chinese, Japanese and Korean. When a participant writes a message, at first he or she translates it into the target language using machine translation and then reads the translation result and rewrites some words and sentences in it so that the translation result can be understood.

Comparing with translation amending, translation returning was used more frequently since most of the participants in 3ASIAN only master their mother languages. When a participant wants to post a message, he or she translates the
original message into the target language and then translates the translation result into the native language again. If the translation result in the mother language can be understood, then the participant confirms that the translation into the target language is well done. Otherwise, he or she will repeat the above process.

Figure 2: Method of translation returning adaptation to machine translation

Figure 2 shows an example of usage of translation returning by a Japanese participant in 3ASIAN. He wanted to translate the following sentence ((1) in figure 2) from Japanese to Korean.

“When you are writing a message by using the machine translation services, if you can pay attention to the following things, you will get better translation result.”

In figure 2, (2) is the translation result in Korean of (1) and (3) is the translation result in Japanese of (2). He found that, after translating twice, the part of “following things” (A in figure 2) in (1) was mistaken as “following days” (B in figure 2) in (3). He then confirmed that the part of “following things” was not well translated into Korean and so he changed the part of “following things” in the original message into “following contents” (C in figure 2) in (4) and repeat the above process by translating (4) into (5) and (5) into (6). In the sentence of (6), the part of “following contents” (D in figure 2) was right and the whole sentence was well translated back into Japanese. Finally, he confirmed that (5) could be understood by Koreans.
4. Conclusion

In this paper, we analyzed the communication using machine translation services in ICE and 3ASIAN. We confirm that, in both multilingual technical collaboration and intercultural non-technical communication, participants can overcome language barriers by using machine translation if the quality of translation is not too terrible. By analyzing the data from the two experiments, we can find that, with human interferences and adaptations to the machines, the quality of communication can be greatly improved.

These two experiments can be considered as practices for digital Asia. Through the experiments, the method of machine translation mediated interactivity has been proved feasible and effective. In the future, the experiences of machine translation mediated interactivity can be applied in many fields in digital Asia such as science and technology collaboration, public intercultural communication, city to city (C2C) information shares, government cooperation, business among Asian countries and so on.

References

3. ICE. http://ice.kuis.kyoto-u.ac.jp/ice/.
5. 3ASIAN. http://www.3asian.com/.