User Adaptation in MT-mediated Communication

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Abstract

This paper analyzes the impact of user adaptation in MT-mediated communication. It clarifies how the user adapts to machine translation and how effective the adaptation is in terms of communication when the purpose of communication is clear. The most common alterations and their effectiveness strongly depend on the translation language pairs. In the case of Japanese-to-English translation, we observed two main alterations: replacing words or phrases to offset the difference in concepts between Japanese and English and supplementing subjects to offset the difference in modes of expression between Japanese and English. Since Korean and Japanese are similar languages, Korean users exhibited similar adaptation tendencies. The adaptation performed by Japanese users when referring to the English translation was very effective in improving the quality of the English translations. However, it was not so effective for Chinese and even less effective for Korean translations.

1 Introduction

When we conduct business with people of other countries, it is difficult to communicate smoothly due to the language barrier. By using English as a common language, we can communicate, but to write messages in English is a heavy burden and it causes the communications process to stagnate. The participants of intercultural collaborations hope to write messages in their native languages.

One solution is to use machine translation (MT) as a communication tool. What problems should be overcome so that MT can well support intercultural collaboration? This question suggests a new study theme for advancing the performance of MT systems.

A MT-mediated communication experiment that utilized a joint software development project in a cross-cultural environment is conducted. We are examining whether MT is effective when the purpose of communication is clear and the user can adapt to the machine translation. This paper clarifies how the user adapts to the MT output when it is used for communication and how effective the adaptation is to the communication. We show the relationship between the languages involved and the adaptation, the effectiveness of the adaptation as regards translation quality, and differences in adaptation actions performed by the different nationalities. A direction for enhancing the support of MT-mediation to communication between different nationalities is discussed.

2 ICE2002

With the aim of overcoming the language barrier in international collaboration, the Intercultural Collaboration Experiment 2002 (ICE2002) (Nomura et al., 2003) was conducted. Its goal was to link developers with different native languages (Japanese, Korean, Chinese and Malay) so that they could jointly write software (Othman et al., 2003). Messages were written in the native lan-
language and machine translated prior to sending. In fact, the user was provided with the information in not only his native language, but also English and Japanese, Korean, Chinese, and Malay. Most developers had some proficiency in English and of course all were proficient in their own language. The experiment used the multilingual communication tools TransBBS and TransWeb. TransBBS translates the message of one user into the other languages. TransWeb can translate software development documents into the user’s native language.

TransBBS allows the translation result to be confirmed before it is posted. Most participants (Japan: Kyoto University, South Korea: Seoul National University & Handong University, China: Shanghai Jiaotong University, Malaysia: University of Malaya) could understand English to some extent. They translated their messages into English and confirmed the English translation. If the translation appeared to be incorrect, they altered the original message and reran the translation. When the English version was adequate, or no further improvement could be discerned, the message was posted. The recipients read the message in their native language and sometimes referred to the English version to resolve any difficulties.

TransBBS was used for exchanging opinions and reporting developing situations, etc. concerning the design of the software being developed. TransBBS output is spoken in style. There were few informal expressions common in chat sessions, and many more polite and formal expressions.

3 Common user adaptation actions

The TransBBS user could rewrite his message before posting it to make it easier to understand. In this paper, we define the rewriting process as consisting of at least one rewriting instance (RI). After the rewriting process, messages are posted. An RI is defined by alteration of the text and retranslation. Each RI can consist of several acts (repairs) such as “Supplementation of a subject” and “Replacement of a noun phrase”. Each repair has a function: adaptation to raise the quality of the MT system output or refinement to improve the quality of the content of the message. Sample 1 shows two typical repairs made to Japanese original messages.

(1) Before rewriting:
 翻訳者が ー とき、
 translation-SUBJ restore when
 私は 皆様に それを
 I-TOP everybody it tell
 伝えます。

After rewriting:
 翻訳者が ー とき、
 translation-SUBJ repair when
 私は 皆様に それを
 I-TOP everybody it tell
 伝えます。

Sanny。ごめんなさい。
Sanny. I’m sorry.

In the first repair, the Japanese predicate 「復旧する (restore)」 is replaced by 「直る (repair)」 which has similar meaning. This represents message adaptation; replacement is used to eliminate word selection error. In the second repair, the message is enhanced through the addition of 「Sanny ごめんなさい。(Sanny. I’m sorry.)」 which expresses an apology to Sanny. This addition enriches the content of the message.

Repair can be classified into “replacement”, “addition” and “deletion”. Furthermore, repair can be subdivided according to what is rewritten. This paper mainly discusses the adaptation of Japanese original messages. Adaptation of Korean original and Chinese original messages is also discussed. Refinement is only briefly addressed.

3.1 Japanese user adaptation

The adaptations performed by Japanese participants in the collaboration experiment are summarized in Table 1, which lists the adaptation methods and their frequency of use. These results were gained from 76 messages. Repairs by replacement, which cover “Replacement of a noun phrase” to “Change in punctuation”, constitute 183 cases (69.6%). Repairs by addition, which cover “Supplementation of a subject” to “Addition of a punctuation mark”, constitute 39 cases (14.8%). Repairs by deletion, from “Deletion of an adverbial expression” to “Deletion of a punctuation mark”, constitute 41 cases (15.6%). Most repairs involve replacement. Deletion is used when the translation fails and the information is not important.
The replacement of a word or a phrase, for example, "Replacement of a predicate" and "Replacement of a noun phrase" represents an attempt to find a synonym that will yield better English translation quality. In "Replacement of a sentence", which is comparatively frequent 36 (13.7%), involves paraphrasing. In "Replacement of a sentence end expression", complex aspect expressions that included particles, auxiliary verbs, and supplementary verbs, etc. were replaced by simple expressions as shown in Sample (2). After rewriting, the indirect expression 「ように（like）」 was removed. The repair represents the recognition that the delicate nuance of the original expression was too difficult to translate.

(2) Before rewriting:
タイトルは 英語で
書くようにして下さい。
write like do please
After rewriting:
タイトルは 英語で
書いて下さい。
write please

Long sentences have strong structural ambiguity and are very difficult to translate. This problem was often solved with "Division of a sentence". "Change of word order" was also used to resolve structural ambiguity.

"Supplementation of a subject" is most common in "Addition". Subjects that are well understood from the context and can be omitted in Japanese are often necessary in English. Current MT systems find it difficult to supply these subjects. Thus "Supplementation of a subject" is necessary to get good English translation.
“Deletion of an adverbial expression” is most common in “Deletion”. Adverbial expressions should be often translated indirectly, that is, the selection of style is requires in their translations. As a result, they are difficult to translate compared with verbs or nouns. Adverbial expressions are not the main elements of sentences. Thus they were omitted if the translation was poor.

These repairs were usually done referring to English. Since the user did not know details of the MT system, user adaptation proceeded by trial and error. If one repair failed, the user would try another or give up on adaptation.

To examine adaptation in detail, we clarified which problems could be rectified by adaptation. Adaptation was possible if it involved the simple replacement of a word or a phrase, a simple sentence paraphrase, or simplification of a sentence; it was impossible when the original text had a special structure (for example, structure with a formal noun) or an abstract expression.

3.2 Difference in user adaptation

In addition to user adaptation in Japanese, we also examined the adaptation of Korean and Chinese users. 100 messages in Korean and 81 messages in Chinese were investigated.1

Table 2 lists Korean user adaptations. The repairs are similar to those of Japanese users indicating that Korean is similar to Japanese linguistically.2

If repairs of “Addition of a punctuation mark” are removed from the data, the Korean users had high rates of “Replacement of a sentence end expression”, “Replacement of a predicate”, “Replacement of a noun phrase”, “Deletion of a sentence”, and “Deletion of an adverbial expression”.

The data for the Chinese participants, summarized in Table 3, shows a quite different tendency. This is reasonable since both Japanese and Korean differ linguistically from Chinese. The Chinese participants made many repairs to remove analysis errors. In Chinese, which is an isolated language, word order has an important role in analysis, and a word can be a verb or a noun. Therefore, the MT system often confused a noun for a verb vice versa. Such analysis errors were prevented through the “Addition of a particle” and “Deletion of a comma”.

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1 The number of repairs and the number of rewriting processes are fewer than for Japanese users. Our reading of the above results is that Japanese are more sensitive to making public errors and so made more repairs than either Koreans or Chinese. This may be due, in part, to the fact that Japan was the prime mover of the experiment.

2 One noticeable point is the high frequency of “Addition of a punctuation mark”. It seems that the Korean users did not use such marks rigorously to indicate a new sentence, and preferred to offset a new sentence to a new line. Unfortunately, the MT system required punctuation marks to delineate sentences.
4 Effect of user adaptation on multilingual translation

We arranged for a group of professional translators to examine the material. Table 4 shows their assessment of the effectiveness of Japanese user adaptation in terms of the quality of the English, Korean and Chinese translations. Only the final versions were assessed.

In Table 4, “↑”, “=”, and “↓”, indicate that translation quality was improved, unchanged, and degraded, respectively, by user adaptation.

The results show that the quality of English was significantly improved by adaptation. This is important in terms of improving communication quality since all users, regardless of their nationality, often used the English translation to better understand the original messages. User adaptation was not effective in improving the quality of the Korean translations. Our explanation is that the Japanese-to-Korean translation module of TransBBS is quite effective so the first translations were judged good, no further improvement could be expected. User adaptation did improve the Chinese translations. Based upon the assessment of the translation experts, the quality of the original translations produced by TransBBS are summarized in Table 5 for the main language pairs.

We analyzed the effectiveness of the major repairs. “Replacement of a predicate” and “Replacement of a noun phrase” were effective for English, but not effective for Korean and Chinese. The difference between Japanese and English concepts is wider than the difference between Japanese and Korean/Chinese concepts, so the word selection in English is difficult. This repair is effective in correcting the errors. The same repair is not so effective for Korean and Chinese because the common cultural background ensured adequate original word selection. “Supplementation of a subject” was effective for English translations, but not effective for Korean and Chinese translations.

“Replacement of a sentence end expression”, particularly simplification, was effective for Chinese. “Replacement of a sentence” was not always effective for English; it seems that making a better new sentence is not so easy. The repairs were somewhat effective in Chinese translations but were sometimes the cause of the poor quality of Korea translations. “Division of a sentence” was effective for English and Chinese translations. In translations to Korean, many original sentences were translated into Korean without problem and so did not benefit from sentence division.

In short, the repairs deeply depending on J/E pair were not effective for other language translations. The repairs of simplification were effective for poor quality translations. The adaptation referring to English translation is not so effective for the other translations because many repairs are language pair dependent and the current adaptation method has limited ability.

Table 6 shows the effect of user adaptation in Korean and Chinese on the quality of Japanese translations. The adaptation in Korean was effective on translations to Japanese (Improvement: 83.3%). It did not degrade the translations to Japanese. The adaptation in Chinese was also effective for translations to Japanese (Improvement: 60.0%). Unfortunately, it also degraded the translations to Japanese in some cases (Deterioration: 13.3%). The effectiveness of adaptation in Japanese is

<table>
<thead>
<tr>
<th>Target Translation</th>
<th>↑</th>
<th>=</th>
<th>↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>85.2%(46)</td>
<td>11.1%(6)</td>
<td>3.7%(2)</td>
</tr>
<tr>
<td>Korean</td>
<td>23.7%(14)</td>
<td>54.2%(32)</td>
<td>22.0%(13)</td>
</tr>
<tr>
<td>Chinese</td>
<td>42.4%(25)</td>
<td>47.5%(28)</td>
<td>10.2%(6)</td>
</tr>
</tbody>
</table>

Table 5: Translation quality of language pairs

<table>
<thead>
<tr>
<th>Target Source</th>
<th>J</th>
<th>E</th>
<th>K</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>-</td>
<td>G</td>
<td>VG</td>
<td>G</td>
</tr>
<tr>
<td>E</td>
<td>G</td>
<td>-</td>
<td>B</td>
<td>NB</td>
</tr>
<tr>
<td>K</td>
<td>VG</td>
<td>B</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>NB</td>
<td>B</td>
<td>B</td>
<td>-</td>
</tr>
</tbody>
</table>

VG: Very Good, G: Good, NB: Not Bad, B: Bad

From evaluation results of commercial MT software in Web pages (14 pages)

In this experiment, MT software which was evaluated or has equivalent quality was used. Japanese-English, Japanese-Korean, Japanese-Chinese and English-to-Chinese were translated directly. However, Chinese-Korean, Korean-English and Chinese-to-English were translated via Japanese. As a result, these translations had lower accuracy than the others.
lower than the effectiveness of adaptation in Korean and Chinese. It seems that this is because Korean-to-English and Chinese-to-English translation used Japanese as the intermediate language.

For Korean user adaptation, “Deletion” such as “Deletion of a sentence” and “Deletion of an adverbial expression” was effective in improving the quality of Japanese translations. Sometimes Korean-to-Japanese translation failed Korean analysis. In such a case, deleting these components improved the English and Japanese translations.

For Chinese user adaptation, the repairs to correct analysis error and of “Deletion” were effective. The drop in translation quality was mainly due to repairs such as “Replacement of a noun phrase”, “Replacement of a conjunctive repression”, and “supplementation of a modifier”. Failure of Chinese analysis was probably the major cause of the poor translation quality.

5 Discussion

MT-mediated communication, discussed in this paper, is a novel style of modern communication. While computer-mediated discourses have caught some research attentions recently (Herring, 2004) almost no literatures have discussed the MT-mediated communications so far.

As easily imagined, effectiveness of the MT-mediated communications considerably depends on performance of the utilized MT systems. However there are many other issues that may affect the effectiveness; these include, tasks and subjects to be discussed, profile of the community, and so on. Therefore the evaluation of the translation quality (Hovy, 1999; Papineni et al., 2002) alone is insufficient. We need to develop a novel evaluation method adequate for this context, and it will be a challenging research theme.

Our results introduced in this paper may be a step toward the goal. That is, we may be able to develop an evaluation metrics based upon the observed user adaptations to the MT systems. Our results also directly contribute to the design of new MT system and arrangement of existing MT systems. We will be able to design some rewriting support functions from the observed user adaptations.

6 Conclusion

We examined the effectiveness of user adaptation, the revision of the original messages to achieve better translation quality, in MT-mediated communication. An extensive experiment involving engineers from four countries confirmed that the tendency of rewriting and the effectiveness of user adaptation strongly depend on the translation language pairs.

Basing user adaptation on English, not the native language of any of the participants, limits the potential of the adaptation method. For example, a user who has weak English skills finds adaptation fairly useless. To solve this problem, we need a communication support tool that allows user adaptation to proceed in the native language. We are currently considering adaptation based on just the native language.

References


Table 6: Effect of adaptation in Korean and Chinese on translations to Japanese

<table>
<thead>
<tr>
<th>Source Language</th>
<th>↑</th>
<th>=</th>
<th>↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korean</td>
<td>83.3%(15)</td>
<td>16.7%(3)</td>
<td>0.0%(0)</td>
</tr>
<tr>
<td>Chinese</td>
<td>60.0%(9)</td>
<td>26.7%(4)</td>
<td>13.3%(2)</td>
</tr>
</tbody>
</table>