Analysis of Factors that Affect the Understanding of Plain Japanese Sentence and Machine-Translated Sentence to Facilitate Cross-culture System Design

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Abstract. A foreign resident of Japan can read and understand the contents of a sentence easily when shown native information in plain Japanese. However, a certain level of skill in Japanese is required to understand plain Japanese. A method is available for displaying native information by machine translation to allow communication with foreign residents. We investigate the difference in the ease of understanding plain Japanese and machine translations (Chinese sentences) for Japanese beginners whose native language is Chinese. Thus, we obtain the following findings: (1) Japanese beginners find machine translations easier than plain Japanese when it comes to understanding the meaning of a sentence. (2) The accuracy of a machine-translated sentence affects the understanding of the meaning of that sentence. However, we find that it is possible to understand the meanings of sentences with low evaluation accuracy in about 60% of cases.

Keywords: level of understanding, machine translation, plain Japanese.

1 Introduction

Plain Japanese is a language that can be understood by foreigners who are not good at Japanese in certain contexts, such as disasters[1]. Plain Japanese rewrites usual Japanese with a plain vocabulary and sentence structure. A foreign resident in Japan can read and understand the contents of a sentence easily when shown native information in plain Japanese. However, a certain level of skill in Japanese is required to understand plain Japanese. Furthermore, rewriting into plain Japanese has a relatively high cost, such as the use of intelligible words and paraphrasing.

A method is available that displays native information by machine translation to allow communication with foreign residents. The acquisition of skills in Japanese is not required because machine translation presents information in a

native language. Machine translation from Japanese into a native language can be performed automatically and it has a low cost compared with rewriting into plain Japanese. If the translation accuracy is not good, however, this method may make it highly demanding to understand the meaning of a sentence, or it might not be possible to understand a sentence at all. Thus, these two support methods have advantages and disadvantages. However, no previous studies have compared the ease of the understanding using these two support methods.

Even when written in plain Japanese, it might not be easy to understand a machine-translated sentence, depending on the level of mastery of Japanese. In the present study, we investigated the ease of understanding a plain Japanese sentence and a machine-translated sentence for a Japanese beginner.

2   Related Work

Plain Japanese is studied as a language by foreigners who are not proficient in Japanese[1–4]. The aim of the present research was to help a foreigner to understand Japanese during disasters or emergencies. This study defines rules for simplifying a Japanese sentence: the use of a restricted vocabulary and use of subject-verb pair in a sentence.

NHK, Japan's national public broadcasting organization, provides a news service in plain Japanese for foreigners[5]. This service provides the main news from Japan in plain Japanese using Ruby characters[1].

It has been shown that plain Japanese is a language that is intelligible to foreigners[2]. The accuracy of plain Japanese is stable when manual rewriting is performed by native Japanese. Thus, a foreigner with any native language can understand the meaning of a sentence if they have some level of language skill in Japanese. However, plain Japanese is not in the native language of a foreigner. Thus, a foreigner needs to acquire a certain level of skill in the Japanese language. The accuracy of machine translation varies depending on each specific sentence. Machine translation can change Japanese sentences to his/her native-language sentence automatically, and enable a foreigner to obtain information by his/her native language.

No previous investigations have compared these two support methods to assess the ease of understanding.

3   Experimental Analysis to Compare the Understanding of Plain Japanese and Machine-Translated Sentences

We considered foreign residents in Japan who had Chinese as their native language. We investigated the degree of comprehension of plain Japanese sentences and machine-translated sentences (Chinese sentences).

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[1] Ruby characters are small annotative glosses, which can be placed above or to the right of a Chinese character when writing languages that use logographic characters, such as Chinese or Japanese, to indicate pronunciation.

3.1 Evaluation Sentences

We used the following three types of text as evaluation sentences.

1. Plain Japanese sentences
2. Machine-translated sentences (Chinese)
3. Manually translated sentences (Chinese)

Three Japanese university students manually rewrote the sentences in plain Japanese. The plain Japanese used in the three sentence types was created from a single Japanese sentence because there are multiple methods of plain Japanese translation.

We used random test sentences to evaluate the machine translation system provided by NTT (Japan's major telecommunications company)[6][2]. In total, we produced 120 plain Japanese sentences.

We generated 40 machine-translated sentences in Chinese using the machine translation system[3] via Language Grid[4].

We evaluated the accuracy of the translated sentences using the adequacy evaluation method[5] developed by Walker et al.[7]. In this method, the following five-point scale was used to evaluate the accuracy of translation.

5: All (the same meaning)
4: Most (some grammar problems but roughly the same meaning)
3: Much (retained some of the meaning)
2: Little (the general idea remains but the actual meaning is not understood)
1: None (quite different meaning)

The evaluators were three Japanese-Chinese translators. We used manually translated sentences produced by a Japanese-Chinese translator. The manually translated sentences were produced after the ideal machine translations were generated.

In this experiment, one test sentence (Japanese) corresponded to one machine-translated sentence (Chinese), one manually translated sentence (Chinese), and three plain Japanese sentences. In total, 120 groups were used in the experiment.

3.2 Experimental Method

In this experiment, a foreign resident in Japan checked how many sentences they could understand when presented with plain Japanese sentences, machine-translated sentences, and manually translated sentences.

We investigated the level of comprehension in the following two types of experiments.

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[2] We used a comparatively long sentence where the average number of characters in 40 sentences was 43.6 characters, the standard deviation was 14.3 characters, the shortest sentence contained 20 characters, and the longest sentence contained 90 characters.

[3] J-Server developed by KODENSHA: `http://www.kodensha.jp/`

[4] Language Grid Project, `http://langrid.org/`

[5] This evaluation was performed by more than two evaluators.

Experiment 1. Description of the contents after reading
Experiment 2. Evaluation of the sentence contents

Each experiment is described in detail in the following section.

Experiment 1: Description of the Contents After Reading. Experiment 1 was the first phase of the comprehension investigation. A foreign subject described the contents that they understood in each sentence produced in their native language (Chinese). The target sentences were plain Japanese sentences, machine-translated sentences, and manually translated sentences.

The foreign subjects comprised three Chinese foreign students who attended a Japanese class for beginners.

To eliminate any possible order effect, we presented the target sentences (plain Japanese sentences, machine-translated sentences, and manual translations) in a random order to each subject.

Experiment 2: Evaluation of the Sentence Contents. In experiment 2, we evaluated the descriptions obtained in experiment 1. We evaluated the meanings of the sentences described by the subjects (level of comprehension).

The evaluator determined: "How much of the meaning expressed in the original sentence was also expressed in the sentence description?"

5: All (the same meaning)
4: Most (some grammar problems but roughly the same meaning)
3: Much (retained some of the meaning)
2: Little (the general idea remains but the actual meaning is not understood)
1: None (quite different meaning)

The evaluators were three Japanese-Chinese translators. To eliminate any possible order effect, we presented the target sentences in a random order to each translator.

4   Experimental Results and Discussion

We verified whether the accuracy of the machine-translated sentences affected their understanding. Table 1 shows the results for the description evaluations of plain Japanese sentences. Table 2 shows the results for the accuracy evaluations and the evaluation values of machine-translated sentences for the descriptions. In Table 2, the sentence accuracy evaluations are the median values for three translators.

Table 1 shows that the foreign subjects did not understood the meaning of many sentences because of plain Japanese sentences. In total 360 plain Japanese sentences, we found that 162 sentences (45%) had an evaluation accuracy of 1 and 2, where 104 sentences (29%) had evaluations of 4 and 5, although the plain Japanese sentences had easy vocabulary and correct grammar. Table 2 shows

Table 1. Results of the description evaluations of plain Japanese sentences

Evaluation of the description contents					
1	2	3	4	5	Total
71	91	94	64	40	360
(20%)	(25%)	(26%)	(18%)	(11%)	(100%)

Table 2. Results of the accuracy evaluations and description evaluations of machine-translated sentences

		Evaluation of the description contents					
		1	2	3	4	5	Total
	1	1	3	4	4	9	21
		(5%)	(14%)	(19%)	(19%)	(43%)	(100%)
	2	3	4	14	21	9	51
		(6%)	(8%)	(27%)	(41%)	(18%)	(100%)
Accuracy of	3	0	0	4	18	17	39
machine-translated		(0%)	(0%)	(10%)	(46%)	(44%)	(100%)
sentences	4	0	0	0	4	5	9
		(0%)	(0%)	(0%)	(44%)	(56%)	(100%)
	5	1	2	7	40	70	120
		(1%)	(2%)	(6%)	(33%)	(58%)	(100%)
	Total	5	9	29	87	110	240
		(2%)	(4%)	(12%)	(36%)	(46%)	(100%)

that the foreign subjects understood the meaning of many sentences, although the machine-translated sentences had low accuracy. We found that 21 sentences had an evaluation accuracy of 1, where 13 sentences (62%) had evaluations of 4 and 5. In total, 51 sentences had an evaluation accuracy of 2, where 30 sentences (59%) had evaluations of 4 and 5.

Figure 1 shows the frequencies of the highly evaluated description values, i.e., evaluations of 4 and 5. Thus, the evaluation of the sentence contents tended to improve with the accuracy of the machine translation. We found that the accuracy of translation affected the ease of understanding. The accuracy of translation was quite low when sentences received an evaluation of 1. However, the subjects could understand the meanings of about 60% (evaluations of 4 and 5) of these sentences. We found that even if a sentence had a low translation accuracy in the native language, the subjects were still able to read the contents to some extent.
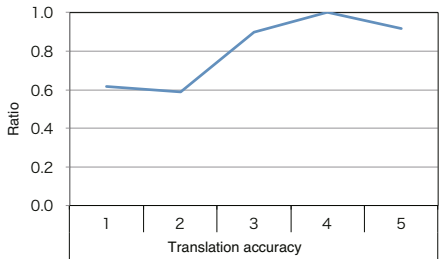

Fig. 1. Frequencies of the highly evaluated descriptions

Ten of 120 manually translated sentences with an evaluation accuracy of 5 received three or less evaluations. This was because the context was missing in these sentences.

5   Conclusion

In this study, we compared the ease of understanding plain Japanese and machine translations (Chinese) by beginners in Japanese who had Chinese as their native language. The main contributions of this study can be summarized as follows.

1. It was easier for Japanese beginners to understand the meaning of machine-translated sentences than plain Japanese.
2. The accuracy of a machine-translated sentence affected its understanding.

In future research, we aim to conduct further experiments and evaluations in other languages.

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