Availability of Multilingual Chat Communication in 3D Online Virtual Space

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Abstract. There is a possibility that a 3D online virtual space can become a more familiar communication medium because of the widespread use of the Internet. However, language differences pose significant barriers to intercultural communications. We have developed a multilingual chat communication support system in Second Life as an initial research. Second Life is one of the most popular 3D online virtual spaces in the world. We have carried out a multilingual chat communication experiment in Second Life. From this experiment, we have found the following. (1) It is important that a machine translation machine make it visible in a 3D virtual space. A user can easily learn the usage of a machine translation. (2) There is not understanding other party's language in the problem because appearances of each avatar are free. It is important for users to show translation language pairs not to give confusion.

Keywords: multilingual chat communication, 3D online virtual space, machine translation.

1 Introduction

The number of accounts on Second Life[1], which is a three-dimensional virtual space, has increased to more than 14 million. Approximately 51% of these users are English-speakers[2], and English is used even in chats with non-English speakers. However, there are many users who cannot speak English well, and therefore, language can become a communication barrier.

Several support methods for communication in a virtual space have been proposed[3,4]. These researches aim to enable communication by using voice conversations in the same language. Research on multilingual chat communications support in a virtual space has been carried out a little. The Internet and technologies supported by high-performance computers have enabled communication in the virtual world for the first time.

This research presents the development of a multilingual chat communications support system in a three-dimensional virtual space. Further, we show the result of experiments that use multilingual chat communications support in a virtual space.

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2 Related Works

Sugawara et al. researched communication in a three-dimensional virtual space [5]. They developed a three-dimensional virtual space, called InterSpace, for their research. In InterSpace, there is an agent who mediates communications in a virtual space. Asynchronous communications in a virtual space have been achieved by this agent. Then, an open experiment was carried out on the Internet using InterSpace. The effect of the development of communities and the use of the communications media was studied in this experiment.

Matsuda et al. developed a virtual society, called PAW, and carried out an open experiment[6]. From the result of the open experiment, they presented the user's profile, the effect of an event, the feature of communities, and the communication tools for using all these together.

Nakanishi et al. studied the impact of a three-dimensional virtual space communication environment[7]. From a comparison of this environment with a face-to-face environment, they have found that the environment of the three-dimensional virtual space contributes to an increase in the switch frequency of the speaker.

Zhang and Bach have developed a context-aware machine translation system, named Virtual Babel, for virtual worlds[8]. They enhance the Second Life viewer to intercept the incoming/outgoing chat messages and reroute the message to a machine translation. The returned translations are appended to the original text message to help users to understand the foreign language. They have the same issue as us. They provide a context-aware language model to estimate a suitable domain for chat.

Our research differs from the abovementioned researches; we discuss the possibility of communication among speakers of several different languages by using machine translation in a virtual space.

3 Multilingual Chat Support System

We have developed a multilingual chat support system by using an object[1] that could be built in an event-driven-type script in a three-dimensional virtual space. Portable and fixed translation systems are expected as multilingual chat communications support. In the following subsections, we discuss the support form in the three-dimensional virtual space and then describe the portable and fixed translation systems.

3.1 Support Form of Multilingual Chat Support System

Table 1 shows the advantages and the disadvantages of a fixed and a portable communication support system in a virtual space.

In the case of the fixed system, the translation object was set up in a certain pre-decided place. When a user (avatar) went to this place, he/she could use the

[1] An "object" is a form combined by "prim," which is the basic object in Second Life.

Table 1. Advantages and disadvantages of a fixed and a portable communication support system in a virtual space

	Advantages	Disadvantages
Fixed	- It is easy to manage and update software because the software is in an object. - The language of the other person is shown clearly by the bench. - It is easy for users to operate the avatar because a user can use translation only while sitting on the bench. - The translation bench can be shown clearly using a translation function.	- The translation chat can be carried out only in that particular area. - One translation object can be translated only in one pair of languages.
Portable	- A user can use the translation function everywhere. - One HUD can support multiple language pairs.	- A user needs to update the translation system by himself/herself because the translation function is in the object. - The language of the other person is not shown clearly. A user needs to ask his/her language in advance. - A user has to operate the HUD for translation. - Because the user is not aware that the other person is using a machine translation function, there could be a lot of confusion.

translation chat system. It was necessary to prepare a separate translation object for each translation language for such a system[2]. The advantage of this system was that the other party's language was specified by the place where it sat.

The operation "Sit an avatar" is an easy operation that is often used in Second Life. The fixed machine translation function was displayed in the three-dimensional virtual space. Therefore, other users could recognize that the other party is using the machine translation system. In the case of the portable system, the translation object was displayed on the user's screen as a head-up display (HUD)[3]. This feature of the portable system did not place limitations on where the user could use the translation functions, and communications that used translation chat could be carried out everywhere. It was necessary to select the translation language for a portable system on HUD; further, it was necessary to know

[2] This limitation is a problem in Second Life.

[3] A head-up display (HUD) is a transparent display that presents information without requiring the user to look away from his/her usual viewpoint.

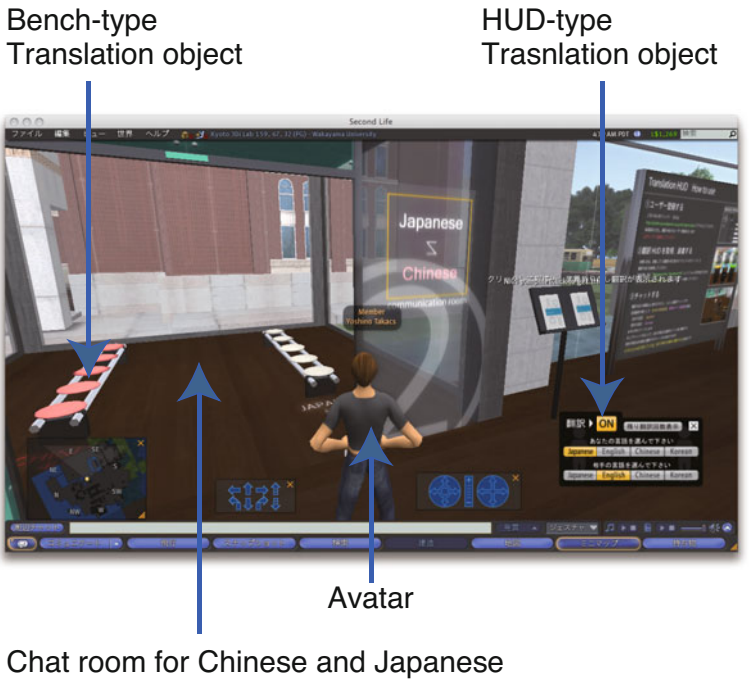

Fig. 1. Screenshot of the multilingual chat support system

the other party's language beforehand[4]. When a portable system was used, sentences in two or more languages were suddenly displayed while chatting because the machine translation function was not displayed in the three-dimensional virtual space. This might confuse the other party.

3.2 Structure of Multilingual Chat Support System

The multilingual chat support system that we have developed is shown in Figure 1.

1. Fixed translation system (Bench-type translation object)
   "Chat room for Japanese and Chinese" in Figure 1 is a fixed translation object. We set up Japanese–English, Japanese–Chinese, and Japanese–Korean chat rooms. The procedure for using the translation chat room was as follows:
   (a) A user clicked the bench-type translation object in the translation chat room, and then the avatar of the user sat on the bench.

[4] When this system was developed, neither the user's national origin nor information on the user's language was offered in Second Life. However, now, a user's language can be known.

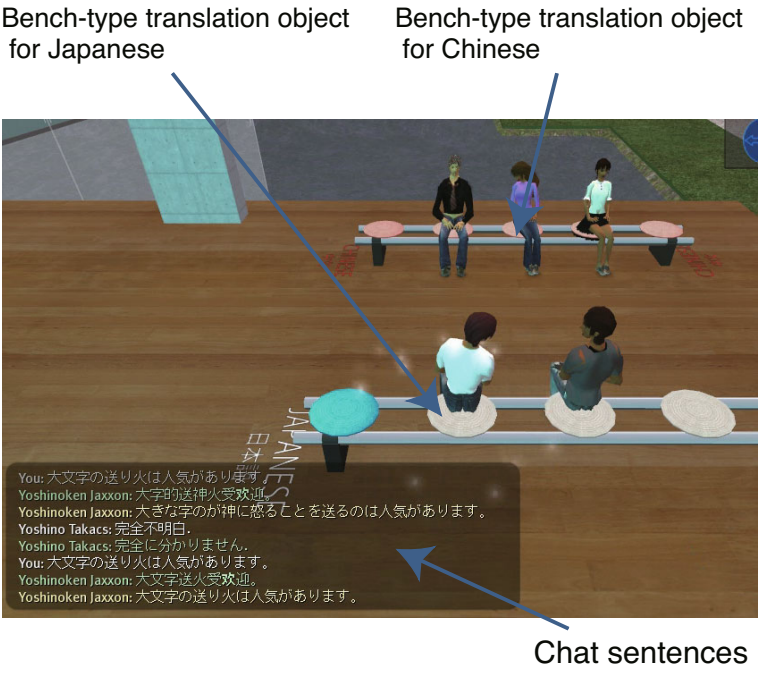

Fig. 2. Screenshot of a chat communication in the translation chat room

(b) The chat sentence was translated automatically during the chat.

The appearance of the chat communication in the chat room is shown in Figure 2. Each user sat on the bench on the native language side. The input chat sentences were machine translated and displayed as a chat sentence.

2. Portable translation system (HUD-type translation object)
   The HUD-type translation object in Figure 1 is a portable translation object. Figure 1 shows an expanding HUD-type translation object. This could translate among Japanese, English, Chinese, and Korean by switching the language tab. The procedure for using the HUD-type translation object was as follows:
   (a) The user installed the HUD-type translation object in his/her avatar.
   (b) The user clicked the language selection tab according to the partner's language and his/her own language.
   (c) The chat sentence was translated automatically during the chat.

3.3 Back Translation

Back translation is the process of translating a sentence that has already been translated into an intermediate language back to the original language. Back translation enables users to check the accuracy of a message using their own native language.

Fig. 3. Screenshot of the heads-up display (HUD)-type translation chat object

Fig. 4. Example of multilingual chat communication

An example conversation is shown in Figure 4. The translation sentence was displayed only on the input user's side and not on the other party's side. When the input sentence had a mistake, the sentence could not be machine-translated correctly. When an unknown word or a complex syntax was used even when the input sentence was correct, the translation would most likely be incorrect. In previous studies, the user confirmed the back-translation result before he/she presented it to the other party's side[9]. When the user judges that there was a problem in the back-translation result, he/she can correct the input sentence[10,11].

A chat in a virtual space communication demanded real-time translation. Therefore, the user could correct the sentence if he/she found that the translation result was not correct.

3.4 System Configuration

Figure 5 shows the system configuration of the multilingual chat support system. The input sentence that the translation object (Bench-type translation object in the translation chat room and the HUD-type object) received from the Second Life server passed through the relay server (Figure 5(B)).

The relay server authenticated the user, limited the translation frequency, and recorded the user log. Then, the input sentence was sent to the translation server (Figure 5 (D)) through the language grid[12] server (Figure 5 (C)).

The relay server sent the translated sentence to the Second Life server (Figure 5 (B)). Finally, the translation object displayed the translated sentence in Second Life. The back translation was carried out using an almost similar procedure.

4 Experiment 1: Portable Multilingual Chat Communication System

We carried out an experiment using the portable multilingual chat communication system. In the experiment, five Japanese university students chatted with some unspecified general users in Second Life.

The purpose of the experiment was to investigate what problems occurred during the use of the portable multilingual chat communication system in Second Life. The procedure of the experiment was as follows:

1. A subject installed the portable translation system (HUD-type translation object) in his/her avatar.

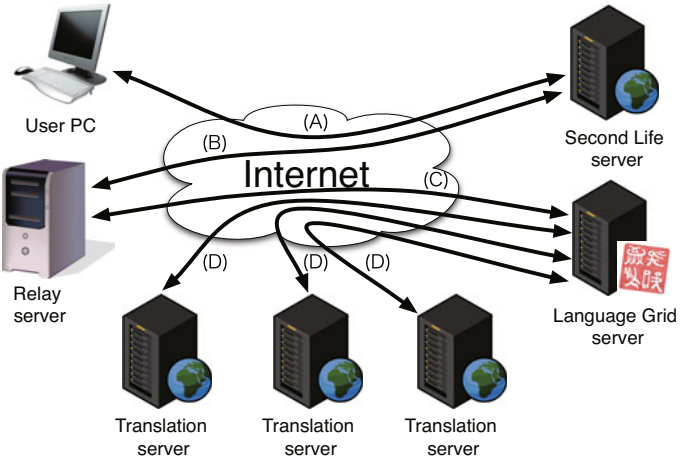

Fig. 5. System configuration of the multilingual chat support system

Table 2. Questionnaire result of the experiment using a portable translation system

Questionnaire items	Average	Standard deviation
(1) The translation result of my chat sentence was correct.	2.2	0.16
(2) I think that the back translation is necessary.	4.6	0.24
(3) I understood the meaning of the foreigner's (the other party of the chat) sentence from the translation.	2.8	0.56
(4) I am satisfied with the accuracy of the translation.	2.0	0.40
(5) I understood the usage of the translation function at once.	4.0	0.40
(6) A problem occurred in the translation system while chatting.	2.2	1.36
(7) I think that the machine translation in the chat is useful.	3.6	1.04

We used a five-point Likert scale for the evaluation, with 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly agree.

2. The subject went to an island (called SIM in Second Life) where the other avatar existed.
3. The subject read a conversation among the general users on Second Life and chatted to them.

The duration of each experiment was approximately 20 or 30 min.

In the experiment, the translation system was not able to translate sentences in many cases. Many users in Second Life used clipped forms for chat. Some users incorrectly used capital and small letters while spelling out a word. Moreover, even if the chat with a general user on Second Life was translated, it was not possible to follow the conversation because the translation could not keep up with the speed of the conversation. Subjects were ignored by almost everyone on Second Life.

Table 2 shows the questionnaire result of the experiment using the portable translation system.

We obtained good results with respect to the necessity and ease-of-use of the system from the questionnaire (Table 2 (2), (5), and (7)). However, the results with respect to the actual use of the system in Second Life were poor (Table 2 (1), (3), and (4)). We found that the sentences of the other party and those of the subject were often translated incorrectly. The main reasons that the subjects gave for not being able to carry out a good chat conversation (Table 2 (3)) were as follows:

- I hardly understood the content of the chat. However, I think that the translation depends on the content of the sentence.
- I think a peculiar word was often used in the chat ('You' is shown 'u'). I did not know what was said at all because the contents of the chat were too unusual.
- Because the translation results were not too correct, I could not understand the conversation well.

We found that the chat in Second Life was similar to the chats on the Internet. The users did not care much about grammar and spelling. When the subjects used the portable translation system, the other party did not answer in consideration of such a special situation.

5 Experiment 2: Fixed Multilingual Chat Communication System

5.1 Experimental Procedure

We carried out the experiment using the fixed multilingual chat communication system. The purpose of the experiment was to investigate what problems occurred during the use of the fixed multilingual chat communication system in Second Life.

In the conversation experiment, we verified the following items:

- Can you carry out a serious conversation using this system?
- Does the meaning of the other party's sentence change because of the machine translation?
- How can we verify that the machine translation function is effective?

From the result of the experiment using the portable system, it was concluded that most of the conversation was not established. We thought that this was because of the following two reasons:

- The other party did not understand the purpose of the conversation.
- The conversation was not meant for machine translation.

Therefore, we gave the subject a purpose "Question your partner by using machine translation." The subjects were seven Second Life users whose native language was English. We recruited the experimental subjects from the official Web page of Second Life. We told the participating subjects that they would be paid 10L$‘30L$ in Second Life currency as a reward.

The procedure of the experiment was as follows:

1. We guided the subject to the translation chat room.
2. We told the subject that this was an experiment to verify the effectiveness of machine translation.
3. We asked the subject to ask a Japanese interlocutor 10 different questions.
4. The Japanese interlocutor requested rephrasing when the question could not be understood from the translation result.
5. When the translation of the rephrased sentence also did not make much sense, the Japanese interlocutor asked the subject to change the question.

The Japanese interlocutor was one of the authors. In the experiment, the subjects did not use back translation. They could only see their input sentences and the translated sentences. We screen-captured the entire experiment. We recorded all the sentences that were exchanged during the chat.

Table 3. Judgment result of the Japanese interlocutor's understanding of the subjects' question

Subjects	Question of subject			
	Apprehensible	Inapprehensible	Average number of characters	Average number of words
A	7	3	74.8	14.6
B	10	0	39.5	7.6
C	10	0	31.9	6.2
D	8	2	53.1	10.0
E	9	1	57.9	10.7
F	9	1	46.7	9.9
G	10	0	66.2	13.1
Average	9.0	1.0	52.9	10.3

5.2 Result and Discussion

Table 3 shows the Japanese interlocutor's understanding of the subjects' questions. The Japanese interlocutor judged whether a translated question was understandable. The subjects were asked to rephrase questions that the Japanese interlocutor did not understand. From Table 3, it could be concluded that the translation result for many of the questions was understandable.

Some of the problems that hindered accurate translation, and hence the overall chat communication, were as follows:

1. The subjects hardly used clipped forms in the chat. We had explained to the subjects that the experiment was about verifying the effectiveness of machine translation in advance. However, we did not explain the features of machine translation and the problems caused by the use of clipped forms.
2. The subjects often made spelling mistakes. Therefore, the machine translation failed. A couple of examples are shown below.
   Input sentence: Who are your favorate singers/music groups?
   Translation result: favorate/yO[vNH
   (The spelling of "favorate "is incorrect.)
   Input sentence: It is a very well desgined welcome area.
   Translation result: desginedGAB
   (The spelling of "desgined "is incorrect.)
3. When the Japanese interlocutor said that he did not understand the translated sentence, the subjects rephrased the sentence. The subject followed the following rephrasing method:
   – The subject numbered each sentence.
   – The subject supplemented the meaning by using parentheses.
   Some of the examples are as follows:
   First input sentence: I am making up questions, it is ok. Next question: This skirt comes in Copy/No Mod/No Trans, can you make the skirt in Copy/Mod/No Trans? I am small, so I have to edit the skirt.
   Second input sentence: (1) I am making up questions, it is ok. (2) This skirt

comes in Copy/No Mod/No Trans, can you make the skirt in Copy/Mod/No Trans? I am small, so I have to edit the skirt.
(After the subject placed (1) and (2) at the beginning of the sentence, he asked the Japanese interlocutor to specify which sentence was poorly translated.)
Third input sentence: (1) This skirt (item of clothing) comes in (has the Second Life Permissions) of Copy/No Modify/No Transfer. Can you (the creator) change the Second Life Permissions to Copy/Modify/No Transfer. (3)I (Kokoro) am a small person, so I have to edit the skirt (item of clothing)[5].
(The subject explained the meaning of the word by using parentheses.)

4. The subjects divided a long sentence.
   First input sentence: When I am speaking (typing) to a Japanese person, what symbol should I use to make each idea/statement easier to seperate?
   Second input sentence: The English tend to put many subjects in their statements. Is there a symbol that would make it easier for you to understand the change of thought?
5. Colloquialism
   When the subjects used colloquial words, the sentence could not be machine-translated well.
   Example: Yay! I look forward to that. Do you enjoy flying or would you rather teleport all the time?
   ("Yay" is colloquialism term that means the affirmative.)
6. The subject used some emoticons.
   Example: And bad spelling does not help :)
7. The foreigner subject asked only simple questions for the conversation experiment. In particular, all questions asked by subjects B and C were simple (Table 3).
   Example 1: What is your name?
   Example 2: What kind of car do you drive?
8. There were subjects who did not begin their sentences with a capital letter. In the case of subjects C and D (Table 3), most of the sentences in their conversations began with a small letter. However, this did not affect the machine translation, and the sentences were translated correctly.
   Example 1: how is the weather there?
   Example 2: what do you think is the biggest source of conflict between most couples?
9. When a subject noticed a mistake in the input, he/she would input only the corrected form of the incorrect word in the next line.
   First input sentence: can you tell mehow many cans of beer would be left in a carton of 24 cans, if I drank eight cans of beer?
   Second input sentence: me how*
   (In the first input sentence, he input "me how " as "mehow")

[5] There is no '(2)' as is written

6 Conclusion

We have developed a multilingual chat communication support system in Second Life as an initial research. We carried out a multilingual chat communication experiment in Second Life.

From the experiments, we found the following:

(1) It is important that a machine translation machine make it visible in a 3D virtual space. A user can easily learn the usage of a machine translation.
(2) There is not understanding other party's language in the problem because appearances of each avatar are free. It is important for users to show translation language pairs not to give confusion.

The present machine translation could not handle colloquialisms well. However, it was possible to talk enough if there is motivation of communications.

Currently, the multilingual chat communication support system in Second Life has been opened to the public as a trial at the following URL:
http://slurl.com/secondlife/3D%20Community%20Lab/209/140/32

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References

1. Linden Lab: Second Life, `http://jp.secondlife.com/`
2. Second Life - Economic Statistics: Key metrics, `http://static.secondlife.com/economy/stats_200807.xls`
3. Minoura, D., Ishibashi, S.: A 3-D Virtual Communication Environment for Thousands of Users. Transactions of Information Processing Society of Japan 42(11), 2595–2606 (2001) (in Japanese)
4. Isbister, K., Nakanishi, H., Ishida, T., Nass, C.: Helper agent: designing an assistant for human-human interaction in a virtual meeting space. In: Proceedings of the SIGCHI conference on Human factors in computing systems, pp. 57–64 (2000)
5. Sugawara, S., Suzuki, G., Nagashima, Y., Matsuura, M., Tanigawa, H., Moriuchi, M.: InterSpace: Networked Virtual World for Visual Communication. IEICE Transactions on Information and Systems E77-D(12), 1344–1349 (1994)
6. Matsuda, K., Miyake, T., Kawai, H.: Culture formation and its issues in personal agent-oriented virtual society: PAW^2. In: Proceedings of the 4th International Conference on Collaborative Virtual Environments, pp. 17–24 (2002)
7. Nakanishi, H., Yoshida, C., Nishimura, T., Ishida, T.: FreeWalk: A 3D Virtual Space for Casual Meetings. IEEE Multimedia 6(2), 20–28 (1999)
8. Ying, Z., Bach, N.: Virtual Babel: Towards Context-Aware Machine Translation in Virtual Worlds. In: Proceedings of the 12th Machine Translation Summit MT Summit XII (August 2009)

9. Yoshino, T., Fujii, K., Shigenobu, T.: Availability of Web Information for Intercultural Communication. In: Ho, T.-B., Zhou, Z.-H. (eds.) PRICAI 2008. LNCS (LNAI), vol. 5351, pp. 923–932. Springer, Heidelberg (2008)
10. Miyabe, M., Yoshino, T., Shigenobu, T.: Effects of Undertaking Translation Repair using Back Translation. In: Proceedings of the 2009 ACM International Workshop on Intercultural Collaboration (IWIC 2009), pp. 33–40 (2009)
11. Miyabe, M., Yoshino, T.: Accuracy Evaluation of Sentences Translated to Intermediate Language in Back Translation. In: Proceedings of 3rd International Universal Communication Symposium (IUCS 2009), pp. 30–35 (2009)
12. Ishida, T.: Language Grid: An Infrastructure for Intercultural Collaboration. In: Proceedings of IEEE/IPSJ Symposium on Applications and the Internet, pp. 96–100 (2006)