Collection of Simultaneous Interpreting Patterns by Using Bilingual Spoken Monologue Corpus

Hitomi Tohyama[†]   **Shigeki Matsubara**[*]

[†]Graduate School of Information Science, Nagoya University
[*]Information Technology Center, Nagoya University,
Furo-cho, Chikusa-ku, Nagoya-shi, 464-8601, Japan
[†]hitomi@el.itc.nagoya-u.ac.jp   [*]matubara@itc.nagoya-u.ac.jp

Abstract

This paper provides an investigation of simultaneous interpreting patterns using a bilingual spoken monologue corpus. 4,578 pairs of English-Japanese aligned utterances in CIAIR simultaneous interpretation database were used. This investigation is the largest scale as the observation of simultaneous interpreting speech. The simultaneous interpreters are required to generate the target speech simultaneously with the source speech. Therefore, they have various kinds of strategies to raise simultaneity. In this investigation, the simultaneous interpreting patterns with high frequency and high flexibility were extracted from the corpus. As a result, we collected 203 cases out of aligned utterances in which simultaneous interpreters' strategies for raising simultaneity were observed. These 203 cases could be categorized into 12 types of interpreting pattern. It was clarified that 4.5 percent of the English-Japanese monologue data were fitted in those interpreting patterns. These interpreting patterns can be expected to be used as interpreting rules of simultaneous machine interpretation.

1. Introductions

To achieve the supporting environment for the natural and smooth multilingual communication, the studies on the simultaneous machine interpreting has been conducted at several institutions (Matsubara 1997, Mima 1998). In order to develop the simultaneous interpretation system with high performance, it is important to observe how professional interpreters generate simultaneous interpretation and to make use of their techniques. Their skills are acquired by tremendous mount of training over many years (Korrnakov 2000, Osaka 2003). Since there exited no large-scale data on the English-Japanese simultaneous interpretation, the study which theorized the English-Japanese simultaneous interpretation based on the actual data is yet to be done. Therefore, it is actually indispensable for us to collect various interpreting patterns by observing thoroughly a large-scale interpretation data.

In this paper, the manual quantitative analysis of CIAIR simultaneous interpretation corpus and the collection of interpreting patterns are described. 4,578 pairs of English-Japanese aligned utterances in the corpus were used (Matsubara 2002). This investigation is the largest scale as the observation by hand.

This paper is organized as follows: Section 2 gives the general information of CIAIR simultaneous interpretation corpus and the observation tool. In section 3, the strategies used by professional simultaneous interpreters are discussed. In section 4, the types of the interpreting patterns. In section 5, the result of the analysis is shown.

2. CIAIR Simultaneous Interpretation Corpus

2.1 Outline of the Corpus

At the Center for Integrated Acoustic Information Research of Nagoya University (following, CIAIR), a corpus of simultaneous interpretation between Japanese and English has been constructed over five years (Tohyama 2004). We collected both monologue and

Table1.   Statistics of investigated data

	Speaker (English)	Interpreter (Japanese)
No.of lectures	26	26
recording time (min)	15,627	15,627
utterance time (min)	12,780	11,001
No.of words/morpheme	38,437	44,399
No.of utterance units	1,494	1,977
No.of alligening papirs		4,578

dialogue data. The contents of the database are daily topics. The recording time is 182 hours in total. The speech data has been all transcribed. The discourse tag and the utterance time tag were given to the corpus. The size of transcribed data is about 1 million words, and the database would deserve to be called the simultaneous interpretation database of the largest-in-the-world class.

2.2 Investigated Data

In this research, we used English-Japanese monologue data in the corpus. The contents of speeches are economics, history, and, culture, etc. Moreover, each monologue speech is interpreted by two or four professional interpreters. The flexibility of a corpus is raised by using four interpreters. Therefore, it becomes possible to compare two or more interpretation examples in a sample of utterances. The speech was recorded for about 10 minutes per lecture.

In this research, 4,578 pairs of English-Japanese aligned utterances in the corpus were used. This investigation is the largest scale as the manual observation of English-Japanese simultaneous interpreting data. Table1 shows the statistics of the investigated data.

Figure 1: Sample of parallel database

Figure 2: Sample of time chart
Example: <X before Y.>   (Refer to sec.5.1.1)

2.3 Tools for Observing the Corpus

We have constructed parallel database as shown in Figure 1. For a detailed analysis of interpreters' speech, such as extraction of temporal characteristics of interpretation, the acquisition of interpreting patterns, the detection of translation units, the database consists of relatively small units of the utterances of speakers and interpreters collected manually. Additionally, we developed a time chart for corpus analysis in order to support the practical use of the database. Figure 2 shows a sample of the time-chart. It visualizes simultaneous interpreting aspect. They have been developed as software which can be performed on the Web server, and a user can refer to the corpus easily by using a browser.

3. English-Japanese Simultaneous Interpretation

3.1 Issue in English-Japanese Simultaneous Interpretation

Simultaneous interpretation is one of the advanced language processing activities by humans (Mizuno 2005). One important characteristic of simultaneous interpretation is that the translation begins along the way of the speaker utterance. As for English and Japanese, there is a considerable difference in sentence structure. In linguistic typology, while English has a sentence structure of subject-verb-object (SVO), Japanese has that of subject-object-verb (SOV). If an object of the English speaker's utterance has a long passage, the interpreter has to wait and begin his/her interpretation until the English speaker finishes the utterance of its object. There is also a case that the postmodification clause in an English sentence is translated as the premodification clause in the Japanese sentence. The similar cases, which are difficult to be translated into Japanese, will be the obstacle for the English-Japanese simultaneous interpretation.

3.2 Strategy of Simultaneous Interpretation

As with the issue concerning simultaneous interpretation suggested in the previous section, to begin translating simultaneously with speaker utterance is also a hard task for executing simultaneous machine interpretation. On the other hand, simultaneous interpreters are succeeded in generating Japanese translations simultaneously with English speeches, because they have various kinds of techniques to raise their simultaneity. Professional simultaneous interpreters deal with those difficulties that they face when they follow the utterance order of original speech by using those strategies relating to when-to-say and how-to-say. In this respect, the strategies used by professional simultaneous interpreters are categorized into the following types and interpreting patterns in those strategies are collected from the corpus (Refer to Figure 3).

3.2.1 Strategies to Raise the Simultaneity ［when-to-say］

The following strategies are employed when the simultaneous interpreters follow the word order of the speakers' utterance as much as possible (Kamei 1994). In the below, we call such the strategies Type A.

- **Type A-1 : Translation based on speakers' word order ［how-to-say］**

    To interpret along with speakers' utterance is the technique which the interpreters use when they follow the word order of the speakers' utterance. When interpreters use this technique, they do not have to wait until the speaker finishes the sentence, and this technique also allows interpreters to raise the simultaneity. What is crucial in this technique are to divide the sentence into small units which determine when to interpret and to connect each unit in appropriate order. Interpreters are required to translate English sentences as natural as possible, so that the amount of their utterance sometime larger than its original speakers' utterance.
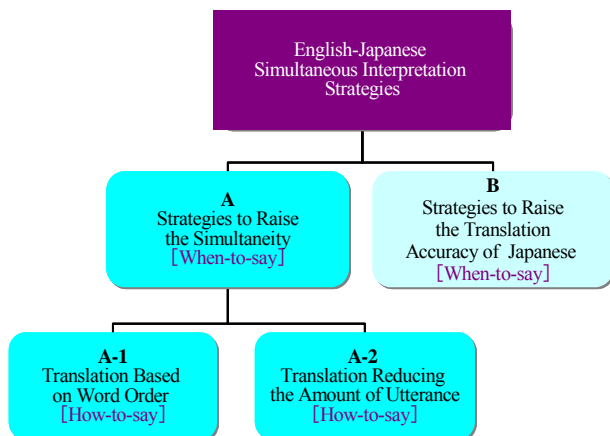
Figure 3: Classification of English-Japanese simultaneous interpretation strategies

- **Type A-2 : Reducing the amount of target speech ［how-to-say］**

    This is the strategies in which interpreters generate fewer amount of target speech. This technique enables interpreters to generate the target speech in shorter time. Since the time needed for speaking the original speech is shorten, the simultaneity of interpretation will be raised. The techniques used in this strategy are to omit unnecessary words or phases and to summarize unimportant part of original speech.

3.2.2 Strategies to Raise Accuracy of Japanese ［when-to-say］

This is the strategy that interpreters do not start translating it until the speakers finished his/ her speech in order to collect enough information for accurate translation. This strategy is called Type B and is used when the original speech was short or the pauses between sentences are long. And this strategy cannot be used when the simultaneity is required. The strategy is not dealt in this paper.

4. Collecting the Interpreters' Translation Patterns

4.1 Purpose of the Investigation

By collecting the interpreting patterns which can be used as the translation rule for the simultaneous interpreting system, the realization of the simultaneous machine interpreting with high reliability can be expected. Thus, we collected the interpreters' translation techniques from the large-scale simultaneous interpretation corpus. Those techniques would enable the speech translation systems to interpret the original speech more simultaneously. The interpreting pattern collection by people is necessary for designing the system that collects those patterns automatically.

4.2 Translation Techniques Examined

In this research, the complex sentence and the passive construction were focused. The reason why those

sentences were focused was that complex sentences are usually long and the passive constructions in the original English sentences have to be translated as the active sentences in Japanese. And this linguistic difference between English and Japanese is the obstacle for the simultaneous machine translation because it is hard for the system to determine translation units and translation timing. Therefore, we paid attention to interpreter's technique such as when and how they translate the speaker's utterances and how they omit unnecessary words and phrases.

5. Collecting the Interpreting Patterns

The following list shows the examples of interpreters' technique to translate concerning complex sentences with conjunction, relative clauses, and passive construction sentences, which were discovered by observing the corpus. The following alphabets and numbers are the symbols used in order to explain interpreting patterns. They show what each symbol stands for. "X" , "Y" are clause. "Z" is words. "(1)" is English structure, "(2)" is standard Japanese structure, "(3)" is an interpreter's technique. How often each symbol appears in the corpus is shown in Table 2. In the following corpus examples, "N" is native speaker utterances and "I" is interpreter utterances.

5.1 Translation According to Word Order
5.1.1 Sub-conjunction Sentence

"because" Clause

When ordinary people translate the English complex sentence <X because Y.> into Japanese and the common translation of the sentence is <Y *nanode* X.>. The interpreter cannot begin the translation until the speaker talks about Y. However, simultaneous interpreters are able to begin the translation without waiting for when the speaker says Y by devising the translation like <X *naze-naraba* Y.>. That is, the order of X and Y occurring is corresponding to English sentence structure. In this research, the following three interpreting patterns are collected in the corpus.

- **(1): X because Y.**
- **(2): Y *nano-de* X.**

<Interpreting pattern type 1>
- **(3)-a: X, *naze-nara-ba* Y.**

    Translate X, and then add the "*naze-naraba*" part and Y.

<Interpreting pattern type 2>
- **(3)-b: X, Y *nano-desu.***

    After translate X and Y consecutively, add "*nano-desu*" which means "because".

<Interpreting pattern type 3>
- **(3)-c: X, Y.**

    Translate X and Y consecutively as the word order seen in the original speech, but omit the word "because." If the contents of X and Y have a strong connection, it is possible that the word "because" itself will be omitted. This technique is the same

Tble2. The result of the investigation

Strategy	Syntax type of sentence	English sentence structure (speaker)	Standard Japanese sentence structure	Interpretation technique with high simultaneity (interpreter)	Occurrence count in the data	Occurrence count (the proportion of the technique (%))
Interpretation according to English structure (A-1)	sub-conjunction	<X because Y.>	<Y *nano-de* X.>	a. <X, *naze-nara-ba* Y.> b. <X, Y nano-*de-su* .> c. <X, Y.>	27	a. 23(85.2) b. 1(3.7) c. 1(3.7)
		<X before Y.>	<Y *su-ru mae-ni* X.>	a. <X *shi-te kara* Y.> b. <X *shita ato-ni* Y.>	4	a. 2(50.0) b. 1(25.0)
		<X even if Y.>	<*tatoe* Y *de-aru -to-shite-mo* X.>	<X, Y *de-aru-to-shi-te-mo* .>	5	4(80.0)
	relative	<X which Y. >	<Y *de-aru* X.>	a. <X, *kore-ni kann-shi-te-wa* Y.> b. <X, Y, X>	30	a. 20(66.7) b. 4(13.3)
		<X where Y.>	<Y *to-iu* X.>	<X, Y.>	17	8(47.0)
Omission (A-2)	subject + perception verb	<Z think Y.>	<Z wa Y *to omoi-masu* .>	a. <Y *to omoi-masu.* > b. <Y *de-aru* .> c. <Y *de-syou* .>	101	a. 58(57.4) b. 35(34.7) c. 2(1.98)
	passive construction	<Z be+past participle.>	<Z wa *sa-reru* .>	<Z *wo su-ru* .>	79	65(82.3)

techniques explained in section 5.2 which areeffective for reducing the gap time between the original speaker's utterance and the interpreter's utterance.

Example 1

N: But you don't see the pedal **because**

 I: *Pedaru-wa amari mi-te inai-to.* **nazenara**

N: you don't understand the pedal.

 I: *Pedaru-no yakuwari-wo rikai-shi-te inai* **kara-de-su**

Example 2

 N: So when I came to Kansai, it was a really big shock **because** these people look so normal.

 I: *Tokoro-ga kannsai-ni kita toki-ni mata bikkuri-shi-mashi-ta. futsuu-**nann**-desu.*

Example 3

N: I was completely shocked **because**

 I: *Watashi-wa sugoi shokku-wo uke-te shimai-mashi-ta. De*

N: it was a train that I had never se, a train like I had never seen before.

 I: *Dennsya-wa mae watashi-ga mita koto-mo nai-youna dennsya-deshita.*

 # "even if" Clause #

 When the phrase "even if" is used, the occurring order of X and Y will be reversed.

  (1): X even if Y.

  (2): *tatoe* Y *de- aru- to shi-temo* X.

 There are four cases of interpreting patterns with "even if," and all cases are translated in the reversed way.

<Interpreting pattern type 4>

  (3): X, Y *de aru-to shi-temo.*

 In order to translate it in the word order seen in the English sentence, an interpreter stops translating

in front of "even if" and say "*tatoe*" before translate the Y part.

Example 4

 N: And another way to start is always be willing to work **even if** you're a student.

 I: *Sore-kara mata hazimeru-ni atari-mashi-te-mo itu-mo-desu-ne. Yorokonn-de shigoto-wo shi-nasai. Gakusei-**de-mo desu-ne.***

 # "before" Clause #

 The reverse clause order also can be observed in the sentences with "before."

  (1): X before Y.

  (2): Y *su-ru mae-ni* X.

 One interesting technique was observed. In the technique, the simultaneous interpreters generate the phrases such as "*shi-te kara*" and "*shi-ta ato-ni*" which have opposite meaning of *"su-ru mae-ni"* seen in (2) after they generate X, and, after that, they translate Y. The following two interpreting patterns were collected in this research.

<Interpreting pattern type 5>

  (3)-a: X *shi-te kara* Y. (Refer to Figure 2)

  (3)-b: X *shi-ta ato-ni* Y.

Example 5

 N: Okay, you should pay back ahh most or all of your loans **before** you invest a lot of money.

 I: *Mina-sann-no syakkinn-no hotonndo-wo kae**shi-te-kara** toushi-wo suru-to-iu koto-ni shita-hou-ga ii-to omoi-masu.*

Example 6

 N: You should pay back ahh most or all of your loans

 I: *kurezittokaado-de-no kariire-wo*

N: **before** you invest a lot of money.

 I: *Hennsai-**shita ato** toushi-wo kanngae-nasai to-iu -koto-de-ari-masu.*

5.1.2 Interpreting Patterns in Sentences Include Relative Pronouns and Relative Adverbs

In this section, the result of analysis on the interpreting patterns with the relative pronoun "which" and relative adverb "where" collected will be described. There was no case of the reverse clause order found in the sentences with the other relative pronouns such as "who," "when," and the like, so that the further research should be done.

"which" Clause

When the sentence including relative pronoun, it is usually the case to translate the relative pronoun clause Y modifies the main clause X.

> **(1): X which Y.**
> **(2): Y *de-aru* X.**

Those interpreting patterns where the speech was translated in accordance with utterance order were categorized into two major types of strategies.

<Interpreting pattern type 6>
> **(3)-a: X, *kore-ni kann-shi-te-wa* Y.**

To translate the relative pronoun in the way that reflects its grammatical function, that is "pronoun plus conjunction".

<Interpreting pattern type 7>
> **(3)-b: X, Y X.**

In this case, X is translated before Y. But soon after Y is translated, X is translated again. The simultaneity will be raised and the content of original speech will not be distorted by using this technique because it retains the original English word order. By translating X, the final translation will have the same clause order as the original Japanese sentence, therefore the final translation will become more natural.

Example 7
N: One exception might be your home **which** you pay off little by little over the years, but
I: *Hito-tsu reigai-wa kore-wa zyuutaku desu-ne **kore-ni kann-shi-te-wa** nagai zikann-wo kake-te sukoshi-zutsu kae-su toiu-koto-desu keredo-mo.*

Example 8
N: exception might be your home **which** you pay off little by little over the years,
I: ***Reigai-wa desu-ne** ie-de ari-masu. suunenn kake-te sukoshi-zutu bunnkatsu-de hara-tte iku ie-no baai-wa **reigai-de ari-masu keredo-mo** roonn-toka*

"where" Clause

Concerning relative adverb "where," the occurring order of clause is also reversed.

> **(1): X where Y.**
> **(2): Y *to-iu* X.**

<Interpreting pattern type 8>
> **(3): X, Y.**

The main clause X and the relative adverb clause Y are translated consecutively and the relative adverb "where" mean is omitted. The similar cases are found in the corpus.

Example 9
N: set about collecting broken toys from the garbage…
I: *Kowareta omocha-wo gomi-no naaka-kara atsume-te-kite…*
N: and bringing them back to his little shoe shop
I: *soshite sore-wo jibun-no kutsukoubou-ni mochikonn-de*
N: **where** he would repair them by hand and repaint them and make then look new.
I: *te-de hito-tsu hito-tsu shuuri-wo shi-tari iro-wo nuri naoshi-tari-shite soshite atarashi-ku kirei-ni*

5.2 Translation Reducing the Amount of Utterance

5.2.1 Omission

Omission sometimes invites the situation that the necessary information is not conveyed or is distorted. Therefore to determine what to omit will be a difficult ability. In this research, the verbs used frequently and related to thinking and perception such as "feel," "find," "notice," "imagine," "see" and "mind" were examined. But no particular interpreting pattern was found. However, the interpreting pattern which the subjects of the verb "think" often omitted was found.

Subject+ think + (that-clause)

The appearance of the phrase, <Z think Y (that-clause).> is numerous in the speaker utterance. Out of 101 appearances of the phrase, the cases in which "Z" wasn't translated were 58 cases, and "Z think" wasn't translated at all were 35 cases. If the machine can shorten the translation that it generates by omitting words and phrases, the time needed for the machine translation will also be shortened and it eventually raises the simultaneity of the system.

> **(1): Z think Y.**
> **(2): Z *wa Y to omoi-masu.***

<Interpreting pattern type 9>
> **(3): Y *to omoi-masu.***

Moreover, the interpreting patterns in which the verb "think" were translated as guess phrase such as "*nanode-shou*" and "*dewa-nai-de-shou-ka*" were found.

Example 10
N: **I think** that is the key, **I think** that is the pedal of our bicycle here.
I: *Kore-ha totemo zyuuyou-da-to **omoi-masu.** Kore-koso-ga sakihodo-no zitennsya-no pedaru-deha-nai-ka-to **omoi-masu.***

Example 11
N: **I think** that's part of maintaining um a proper appearance
I: *Minari-wo tadashi-ku totonoe-nakereba to-iu-koto **nann-de-show.***

Example 12
N: **I think** that has a very major affect on your mind.
I: *Kou-itta koto-ga sunn-de-ru hito-no kokoro-ni ooki-na eikyou-wo ataeru-**nnde-wa nai-de-syhow-ka***

5.2.2 Summarized Translation

To construct the passage from the speakers' point of view is one of the characteristic of Japanese. On the contrary, the passive sentences are often used in English. Therefore, the investigation on how the passive sentences are translated and summarized was conducted in this research.

Passive Construction

When the passive sentences of English are translated into Japanese, the direct translation could not be considered as the natural Japanese.

(1):   Z be+past participle.
(2):   Z *wa   sare-ru.*

In this research, the technique of modifying the passive English sentence into the active sentence was found. It was also clarified that the smooth and natural translation English into Japanese becomes possible by using this technique.

<Interpreting pattern type 12>
(3):   Z *wo   su-ru.*

Example 13

N: We have places in North America, South America, Europe and Africa that where the land can be developed better.

I: *Kita-america minami-amerika youroppa soshite afurica-de souiu tochi-wo-desu-ne yoku kaihatsu-wo shi-te-iku-koto-ga deki-masu.*

6.   Conclusion

It is one of the effective techniques to use the translation strategies collected by observing interpreter's behavior for the development of the simultaneous machine interpreting. In this research, 4,578 pairs of English-Japanese aligned utterances were examined. This investigation was large-scale as the observation of simultaneous interpretation data manually. As a result, we observed 203 interpreting patterns. These were able to be classified into 12 interpreting pattern. It was clarified that 4.5 percent of the English-Japanese monologue data were fitted in those interpreting patterns and those patterns can be expected to be used as translating rules for developing simultaneous machine interpretation.   It will also be necessary to collect more simultaneous interpreters'

techniques, such as how they translate other English sentence structures in addition to complex sentences. As for developing the simultaneous interpreting system, the further research concerning how to apply those interpreting patterns to the simultaneous interpreting system has to be done.

7.   References

Korrnakov, P. (2000). Five Principles and Five Skills for Training Interpreters. *META* Vol. 45, pp. 241-248.

Kamei, T. (1994). Atamakarano Honyaku-ho (Top-down English— English-Japanese Translation Method). (in Japanese) Sinzansha publisher.

Matsubara, S., Asai,S. Toyama,K., and Inagaki, Y. (1997). Chart-based Parsing and Transfer in Incremental Spoken Language Translation System, *The Fourth Natural Language Processing Pacic Rim Symposium (NLPRS'97) Incorporating Symposium on Natural Language Processing (SNLP-97)*, pp. 521-524.

Matsubara, S., Takagi, A., Kawaguchi, N., and Inagaki, Y. (2002). Bilingual Spoken Monologue Corpus for Simultaneous Machine Interpretation Research. *Proceedings of 3rd International Conference on Language Resources and Evaluation (LREC-2002), Vol. 1*, pp. 153-159.

Mima, H. Iida, H. and Furuse, O. (1998). Simultaneous Interpretation Utilizing Example-based Incremental Transfer, *Proc. 17th COLING and 36th ACL*, pp.855-861.

Osaka, M. (2003). Working memory : the sketchpad in the brain. Shinyousya . (in Japanese).

Tohyama, H. and Matsubara, S. (2005). Construction and Utilization of Bilingual Speech Corpus for Simultaneous Machine Interpretation Research, *Proc. Eurospeech-2005,* pp.1585-1588.