

# The Processing Hierarchy of Anaphoric Expressions and Its Implication for Japanese Reflexive *zibun-zisin* and Pronoun *kare*

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ATSUSHI YUHAKU and SATORU NAKAI

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## 1. Introduction

It is well known that there exist a variety of anaphoric expressions crosslinguistically and that those expressions differ in terms of the domain in which they can refer to their antecedent. For example, English reflexive *himself* can refer to the embedded subject *Bob*, not to the matrix subject *John* in (1). On the other hand, Japanese reflexive *zibun* can refer both to the embedded subject *Ziroo* and to the matrix subject *Taroo* in (2).

(1) John<sub>1</sub> thought that Bob<sub>2</sub> criticized himself<sub>s1/2</sub>.<sup>1</sup>

(2) Taroo<sub>1</sub> wa Ziroo<sub>2</sub> ga zibun<sub>1/2</sub> o hinan-sita to  
Taro TOP Ziro NOM self ACC criticize-PAST COMP  
omotta<sup>2</sup>  
think-PAST

‘Taroo<sub>1</sub> thought that Ziroo<sub>2</sub> criticized himself<sub>1/2</sub>.’

A lot of psycholinguistic research has paid great attention to the online processing of anaphoric expressions, especially those in Indo-European languages such as English and Dutch. For example, Nicol (1988) showed that English native speakers correctly chose the grammatical antecedent of the English reflexive and pronoun, using the Cross-Modal Lexical Priming Method. However, little is known about the processing of anaphoric expressions in non-Indo-European languages. The purpose of this research is to examine how Japanese native speakers process Japanese

reflexive *zibun-zisin* and pronoun *kare* online, using the Cross-Modal Lexical Decision Method, and to show whether this processing is based on the processing hierarchy (Reuland 2001, 2011), which predicts that the processing cost of anaphoric expressions is linearized: the syntactic module < the semantic module < the discourse module.

This paper consists of the following sections. The next section explains about the theoretical background of the research. The third section describes the experiment. The fourth section discusses the main findings and their implication for the online processing of Japanese. The final section concludes this paper.

## 2. Theoretical background

Reuland (2001, 2011) proposes that the processing cost of anaphoric expressions is linearized: the syntactic module < the semantic module < the discourse module. Reuland claims that an anaphoric expression is processed most economically in the syntactic module when the anaphoric expression and its antecedent are coarguments of the same predicate as in (3).<sup>3</sup>

(3) John<sub>1</sub> criticized himself<sub>1</sub>.

He further maintains that an anaphoric expression is processed in the semantic module when the anaphoric expression and its antecedent are not coarguments of the same predicate, but the bound variable relationship is formed as in (4).<sup>4,5</sup>

(4) John<sub>1</sub> read his<sub>1</sub> book.

Finally, he insists that an anaphoric expression is processed in the discourse module when the anaphoric expression and its antecedent are not coarguments of the same predicate, and the bound variable relationship is not formed as in (5).

(5) The clown<sub>1</sub> is very happy. The beautiful woman loves him<sub>1</sub>.

If this proposal can be applied universally, it is predicted that the Japanese reflexive *zibun-zisin* and pronoun *kare* will be processed differently in the online processing.

- (6) Taroo<sub>1</sub> wa zibun-zisin<sub>1</sub> no musuko o hometa.  
 Taro TOP self-self POSS son ACC praise-PAST  
 ‘Taro<sub>1</sub> praised his<sub>1</sub> son.’
- (7) Taroo<sub>1</sub> wa kare<sub>1</sub> no musuko o hometa.  
 Taro TOP he POSS son ACC praise-PAST  
 ‘Taro<sub>1</sub> praised his<sub>1</sub> son.’

It is predicted that the Japanese reflexive *zibun-zisin* in (6) will be processed in the semantic module, because *zibun-zisin* is not in a coargument relation with its antecedent *Taroo*, but the bound variable relationship can be formed. The following example (8) shows that the reflexive *zibun-zisin* allows the bound variable interpretation.

- (8) Daremo<sub>1</sub> ga zibun-zisin<sub>1</sub> no musuko o hometa.  
 Everyone NOM self-self POSS son ACC praise-PAST  
 ‘Everyone<sub>1</sub> praised his<sub>1</sub> son.’

On the other hand, it is expected that Japanese pronoun *kare* in (7) will be processed in the discourse module, because *kare* is neither in a coargument relation with its antecedent *Taroo* nor can the bound variable relationship be formed. Hoji (1990) clearly shows that Japanese pronoun *kare* cannot be construed as a bound variable as the example (9) shows.

- (9) \*Daremo<sub>1</sub> ga kare<sub>1</sub> ga tukut-ta omotya o  
 everyone NOM he NOM make-PAST toy ACC  
 kowasi-ta  
 break-PAST  
 ‘Everyone<sub>1</sub> broke the toy that he<sub>1</sub>, made.’ (Hoji 1991: 278)

If Reuland (2001; 2011) is on the right track, it is predicted that the Japanese reflexive *zibun-zisin* in (6) is to be processed in the semantic

module and its processing is easier than that of Japanese pronoun *kare* in (7), which is processed in the discourse module. The next section will confirm whether this prediction is borne out.

### 3. Experiment

#### 3.1 Participants

23 native Japanese university students (9 males and 14 females;  $M = 19.4$  years old) participated in this experiment.

#### 3.2 Method

This research used the Cross-Modal Lexical Decision Method (henceforth, the CMLD method). The CMLD method is a dual-task paradigm, in which participants are required to listen to the stimuli and answer the question (the primary task) while making a lexical decision (the secondary task). In the CMLD method, it is assumed that the reaction time (RT) of the lexical decision task is an indicator for the processing resources that are necessary for the primary task of sentence comprehension. This is because the CMLD method supposes that our processing capacity has some limit and that the two tasks compete for the same processing resource. If the processing cost for the comprehension task is heavy, the processing resource which can be assigned to the lexical decision task becomes smaller, which is reflected in a slower RT of the lexical decision task.

In this experiment, the stimuli were presented with SuperLab 4.0 (Cedrus, USA). Participants heard stimuli such as (10) including *zibun-zisin* or *kare* through a MacBook Pro speaker. After presenting the stimuli, the comprehension questions and answers such as (11) and (12) were visually presented on the screen successively and the participants were required to answer whether the answer was correct or not.

- (10) Ekityou<sub>1</sub> wa dezaina<sub>2</sub> ga mukasikara itumo  
 station-master TOP designer NOM long-time-ago always  
 zibun-zisin<sub>s1/2</sub> no yuuzin o sinziteita to itta.  
 self-self POSS friend ACC trust-PAST COMP say-PAST  
 ‘The station master<sub>1</sub> said the designer<sub>2</sub> always trusted his<sub>s1/2</sub> friend.’
- (11) Dezaina wa dare o sinzite-imasu ka?  
 designer TOP who ACC trust-PRE Q  
 ‘Who does the designer trust?’
- (12) Dezaina no yuujin  
 designer POSS friend  
 ‘The designer’s friend’

Furthermore, while the participants listened to the stimuli (10), they had to judge whether the visually presented word was acceptable for Japanese or not. All the words were written in *hiragana* and no words were related with the nouns in the stimuli in order to prevent the priming effect. The words were presented at two points. The first point was a control position, which was set 1500 ms before the possessive marker *no*, as shown (#) in (13) and (14), and the second point was a probe position, which was set 500 ms after the possessive marker *no*, as shown (^) in (13) and (14).

(13) reflexive stimuli

Ekityou<sub>1</sub> wa dezaina<sub>2</sub> ga mukasikara itumo (#)  
 station-master TOP designer NOM long-time-ago always  
 zibun-zisin<sub>s1/2</sub> no (^) yuuzin o sinziteita to  
 self-self POSS friend ACC trust-PAST COMP  
 itta.  
 say-PAST  
 ‘The station master<sub>1</sub> said the designer<sub>2</sub> always trusted his<sub>s1/2</sub> friend.’

## (14) pronoun stimuli

Ekityou<sub>1</sub> wa dezaina<sub>2</sub> ga mukasikara itumo (#)  
 station-master TOP designer NOM long-time-ago always  
 kare<sub>1/2</sub> no (^) yuuzin o sinziteita to  
 he POSS friend ACC trust -PAST COMP  
 itta.  
 say-PAST

‘The station master<sub>1</sub> said the designer<sub>2</sub> always trusted his<sub>1/2</sub> friend.’

## 3.3 Stimuli

Sixteen pairs of stimuli including *zibun-zisin* and *kare* like (13) and (14) were used in Latin square. In addition, 48 fillers were presented to the participants.

## 3.4 Prediction

If Reuland (2001, 2011) is on the right track, the reflexive *zibun-zisin* in (13) will be processed in the semantic module and require less processing load than the pronoun *kare* in (14). As a result, the RT for the secondary task for the reflexive *zibun-zisin* will be shorter than that for pronoun *kare* at the probe position (^), not at the control position (#).

## 3.4 Results

The accuracy rate for the primary task was 85.1%, which showed that participants generally listened to and understood the stimuli. The accuracy rate for the reflexive stimuli was 86.9% and that for the pronoun stimuli was 80.4%. There was no significant difference ( $p = .185$ ).

Only the correct responses were analyzed for the secondary task. Furthermore, two participants whose average RT exceeded +/- two times of the average RT were excluded from the analysis. At the control position,

there was no significant difference ( $p = .66$ ) between the reflexive stimuli and the pronoun stimuli. The average RT for the reflexive stimuli was 863.3 ms and that for the pronoun stimuli was 891.7 ms (see Fig.1). On the other hand, a t-test showed that there was a significant difference ( $p = .025$ ) between the reflexive stimuli and the pronoun stimuli at the probe position. The average RT for the reflexive stimuli was 825.9 ms and that for the pronoun stimuli was 926.1 ms (see Fig.2).

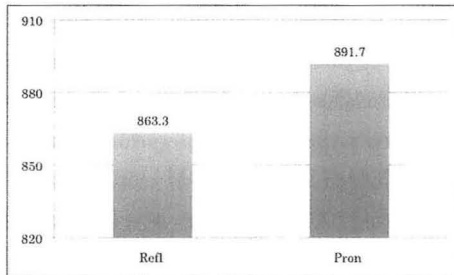


Fig.1. RT at the control position

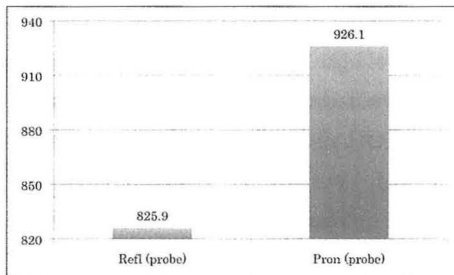


Fig. 2. RT at the probe position

#### 4. Discussion

The objective of this research is to examine how Japanese native speakers process the Japanese reflexive *zibun-zisin* and pronoun *kare*

online, using the CMLD method, and to show whether this processing is based on the processing hierarchy (Reuland 2001, 2011), which predicts that the processing cost of anaphoric expressions is linearized. The results of our CMLD experiment clearly show that Japanese native speakers process the reflexive *zibun-zisin* much quicker than the pronoun *kare*.

Let us consider the reasons for the above results. First, we will deal with the distance to the antecedent from anaphoric expressions. As the examples (15) and (16) show, the distance to the nearest antecedent from anaphoric expressions is the same in that both the reflexive *zibun-zisin* and the pronoun *kare* refer to the embedded subject noun *dezaina* ‘designer’.

(15) reflexive stimuli (=13)

Ekityou<sub>1</sub>            wa    dezaina<sub>2</sub> ga            mukasikara    itumo (#)  
 station-master TOP designer NOM long-time-ago always  
 zibun-zisin<sub>s1/2</sub> no        (^)    yuuzin o            sinziteita    to  
 self-self            POSS            friend ACC trust-PAST COMP  
 itta.  
 say-PAST

‘The station master<sub>1</sub> said the designer<sub>2</sub> always trusted his<sub>s1/2</sub> friend.’

(16) pronoun stimuli (=14)

Ekityou<sub>1</sub>            wa    dezaina<sub>2</sub> ga            mukasikara    itumo (#)  
 station-master TOP designer NOM long-time-ago always  
 kare<sub>1/2</sub> no        (^)    yuuzin o            sinziteita    to  
 he            POSS            friend ACC trust -PAST COMP  
 itta.  
 say-PAST

‘The station master<sub>1</sub> said the designer<sub>2</sub> always trusted his<sub>1/2</sub> friend.’

Therefore, the distance between the antecedent and anaphoric expressions is irrelevant.

Second, we will consider the spillover effect. It is often the case in



language processing studies that some expressions require much processing load and its influence appears not at its position, but much later. Such an effect is called the spillover effect. This explanation, however, cannot be applied to this experiment. It is because there was no significant difference between the reflexive stimuli and the pronoun stimuli at the control position, which is before the anaphoric expressions (see Fig. 1).

Third, we will examine the difference in the number of possible antecedents between the reflexive *zibun-zisin* and the pronoun *kare*. As the subscripts in (13) and (14) show, the pronoun *kare* can refer to not only the embedded subject but also the matrix subject, whereas the reflexive *zibun-zisin* can refer to only the embedded subject.

The primary task, however, served to confirm how the participants interpreted the anaphoric expressions. Take the primary task for the pronoun as an example.

- (17) Isya<sub>1</sub> wa pianisuto<sub>2</sub> ga kinô totuzen kare no  
 doctor TOP pianist NOM yesterday suddenly he POSS  
 yûzin o yurusita to itta.  
 friend ACC forgive-PAST COMP say-PAST

‘The doctor<sub>1</sub> said the pianist<sub>2</sub> suddenly forgave his<sub>1/2</sub> friend yesterday.’

- (18) Pianisuto wa dare o yurusimasita ka?  
 pianist TOP who ACC forgive-PAST Q

‘Who does the pianist forgive?’

- (19) Isya  
 doctor

‘The doctor’

In these examples, the answer (19) is false because the stimuli were designed so that the answers were correct only when the reflexive or the pronoun referred to the embedded subject, not the matrix subject. Analyzing the answers for the primary task, the data showed that

participants correctly chose the embedded subject as the antecedent for both the reflexive and the pronoun, so this possibility can be ruled out.

Finally, we will deal with the processing hierarchy by Reuland (2001, 2011). This hierarchy proposes that the syntactic module is the most economical for deciding the reference of the anaphoric expression and that the discourse module is the least economical. The semantic module is in-between the syntactic module and the discourse module.

(20) the syntactic module < the semantic module < the discourse module. According to this hierarchy, it is predicted that the reflexive *zibun-zisin* will be processed much more easily than the pronoun *kare*, because the former is computed in the semantic module while the latter in the discourse module. This prediction was borne out by our results.

Similar results have been obtained by other researches. Burkhardt (2005) examined the processing of English pronoun, adopting the CMLD method.

(21) Everyone<sub>1</sub> thinks that the audience admires her<sub>1</sub>. (Burkhardt 2005: 130)

(22) The actress<sub>1</sub> thinks that the audience admires her<sub>1</sub>. (ibid.)

In these stimuli, she assumed that English pronoun in (21) was processed in the semantic module and that English pronoun in (22) was processed in the discourse module, because the former pronoun allowed only the bound variable interpretation.<sup>6</sup> In fact, it was found that the English pronoun in (21) was processed much faster immediately after the reflexive than English pronoun in (22), which supported the processing hierarchy.

Furthermore, Koornneef (2010) researched the processing hierarchy of Dutch pronouns, using the eye-tracking method. In both stimuli below, the Dutch pronoun *hij* 'him' refers to *de soldat* 'the soldier', but the antecedent and the pronoun are within the same sentence in (23) whereas they are across the sentence boundary in (24). As a consequence, the

former allows the bound variable interpretation and is processed in the semantic module. On the other hand, the latter cannot be interpreted as a bound variable because the antecedent and the pronoun are not within the same sentence, so that it is processed in the discourse module.

(23) Het was oorlog in Soedan en een soldaat aan de frontlinie was constant met de dood bezig. De soldaat<sub>1</sub> was ontzettend bang dat hij<sub>1</sub> zou sterven op het bloedige slagveld. (Koornneef 2010: 153)

‘A war was going on in Sudan and a soldier at the front was constantly thinking about death. The soldier<sub>1</sub> was very afraid that he<sub>1</sub> was going to die on the bloody battlefield.’

(24) Het was oorlog in Soedan en een soldaat aan de frontlinie was constant met de dood bezig. De soldaat<sub>1</sub> was ontzettend bang. Hij<sub>1</sub> zou sterven op het bloedige slagveld. (Koornneef 2010: 153-54)

‘A war was going on in Sudan and a soldier at the front was constantly thinking about death. The soldier<sub>1</sub> was very afraid. He<sub>1</sub> was going to die on the bloody battlefield.’

The experimental result showed that there was a significant main effect at the words immediately following the critical pronoun, with the longer reading time for the pronoun in (24) than that in (23). This result was in accordance with the prediction of the processing hierarchy by Reuland (2001, 2011).

Language acquisition data also support the processing hierarchy of anaphoric expressions (Chien and Wexler, 1990; Grodzinsky and Reinhart, 1993; Reinhart, 2006). Furthermore, aphasic studies showed that the processing hierarchy is applicable in the processing of Dutch anaphoric expressions (Ruigendijk, Burkhardt and Avrutin, 2005).

The processing hierarchy claims that to decide the reference of an anaphoric expression is most economical when it is computed in the syntactic module. This claim itself has been buttressed by previous

research (Burkhardt, 2005; Koornneef, 2010; Yuhaku and Nakai, 2013). Yuhaku and Nakai (2013) examined whether the hierarchy could be applied to the Japanese reflexive, with the CMLD method. It was found that the Japanese reflexive *zibun-zisin* is processed much faster in the syntactic module, when it is the coargument with its antecedent, compared with that in the semantic module.

### **5. Conclusion**

The purpose of this research was to examine how Japanese native speakers process Japanese reflexive *zibun-zisin* and pronoun *kare* online, using the CMLD method, and to show whether this processing is based on the processing hierarchy (Reuland 2001, 2011), which predicts that the processing cost of anaphoric expressions is linearized: the syntactic module < the semantic module < the discourse module. Our results convincingly show that Japanese native speakers compute the reflexive *zibun-zisin* much faster than the pronoun *kare* and that this processing is in accordance with the processing hierarchy of anaphoric expressions. This hierarchy has been supported in a variety of areas such as language processing studies, language acquisition, and aphasic data. Further research is necessary for crosslinguistic processing data, but on the basis of these facts above, it can be concluded that the processing hierarchy is applied crosslinguistically to the processing of anaphoric expressions.

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Remaining errors are, of course, ours.

### Notes

1. Subscript shows that an anaphoric element has the same reference as its antecedent.
2. Abbreviations used in this article are: ACC: accusative marker; COMP: complementizer; NOM: nominative marker; PAST: past tense marker; POSS: possessive marker; PRE: present tense marker; Q: question marker; TOP: topic marker
3. Reuland supposes that noun phrases are regarded as coarguments when noun phrases are assigned their Case and  $\theta$ -role by the same predicate. For example, in (3), the predicate *criticize* assigns the Nominative Case to *John* and Accusative Case to *himself*. Furthermore, the predicate *criticize* assigns the Agent  $\theta$ -role to *John* and Patient  $\theta$ -role to *himself*.
4. In (6), the predicate *read* assigns Nominative Case and Agent  $\theta$ -role to *John*, but the whole noun phrase *his book*, not the pronoun *his*, is given its Case and  $\theta$ -role by the predicate, so *John* and *his* are not coarguments.
5. Several conditions are required for the bound-variable relationship between an anaphoric expression and its antecedent. First, the antecedent c-commands the anaphoric expression. C-command is defined as follows: A node  $a$  c-commands a node  $\beta$  iff (i) neither node dominates the other, and (ii) the first node dominating  $a$  also dominates  $\beta$  (Reinhart 1983). Second, the antecedent and the anaphoric expression have the same index. Third, the antecedent and the anaphoric expression exist in the same sentence.
6. Koornneef (2010) claims that English example (22) can be interpreted as bound variable because the c-command between the antecedent and the pronoun is obtained and both elements are within the same sentence. If true, the result by Burkhardt cannot support the processing hierarchy fully.

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