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Identifying empty subjects by modality information: the case of the Japanese sentence-final particles *-yo* and *-ne*

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Abstract The present study conducted four experiments to investigate how modality information provided through the sentence-final particles *-yo* and *-ne* were utilized in identifying an empty subject by native Japanese speakers. Experiment 1 conducted a whole-sentence anomaly decision task, finding that base sentences without *-yo* and *-ne* attached were processed more quickly than sentences with either *-yo* or *-ne* and that sentences with *-yo* were processed more quickly than the same sentences with *-ne*. A delay in processing sentences with *-ne* was created by the ambiguity of an empty subject identified by *-ne* as either 'I' or 'you'. In Experiment 2, the auxiliary verb *-ou* 'let us' was added to the base sentence before *-yo* and *-ne*, providing a cue to identify the empty subject as 'we'. Although the base sentences were processed more quickly than those containing the particles *-yo* and *-ne*, no other difference resulted from the attachment of these particles. To eliminate the possibility of orthographic-length effects, Experiment 3 compared base sentences with *-ou*, *-ou-yo*, and *-ou-ne*, finding no difference among them (i.e., no orthographic-length effects). Experiment 4 was conducted to further eliminate the

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possible involvement of discourse-level computation by utilizing base sentences with overt subjects, past tense verbs, and the auxiliary verb *-rasii* 'appear to'. Once subjects of sentences were clearly shown, there was no difference among base sentences and those with either *-yo* or *-ne* attached (i.e., no discourse-level computation effects). Thus the present study proved that the modality information inherent in the particles *-yo* and *-ne* was used for identifying empty subjects.

Keywords Empty subject · Japanese sentence-final particles · Modality information · Prodrop language · Discourse-level computation

1 Introduction—purpose of the study

A sentence occasionally seems not to provide all the information necessary to complete its meaning. For example, a grammatical subject is often omitted in Japanese sentences. Nevertheless, native Japanese speakers can often effortlessly identify those unexpressed elements. Sakamoto (1995, 1996, 2002) and Sakamoto and Walenski (1998) investigated the processing of Japanese empty subjects in subordinate clauses, suggesting that native Japanese speakers seem to utilize two different levels of information for two different tasks. *Case information* at the syntactic level is effectively used in recognition tasks whereas *theta-role* is implicated at the semantic level in retrieval tasks. Sakamoto (2002) refers to these two streams of processing as the *Multi-level Parsing Model*, which was initially conceptualized by Frazier and Fodor (1978) as the *Two Stage Parsing Model*. In this model, case information relevant at the syntactic level is utilized for automatic and shallow processing whereas the theta-role information relevant at the semantic level is used for conscious and deep processing. Recent cognitive neurological studies (e.g., Friederici et al. 2003a, b; Hahne and Friederici 1999, 2002; Nakagome et al. 2001) provide evidence to support this interplay between syntax and semantics although the findings of these studies are not always consistent (Hagoort 2003). The present study proposes another kind of information utilized for the processing of an empty subject, that is, *modality information* (for detailed discussions on modality, see Akatsuka and Tsubomoto 1998; Moriyama et al. 2000; Nitta and Masuoka 1998).

Japanese sentence-final particles are intensively used in colloquial Japanese to express the various *moods* of a speaker so that they are considered to contain modality information. The referent to an empty subject shifts dramatically by simply altering the particles *-yo* and *-ne*, a typical example of this being *Raisyuu-wa ø Tokyo-e ikitain desu-yo* (*ø* refers to an empty subject) 'I want to go to Tokyo next week'. In this sentence, the information expressed in the context (i.e., the desire to go to Tokyo) is exclusively possessed by the speaker, and thus the empty subject is interpreted as 'I' (i.e., the speaker). In contrast, once *-yo* is changed to *-ne*, as in *Raisyuu-wa ø Tokyo-e ikitain desu-ne* with a rising intonation (for a detailed discussion of intonation, see Katagiri 1997; Eda 2000) upon *-ne* at the end, the subject is identified as 'you', and the meaning of the sentence becomes 'You want to go to Tokyo next week, don't you?' In this sentence, information is possessed mainly by the hearer, and thus the empty subject is found to be 'you'. To summarize, the sentence-final particles *-yo* and *-ne* imply the possible referents to empty subject as either 'I' or 'you' by shifting the possessor of information between speaker and hearer, thereby

identifying the empty subject. The present study investigated how the sentence-final particles *-yo* and *-ne* affect the identification of empty subjects in sentence processing.

2 An overview of the sentence-final particles *-yo* and *-ne*

Recently, a great deal of Japanese linguistic research into the nature of sentence-final particles has resulted in some intriguing theories (e.g., Eda 2000; Inoue 1997; Kamio 1990, 1994, 2002; Katagiri 1995, 1997; Kinsui 1993; Masuoka 1991; Matsuoka 2003; Maynard 1993; Nakagawa and Ono 1996; Ohso 1986; Takahashi et al. 2004; Takubo and Kinsui 1996; Xu 2002). Before discussing the experiments of the present study, let us briefly survey the main usages of the two major sentence-final particles *-yo* and *-ne*.

2.1 The usages of *-yo*

In the framework of discourse management theory, Kinsui (1993) identified *informative* and *warning* usages of the particle *-yo*. For informative usage, a typical example is a sentence such as *Ah, hankati-ga otimasita-yo* 'Oh, your handkerchief has dropped!' In this sentence, the speaker informs the hearer of the unnoticed fact that the latter has dropped his/her handkerchief. Without the final particle *-yo*, the sentence carries only the meaning of a blunt statement, 'a handkerchief has dropped'. Without *-yo*, this sentence does not even indicate whose handkerchief was dropped. Thus, in this context, *-yo* functions as a relational bridge between the speaker and the hearer whereby the speaker tells the hearer that his/her handkerchief has dropped.

An example of the *warning usage of -yo* is a sentence such as *Omae-wa jukensei da-yo. Terebi-o kesite, benkyoo sinasai* 'You are a candidate for entrance examinations! Turn off the TV and study!' In this sentence, the speaker warns the hearer that watching TV is not appropriate for a candidate for entrance examinations. Again, without *-yo*, this sentence conveys only the simple statement that the hearer is a candidate for entrance examinations. Like the informative usage, *-yo* provides a relation between the speaker and the hearer, but instead of merely providing information, the speaker warns the hearer.

In addition to these two usages, Nakagawa and Ono (1996) describe a usage for *-yo* which does not assume the existence of the hearer, and thus there is no relation between the speaker and the hearer with this usage of *-yo*. For example, a sentence such as *A~a mata hooroo da-yo* 'Alas! It's back to a vagrant's life' does not require any hearer. The speaker is saying to himself/herself that he/she is regressing to a vagrant life again. Nakagawa and Ono (1996) point out that since no hearer is assumed in this context, this usage can be classified as *soliloquy* usage. Thus, *-yo* has three basic usages: informative, warning, and soliloquy.

2.2 Usages of *-ne*

According to Kinsui (1993), usages of the sentence-final particle *-ne* can also be classified into three types, namely, usages of *confirmation*, *requesting agreement/confirmation*, and *self-confirmation*. A typical example of confirmation might occur during an interview. The interviewer asks *ø Suzuki Taro-kun desu-ne* 'You are Taro

Suzuki, aren't you?' and the interviewee responds *Hai, sou desu* 'Yes, I am'. The interviewer (i.e., the speaker) uses *-ne* to confirm the uncertain information of the name of the applicant. The interviewee's name, Taro Suzuki, which is known by the interviewee (i.e., the hearer), is new information for the speaker (the interviewer). The particle *-ne* in this sentence provides a cue toward identifying an empty subject for the information possessor 'you'. By adding *-ne* at the end of sentence, the speaker not only asks a question but also confirms this new information.

The second usage of *-ne* is to request agreement/confirmation. A common convention for starting conversation in Japanese is to ask a question such as *Kyoo-wa ii tenki desu-ne* 'It's a fine day, isn't it?' The hearer replies *Ee*, 'Yes, it is'. In this conversation, the information regarding the weather is shared by both the speaker and the hearer. The speaker is merely asking the hearer to give assent to a remark regarding the weather. For this reason, Kinsui (1993) defines this usage of *-ne* as requesting agreement/confirmation.

The third usage is self-confirmation. Someone asks another *Ima nanzi desu ka* 'What time is it now?' While looking at his/her watch, the hearer replies *Eeto, sanzi desu-ne* 'Well, it's three o'clock'. In this context, the person who states the time knows that the present time is three o'clock and is just checking his/her watch to confirm it. Unlike the first usage of confirmation, the information the speaker possesses (i.e., the time of day) is not known by the person who asked for it (i.e., the hearer). Thus, this usage of *-ne* is distinguished from the first usage of hearer's confirmation and is classified as speaker's self-confirmation.

2.3 Summarizing the usages of *-yo* and *-ne* from two different perspectives

When all the usages of *-yo* and *-ne* are combined in discourse, they can be viewed from the two perspectives of *existence of the hearer* and *possessor of information*, as depicted in Table 1. Under the first perspective (existence of the hearer), usage of *-yo* and *-ne* can be categorized by the existence or non-existence of the hearer. The usage of *-yo* for soliloquy and the usage of *-ne* for self-confirmation do not assume the existence of the hearer (indicated as '–'). In other words, the speaker merely speaks to himself/herself in these two usages. Other usages of *-ne* and *-yo* imply the

Table 1 Usages of the sentence-final particles *-yo* and *-ne*

Type of the sentence-final particle	Types of usages	Existence of the hearer	Possessor of information
-yo	Informative	+	Speaker
	Warning	+	Speaker and hearer
	Soliloquy	–	Speaker
-ne	Confirmation	+	Hearer
	Requesting agreement/confirmation	+	Speaker and hearer
	Self-confirmation	–	Speaker

Note 1: '+' refers to existence of the hearer while '–' refers to non-existence
Note 2: Usages in shaded cells are utilized for the experiments

existence of the hearer (indicated by '+'). These usages imply communication between the speaker and the hearer.

Under the second perspective (possessor of information), the usages of *-yo* and *-ne* can be categorized three ways on the basis of who possesses the information: the speaker, the hearer, or both. The information expressed in the informative *-yo* usage, as in *Hankati-ga otimasita-yo* 'Your handkerchief has dropped' is exclusively possessed by the speaker. The speaker may have actually seen the handkerchief drop while walking on the street and then approached the hearer and made the statement. Thus, the hearer had no prior information about the dropped handkerchief. On the contrary, with the usage of *-ne* for confirmation, *Suzuki Taro-kun desu-ne* 'You are Taro Suzuki, aren't you?', the information regarding the name of the applicant is held by the hearer (interviewee) rather than by the speaker (interviewer). For the usage of *-yo* for soliloquy and the usage of *-ne* for self-confirmation, the information is held by the speaker because the speaker is talking to himself/herself without any intention of conveying a message to a hearer.

In the third classification, the information is shared by both the hearer and the speaker. The usage of *-yo* for warning is applied, for example, in the discourse of a mother scolding a child who has been watching TV for three hours: *Omae-wa jukensei da-yo* 'You are a candidate for entrance examinations!' The information regarding her child being a candidate for examination is shared by the mother (the speaker) and the child (the hearer). Likewise, in the usage of *-ne* for requesting agreement/confirmation, a speaker meets someone and initiates a conversation with the sentence *Kyoo-wa ii tennki desu-ne* 'It's a fine day, isn't it?' Again, the information regarding the fine weather is already known to both the speaker and the hearer.

The contrast of *-yo* and *-ne* under the perspective of information possessors makes the particles *-yo* and *-ne* unique in terms of empty subjects. In the aforementioned sentence, *ø Tokyo-e ikitain desu-yo* 'I want to go to Tokyo', the information about the desire to go to Tokyo belongs exclusively to the speaker, and therefore the empty subject is identified as 'I', the speaker. However, once *-yo* is changed to *-ne* as in *ø Tokyo-e ikitain desu-ne*, 'You want to go to Tokyo, don't you?', information regarding the desire to go to Tokyo is held by the hearer, not the speaker. Thus, the empty subject is found to be 'you'. As such, the shift between *-yo* and *-ne* closely relates to the identification of empty subjects.

3 Outline of four experiments and their limitation

The present study consists of four experiments used to examine the effects of the sentence-final particles *-yo* and *-ne* in the identification of empty subjects. Since these particles come after a whole sentence is processed, there was no need to measure the processing time for each phrase, which can otherwise be accomplished by the self-pace reading method (see, e.g., Inoue 1998; Miyamoto et al. 1999; Tokimoto 2005). Thus all four experiments employed an anomalous-sentence decision task which required participants to determine whether or not a sentence was correct after seeing it in its entirety. This experimental approach has been proven sufficiently sensitive to detect scrambling effects (e.g., Koizumi and Tamaoka 2004; Tamaoka et al. 2005) and was therefore selected for the purpose of the present study.

Experiment 1 compared three types of sentences: (1) base sentences, (2) sentences with *-yo*, and (3) sentences with *-ne*. Base sentences were created using

activity verbs in non-past indicative form (*syuushi-kei*) requiring agentive subjects, as in *ø Terebi-o miru* 'ø watch TV'. In this base sentence, any subject, including not only 'I' or 'you' but also 'we', 'they', 'he', or 'she', could be a candidate for the subject. However, because base sentences were constructed using the non-past indicative form, which can be understood as a simple assertion or citation-like form rather than a full sentence requiring subjects or tense/modality, it was assumed that processing would be terminated before an empty subject was identified. In this sense, such base sentences could be considered 'defaults'.

To create two experimental conditions, the sentence-final particles of *-yo* and *-ne* were attached to base sentences. For example, a sentence with *-yo* is formed: *ø Terebi-o miru-yo*. In this sentence, the 'default' base sentence is further processed to identify the empty subject and complete its meaning; an empty subject is interpreted as the speaker 'I' by the sentence-final particle *-yo*. This is the *-yo* informative usage indicated by the shaded cell in Table 1. Compared to the base sentence, extra time would be required for the processing of sentences with *-yo* due to the need to identify the empty subject. Instead of *-yo*, when sentence-final particle *-ne* is added, as in *ø Terebi-o miru-ne*, the subject of the sentence becomes ambiguous, as it can be interpreted in two ways. The sentence could be understood to mean 'I will watch TV' with the implicit question, 'Will it bother you if I watch TV?' (i.e., *-ne* requesting agreement). It could be also interpreted as a question to the hearer: 'You watch TV, don't you?', assuming 'naturally, you do' (i.e., *-ne* confirmation usage). These two interpretations, indicated by the shaded cells of *-ne* in Table 1, could be distinguished in natural conversation by intonation, the former with a falling tone and the latter with a rising tone (for a more detailed discussion, see Eda 2000; Katagiri 1997). In written form, of course, the prosodic information is not available. In written Japanese, unlike the example of English, since a question mark is not required to compose an interrogative statement and since the particle *-ne* is never followed by the question form *-ka*, there is no way to identify the empty subject as 'I' or 'you'. Thus, Experiment 1 assumed that sentences with *-yo* and *-ne* would both need a processing time longer than the base sentences and that sentences with *-ne* would require a processing time even longer than the same sentences with *-yo*.

Interestingly, when the auxiliary verb *-ou*, referring to 'invitation', is placed between the verb *mi-* 'watch' and the final particles *-yo* and *-ne* as in *mi-y-ou-yo* and *mi-y-ou-ne*, the subject of the sentence becomes clearly as 'we', meaning 'Let's watch TV!'. Therefore, Experiment 2 investigated how native Japanese speakers utilize the auxiliary verb *-ou* to identify an empty subject. To do so, Experiment 2 compared three types of sentences: (1) base sentences, (2) sentences with *-ou-yo*, and (3) sentences with *-ou-ne*. It was assumed that sentences with *-ou-yo* and *-ou-ne* would both require a longer time to process than base sentences. However, since both *-ou-yo* and *-ou-ne* sentences contained *-ou*, indicating the empty subject 'we', it was assumed that there would be no difference in the processing time between them.

The present study presumed that base sentences were 'defaults', which would not invite the identification of empty subjects. However, the longer processing time in *-yo/-ne* sentences, which was expected in Experiments 1 and 2, could be caused by the simple orthographic-length effect of an added word(s), namely *-yo* and *-ne* in Experiment 1 and *-ou-yo* and *-ou-ne* in Experiment 2, which were attached to the base sentences. Thus, Experiment 3 compared three types of sentences: (1) sentences with *-ou*, (2) sentences with *-ou-yo*, and (3) sentences with *-ou-ne*. The empty

subjects of all three types of sentences were identified as 'we' by the auxiliary verb *-ou*. If orthographic-length affects processing time, sentences with *-ou* would obviously be processed more quickly than the other two types of sentences, the processing times for which would not be expected to differ. However, if the processing of empty subjects requires extra time, then all three types of sentences should display the same or similar processing times.

Experiments 1–3 focused only on the identification of empty subjects. However, a possible factor influencing the outcome of the present study remained the aspect of discourse-level computation, i.e., *speech acts*. As base sentences without particles can be understood as simple assertions, they were judged to be correct or incorrect based simply on their syntactic and semantic well-formedness. In contrast, sentences with the attachment of two types of particles might be associated with certain types of speech acts. As such, it was expected that without any effort to identify empty subjects, sentences with *-yo* would most likely be understood as informative usage whereas sentences with *-ne* would be interpreted as either confirmation or request for confirmation/agreement usage. Due to the ambiguity of *-ne*, sentences with this particle might require a longer processing time than those with *-yo*. In other words, any findings of difference between *-yo* and *-ne* in Experiments 1 and 2 could not disassociate factors of processing time caused by the identification of empty subjects or discourse-level computation.

Experiment 4 was conducted to eliminate the possible involvement of speech acts in sentence processing by utilizing base sentences with both *-yo* and *-ne* particles and overt subjects. In addition, activity verbs in the indicative past tense form were used to avoid an interpretation of the modality *volition*. Furthermore, the auxiliary verb *-rasii* 'appear to' was used to make sentences seem more natural. A base sentence which reflects these considerations might be constructed such as *Mayumi-ga kami-o kitta-rasii*, 'Mayumi seems to have had her hair cut'. Two more stimulus conditions were constructed by attaching the sentence-final particles *-yo* and *-ne*. Experiment 4 assumed that if speech acts were involved in sentence processing, sentences with *-ne* (more ambiguous) could be expected to require a longer processing time than those with *-yo*, both of which would probably be slower in processing times than base sentences.

Base sentences for the whole-sentence anomaly decision task in the present study were created with the use of transitive verbs requiring agentive subjects and accusative objects in the indicative non-past tense form in Experiments 1–3 and with indicative past tense form in Experiment 4. However, the particles *-yo* and *-ne* can be attached to a variety of verbs and display multiple functions in modality. In the interest of experimental control, the present study focused only on specific types of verbs and their forms to create base sentences. Thus it should be noted that any findings regarding the identification of empty subjects as determined by the particles *-yo* and *-ne* is limited to the scope of the particular sentence types selected in the present study.

4 Experiment 1

Experiment 1 tested whether or not the sentence-final particle *-ne* is associated with extra processing time for ambiguous empty subjects in comparison to the sentences with *-yo* and base sentences.

4.1 Method

Participants. Twenty-four graduate and undergraduate students (18 females and 6 males) at Hiroshima University in Japan, all native speakers of Japanese, participated in Experiment 1. Ages ranged from 19 years and 4 months to 24 years and 9 months. The average age was 20 years and 12 months with the standard deviation of 2 years and 1 month on the day of testing.

Materials. As listed in Appendix A, 30 correct, 30 incorrect, and 40 dummy sentences (a total of 100 sentences) were prepared for Experiment 1. Thirty simple two-phrase sentences with an empty subject, such as *ø terebi-o miru* 'ø watch television', *ø tegami-o kaku* 'ø write a letter', and *ø syasin-o toru* 'ø take a picture', were prepared for target stimuli of correct 'yes' responses. Based upon these base sentences, two sets of 30 more sentences were created by adding simply the particles *-ne* (e.g., *ø terebi-o miru-ne*) and *-yo* (e.g., *ø terebi-o miru-yo*). In this form, sentences still consisted of two phrases, combining the particle with a verb such as *miru-ne* and *miru-yo*.

In the same manner, 30 different incorrect sentences were prepared for correct 'no' responses. Again, these target sentences consisted of two phrases with empty subjects. The 30 sentences were further divided into 15 syntactically incorrect and 15 semantically incorrect sentences, such as *ø densya-no noru* 'ø get on of a train', having the possessive particle *-no* and *ø kitakaze-o yogosu* 'ø dirty north wind'. As in the case of correct 'no' responses, the *-ne* (e.g., *ø densya-no noru-ne*) and *-yo* (e.g., *ø densya-no noru-yo*) particles were added to these incorrect sentences.

It was expected that reading times would become shorter when participants saw sentences containing the same words. Thus, in order to prevent the problem of repeatedly encountering sentences with same words, a counterbalanced design was used to assign participants to different sentences. Three lists of sentences were given to three groups of participants (8 each). Each list consisted of 30 sentences (10 base sentence, 10 sentences with *-ne*, and 10 sentences with *-yo*) for the correct 'yes' responses and 30 sentences (10 base sentence, 10 sentences with *-ne*, and 10 sentences with *-yo*) for the correct 'no' responses. In addition, 40 sentences (20 correct and 20 incorrect) were put in each list as dummy sentences (a total of 100 sentences each list), such as *Kekkon-seikatu-wa barairo da* 'Married life is rosy'.

Procedure. Since target sentences consisted of only two phrases, the experiment employed a whole-sentence anomaly decision task, by showing one sentence at a time on a computer screen. The presentation was controlled by Microsoft's Visual Basic 6.0 + Microsoft DirectX8 computer program. Stimuli with both 'yes' and 'no' correct responses were presented to participants in random order in the center of a computer screen 600 ms after the appearance of an asterisk '*' indicating an eye fixation point. Participants were instructed to respond as quickly and as accurately as possible in deciding whether or not the sentences made sense, with responses for each registered by pressing a 'yes' or 'no' button. Twenty-four practice trials were given to the participants prior to the commencement of actual testing.

4.2 Analysis and results

There were no extremes in reaction times for sentence correctness decisions (i.e., less than 300 ms or longer than 3,000 ms). Only stimulus items which received correct responses were used in the analyses of reaction times. The means of correct

Table 2 Reaction times and error rates of correctness decisions for sentences ending with the particles *-yo* and *-ne* in Experiment 1

Response type	Sentence type	Reaction time (ms)		Error rate (%)	
		M	SD	M	SD
'Yes' responses	Base sentence	778	137	3.75%	4.95%
	With *-yo* (only 'I')	841	148	2.92%	5.50%
	With *-ne* ('I' or 'you')	886	159	1.25%	3.38%
'No' responses	Base sentence	1086	246	5.42%	7.79%
	With *-yo* (only 'I')	1052	192	7.92%	8.33%
	With *-ne* ('I' or 'you')	1092	273	4.17%	5.04%

Note: 24 subjects and 30 sentences for 'yes' and 'no' responses in each category

'yes' and 'no' reaction times and error rates for sentence correctness decisions are presented in Table 2. Before performing the analysis, reaction times outside of 2.5 standard deviations at both the high and low ranges were replaced by boundaries indicated by 2.5 standard deviations from the individual means of participants in each category. The statistical tests which follow analyze both subject (F_1) and item (F_2) variability.

A series of one-way analyses of variance (ANOVAs) with repeated measures for three sentence types (base, *-yo*, and *-ne*) of correct 'yes' responses was conducted on reaction times (milliseconds) and error rates (percents), using subject (F_1) and item (F_2) variabilities. The results showed a significant main effect for sentence types in reaction times [$F_1(2, 46) = 9.10$, $p < .001$; $F_2(2, 58) = 9.92$, $p < .001$] but not in error rates [$F_1(2, 46) = 2.09$, $p = .135$; $F_2(2, 58) = 1.59$, $p = .214$]. Simple contrast comparisons were applied to the means of reaction times among the three types of sentences. The mean of base sentences without any particle was compared to the same sentences with the particles *-ne* and *-yo*. The results indicated that the base sentences were processed faster than those with *-ne* [$F_1(1, 23) = 5.77$, $p < .05$; $F_2(1, 29) = 5.63$, $p < .05$] and with *-yo* [$F_1(1, 23) = 5.31$, $p < .05$; $F_2(1, 29) = 14.00$, $p < .001$], confirming the extra processing load required for the processing of the sentence-final particles attached to the base sentences. Furthermore, a curtail finding was that the sentences with *-yo* were processed faster than those with *-ne* [$F_1(1, 23) = 4.29$, $p < .05$; $F_2(1, 29) = 8.14$, $p < .01$].

The same ANOVAs were carried out for correct 'no' responses on reaction times and error rates. The main effect of sentence types was not significant either in reaction times [$F_1(2, 46) = 0.94$, $p = .399$; $F_2(2, 58) = 0.48$, $p = .620$] or in error rates [$F_1(2, 46) = 1.57$, $p = .218$; $F_2(2, 58) = 1.07$, $p = .350$]. The results suggest that the three types of sentences did not differ in speed and accuracy for properly rejecting incorrect sentences.

4.3 Discussion

The results of Experiment 1 revealed how three types of sentences were processed. First, sentences with the ending particles *-yo* and *-ne* attached required extra processing time compared to their counter group of base sentences even though the particles consisted of only a single Japanese *hiragana* moraic symbol, which was

expected to have only a minor effect in terms of orthographic processing. Second, sentences with particle *-ne* needed a longer processing time than those with *-yo*. Sentences with *-ne* can be interpreted as requiring extra processing time due to the ambiguity of potential subject (i.e., empty subject), either 'I' or 'you'. In contrast, the sentences with *-yo* were quickly processed because their empty subject is identified only as 'I'. If this interpretation is true, any difference in reaction times should disappear when neither type of sentence requires *-yo* and *-ne* to identify the empty subject. To test this assumption, Experiment 2 attached the auxiliary verb *-ou* meaning 'let us' or 'let's' just before *-yo* and *-ne* as in *-ou-yo* and *-ou-ne*. Since the empty subject of sentences with *-ou* is clearly 'we', the processing times of both types of *-yo* and *-ne* sentences should be equalized.

5 Experiment 2

Experiment 2 investigated whether the attachment of the auxiliary verb *-ou* 'let us' neutralizes the difference in reaction times between sentences including *-yo* and *-ne* found in Experiment 1.

5.1 Method

Participants. None of the participants in Experiment 2 was involved in Experiment 1. Twenty-four graduate and undergraduate students (19 females and 5 males) at Hiroshima University in Japan, all native speakers of Japanese, participated in Experiment 2. Ages ranged from 18 years and 2 months to 27 years and 8 months. The average age was 21 years and 4 months with the standard deviation of 7 years and 8 months on the day of testing.

Materials. The same base and dummy sentences used in Experiment 1 were utilized for Experiment 2. As for correct 'yes' responses, the auxiliary verb *-ou* was added to 30 two-phrase base sentences (see Appendix) just before the particle *-yo* and *-ne*. The examples of the sentences include *ø terebi-o mi-y-ou-ne* and *ø terebi-o mi-y-ou-yo*, both of which have the same invitational meaning 'Let's watch television!' Using this procedure, 30 sentences in each of the three conditions (i.e., base, *-yo* and *-ne*) were created.

In the same manner, the same 30 incorrect sentences used in Experiment 1 were also adapted for correct 'no' responses in Experiment 2. With the auxiliary verb *-ou*, syntactically incorrect sentences were created like *ø densya-no nor-ou-yo* 'Let's get on of a train', having a possessive particle *no* while semantically incorrect sentences were created such as *ø kitakaze-o yogos-ou-ne* 'Let's dirty north wind'. As in Experiment 1, in order to prevent repeating the same sentences, a counterbalanced design was used to assign participants to different sentences.

Procedure. Same as Experiment 1.

5.2 Analysis and results

There were no extremes in reaction times for sentence correctness decisions (less than 300 ms or longer than 3,000 ms). Only stimulus items which received correct responses were used in the analyses of reaction times. The means of correct 'yes' and 'no' reaction times and error rates for sentence correctness decisions are presented in Table 3. Before performing the analysis, reaction times outside of 2.5 standard

Table 3 Reaction times and error rates of correctness decisions for sentences ending with *-ou-yo* and *-ou-ne* in Experiment 2

Response type	Sentence type	Reaction time (ms)		Error rate (%)	
		M	SD	M	SD
'Yes' responses	Base sentence	763	103	1.67%	4.32%
	With *-ou-yo*	806	86	1.25%	5.03%
	With *-ou-ne*	832	104	1.67%	4.32%
'No' responses	Base sentence	975	133	4.58%	7.69%
	With *-ou-yo*	1007	123	5.00%	9.63%
	With *-ou-ne*	1015	113	4.17%	7.58%

Note: 24 subjects and 30 sentences for 'yes' and 'no' responses in each category

deviations in both the high and low ranges were replaced by the boundaries indicated by 2.5 standard deviations from the individual means of participants in each category.

A series of ANOVAs with repeated measures for three sentence types (base, *-ou-yo*, and *-ou-ne*) of correct 'yes' responses was conducted on reaction times and error rates, using subject (F_1) and item (F_2) variabilities. The results showed a significant main effect of sentence types in reaction times [$F_1(2, 46) = 5.41, p < .01; F_2(2, 58) = 10.37, p < .001$] but not in error rates [$F_1(2, 46) = 0.11$, $p = .899$; $F_2(2, 58) = 0.11$, $p = .898$]. Simple contrast comparisons were applied to the means of reaction times. The mean of base sentences without any particle was compared to the same sentences with *-ou-yo* and *-ou-ne*. The results indicated that the base sentences were processed faster than those with *-ou-ne* [$F_1(1, 23) = 11.29$, $p < .01$; $F_2(1, 29) = 18.39$, $p < .001$] and with *-ou-yo* [$F_1(1, 23) = 4.52, p < .05; F_2(1, 29) = 9.66, p < .01$], confirming the extra processing load for the combination of the auxiliary verb *-ou* and the particles attached to the base sentences. However, there was no significant difference between sentences with *-ou-yo* and *-ou-ne* [$F_1(1, 23) = 1.35$, $p = .257$; $F_2(1, 29) = 2.64$, $p = .115$].

The same ANOVAs were carried out for correct 'no' responses on reaction times and error rates. The main effect of sentence types was not significant either in reaction times [$F_1(2, 46) = 1.44$, $p = .248$; $F_2(2, 58) = 1.39$, $p = .257$] or in error rates [$F_1(2, 46) = 0.07$, $p = .934$; $F_2(2, 58) = 0.08$, $p = .925$]. The results suggest that the three types of sentences did not differ in speed and accuracy for properly rejecting incorrect sentences.

5.3 Discussion

Experiment 2 was conducted to ascertain whether the insertion of the auxiliary verb *-ou* before the particles *-yo* and *-ne* diminishes the ambiguity effects of empty subjects that had been observed in Experiment 1. The result of Experiment 2 indicates that differences in reaction times between the sentences with *-ou-yo* and *-ou-ne* were not observed. Both type of the sentences with *-yo* and *-ne* took longer to process than the base sentences. Since *-ou* provides information to determine the empty subject as 'we' in the form of the invitation 'let us', the particles *-yo* and *-ne* are no longer necessary to identify the empty subject. As a result, the ambiguity effect observed in Experiment 1 disappeared in Experiment 2.

The study provided the assumption of base sentences as 'defaults' in being simple assertion (or citation-like) form. Due to the lack of clues, identification of the empty subject is not implicated in the processing of these base sentences. However, there is still another possibility, contrary to the assumption of the defaults, that the results of Experiment 2 and, to some extent, Experiment 1 could simply be created by the processing effects of an extra word added to the base sentences. To test orthographic-length effects, three types of sentences ending with *-ou*, *-ou-yo*, and *-ou-ne*, all of which have the easily identifiable empty subject 'we', were compared in Experiment 3. If the results of processing times proved to be due to simple orthographic-length effects, sentences with *-ou* should be processed faster than sentences with *-ou-yo* and *-ou-ne*.

6 Experiment 3

Experiment 3 investigated whether the attachments of *-yo* and *-ne* at the end of base sentences plus *-ou* (i.e., orthographic-length effects) influences the processing time.

6.1 Method

Participants. None of the participants in Experiments 1 and 2 was involved in Experiment 3. Twenty-seven graduate and undergraduate students (10 females and 17 males) at Kyushu University in Japan, all native speakers of Japanese, participated in Experiment 3. Ages ranged from 18 years and 8 months to 31 years and 3 months. The average age was 22 years and 5 months with the standard deviation of 3 years and 5 months on the day of testing.

Materials. The same base and dummy sentences used in Experiment 1 were utilized for Experiment 3. As for correct 'yes' responses, three types of sentences were used. First, the auxiliary verb *-ou* was added to all 30 two-phrase base sentences. Second, the particle *-yo* was added to the sentences with *-ou*, and likewise, the particle *-ne* was added to the sentences with *-ou*. Examples of these sentences include *ø terebi-o mi-y-ou*, *ø terebi-o mi-y-ou-ne*, and *ø terebi-o mi-y-ou-yo*. In the same manner, the same 30 incorrect base sentences used in Experiment 1 were also adapted for correct 'no' responses in Experiment 3 by adding the auxiliary verb *-ou*, *-ou-yo*, and *-ou-ne*. In order to prevent repeating the same sentences, as in Experiments 1 and 2, a counterbalanced design was used to assign participants to different sentences.

Procedure. Same as Experiments 1 and 2.

6.2 Analysis and results

There were no extremes in reaction times for sentence correctness decisions (less than 300 ms or longer than 3,000 ms). Only stimulus items which received correct responses were used in the analyses of reaction times. The means of correct 'yes' and 'no' reaction times and error rates for sentence correctness decisions are presented in Table 4. Before performing the analysis, reaction times outside of 2.5 standard deviations in both the high and low ranges were replaced by the boundaries indicated by 2.5 standard deviations from the individual means of participants in each category.

Table 4 Reaction times and error rates for correctness decision of sentences with an auxiliary verb *-ou* and the particles *-yo* and *-ne* in Experiment 3

Response type	Sentence type	Reaction time (ms)		Error rate (%)	
		M	SD	M	SD
'Yes' responses	With *-ou*	871	146	1.11%	3.20%
	With *-ou+yo*	894	160	1.85%	4.83%
	With *-ou+ne*	918	180	0.37%	1.92%
'No' responses	With *-ou*	1013	169	5.56%	9.74%
	With *-ou+yo*	1054	160	7.78%	14.23%
	With *-ou+ne*	1058	166	8.89%	11.21%

Note: 27 subjects and 30 sentences for 'yes' and 'no' responses in each category

A series of ANOVAs with repeated measures for three sentence types (*-ou*, *-ou-ne*, and *-ou-yo*) of correct 'Yes' responses was conducted on reaction times and error rates, using subject (F_1) and item (F_2) variabilities. The results showed no significant main effect of sentence types either in reaction times [$F_1(2, 52) = 1.66$, $p = .200$; $F_2(2, 58) = 1.84$, $p = .169$] or in error rates [$F_1(2, 52) = 1.10$, $p = .342$; $F_2(2, 58) = 2.52$, $p = .089$]. The same ANOVAs were carried out for correct 'no' responses on reaction times and error rates. Again, the main effect of sentence types was not significant either in reaction times [$F_1(2, 52) = 1.72, p = .191; F_2(2, 58) = 1.32$, $p = .276$] or in error rates [$F_1(2, 52) = 1.39, p = .258$; $F_2(2, 58) = 1.33, p = .273$]. The results suggest that the three types of sentences did not differ in speed and accuracy for accepting correct sentences and for rejecting incorrect sentences.

6.3 Discussion

Experiment 3 was conducted to ascertain whether or not orthographic length of sentences influences sentence processing. The results showed no differences among the three types of sentences ending with *-ou*, *-ou-yo*, and *-ou-ne*. Since the orthographic difference in both conditions of Experiments 1 (the base sentence) and 3 (the base sentence plus *-ou*) was caused by the addition of the particles *-yo* and *-ne*, the difference in reaction times observed in Experiment 1 are apparently created by the inherent ambiguity of the empty subject with the attachment of the particle *-ne*. As such, the findings of Experiment 3 supported those of Experiment 1.

7 Experiment 4

To eliminate the possible involvement of discourse-level computation (i.e., speech acts) by utilizing base sentences with both *-yo* and *-ne* particles and overt subjects, Experiment 4 investigated whether the attachments of *-yo* and *-ne* at the end of base sentences plus the auxiliary verb *-rasii* 'appear to' influenced processing time.

7.1 Method

Participants. None of the participants in Experiments 1 through 3 was involved in Experiment 4. Twenty-seven graduate and undergraduate students (12 females and

15 males) at Hiroshima University in Japan, all native speakers of Japanese, participated in Experiment 4. Ages ranged from 18 years and 10 months to 24 years and 5 months. The average age was 20 years and 8 months with the standard deviation of 1 years and 8 months on the day of testing.

Materials. Base sentences are listed in Appendix B. The same dummy sentences used in Experiment 1 were utilized for Experiment 4. As for correct 'yes' responses, three types of sentences were used. First, the auxiliary verb *-rasii* 'appear to' was added to all 30 three-phrase base sentences with past tense activity verbs. Second, the particle *-yo* was added to sentences with *-rasii*, and, likewise, the particle *-ne* was added to those with *-rasii*. Examples of these sentences include *Hiroko-ga syoosetu-o ka-ita-rasii* 'Hiroko seems to have written a novel', *Hiroko-ga syoosetu-o ka-ita-rasii-yo*, and *Hiroko-ga syoosetu-o ka-ita-rasii-ne*. In the same manner, the same 30 incorrect base sentences were also adapted for correct 'no' responses in Experiment 4 by adding the auxiliary verb *-rasii*, *-rasii-yo*, and *-rasii-ne*. In order to prevent repeating the same sentences, as in Experiments 1–3, a counterbalanced design was used to assign participants to different sentences.

Procedure. Same as Experiments 1 to 3.

7.2 Analysis and results

There were no extremes in reaction times for sentence correctness decisions (less than 400 ms or longer than 4,000 ms). Only stimulus items which received correct responses were used in the analyses of reaction times. The means of correct 'yes' and 'no' reaction times and error rates for sentence correctness decisions are presented in Table 5. Before performing the analysis, reaction times outside of 2.5 standard deviations in both the high and low ranges were replaced by the boundaries indicated by 2.5 standard deviations from the individual means of participants in each category.

A series of ANOVAs with repeated measures for three sentence types (*-rasii*, *-rasii-yo*, and *-rasii-ne*) of correct 'yes' responses was conducted on reaction times and error rates, using subject (F_1) and item (F_2) variabilities. The results showed no significant main effect of sentence types either in reaction times [$F_1(2, 52) = 1.40$, $p < .256$; $F_2(2, 58) = 3.02$, $p = .056$] or in error rates [$F_1(2, 52) = 2.08$, $p = .135$;

Table 5 Reaction times and error rates for correctness decision of sentences with overt subjects, an auxiliaryn verb *-rasii* and the particles *-yo* and *-ne* in Experiment 4

Response type	Sentence type	Reaction time (ms)		Error rate (%)	
		M	SD	M	SD
'Yes' responses	With *-rasii*	1323	338	4.44%	8.01%
	With *-rasii+yo*	1331	343	1.48%	6.02%
	With *-rasii+ne*	1366	347	3.70%	6.88%
'No' responses	With *-rasii*	1531	395	6.67%	9.61%
	With *-rasii+yo*	1583	373	10.00%	12.09%
	With *-rasii+ne*	1580	420	8.15%	10.39%

Note: 27 subjects and 30 sentences for 'yes' and 'no' responses in each category

$F_2(2, 58) = 2.36$, $p = .104$]. The same ANOVAs were carried out for correct 'No' responses on reaction times and error rates. Again, the main effect of sentence types was not significant either in reaction times [$F_1(2, 52) = 1.58$, $p = .216$; $F_2(2, 58) = 0.31$, $p = .736$] or in error rates [$F_1(2, 52) = 0.86$, $p = .431$; $F_2(2, 58) = .75$, $p = .476$]. The results suggest that the three types of sentences did not differ in speed and accuracy for accepting correct sentences and for rejecting incorrect sentences.

7.3 Discussion

Using base sentences with overt subjects and the auxiliary verb *-rasii*, Experiment 4 was conducted to eliminate the possibility of discourse-level computation affecting sentence processing with the particles *-yo* and *-ne*. The results revealed that all three conditions for base sentences, those with *-yo* and those with *-ne* required the same processing times. Therefore, as revealed in the results of Experiment 1, the sentence-final particles *-yo* and *-ne* must act as key factors for identifying empty subjects.

8 General discussion

Four experiments in the present study were carried out to examine whether or not the sentence-final particles *-yo* and *-ne* were used for the identification of empty subjects and, if so, how these particles functioned.

Experiment 1 showed that extra processing time was required for sentences with *-yo* and *-ne* in comparison to their base sentences. Sentences with *-yo* were, furthermore, processed faster than the same sentences with *-ne*. The explanation for these results is twofold. First, a base sentence like *ø terebi-o miru* 'ø watch television' is a simple assertion acting as a 'default', which would hold no implication toward the identification of empty subjects. Thus native Japanese speakers terminated sentence processing in these cases due to a lack of cues to identify empty subjects. Second, as shown in Fig. 1, the *yo*/*ne* phrase provided cues for identifying an empty subject. Here it was assumed that the *yo/ne* phrase projects a kind of the modality phrase (YoNeP). In the case of *-yo*, native Japanese speakers receive information concerning the desire to watch television held by the speaker (i.e., *-yo* informative usage in Table 1) and then are able to identify the empty subject as 'I'. Likewise, native Japanese speakers try to identify an empty subject when occurring with the particle *-ne*. However, in the context of the sentences given in Experiment 1, the possessor of information can be 'I' or 'you'; the empty subject thus becomes ambiguous. This ambiguity results in a greater delay in the processing of sentences with *-ne* compared to those with *-yo*. Thus Experiment 1 confirmed that native Japanese speakers utilize the particles *-yo* and *-ne* to identify an empty subject.

Experiment 2 was designed to confirm the results of Experiment 1. If ambiguity is the true reason for finding that sentences with the particle *-ne* require more processing time than the same sentences with *-yo*, then removing the ambiguity of the subject should result in equal processing times for both particles. With this logic in mind, Experiment 2 inserted the volitional auxiliary verb *-ou*, making the subject of the sentences clearly 'we', and in turn revealed that, in fact, difference in processing times between the sentences with *-yo* and *-ne* disappeared. In addition, as with Experiment 1, sentences with *-ou-yo* and *-ou-ne* took longer to process than base sentences.

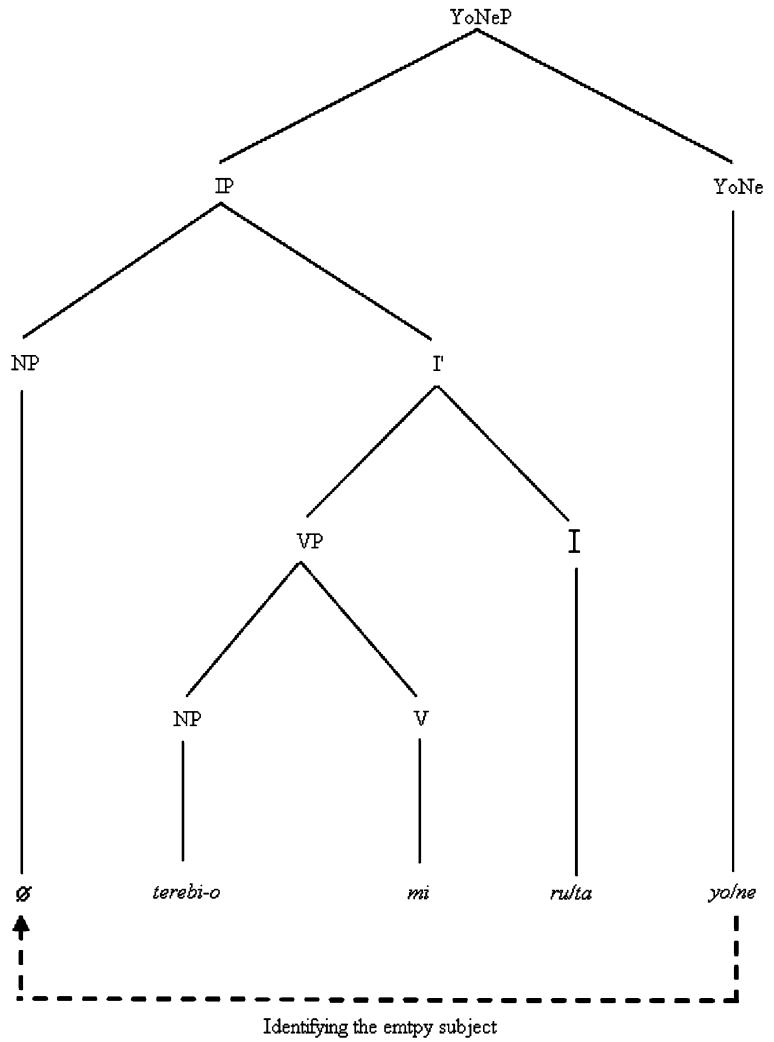

Fig. 1 Identifying the empty subject by the particles *-yo* and *-ne*

The explanation for sentence processing in Experiment 2 by native Japanese speakers is as follows. As shown in Fig. 2, native Japanese speakers process a part of the base sentence *ø terebi-o miru* 'ø watch television' and then read *-ou*, which indicates an empty subject 'we'. Up to this point, the sentence 'Let's watch television' is completed without reading *-yo* and *-ne*. As a result, the difference in processing time between *-yo* and *-ne* observed in Experiment 1 disappeared in Experiment 2. As assumed in Experiment 1, the processing of base sentences was terminated as there is no cue for identifying an empty subject. Thus, in this sense, the present study considered base sentences as 'defaults': native Japanese speakers made correctness decisions for base sentences without clarifying empty subjects.

The 'default' assumption needed to be tested, however, because the possibility remained that the results in Experiments 1 and 2 were simply created by the

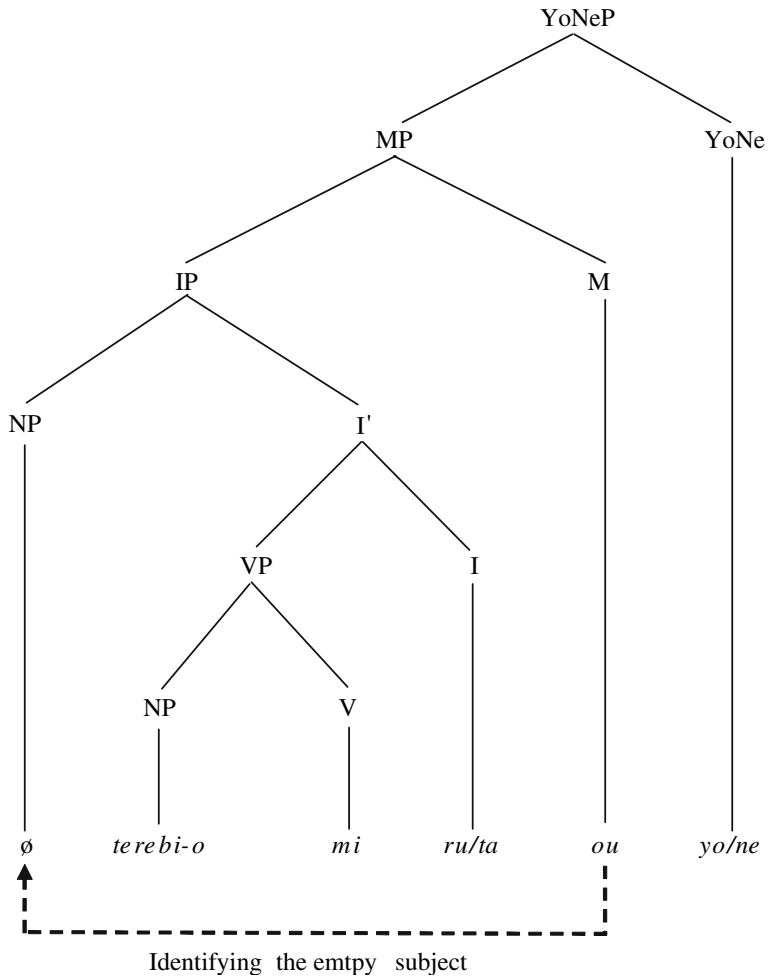

Fig. 2 Identifying the empty subject by the auxillary verb *-ou*

presence of extra script (*-yo* or *-ne* in Experiment 1 and *-ou-yo* or *-ou-ne* in Experiment 2) added to the base sentences. Experiment 3 was therefore carried out to test this orthographic-length effect by comparing three types of sentences ending with *-ou*, *-ou-yo*, and *-ou-ne*, all of which provided 'we' as an empty subject. The results in Experiment 3 showed no differences among the three types of sentences and hence ascertained that quicker processing times for base sentences were not evidence of orthographic-length effects. By proving null effects, the processing of empty subjects as proposed for the results in Experiments 1 and 2 stands out as a persuasive explanation.

Sentences with attachment of the particles *-yo* and *-ne* might be associated with the discourse-level computation or speech acts. If so, it would be expected that sentences with *-yo* would be understood as informative usage whereas sentences with *-ne* would be either confirmation or request of confirmation/agreement usage, without any effort given to the identification of empty subjects. Thus Experiment 4

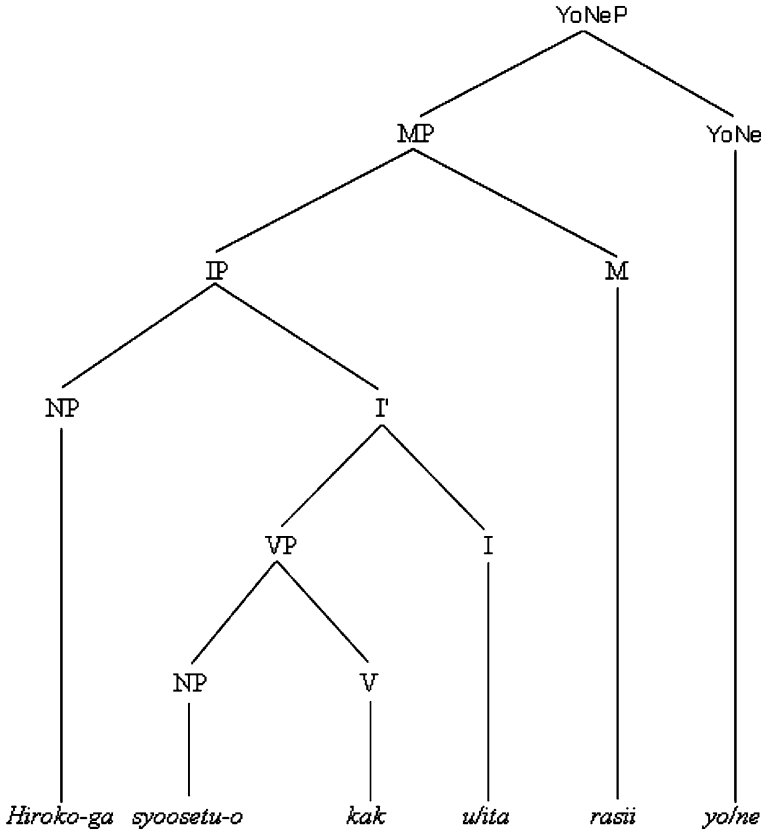

Fig. 3 Sentence structure with an overt subject

was conducted to eliminate the possible involvement of discourse-level computation from the identification of empty subjects found thus far in Experiments 1–3. To accomplish this, overt subjects were included in stimulus sentences. An example of a base sentence is *Hiroko-ga syoosetu-o kaita-rasii* 'Hiroko seems to have written a novel' as depicted in Fig. 3. In this sentence, a female subject by the name of *Hiroko* is clearly shown in the beginning of the sentence. The verb *kaita* 'wrote' is presented in the past tense to avoid an interpretation of the modality *volition*. The auxiliary verb *-rasii* 'appear to' was used to make a sentence seem more natural. Two more conditions were constructed by attachment of the sentence-final particles *-yo* and *-ne* as in *Hiroko-ga syoosetu-o kaita-rasii-yo/ne*. Sentences with *-ne* were expected to be more ambiguous than those with *-yo* in modality. Thus, if the discourse-level computation is involved, sentences with *-ne* were expected to require a longer processing time than those with *-yo*. However, the results of Experiment 4 displayed no difference among conditions of base sentences, those with *-yo*, and those with *-ne*, suggesting that the discourse-level computation per se does not affect the processing of sentences with the particle *-yo* and *-ne*. Consequently, as found and confirmed in Experiments 1–3, the particles *-yo* and *-ne* trigger the identification of empty subjects during sentence processing.

In summary, the present study proved that native Japanese speakers utilize the modality information of the sentence-final particles *-yo* and *-ne* as a cue for identifying an empty subject in sentence processing. More specifically, although the scope of present study was limited to a consideration of the processing of simple sentences with activity verbs of indicative non-past tense form requiring agentive subjects, the results of Experiments 1–4 yielded clear findings in regards to the identification of empty subjects by native Japanese speakers. First, the particle *-ne* showed ambiguity effects, resulting in a greater delay in sentence processing than *-yo* because it provides cues of both 'I' and 'you' for empty subjects. Second, the empty subject 'we' from the auxiliary verb *-ou* can be found without referring to the particle *-yo* or *-ne*. Third, base sentences, considered as 'defaults', exhibited the shortest processing times due to a lack of cues for a specific empty subject understood as a simple assertion. Fourth, discourse-level computation seems not to involve the above dynamics, at least under the sentence conditions of the present study. All together, these findings indicate that the processing of sentences with *-yo/-ne* is affected by the status of empty subjects. This, in turn, proves that modality information provided by the sentence-final particles *-yo* and *-ne* plays an important role in identifying the unexpressed subject. Thus the present study showed that native Japanese speakers make use of various levels of information including modality.

Appendix

Appendix A Base sentences used for stimuli of Experiments 1, 2 and 3

(a) Base sentences for correct 'yes' responses (i.e., correct sentences)

1	テレビを見る。	Terebi-o miru.	Watch television.
2	犬を飼う。	Inu-o kau.	Have a dog.
3	音楽を聴く。	Ongaku-o kiku.	Listen to music.
4	手紙を書く。	Tegami-o kaku.	Write a letter.
5	ＣＤを買う。	CD-o kau.	Buy a CD.
6	ケーキを作る。	Keeki-o tukuru.	Bake a cake.
7	写真を撮る。	Syasyin-o toru.	Take a picture.
8	パソコンを習う。	Pasokon-o narau.	Learn how to use a computer.
9	荷物を運ぶ。	Nimotu-o hakobu.	Carry a bag.
10	ゴミを捨てる。	Gomi-o suteru.	Dump garbage.
11	ボールを蹴る。	Booru-o nageru.	Kick a ball.
12	ゆかたを着る。	Yukata-o kiru.	Wear a yukata (Japanese clothing).
13	新聞を読む。	Syinbun-o yomu.	Read a newspaper.
14	警察を呼ぶ。	Keisatu-o yobu.	Call the police.
15	洗濯物をたたむ。	Sentakumono-o tatamu.	Fold laundry.
16	プレゼントを贈る。	Purezento-o okuru.	Send a present.
17	本を探す。	Hon-o sagasu.	Look for a book.
18	うたを歌う。	Uta-o utau.	Sing a song.
19	お金を数える。	Okane-o kazoeru.	Count money.
20	漢字を覚える。	Kanzi-o oboeru.	Learn kanji.

Appendix A continued

21	お母さんを手伝う。	Okaasan-o tetudau.	Help one's mother.
22	芋を焼く。	Imo-o yaku.	Bake potatoes.
23	家賃を払う。	Yatyin-o harau.	Pay rent.
24	スープを温める。	Suupu-o atatameru.	Warm soup.
25	車を洗う。	Kuruma-o arau.	Wash a car.
26	ピアノを弾く。	Piano-o hiku.	Play the piano.
27	熱を計る。	Netu-o hakaru.	Gauge temperature.
28	歯を磨く。	Ha-o migaku.	Brush teeth.
29	テストを受ける。	Tesuto-o ukeru.	Take a test.
30	ビデオを借りる。	Bideo-o kariru.	Rent a video.

(b) Base sentences for correct 'no' responses (i.e., incorrect sentences)

1	飴が舐める。	Ame-ga nameru.	A candy licks.
2	水が撒く。	Mizu-ga maku.	Water sprinkles.
3	畑が耕す。	Hatake-ga tagayasu.	Field cultivates.
4	お金が貯める。	Okane-ga tukau.	Money keeps.
5	道具が使う。	Doogu-ga tukau.	Instruments use.
6	結婚を殺す。	Kekkon-o korosu.	Kill marriage.
7	アフリカを噛む。	Ahurika-o kamu.	Bit Africa.
8	ドライブをちぎる。	Doraibu-o tyigiru.	Tear driving.
9	忠告を冷ます。	Tyuukoku-o samasu.	Cool an advice.
10	北風を汚す。	Kitakaze-o yogosu.	Dirty the north wind.
11	電車の降りる。	Densya-no oriru.	Get off of a street car.
12	みこしの担ぐ。	Mikosi-no katugu.	Carry on of portable shrine.
13	背中のなでる。	Senaka-no naderu.	Pet of the back.
14	帽子のかぶる。	Boosi-no kaburu.	Wear of a hat.
15	野菜の切る。	Yasai-no kiru.	Cut of vegetables.
16	満月を泳ぐ。	Mangetu-o oyogu.	Swim the full moon.
17	クリスマスを走る。	Kurisumasu-o hasiru.	Run the Christmas.
18	アルプスをつまむ。	Arupusu-o tumamu.	Pick the Alps.
19	幸運を沸かす。	Kooun-o wakasu.	Boil happiness.
20	海を回す。	Umio mawasu.	Turn the ocean.
21	バスに待つ。	Basu-ni matu.	Wait to a bus.
22	橋に渡る。	Hasi-ni wataru.	Cross to the bridge.
23	映画に観る。	Eiga-ni miru.	See to the movie.
24	要求に呑む。	Yookuu-ni nomu.	Accept to a request.
25	植木に抜く。	Ueki-ni nuku.	Pull to the plant.
26	経験を倒す。	Keiken-o taosu.	Knock down experience.
27	田舎生活を刺す。	Inakaseikatu-o sasu.	Thrust country life.
28	人生を殴る。	Zinsei-o naguru.	Strike life.
29	卒業を抱える。	Sotugyoo-o kakaeru.	Hold graduation.
30	電話番号を歩く。	Denwabangoo-o aruku.	Walk a telephone number.

Note: The experimental conditions were created by attaching the particle *yo* and *ne* to the end of the above 60 base sentences for Experiment 1, and by attaching *-ou-yo* and *-ou-ne* for Experiments 2 and 3. In addition, 40 dummy sentences were added for the experiments

Appendix B Base sentences used for stimuli of Experiment 4

(a) Base sentences for correct 'yes' responses (i.e., correct sentences)

1	ケンジが家を買ったらしい。	Kenzi-ga ie-o katta-rasii.	Kenzi seems to have purchased a house.
2	ナオミが賞をもらったらしい。	Naomi-ga syoo-o morat-ta-rasii.	Naomi seems to have received an award
3	ヒロコが小説を書いたらしい。	Hiroko-ga syosetu-o kaita-rasii	Hiroko seems to have written a novel.
4	タケシがマンションを売ったらしい。	Takesi-ga mansyon-o utta-rasii	Takesi seems to have sold his mansion.
5	マユミが髪を切ったらしい。	Mayumi-ga kami-o kitta-rasii	Mayumi seems to have had her hair cut
6	アキラが足を骨折したらしい。	Akira-ga asi-o kossetu sita-rasii	Akira seems to have broken his leg.
7	マドカが恋人をふったらしい。	Madoka-ga koibito-o hutta-rasii	Madoka seems to have thrown over her boyfriend
8	クミコが子猫を拾ったらしい。	Kumiko-ga koneko-o hirotta-rasii	Kumiko seems to have picked a kitty up.
9	ヒデキが部活を始めたらしい。	Hideki-ga bukatu-o hazimeta-rasii	Hideki seems to have started his club avtivity.
10	ヤスオが風邪をひいたらしい。	Yasuo-ga kaze-o hiita -rasii	Yasuo seems to have caught a cold.
11	ケンジが父親を亡くしたらしい。	Kenzi-ga titioya-o nakusita-rasii.	Kenzi seems to have lost his father.
12	ナオミが子どもを産んだらしい。	Naomi-ga kodomo-o unda-rasii.	Naomi seems to have delivered a baby.
13	ヒロコが事故を起こしたらしい。	Hiroko-ga ziko-o okosita-rasii	Hiroko seems to have had an accident.
14	タケシが借金を返したらしい。	Takesi-ga syakkin-o kaesita-rasii	Takesi seems to have payed off his debts.
15	マユミが個展を開いたらしい。	Mayumi-ga koten-o hiraita-rasii	Mayumi seems to have hold an individual show.

Appendix B continued

16	アキラが手術を受けたらしい。	Akira-ga shyzyutu-o uketa-rasii	Akira seems to have had an operation.
17	マドカが嘘をついたらしい。	Madoka-ga uso-o tuita-rasii	Madoka seems to have told a lie.
18	クミコが仕事を辞めたらしい。	Kumiko-ga sigoto-o yameta-rasii	Kumiko seems to have quited her job.
19	ヒデキが刑期を終えたらしい。	Hideki-ga keiki-o oeta-rasii	Hideki seems to have served his term in prison.
20	ヤスオが自伝を出版したらしい。	Yasuo-ga ziden-o syup-pansita-rasii	Yasuo seems to have published his autobiography.
21	ケンジが財布を落としたらしい。	Kenzi-ga saihu-o otosita-rasii	Kenzi seems to have lost his wallet.
22	ナオミが宝くじをあてたらしい。	Naomi-ga takarakuzi-o ateta-rasii	Naomi seems to have won a lottery.
23	ヒロコが大学を卒業したらしい。	Hiroko-ga daigaku-o sotugyoosita-rasii	Hiroko seems to have graduated from a university.
24	タケシが泥棒を捕まえたらしい。	Takesi-ga dor-oboo-o tuka-maeta-rasii	Takesi seems to have caught a thief.
25	マユミが着を着たらしい。	Mayumi-ga kimono-o kita-rasii	Mayumi seems to have dressed a kimono.
26	アキラが失敗を認めたらしい。	Akira-ga sippai-o mito-meta-rasii	Akira seems to have admitted his fault.
27	マドカが産休を取ったらしい。	Madoko-ga sankyuu-o totta-rasii	Madoka seems to have had her maternity leave.
28	クミコが約束を破ったらしい。	Kumiko-ga yakusoku-o yabutta-rasii	Kumiko seems to have broken her promise.
29	ヒデキが先輩を殴ったらしい。	Hideki-ga senpai-o nagutta-rasii	Hideki seems to have hit his senior.
30	ヤスオが仲間を裏切ったらしい。	Yasuo-ga nakama-o uragitta-rasii	Yasuo seems to have betrayed his friend.

Appendix B continued

(b) Base sentences for correct 'no' responses (i.e., incorrect sentences)

1	ハジメが飴に舐めたらしい。	Hazime-ga ame-ni nameta-rasii	Hazime seems to have licked to a candy.
2	サトコが水の撒いたらしい。	Satoko-ga mizu-no maita-rasii	Satoko seems to have sprinkled of water.
3	アユミが畑に耕したらしい。	Ayumi-ga hatake-ni tagayasita-rasii	Ayumi seems to have cultivated to field.
4	シンゴがお金に貯めたらしい。	Singo-ga okane-ni tameta-rasii	Singo seems to have kept to money.
5	タクヤが道具と使ったらしい。	Takuya-ga dougu-to tukatta-rasii	Takuya seems to have used with instruments
6	ヤスコをバスに待ったらしい。	Yasuko-o basu-ni matta-rasii	Yasuko seems to have waited to a bus.
7	メグミを橋に渡ったらしい。	Megumi-o hasi-ni watatta-rasii	Megumi seems to have crossed to a bridge.
8	レイコを映画に観たらしい。	Reiko-o eiga-ni mita-rasii	Reiko seems to have seen to a movie.
9	テツヤを要求にのんだらしい。	Tetuya-o yookyuu-ni nonda-rasii	Tetuya seems to have accepted to a request.
10	ユキオを植木に抜いたらしい。	Yukio-o ueki-ni nuita-rasii	Yukio seems to have pull to a plant.
11	ハジメがみこしの担いだらしい。	Hazime-ga mikosi-no katuida-rasii	Hazime seems to have carried on of portable shrine.
12	サトコが電車の降りたらしい。	Satoko-ga densya-no orita-rasii	Satoko seems to have got off of a street car.
13	アユミが背中のなでたらしい。	Ayumi-ga senaka-no nadeta-rasii	Ayumi seems to have petted of the back.
14	シンゴが帽子にかぶったらしい。	Singo-ga bousi-ni kabutta-rasii	Singo seems to have worn of a hat.

Appendix B continued

15	タクヤが野菜の切ったらしい。	Takuya-ga yasai-no kitta-rasii	Takuya seems to havecut of vegetables.
16	ヤスコが結婚を殺したらしい。	Yasuko-ga kekkon-o korosita-rasii	Yasuko seems to have killed marriage.
17	メグミがアフリカを噛んだらしい。	Megumi-ga ahurika-o kanda-rasii	Megumi seems to have bitten Africa.
18	レイコがドライブを引き裂いたらしい。	Reiko-ga doraibu-o hikisaita-rasii	Reiko seems to have torn driving.
19	テツヤが忠告を冷ましたらしい。	Tetuya-ga tyuukoku-o samasita-rasii	Tetuya seems to have cooled an advice.
20	ユキオが北風を汚したらしい。	Yukio-ga kitakaze-o yogosita-rasii	Yukio seems to have dirtied the north wind.
21	ハジメが経験を倒したらしい。	Hazime-ga keiken-o taosita-rasii	Hazime seems to have knocked down experience.
22	サトコが田舎生活を刺したらしい。	Satoko-ga inakaseikatu-o sasita-rasii	Satoko seems to have thrusted country life.
23	アユミが人生を引っかいたらしい。	Ayumi-ga zinsei-o hikkaita-rasii	Ayumi seems to have scratched life.
24	シンゴが卒業を抱えたらしい。	Singo-ga sotugyoo-o hikkaita-rasii	Sinogo seems to have held graduation.
25	タクヤが電話番号を歩いたらしい。	Takuya-ga denwabangoo-o aruita-rasii	Takuya seems to have walked a telephone number.
26	ヤスコが満月を泳いだらしい。	Yasuko-ga mangetu-o aruita-rasii	Yasuko seems to have swum the full moon.
27	メグミがクリスマスを走ったらしい。	Megumi-ga kurisumasu-o hasitta-rasii	Megumi seems to have run the Christmas.
28	レイコがアルプスを摘まんだらしい。	Reiko-ga arupusu-o tumanda-rasii	Reiko seems to have picked the Alps.

Appendix B continued

29	テツヤが幸運を沸かしたらしい。	Tetuya-ga kooun-o wakasita-rasii	Tetuya seems to have boiled hapiness.
30	ユキオが海を回したらしい。	Yukio-ga umi-o mawasita-rasii	Yukio seems to have turned the ocean.

Note: The experimental conditions were created by attaching the particle *yo* and *ne* to the end of the above 60 base sentences for Experiment 4. In addition, 40 dummy sentences (20) correct 'yes' and 20 correct 'no' were added for Experiment 4

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