The Effect of Present Activity Verbs on Processing Structural Ambiguity in Japanese Garden-Path Sentences

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This paper addresses the semantics of the present form (known as the -ru form) of activity verbs in Japanese and examines the effect of these verbs in contrast to that of the inflected form (the -ta form). Garden-path sentences involving an ambiguity between a simple sentential reading and a relative clause reading generally show a preference for the former reading; when the preferred reading proves to be inconsistent with the correct reading of the sentence, the ensuing processing difficulty is known as the ‘garden-path effect.’ Interestingly, it has been observed that the effect is reduced in sentences that contain activity verbs in the present -ru form in the adnominal clause. One major problem that arises in the interpretation of the -ru form in subordinate clauses is that it is temporally ambiguous, and may be interpreted as belonging to the matrix clause instead. To date, no uniform analysis has been developed to characterize the semantic nature of the -ru form in subordinate clauses. This study will develop a semantics of the -ru form. The data revealed some interesting findings suggesting some logical characteristics of the -ru form. The results help to clarify how the semantic nature of the -ru form exerts an effect on the processing of garden-path sentences, and to show that, contrary to what had been assumed in the absence of semantic research into the embedding verb, the activity verbs ending in the -ru form extend the worlds against which a given proposition is evaluated, which has the effect of reducing the GP effect.

Keywords: garden-path sentences, garden-path effect, activity verbs, present, -ru form, sentence processing, Japanese

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1. Introduction

This study examines Japanese garden-path sentences that contain an active verb in an adnominal clause. Usually, an adnominal clause that contains an activity verb marked for past tense (the -ta form)\(^1\) has a ‘forward shifted’ reading in which the event denoted by the adnominal clause temporally precedes the matrix clause event. Sentences with adnominal clauses pose some problems in processing the semantic/syntactic relations linking their components. In (1), when Kobayasi-ga (Kobayasi-NOM) is interpreted as the subject of sikat-ta ‘scold-PAST,’ the sentence yields a simple sentential reading meaning “Kobayasi scolded the employee.”

(1) Kobayasi-ga syain-wo sikat-ta Yasuda-wo yobituke-ta.
   Kobayasi-NOM employee-ACC scold-PAST Yasuda-ACC call-PAST
   ‘Kobayasi called Yasuda who had scolded the employee.’

But this interpretation crashes when another NP Yasuda-wo (Yasuda-ACC) occurs after the V sikat-ta (scold-PAST), signaling that the VP preceding Yasuda-wo (Yasuda-ACC) must be construed as part of the adnominal clause modifying Yasuda and that the first NP Kobayasi-ga (Kobayasi-NOM) must be construed as the subject of the sentence-final V yobituke-ta ‘call-PAST.’ This reinterpretation process, which requires some time, is known as the garden-path (GP) effect.

However, the GP effect in adnominal clause constructions, such as in (1), is slightly reduced when a bare NP such as syain ‘employee’ is replaced with a proper noun such as Imai, as in (2), below (Inoue, 2008):

(2) Kobayasi-ga Imai-wo sikat-ta Yasuda-wo yobituke-ta.
   ‘Kobayasi called Yasuda who had scolded Imai.’

A similar influence of NP type on the magnitude of the GP effect is also observed in scrambled sentences. The sentences in (3c, d) contain an object–

\(^1\) Descriptions of -ta and –ru do not explicitly address the question that -ta and –ru also indicate perfective and imperfective aspect, but we ignore this in this paper.
subject–verb word order that is assumed to be derived from the subject–object–verb word order contained in the sentences (3a, b) (Saito, 1985). In a filler-driven parsing account of the processing of scrambled sentences, it is assumed that the object (e.g., *Imai-wo nagut-ta Yasuda-wo* ‘Yasuda who had hit Imai’) is reactivated at the trace position, so that scrambled sentences such as (3c, d) result in a diminished GP effect relative to sentences such as (3a, b), which exhibit canonical word order (Inoue, 2012).

   *Kobayasi- NOM Imai-ACC hit-PAST Yasuda-ACC praise-PAST*  
   ‘Kobayasi praised Yasuda who had hit Imai.’ (ambiguous)

b. Tamori-ga Imai-wo nagut-ta Yasuda-wo home-ta.  
   *Tamori- NOM Imai-ACC hit-PAST Yasuda-ACC praise-PAST*  
   ‘Tamori praised Yasuda who had hit Imai.’ (ambiguous)

c. Imai-wo nagut-ta Yasuda-wo Kobayasi-ga home-ta.  
   ‘Kobayasi praised Yasuda who had hit Imai.’ (unambiguous)

d. Imai-wo nagut-ta Yasuda-wo Tamori-ga home-ta.  
   ‘Tamori praised Yasuda who had hit Imai.’ (unambiguous)

Given these facts, there is a long-standing generalization that Japanese is a head-final SOV language in contrast with English, which is a head-initial SVO language. Therefore, in processing Japanese relative/adnominal clause constructions, an initial string of words such as subject and object NPs is a deciding factor in processing difficulty when a sentence is disambiguated (Mazuka and Itoh, 1995 among others.).

However, some counterexamples stand in contrast to this notion. Inoue (2000) refers to an adnominal clause, such as (4), as involving a low GP

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2 This movement of the object is referred to as scrambling.
3 The judgment of the data is examined by using a self-paced moving-window reading paradigm (Inoue, 2012).
4 *Tamori* is a name of a well-known Japanese comedian.
5 Concerning this generalization, we will refer to Hirose (2003) to refine the point in Sect. 3.
effect, in contrast to a clause like (5)\(^6\). He suggests that one major reason for this difference is probably the more frequent occurrence of the \(-ta/da\) form in adnominal clauses, contrary to the \(-ru\) form.\(^7\)

(4) Tyoonan-ga nooka-wo tug-u  
   *Eldest son -NOM farmhouse-ACC inherit-PRESENT* 
   zinan-wo home-ta  
   *second son-ACC praise-PAST*  
   ‘The eldest son praised the second son who inherits/was inheriting to the farmhouse.’

(5) Tyoonan-ga nooka-wo tui-da  
   *Eldest son -NOM farmhouse-ACC inherit-PAST* 
   zinan-wo home-ta  
   *second son-ACC praise-PAST*  
   ‘The eldest son praised the second son who inherited to the farmhouse.’

We can observe the same phenomena in (1), (2), and (3a-d). Native speakers report that the above sentences become notably easier with the minimal change, that is, the GP effect with adnominal clauses observed in these examples is strikingly reduced only when the past \(-ta\) form is replaced with the present \(-ru\) form as shown in (1’), (2’), and (3’a-d) below:

(1’) Kobayasi-ga syain-wo sikar-u  
   *Kobayasi-NOM employee-ACC scold-PRESENT*  
   Yasuda-wo yobituke-ta.  
   *Yasuda-ACC call-PAST*  
   ‘Kobayasi called Yasuda who scolds/was scolding the employee.’
   (unambiguous)

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\(^6\) By default, the inflected (past tense) form of verbs is the \(-ta\) form as follows: *mi-ru* ‘see’ \(\rightarrow\) *mi-ta* ‘saw’. In the case of the inflected form of *tug-u*, however, the euphonic change occurs as follows: *tug-u* \(\rightarrow\) *tui-da* (cf. (4) and (5)). Moreover, (unlike *mi-ru* \(\rightarrow\) *mi-ta*), verbs whose stem includes a voiced sound like *tug-u*, their inflected form must include the voiced sound such as *tui–da*.

\(^7\) We will re-examine this point afterwards.
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(2)’ Kobayasi-ga Imai-wo sikar-u Yasuda-wo yobituke-ta.
(ambiguous)

(3)’ a. Kobayasi-ga Imai-wo nagur-u
   Kobayasi-NOM Imai-ACC hit-PRESENT
   Yasuda-wo home-ta.
   Yasuda-ACC praise-PAST
   ‘Kobayasi praised Yasuda who hits/was hitting Imai.’
(ambiguous)
b. Tamori-ga Imai-wo nagur-u Yasuda-wo home-ta.
(ambiguous)
c. Imai-wo nagur-u Yasuda-wo Kobayasi-ga home-ta.
(ambiguous)
d. Imai-wo nagur-u Yasuda-wo Tamori-ga home-ta.
(ambiguous)

The interpretations observed in (1)’ (2)’ and (3)’a–d suggest that the contrast between the -ru form and the -ta form plays a significant role in reducing the GP effect, as the syntactic structure of the sentences in the sets (1), (2), (3a–d) and (1)’, (2)’, (3’a–d) are all the same.

As mentioned above, garden-path sentences include a structural ambiguity between a simple sentential reading and a subordinate clause reading; it is assumed that this structural ambiguity is the cause of the GP effect. For example, in sentence (1), Kobayasi-ga (Kobayasi-NOM) potentially serves as the subject of both sikat-ta ‘scold-PAST’ and yobituketa ‘call-PAST,’ although it eventually becomes evident that Yasuda is the correct subject of sikat-ta ‘scold-PAST.’ If we faithfully follow the analysis that the source of the GP effect lies in the structural ambiguity of the sentence, we would expect all of the sentences in (1)’ (2)’ and (3’a, b) to result in a GP effect. However, (1)’ is easily understood as “Kobayasi called Yasuda who scolds/ was scolding the employee,” with little or no GP effect. The same result is observed in (2)’ and (3’a, b). Consequently, one might suppose that the morphological contrast (such as -ru versus -ta) of embedding verbs has some effect in processing difficulty when a sentence is disambiguated. If so, the question arises as to how and why the GP effect is mitigated in these
Before tackling this issue, it must be noted that data on sentences containing verbs that denote states also show reduced GP effects. Sentences (6a) and (6b), which have the same meaning, indicate that the contrast between the present -ru form and the past -ta form is abstracted away in the subordinate clause.

(6) a. Kare-ga i-ru koro-wa, yokat-ta.  
*He-NOM exist-PRES time-TOP good-PAST*  
‘The days where he was are the good days.’

b. Kare-ga i-ta koro-wa, yokat-ta.  
*He-NOM exist-PAST time-TOP good-PAST*  
‘The days where he was are the good days.’

Interestingly, the same is true in the GP sentences. When the activity verbs *sikat-ta* ‘scold-PAST’ in (1) and (2) and *nagut-ta* ‘hit-PAST’ in (3a, b) are replaced with a stative verb *kirat-te-i-ru* ‘hate’, the GP effect is not observed, regardless of NP type, as shown below.

(7) a. Kobayasi-ga syain-wo kirat-te-i-ru  
*Kobayasi-NOM employee-ACC hate-STATE*  
Yasuda-wo yobituke-ta.  
*Yasuda-ACC call-PAST*  
‘Kobayasi called Yasuda who hates the employee.’

b. Kobayasi-ga Hirata-wo kirat-te-i-ru  
*Kobayasi-NOM Hirata-ACC hate-STATE*  
Yasuda-wo yobituke-ta.  
*Yasuda-ACC call-PAST*  
‘Kobayasi called Yasuda who hates Hirata.’

(8) a. Kobayasi-ga Imai-wo kirat-te-i-ru  
*Kobayasi-NOM Imai-ACC hate-STATE*  
Yasuda-wo home-ta.  
*Yasuda-ACC praise-PAST*  
‘Kobayasi praised Yasuda who hated Imai.’
b. Tamori-ga Imai-wo kirat-te-i-ru Yasuda-wo
   Tamori-NOM Imai-ACC hate-STATE Yasuda-ACC
   praise-PAST
   ‘Tamori praised Yasuda who hated Imai.’

A natural question to ask is whether the -ru form can be construed as being stative as well as –te-i-ru. The answer is no. The aspectual effect on the verbs embedded in relative/adnominal clauses is not simple.\(^8\)

Consider (9a-c). Sentence (9a) is taken to report the same meaning as (9b), with most researchers of Japanese linguistics stipulating that the -ta form such as in (9a) is used to characterize a head noun like sinsi ‘gentleman’; that is, kabut-ta is taken to be used as adjective\(^10\) (Kageyama(1996) and Kinsui(1994) among others.), while (9c) is unnatural.

   Hat-ACC wear-PAST gentleman-NOM can see-PRESENT
   ‘I can see a gentleman who wears a hat.’

   Hat-ACC be wearing gentleman-NOM can see-PRESENT
   ‘I can see a gentleman who wears a hat.’

   Silk hat-ACC wear-PRESENT gentleman-NOM can see-PRESENT
   ‘I can see a gentleman who wears a hat.’

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\(^8\) We thank an anonymous reviewer for prompting us to clarify this aspectual issue in detail.

\(^9\) The adnominal clause in (9a) boosi -wo kabut-ta sinsi ‘a gentleman who wore a hat’(lit.) is obligatorily interpreted ‘a gentleman who wears a hat’ as in (9b).

\(^10\) Despite the past –ta, the -ta ending verb in (9a) cannot occur with a temporal adverbial like kinoo ‘yesterday’ as shown in (i) below. This shows that the -ta ending verb kabut-ta in (9a) expresses the state/property of the head noun such as sinsi ‘gentleman’, and does not express when he did the action wearing a hat.

(i) * Boosi-wo kinoo kabut-ta sinsi-ga mie-ru.
   Hat-ACC yesterday wear-PAST gentleman-NOM can see-PRESENT
   ‘I can see a gentleman who wore a hat yesterday.’

(i) is, however, acceptable when kabut-ta has a past event reading.
So when the sentences (9a-c) are embedded in the carrier sentence “Tanaka-ga ....to it-ta.”(Tanaka says that ....), if (9a) and (9b) have no difference in processing cost, we might think that the -ru ending does not always bring less processing cost. In other words, if the -ta ending verb like kabut-ta is a counterpart of a -ru ending verb like sikar-u, then it must be expected that the -ta ending verb also brings less processing cost.

However, there is some preliminary evidence that not every -ta ending verb, which occurs in adnominal clauses, can express the adjectival meaning like kabut-ta. Kageyama (1996) and Kinsui (1994), among others, point out that the adjectival ‘-ta’ in an adnominal clause highlights a result state, which is caused by a changing state action denoted by a -ta ending verb. Therefore, they posit a requirement that only verbs of causative change-of-state can be realized as an adjectival ‘-ta’ in adnominal clauses. For example, the unergative verbs, which denote an intentional action like hasir-u ‘run’, cannot be realized as adjectival ‘-ta’, contrary to the transitive verbs like yude-ru ‘boil’ and unaccusative verbs, which denote a result state, like siore-ru ‘wilt’, as shown below: *hasit-ta otoko ‘the run man’, yude-ta tamago ‘boiled egg’ and siore-ta retasu ‘wilted lettuce’. So even though it is an unaccusative verb, if it denotes a simple state such as atais-uru ‘be worthy’, or yoos-uru ‘need’, it does not entail any result state. Therefore, to express adjectival meaning, the noncausative verbs obligatorily take the -ru ending, such as shoosan-ni atais-uru/*atais-i-ta sakuhin ‘a work that is worthy of praise’ and tyoozikan-wo yoos-uru/*yoos-i-ta kadai ‘an issue that needs to take long time’ (Kageyama, 1996).

Following Rappaport Hovav and B. Levin (1998), we can illustrate the effect of the above requirement by contrasting the verbs, which are basically noncausative and, thus have a simple event structure as shown in (10a), with that of verbs which are causative, and thus have a complex event structure as shown in (10b). (*’x’: an external argument/actor, ‘y’: an internal argument/theme.)

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11 Hasit-ta otoko ‘the run man’ becomes acceptable, when it has a past interpretation.
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We here describe a verb, which is available to be realized as adjectival –ta, just in case it unambiguously has a complex event structure as in (10b). The causative change-of-state verb is such a verb.

Keeping this in mind, let us now consider the case of (9b). Kabut-te-i-ru ‘be wearing’ (lit.) is taken to illustrate a state of the the man in question. But notice that there is no a priori reason to think that “an aspectual morpheme –te + an existential verb i-ru” referred to as -te-i-ru always gives rise to a stative meaning. In principle, -te-i-ru displays a durational aspectual meaning and, in combining with any verb stem except for existential verbs such as i-ru and ar-u, attributes this aspectual meaning to them. But the meaning of “V -te-i-ru” is defined in terms of an (a)telicity of events denoted by the head verb V of “V -te-i-ru”. When the verb V is telic, as shown in (9b), a telic event involves a transition to a new state, such as transition from ‘no hat’ to ‘with a hat’, which is illustrated in terms of the complex event structure of (10b); therefore, “V -te-i-ru” expresses a duration of result (‘with a hat’), that is, result state. When the verb V is atelic, an atelic event does not involve a transition to a new state, which is illustrated by the simple event structure of (10a); therefore, “V -te-i-ru” expresses a duration of action or state, that is, an ongoing action or state denoted by V. For instance, when V is stative such as kiraw-u ‘hate’ in (7a,b) and (8a,b), kirat-te-i-ru expresses a duration of state denoted by kiraw-u ‘hate’, and when V denotes an activity such as aruk-u ‘walk’, arui-te-i-ru ‘be walking” expresses an ongoing event.

The idea that the notion of event complexity – whether a verb has a simple or a complex event structure – appears to figure in the explanation of the fact that (9a) and (9b) have the same meaning and provides an opportunity to recognize that the unearthing of the relationship between

12 We can conceive the notion of ‘(a)telicity’ as ‘(un)boundedness’ of the events of affairs.
verb meaning and morphology has a strong impact on the magnitude of the GP effect, which sometimes goes beyond the effects of the syntactic structure of the sentence and the type of NP. We will show that the conception of this strong impact of grammatical information on the disambiguation of the sentence also enables us to capture more precisely our conjecture that, in an adnominal clause, the morphological contrast such as -ru versus -ta in activity verbs diminishes the GP effect\footnote{This paper is attempting to explain the previous experimental findings. One of the challenges in this area is to account for the fact that the activity verbs ending in the -ru form bring markedly less processing cost in GP sentences. In this paper, we pursue the idea that the -ru form (in episodic sentences) denotes a ‘propositional concept’ whose truth-value is not determined.}.

We proceed as follows. Section 2 presents and examines a widely accepted prosodic explanation. Section 3 presents three hypotheses. Section 4 examines Hypothesis 1, and section 5 lays out our discussion concerning Hypothesis 2. In Sect. 6, we develop an account that the –ru form serves as a function from a proposition to sets of a possible world, which provides the reduced GP effect. Section 7 concludes the paper.

2. Prosodic Explanation

To my knowledge, there is no prior research on the effect of activity verbs ending in the –ru form, which require markedly less processing in GP sentences. In the Introduction, we refer to the explanation that attributes the GP effect to the syntactic ambiguity or NP type (Inoue, 2008; Ohtani and Kurafuji, 2011). In this section, we turn our attention to the perspective that a nonsyntactic and nonsemantic factor, such as the length of the initial constituent, plays a role in sentence processing.

How is clause boundary ambiguity resolved? Following Hirose (2003), in Japanese relative clause construction, the phonological length of the initial subject phrase can influence preference in clause boundary ambiguity when conducting a reanalysis. Consider Hirose’s (2003) examples (11) and (12).
In the relative clause of (11) and (12), the word-string up to the first verb, such as *sinyoo-si-ta* ‘trust-PAST,’ is ambiguous between the simple clause (initially preferred) and a relative clause analysis, until a head noun like *yuuzin-tati* ‘friends’ is encountered. The relative clause opens either before or after the accusative NP like *sin-yaku-wo* ‘new medicine-ACC’, depending on the type of matrix verb: a monotransitive verb like *at-ta* ‘meet-PAST’ forces the relative clause to open before the accusative NP, as in (11), while a ditransitive verb like *mise-ta* ‘show-PAST’ forces the relative clause to open after the accusative NP, as in (12). Despite a widely accepted explanation that the former requires less processing rigor than the latter (Mazuka & Ito, 1995), Hirose argued that native speaker intuitions do not agree with the prediction that the latter reading should be associated with a heavy processing cost, and she predicted that length/prosody slows ambiguity resolution. To verify this intuitive assumption, Hirose (2003) conducted experiments: two kinds of length contrast, that is, conjoined-name versus single-name subjects ((13) vs. (14)) and full-name versus single-name subjects ((15) vs. (14)) were compared in two separate off-line sentence completion questionnaire studies examining preference of opening position of an embedded clause between before object NP (that is, Early Opening as in (11)) and after object NP (that is, Late Opening as in (12)).
(13) Conjoined-name subject:

Hosokawa-and Morisita-NOM new medicine-ACC
truly trust-PAST friends-DAT

Hosokawa to Morisita-ga sin-yaku-wo
kokoro-kara sinyoo-si-ta yuuzin-tati-ni ....

(14) Single-name subject:

Morisita-ga sin-yaku-wo kokoro-kara sinyoo-si-ta
Morisita-NOM new medicine-ACC truly trust-PAST
yuuzin-tati-ni ....
friends-DAT

(15) Full-name subject:

Hosokawa Sinziro-ga sin-yaku-wo kokoro-kara
Hosokawa Sinziro-NOM new medicine-ACC truly

The result showed that in contrast with the prevailing explanation of Mazuka & Ito (1995), among others, in neither of the experiments was there clear evidence of a preference for Late Opening (cf. (12)) for the single subject, and that the observed major phrase formation patterns were different depending on the subject length: a major phrase boundary occurred immediately following the subject NP in (13) and (15), but it followed the accusative NP in (14). This result is illustrated as seen below, where the left major phrase boundaries are indicated by {MajP.

(13’)

{MajP

Hosokawa-and Morisita-NOM new medicine-ACC
{kokoro-kara sinyoo-si-ta yuuzin-tati-ni ....
truly trust-PAST friends-DAT

(14’)

{MajP

Morisita-ga sin-yaku-wo kokoro-kara
Morisita-NOM new medicine-ACC truly
{sinyoo-si-ta yuuzin-tati-ni ....
trust-PAST friends-DAT
Hirose noticed that constituent length has an effect on prosodic phrasing. Therefore, she argued that the length effect can be redefined as an effect of the presence and position of a major phrase boundary on the preferred position for a syntactic clause boundary. Following Bader (1998), even in silent reading, prosodic contours are created by the reader, and the syntactic processor is sensitive to them. Moreover, Bader (1998) formulated a prosodic constraint on reanalysis (PCR): syntactic revision is difficult if it necessitates a concomitant reanalysis of the associated prosodic structure. Furthermore, Fodor (1998) argued that parsing preferences in attachments of modifiers (N1 + Prep + N2 + modifier) that are apparently linguistically diverse are prosodic in origin, and he formalizes the idea as the implicit prosody hypothesis (IPH), as follows:

In silent reading, a default prosodic contour is projected onto the stimulus, and it may impede syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.

Based upon the IPH and the PCR, Hirose (2003) asserted that the prosodic structure is sensitive to a length constraint that attracts a major phrase boundary after the second minor phrase; that is, a boundary immediately following the subject NP if the subject consists of two minor phrases and following the object NP if the subject and the following object NP both contain one major phrase.

However, if one applies Hirose’s proposal to our data above, such as (1)–(3a–d), no change is observed. In these examples, the subject and the following object NP are both made of one major phrase; thus, a major phrase boundary follows the object/accusative NP. However, in these
sentences, the object/accusative NP is a constituent of the adnominal clause; subsequently, the parser reconstructs a major clause boundary when a head noun like Yasuda provides a syntactic cue that the adnominal clause must have begun; that is Early Opening. Though the prosodic structure makes a wrong prediction in these examples, the crucial aspect of Hirose’s prosodic analysis is that the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction, as proposed by Fodor (1998). It seems then that the morphological contrast between –ru and –ta ending verbs embedded in the adnominal clause assumed here is irrelevant in resolving structural ambiguity in sentence processing.

Furthermore, it is not unreasonable to suppose that the –ru versus –ta contrast would be borne out, if we examine Hirose’s prosodic explanation from a linguistic view; that is, applying our proposal to the data of Hirose (2003): replacing the -ta with the -ru, as shown below:

(11’)/(12’) Morisita-ga sin-yaku-wo kokoro-kara
   Morisita-NOM new medicine-ACC truly
   sinyoo-su-ru yuuzin-tati-ni toooto at-ta/mise-ta.
   trust-PRESENT friends-DAT finally meet/show-PAST

(13’) Hosokawa-to Morisita-ga sin-yaku-wo
    Hosokawa-and Morisita-NOM new medicine-ACC
    kokoro-kara sinyoo-su-ru yuuzin-tati-ni ….
    truly trust-PRESENT friends-DAT

(14) Single-name subject
    Morisita-ga sin-yaku-wo kokoro-kara
    Morisita-NOM new medicine-ACC truly
    sinyoo-su-ru yuuzin-tati-ni ….
    trust-PRESENT friends-DAT

(15) Full-name subject:
    Hosokawa Sinziro-ga sin-yaku-wo kokoro-kara
    Hosokawa Sinziro-NOM new medicine-ACC truly
    sinyoo-su-ru yuuzin-tati-ni ….
    trust-PRESENT friends-DAT
On a natural reading of these sentences, a native speaker demonstrates that the GP effect with relative clauses is apparently reduced/disappears. It seems then that the processing method in these sentences is illustrated as follows: the -ru ending verb passes judgment for a major phrase boundary and assumes a position of the head noun like yuuzin-tati ‘friends’, which is the position of the correct major phrase boundary, thereby enabling the object/accusative NP like sinyaku-wo ‘new medicine-ACC’ to be checked on the constituent of the relative clause or the constituent of the matrix clause.

The –ta and the –ru have the same prosodic length and occur in the same place, so the length and the syntax of the sentences in the sets (11)/(12) and (11’)/(12’)) are all the same, arguably capturing the parallel between these examples and our above data in (1)–(3a–d) containing the adnominal clause. Thus, it is correctly predicted that the contrast between the -ru and the -ta has a strong impact on the magnitude of the GP effect, which goes beyond the length effect. This shows that the length effect becomes irrelevant.

A linguistic viewpoint underpins a question for Hirose’s experiments. Notice that the verb sinyoo-su-ru ‘trust-PRESENT,’ which is evident in the relative clauses in Hirose’s data, denotes firm belief and can be classified as a stative verb as well as a ‘belief’ (sinzi-ru in Japanese). As mentioned in the previous section, a Japanese stative verb has a distribution pattern that obligatorily takes the -ru ending in a relative clause (Kageyama, 1996). If so, the data using the –ta ending verb in the relative clause, which is observed in Hirose (2003), is problematic, and the –ta must be modified in the -ru form, which may bring undesired results. Consequently, it can be said that unearthing the morphological contrast, such as -ru versus -ta in activity verbs embedded in the relative clause, also has a strong impact on the magnitude of the GP effect, which extends beyond the length effects.

We shall now focus on how and why the GP effect is mitigated in the instance of –ru ending activity verbs.

3. Three Hypotheses

The fact that adnominal clauses involving an activity verb in the present -ru form exhibit a reduced GP effect cannot be accounted for by previous
analyses, in which the GP effect was attributed to the structural ambiguity or NP type or the length of the sentence initial subject or the length of sentence initial constituent, as claimed, for example, by Inoue (2008), Ohtani and Kurafuji (2011), Hirose (2003). Therefore, the question remains as to why a reduced GP effect is observed only for activity verbs in the present -ru form. In other words, what are the logical characteristics of the present -ru form that result in a reduction in the GP effect? I will pursue this question by testing three hypotheses below.

(16) **Hypothesis 1**

The present -ru form (in episodic sentences) is temporally neutral in contrast with the past -ta form. It could take on any reference, with the context determining its semantic value.

(17) **Hypothesis 2**

The present -ru form (in episodic sentences) is a perspective shifter. It indicates the movement of point of view (for instance, from speaker to listener) in a given sentence.

(18) **Hypothesis 3**

The present -ru form (in episodic sentences) denotes a ‘propositional concept’ whose truth-value is not determined. Thus, GP sentence (1) is interpretable either way, regardless of whether Kobayasi or Yasuda is construed as subject of the V nagu-ru.

Hypothesis 1 appears to be the most plausible option, consistent with the observation these verbs in the -ru form (in episodic sentences) have various temporal readings, as illustrated in (19):
(19) a. Ashita, Tokyo-ni ik-u. (Future)
   Tomorrow, Tokyo-to go-FUTURE
   ‘Tomorrow, I will go to Tokyo.’

b. Ima, dekake-ru-tokoro-da. (Near future/present)
   Now, go-out-PRESENT place-COPULA-PRESENT
   ‘I am going to go out.’

c. Hati-wa mitu-wo atume-ru. (Generic sentence)
   Bee-TOP honey-ACC collect-PRESENT
   ‘A bee collects honey.’

d. Ken-wa kinoo takusan tabe-ru kara,
   Ken-TOP yesterday lot eat-PRESENT since,
   onaka-ga itai-nda. (Past)
   stomach-NOM have a pain-PRESENT
   ‘Since Ken ate a lot yesterday, he has a stomachache.’

Hypothesis 2 is also reasonable. It is typical for the utterer to express her/his own point of view anchored in terms of “here,” indicating the place where she/he exists, and “now,” indicating the utterance time. The historic present is a rhetorical device for using the present tense to describe a past event. According to hypothesis 2, the processing of GP sentences such as (1’) could be described as follows: the V sikar-u ‘scold-PRESENT’ induces a shift in point of view from the sentential subject Kobayasi to the speaker or author of (1’). In other words, the adnominal clause in (1’) represents the event that is observed directly by the speaker or the author. As a result, the VP syain-wo sika-ru ‘scold-PRESENT the employee’ preceding Yasuda-wo (Yasuda-ACC) could be easily construed as part of the adnominal clause modifying Yasuda.

Hypothesis 3 appears to be the least preferred option because it runs contrary to the observation that in sentences (19a, b, d), the verbs in the present -ru form co-occur with the definite temporal adverbial ashita ‘tomorrow’ and kinoo ‘yesterday,’ and the propositions denoted by these sentences seem to be evaluated as true.

However, I will argue in this paper that Hypothesis 3 is ultimately the most plausible choice among the three, as the other two can be contradicted by empirical evidence.
4. Hypothesis 1

This section examines Hypothesis 1, which is restated as (20) below:

(20) a. The present -ru form (in episodic sentences) is temporally neutral in contrast to the past -ta form.
   b. It could take on any reference, with the context determining its semantic value.

Data such as (19d) seem to support this line of analysis. In this example, the literal meaning of the expression of the V tabe-ru ‘eat-PRESENT’ in the subordinate clause describes an event in the present, but the pragmatic meaning conveys a past event: (19d) can be paraphrased as (21), in which the past -ta form is used in the subordinate clause.

(21) Ken-wa kinoo takusan tabe-ta kara, (Past)
    Ken-TOP yesterday lot eat-PAST since,
    onaka-ga itai-nda
    stomach-NOM have a pain-PRESENT
    ‘Since Ken ate a lot yesterday, he has a stomachache.’

However, it must be noted that the sentence (19d) cannot be embedded in the negated complement of the factive verb sira-nai ‘do not know-PRESENT,’ as illustrated below:

(22) a.* Ken-wa kinoo takusan tabe-ru kara,
    Ken-TOP yesterday lot eat-PREST since,
    onaka-ga itai koto-wo
    stomach-NOM have a pain-PRESENT COMP-ACC
    watasi-wa sir-a-nai.
    I-TOP know-NEG-PRESENT
    ‘I do not know that since Ken ate a lot yesterday, he has a stomachache.’
b. Ken-wa kinoo takusan tabe-ru kara,  
Ken-TOP yesterday lot eat-PRESENT since,  
onaka-ga itai koto-wo  
stomach-NOM have a pain-PRESENT COMP-ACC  
watasi-wa sit-te-i-ru.  
I-TOP know-PRESENT  
‘I know that since Ken ate a lot yesterday,  
he has a stomachache.’

(23) a. Ken-wa kinoo takusan tabe-ta kara,  
Ken-TOP yesterday lot eat-PAST since,  
onaka-ga ita-i koto-wo  
stomach-NOM have a pain-PRESENT COMP-ACC  
watasi-wa sir-a-nai.  
I-TOP know-NEG-PRESENT  
‘I do not know that since Ken ate a lot yesterday,  
he has a stomachache.’

b. Ken-wa kinoo takusan tabe-ta kara,  
Ken-TOP yesterday lot eat-PAST since,  
onaka-ga ita-i koto-wo  
stomach-NOM have a pain-PRESENT COMP-ACC  
watasi-wa sit-te-i-ru.  
I-TOP know-PRESENT  
‘I know that since Ken ate a lot yesterday,  
he has a stomachache.’

Karttunen (1973) described three types of operators under which presupposition-carrying expressions may be embedded: ‘holes,’ ‘plugs,’ and ‘filters.’ Factive verbs such as *know* are classified as ‘holes,’ which let presuppositions go through so that a presupposition embedded under a ‘hole’ is inherited by the larger sentence containing that ‘hole.’ For instance, in “Sue knows that the king of France is bald,” the matrix sentence inherits the presupposition that there exists a king of France. With respect to the nature of presupposition that survives when the matrix V *know* is negated, I will focus on the differences in meanings between sentences such as (10d) and (12). Relevant pragmatic meanings are shown in (15a, b).
(24) a. Actually, I saw Ken eat yesterday, and I think that Ken ate a lot, and this causes a stomachache.
   b. Actually, I did not see Ken eat yesterday. But it is objectively true that Ken ate a lot, and this causes a stomachache.

(24a, b) are the predicted interpretations of (19d) and (21) respectively.

The fact that the sentence in (19d), where the -ru form is selected, is only available in the complement of sit-te-iru ‘know-PRESENT’ but is not available in the complement of sir-a-nai ‘know-NEG-PRESENT’ demonstrates that the subordinate clause in (19d) is truth-conditionally ambiguous/non-decisive, allowing each of the following possibilities regarding Ken’s eating activity (25):

(25) a. Ken ate a lot.
   b. It is not the case that Ken ate a lot.
   c. Ken ate a little.

In contrast, it is quite obvious that the subordinate clause in (21), where the -ta form is selected, is truth-conditionally decisive, allowing only the reading in (16a). This is confirmed by the fact that the sentence in (21) can be embedded in both the complement of sir-a-nai ‘know-NEG-PRESENT’ and sit-te-iru ‘know-PRESENT.’ Therefore, the available readings for (24a) (= (19d) and (24b) (= (21)) seem to be determined by the -ru form and the -ta form, respectively. These observations hint at the presence of a hidden cognitive subject other than the sentential subject Ken. However, Hypothesis 1 is not able to account for these nuances involving (25a-c).

The reader may argue that these nuances come from the context rather than the content of the sentence, thereby allowing Hypothesis 1 to be maintained. However, this line of reasoning cannot be supported because the reading of the -ta form in the subordinate clause must also be explained in terms of Hypothesis 1 (cf. (20a, b)), as shown in (26a, b) and (27a,b), where the -ta forms in the subordinate clause denote the time qua the past in (26a) and qua the future in (26b), and -ru forms denote the time qua the past in (27a) and qua the future in (27b).
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(26) a. Ken-wa furansu-ni it-ta toki,
Ken-TOP France-to go-PAST time,
kaban-wo kat-ta.
bag-ACC buy- PAST
‘Ken bought a bag when he had been in France.’
b. Ken-wa furansu-ni it-ta toki,
Ken-TOP France-to go-PAST time,
kaban-wo kaw-u.
bag-ACC buy- PRESENT
‘Ken will buy a bag when he will be in France.’

(27) a. Ken-wa furansu-ni ik-u toki,
Ken-TOP France-to go-PRES time,
kaban-wo kat-ta.
bag-ACC buy-PAST
‘Ken bought a bag when he went to France.’
b. Ken-wa furansu-ni ik-u toki,
Ken-TOP France-to go-PRES time,
kaban-wo kaw-u.
bag-ACC buy-FUTURE
‘Ken will buy a bag when he will go to France.’

These readings can be captured by means of the following principle.\(^\text{14}\).

\(^{14}\) More precisely, the principle of (28a, b) reflects the SOT rule below.
The SOT (sequence of tense) rule:

If a tense feature B is the local tense feature of a tense feature A at LF and A and B are occurrences of the same feature (i.e., either [+past] or [+pres]), then A and the tense associated with A (if any) are optionally deleted. N.B.: (i) The tense features include [+past] and [+pres] and nothing else. (ii) A tense feature A is “in the scope” of a tense feature B iff B is associated with a common noun and asymmetrically c-commands A or B is associated with a tense or a perfect and asymmetrically commands A. (iii) A tense feature B is the local tense feature of a tense feature A iff A is “in the scope” of B and there is no tense feature C “in the scope” of B such that A is “in the scope” of C (Ogihara, 1996:134).
(28) a. Activity verbs in the -ta form denote a time prior to the reference time.
b. Activity verbs in the -ru form denote a time posterior to the reference time.

When the -ru form is replaced with the -ta form in the subordinate clause, a parallel temporal interpretation is obtained, unless the two matrix clauses are different. Therefore, in conclusion, Hypothesis 1 is somewhat plausible, but given the parallel readings of the -ru and -ta forms in subordinate clauses, Hypothesis 1 is simply a different way of stating the principle in (28a, b), and it cannot adequately address the issue of why a reduction in the GP effect is obtained only for activity verbs in the present -ru form.

5. Hypothesis 2

Next, we pursued the possibility that the present -ru form (in episodic sentences) is a perspective shifter. Under this account, the present -ru form indicates the shift in point of view in (1’) and (3’a, b). Given that there is no morphologically overt operator that indicates a perspective shift in these sentences, the -ru form is a good candidate for fulfilling this function. Hypothesis 2 is repeated in (29) below:

(29) a. The present -ru form (in episodic sentences) is a perspective shifter.
b. The present -ru form includes, as part of its meaning, the movement of the point of view within the sentence.

As mentioned in the previous section, the predicted interpretation of (19d), which includes the -ru form in the backward shifted reading, is repeated below in (24a):

(24) a. Actually, I saw Ken eat yesterday, and I think that Ken ate a lot, and this causes a stomachache.
Presumably, the sentences in (1’) and (19d) demonstrate that the subordinate clause is truth conditionally ambiguous/non-decisive. If this presumption is correct, the meaning of (19d), according to Hypothesis 2, is (24a), which includes a perspective shift from the sentential subject *Ken* to the speaker.

However, this analysis can be challenged in several ways. First, (1’) (repeated below) is the same as (19d) except that no acquaintance relationship is apparent, which would put a speaker in cognitive contact with the situation, “Kobayasi scolds the employee,” or “Yasuda scolds the employee.”

(1’) Kobayasi-ga syain-wo sikar-u Yasuda-wo yobituke-ta.
  (unambiguous)

This fact is not predicted under Hypothesis 2. When the present -ru form appears in the matrix clause, the acquaintance relationship disappears, but the present -ru form is still expected to induce the perspective shift from *Kobayasi* to *Yasuda*. However, the sentence in (1’) is highly distinguishable and no perspective shift is observed.

Second, suppose that the present -ru form triggers a shift in point of view as a last resort only when there is no other overt morphological element that can indicate a shift in point of view within the sentence. In that case, when the present -ru form is included in the sentences in (19a–c) (repeated below), we would expect them to exhibit a perspective shift.

(19) a. Ashita, Tokyo-ni ik-u. (Future)  
   ‘Tomorrow, I will go to Tokyo.’

b. Ima, dekake-ru tokoro-da. (Near future/present)  
   ‘I am going to go out.’

c. Hati-wa mitu-wo atume-ru. (Generic statement)  
   ‘A bee collects honey.’

d. Ken-wa kinoo takusan tabe-ru kara onaka-ga itai-nda. (Past)  
   ‘Since Ken ate a lot yesterday, he has a stomachache.’
However, this prediction is not borne out: the -ru forms in (19a–c) can be understood as “future”, “near future or present”, and “generic statement”, respectively. In these sentences, we do not observe the perspective shift. Rather, these sentences are bound together by a common characteristic: they are truth-conditionally indecisive. Therefore, it seems reasonable to argue that the -ru form can be semantically characterized as a function from propositions to sets of possible worlds.

The general observation is as follows:

A reduced GP effect in adnominal clauses depends upon the present -ru form. This close relationship between the GP effect and the -ru form suggests that the present -ru form itself serves as a function from propositions to sets of possible worlds.

6. Hypothesis 3

The discussion above leads us to Hypothesis 3 below, at first glance, the least favored hypothesis:

(30) a. The present -ru form (in episodic sentences) denotes a ‘propositional concept’.

b. The present -ru form serves as a function from propositions to sets of possible worlds. Thus, a proposition that contains the -ru form is interpreted as being true in some presupposed possible world but not in all possible worlds that are accessible in a given context.

This may seem to be a peculiar hypothesis, but it accounts for the facts. First, the meaning of (1’) under Hypothesis 3 is as shown in (31). This is the same as seen in (1), which exhibits a GP effect, except that the GP effect is not observed in the reinterpretation process: it is easy to cancel the reading in (a) and shift to reading (b) and then (c).
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(31) a. “Kobayasi scolded the employee.”
    b. Reading (a) is accommodated as “Yasuda scolded the employee.”
    c. Reading (b) is accommodated as “Kobayasi called Yasuda who had scolded the employee.”

In (19d), we saw that a subordinate clause involving the -ru form expresses an ‘acquaintance relation’ in Lewis’ (1979) sense, which puts the speaker in cognitive contact with the situation expressed by the sentence, but the content of the sentence/proposition is truth-conditionally ambiguous/indecisive. Thus, the reading of Ken-wa takusan tabe-ru “Ken eats a lot” is treated on a par with the readings listed in (25) (repeated below).

(25) a. Ken ate a lot.
    b. It is not the case that Ken ate a lot.
    c. Ken ate a little.

Suppose that the speaker presupposes that Ken ate a lot, while Ken himself thinks that it is not the case that he ate a lot. Following Stalnaker (1999), it is possible to represent the difference between the two ways in which the truth values of the proposition expressed in (19d) depend on possible worlds by using the following two-dimensional matrix (where $i$ is the world presupposed by the speaker and $j$ is the world presupposed by Ken):

(32) $\begin{array}{cc}
           & i & j \\
\hline
i & T & F \\
j & T & F \\
\end{array}$

The vertical axis represents possible worlds in the context of evaluation. The horizontal axis represents possible worlds as the arguments of the functions corresponding to the expressed propositions. Thus, the two horizontal lines represent what is expressed in (19d), in different possible contexts. In the two-dimensional matrix (32), the horizontal line following
$i$ is the same as the one following $j$. This indicates that the speaker and Ken agree on/understand the content of the sentence. The vertical column under $i$ yields values that are the opposite of the values in the column under $j$. This indicates that the speaker said something true at $i$ and false at $j$, even though in none of these worlds is the given proposition true in $i$ and false in $j$. Stalnaker refers to the proposition represented in this two-dimensional matrix as the ‘diagonal proposition’ since it characterizes a function from possible worlds to truth values such that those values are read along the diagonal of the matrix from upper left to lower right. Moreover, Stalnaker also invokes the notion of a ‘propositional concept’, that is, a function from possible worlds to propositions.

In this vein, the sentence in (1’) is also accounted for, since without the -ru form, there is no element that represents a different state of possible worlds against which to evaluate the given proposition. For convenience, let us suppose only two worlds, such that $i$ is the world in which Kobayasi is taken to be the subject of the V sikar-u ‘scold-PRESENT’ and $j$ is the world in which Yasuda is taken to be the subject; we can represent the adnominal proposition in (1’) using the twodimensional matrix below:

(33) Kobayasi-ga syain-wo sikar-u Yasuda-wo yobituke-ta.
(Kobayasi called Yasuda who scolds/was scolding the employee.)

\[
\begin{array}{c|cc}
    & i & j \\
\hline
    i & T & F \\
    j & T & F
\end{array}
\]

Matrix (33) represents the propositional concept corresponding to the adnominal clause in (1’). What the twodimensional matrix conveys is roughly this: the proposition “Kobayasi scolds the employee” is true in $i$ but not $j$. At the same time, the proposition “Yasuda scolds the employee” is true in $j$ but not $i$. In a sense, the adnominal clause in the sentence (1’) extends worlds, that is, it extends perspectives. In this sense, the sentence (1’) represents a ‘diagonal proposition’. Therefore, the sentence in (1’) is interpretable either way, regardless of whether Kobayasi or Yasuda is
construed as the subject of the V *sikar-u*. This explains why the -*ru* form can play a principal role in reducing the GP effect.

In contrast, it is obvious that the adnominal clause in (1) containing the *ta*-form is truth-conditionally decisive; in this case, the GP effect is observed. Let us suppose two worlds such that *i* is the world in which *Kobayasi* is taken to be the subject of the V *sikat-ta* ‘scold-PAST’ and *j* is the world in which *Yasuda* is taken to be the subject; we can represent the adnominal proposition in (1) using the one-dimensional matrix below:

(34) *Kobayasi-ga syain-wo sikat-ta Yasuda-wo yobituke-ta.*  
(Kobayasi called Yasuda who scolded the employee.)

<table>
<thead>
<tr>
<th></th>
<th><em>i</em></th>
<th><em>j</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

Matrix (34) does not represent a diagonal proposition. The one-dimensional matrix conveys roughly the following: the proposition “*Kobayasi* scolded the employee” is true in *i*, and there is no world other than *i*. Thus, it is not possible for the proposition “*Yasuda* scolds the employee” to be true in *j* at the same time. The past *-ta* form blocks the extension of the worlds under which the proposition is evaluated and forces a one-dimensional perspective. This explains why the *-ta* form induces a GP effect.

7. Conclusion

The analysis provided in this paper can be summarized in (35) to (37):

(35) Subordinate clauses containing active verbs in the present *-ru* form as the main predicate result in a reduction of the GP effect.

(36) The present *-ru* form serves as a function from propositions to sets of possible worlds. Thus, a proposition containing the *-ru* form is interpreted as true in some presupposed possible world but not in all possible worlds accessible in a given context.
(37) For the reason expressed in (27), the -ru form extends the worlds against which a given proposition is evaluated, yielding a ‘diagonal proposition’, which has the effect of reducing the GP effect.

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