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

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Abstract

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. The main goal of this study was to 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.

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

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) 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
Kobayasi-NOM employee-ACC scold-PAST Yasuda-ACC
yobituke-ta.
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 Hirata.'

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–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)[1]. 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, 2007; 2012)[2].

(3) a. Kobayasi-ga Imai-wo nagut-ta Yasuda-wo home-ta.
Kobayasi-NOM Imai-ACC hit-PAST Yasuda-ACC praise-PAST
'Kobayasi praised Yasuda who had hit Imai.'
(ambiguous)
b. C. Ronaldo-ga Imai-wo nagut-ta Yasuda-wo home-ta
C. Ronaldoi-NOM Imai-ACC hit-PAST Yasuda-ACC praise-PAST
'C. Ronaldo 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 C. Ronaldo-ga home-ta.
'C. Ronaldo praised Yasuda who had hit Imai.'
(unambiguous)

However, there are some counterexamples to the general effect of NP type. The GP effect with adnominal clauses observed in the above examples is reduced only when the past *-ta* form is replaced with the present *-ru* form, as shown 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 Imai.'

[1] This movement of the object is referred to as scrambling.
[2] The judgment of the data is examined by using self-paced moving-window reading paradigm (Inoue , 2012).

(unambiguous)

(2)'Kobayasi-ga Imai-wo *sikar-u* Yasuda-wo yobituke-ta.
(unambiguous)

(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.'
(unambiguous)

b. C. Ronaldo-ga Imai-wo *nagur-u* Yasuda-wo home-ta.
(unambiguous)

c. Imai-wo *nagur-u* Yasuda-wo Kobayasi-ga home-ta.
(unambiguous)

d. Imai-wo *nagur-u* Yasuda-wo *C. R*onaldo-ga home-ta.
(unambiguous)

The interpretations observed in (1') (2') and (3'a–d) suggest that the contrast between the present *-ru* form and the past *-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 *yobituke-ta* '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). The question is why the GP effect is mitigated in these cases.

Before tackling this issue, it must be noted that data on sentences containing verbs that denote states also show reduced GP effects. Sentences (4a) and (4b), 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.

(4) 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.

(5)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* Yasuda-wo yobituke-ta.
'Kobayasi called Yasuda who hates Hirata.'

(6)a. Kobayasi-ga Imai-wo *kirat-te-i-ru* Yasuda-wo home-ta.
'Kobayasi praised Yasuda who hated Imai.'

b.C. Ronaldo-ga Imai-wo *kirat-te-i-ru* Yasuda-wo home-ta.
'C. Ronaldo praised Yasuda who hated Imai.'

This result is significant because it suggests that the present *-ru* form, when occurring with activity verbs, has a stronger impact on the magnitude of the GP effect than the syntactic structure of the sentence or the type of head NP in the adnominal clause has. 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, as claimed, for example, by Inoue (2008) and Ohtani and Kurafuji (2011). 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.

(7) 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.

(8) 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.

(9) 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 (10):

(10) 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. (Past)
Ken-TOP yesterday lot eat-PRESENT since,
onaka-ga itai-nda
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 (10a, 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.

2. Hypothesis 1

This section examines Hypothesis 1, which is restated as (11) below:

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

Data such as (10d) seem to support this line of analysis[3]. 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: (10d) can be paraphrased as (12), in which the past *-ta* form is used in the subordinate cause.

(12) 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 (10d) cannot be embedded in the negated complement of the factive verb *sira-nai* 'do not know-PRESENT,' as illustrated below:

(13) a.* 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 sira-nai.
I-TOP know-NEG-PRESENT
'I do not know that since Ken eats 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 eats a lot yesterday, he has a stomachache.'

(14) 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 sira-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).

(15) 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.

(15a, b) are the predicted interpretations of (10d) and (12) respectively.

The fact that the sentence in (10d), 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 sira-*nai* 'know-NEG-PRESENT' demonstrates that the subordinate clause in (10d) is truth-conditionally ambiguous/non-decisive, allowing each of the following possibilities regarding Ken's eating activity (16):

(16) 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 (12), where the *-ta* form is selected, is truth-

[3] As for (10d), see Yamamori(2015).

conditionally decisive, allowing only the reading in (16a). This is confirmed by the fact that the sentence in (12) can be embedded in both the complement of *sira-nai* 'know-NEG-PRESENT' and *sit-te-iru* 'know-PRESENT.' Therefore, the available readings for (15a) (= (10d) and (15b) (= (12)) 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 (16a-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. (11a, b)), as shown in (17a, b) and (18a,b), where the *-ta* forms in the subordinate clause denote the time *qua* the past in (17a) and *qua* the future in (17b), and *-ru* forms denote the time *qua* the past in (18a) and *qua* the future in (18b).

(17) 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 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.'

(18) 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-ACCbuy-FUTURE
'Ken will buy a bag when he will go to France.'

These readings can be captured by means of the following principle[4].

(19) 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 both the matrix clauses are not same. 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 (19a, 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.

3. 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 (20) below:

(20)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 (10d), which includes the *-ru* form in the forward shifted reading, is repeated below in (15a):

(15) 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 (10d) demonstrate that the subordinate clause is truth conditionally ambiguous/non-decisive. If this presumption is correct, the meaning of (10d), according to Hypothesis 2, is (15a), 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 (10d) 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

[4] More precisely, the principle of (19a, 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)

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 (10a–c) (repeated below), we would expect them to exhibit a perspective shift.

(10) 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 (10a–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.

4. Hypothesis 3

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

(21) 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 (22). 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).

(22) 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 (10d), 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 (16) (repeated below).

(16) 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 (10d) 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):

(23)

	i	*j*
i	T	F
j	T	F

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 (10d), in different possible contexts. In the two-dimensional matrix (23), 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 two-dimensional matrix below:

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

	i	*j*
i	T	F
j	T	F

Matrix (24) represents the propositional concept corresponding to the adnominal clause in (1'). What the two-dimensional 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:

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

i	*j*
T	F

i	*j*
F	T

Matrix (25) 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.

5. Conclusion

The analysis provided in this paper can be summarized in (26) to (28):

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

(27) 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.

(28) 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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