The semantic inertness of medial right-node raising in Japanese

Shûichi Yatabe
University of Tokyo

1 Introduction

Two fundamentally distinct types of analyses have been proposed in the literature concerning medial right-node raising, a type of right-node raising (RNR) that places all or part of the right-node-raised material at a location other than the right edge of the final conjunct. (1) is a Japanese example of medial RNR discussed in Yatabe (2013). The right-node-raised expressions are shown in boldface here as well as in other example sentences below. Note that two of the right-node-raised words, namely *bôshi* and *o*, precede the phrase *migi-gawa no manekin ni*, which is unambiguously part of the second conjunct and not part of the right-node-raised material.

(1) [Tarô wa] [hidari-gawa no manekin ni]
[Taro TOP] [left side GEN mannequin DAT]
[makkuro na], soshite [Hanako wa] [awai
[pitch black COP] and [Hanako TOP] [pale
pinku-iro no] **bôshi o** [migi-gawa no
pink COP] hat ACC [right side GEN
manekin ni], **kabuseta**.
mannequin DAT] put
'Taro put a pitch-black hat on the mannequin on the left side and Hanako put a pale pink hat on the mannequin on the right side.'

Here we will focus on the analyses that are explicitly intended to apply to medial RNR in Japanese, although later in the present paper we will have occasion to discuss other analyses of medial RNR as well. In the analysis proposed in Yatabe (2012), which is based on Head-Driven Phrase Structure Grammar (HPSG), medially right-node-raised expressions are taken to be syntactically part of the final conjunct. Thus, (1) is taken to be generated by conjoining two sentences *Tarô wa hidari-gawa no manekin ni makkuro na bôshi o kabuseta* 'Taro put a pitch-black hat on the mannequin on the left side' and *Hanako wa awai pinku-iro no bôshi o migi-gawa no manekin ni kabuseta* 'Hanako put a pale pink hat on the mannequin on the right side' and then eliding the string *bôshi o kabuseta* at the end of the first conjunct. On the other hand, in the analysis proposed in Kubota (2014), which is based on Categorial Grammar (CG), a right-node-raised expression is taken to be outside the coordinate structure involved even when the expression is phonologically realized medially within the final conjunct. Thus, (1) above is taken to be generated by combining a coordinate structure *Tarô wa hidari-gawa no manekin ni makkuro na, soshite Hanako wa migi-gawa no manekin ni awai pinku-iro no* 'Taro, on the mannequin on the left side, a pitch-black, and Hanako, on the mannequin on the right side, a pale pink' and the expression *bôshi o kabuseta* 'hat put', and then phonologically displacing the phrase *migi-gawa no manekin ni* 'on the mannequin on the right side' from the former into the latter.

These two analyses make different predictions about the semantic import of medial RNR. The CG-based analysis predicts that, like the more usual type of RNR, medial RNR must be able to affect the truth-conditional meaning of the sentence; for instance, a quantifier that has been right-node-raised from multiple conjuncts is predicted to be able to scope over the entire coordinate structure as a single quantifier, whether the RNR involved is medial or not. In contrast, the HPSG-based analysis, which treats medial RNR as phonological ellipsis that does not affect constituent structure, predicts that medial RNR must be unable to affect the truth-conditional meaning of the sentence, unlike the more usual, non-medial RNR. More specifically, in the theory of non-constituent coordination developed in Yatabe (2001) and Yatabe (2012), there are claimed to be two types of RNR, syntactic RNR, which can have semantic effect, and prosodic RNR, which is semantically inert. The analysis of medial RNR in Yatabe (2012) adds to this theory a stipulation that medial RNR can only be the latter type of RNR. It is this stipulation, coupled with the overall theory of non-constituent coordination, that produces the prediction that medial RNR must be semantically inert.

In Section 2 of the present paper, the results of questionnaire studies are presented which indicate that medial RNR in Japanese is semantically inert. On the other hand, it has been shown by Kubota (2014) and

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Warstadt (2015) that (pace Sabbagh (2012)) medial RNR in English is not semantically inert. These findings, taken together, mean that the two types of theories described above are both inadequate. Accordingly, in Section 3 of this paper, a new analysis of medial RNR will be outlined which builds on the HPSG-based theory but correctly captures the difference between English and Japanese by relaxing the constraint on syntactic RNR.

2 Two questionnaires

In order to determine whether medial RNR in Japanese is semantically inert or not, two questionnaires were conducted. In both questionnaires, the respondents, who were students at the University of Tokyo and were compensated for their time, were asked to judge the acceptability of six experimental sentences and 10 filler sentences on the following scale of 1 to 4.

1: 'The sentence is perfectly natural under the intended reading.'
2: 'The sentence is slightly unnatural under the intended reading.'
3: 'The sentence is considerably unnatural under the intended reading.'
4: 'The sentence is completely impossible under the intended reading.'

Each sentence was accompanied by a description of what the intended reading of that sentence was. The order of sentences was randomized for each respondent.

(2), (3), and (4) are three of the six experimental sentences in the first questionnaire.

(2) [Kyôko wa] [Pari de] [muji no] [masshiro [Kyoko TOP] [Paris in] [plain COP] [pure white na], soshite [Jirô wa] [aoi moyô no] **o-sara** COP] and [Jiro TOP] [blue pattern COP] plate **o** [Honkon de], **sorezore kônyû shita** ACC [Hong Kong in] individually bought **no desu**.
NML COP
'Kyoko bought pure white plates without patterns in Paris, and Jiro bought plates with blue patterns in Hong Kong, the two of them acting individually.'
<11, 6, 1, 1>

(3) ?[Kyôko wa] [Pari de] [muji no] [masshiro [Kyoko TOP] [Paris in] [plain COP] [pure white na], soshite [Jirô wa] [Honkon de] [aoi COP] and [Jiro TOP] [Hong Kong in] [blue moyô no], [**gôkei jû-mai ijô no**] **o-sara o** pattern COP] [in total ten or more] plate ACC **sorezore kônyû shita no desu**.
individually bought NML COP
'Kyoko bought pure white plates without patterns in Paris, and Jiro bought plates with blue patterns in Hong Kong, buying ten or more plates in total between them and the two of them acting individually.'
<4, 6, 5, 4>

(4) *[Kyôko wa] [Pari de] [muji no] [masshiro [Kyoko TOP] [Paris in] [plain COP] [pure white na], soshite [Jirô wa] [aoi moyô COP] and [Jiro TOP] [blue pattern no], [**gôkei jû-mai ijô no**] **o-sara o** COP] [in total ten or more] plate ACC [Honkon de], **sorezore kônyû shita** [Hong Kong in] individually bought **no desu**.
NML COP
'(Same as (3))'
<0, 2, 4, 13>

The four figures following each experimental sentence indicate the number of respondents who chose 1, 2, 3, and 4 respectively for that sentence. A sentence for which the mean acceptability rating was R is shown throughout this paper with no diacritic if $1 \leq R < 2$, with '?' if $2 \leq R < 2.5$, with '??' if $2.5 \leq R < 3$, with '?*' if $3 \leq R < 3.5$, and with '*' if $3.5 \leq R \leq 4$.

Example (2) involves medial RNR that does not affect the truth-conditional meaning of the sentence, and is acceptable, as expected in both types of theory. (3) involves non-medial RNR that affects the truth-conditional meaning of the sentence; the version of this sentence without application of RNR (i.e. *Kyôko wa Pari de muji no masshiro na gôkei jû-mai ijô no o-sara o sorezore kônyû shita no desu, soshite Jirô wa Honkon de aoi moyô no gôkei jû-mai ijô no o-sara o sorezore kônyû shita no desu*) would only mean 'Kyoko bought ten or more pure white plates without patterns individually in Paris, and Jiro bought ten or more plates with blue patterns individually in Hong Kong,' which is different from the intended reading of (3) and may even be semantically anomalous. The result of the questionnaire shows that (3) is slightly unnatural but acceptable under the intended reading, as expected in both types of theory. Example (4) involves medial RNR that affects the truth-conditional meaning, and, as indicated by the four figures following it, it turns out to be unacceptable, as predicted by

the HPSG-based theory.

(5), (6), and (7) are the rest of the experimental sentences in the first questionnaire. The grammatical structure of these sentences parallells that of the three sentences above.

(5) [[Hanako ga] [toshokan kara] [shinrigaku ni kankei suru yô na], soshite [Tarô ga] [kôkogaku ni kankei suru yô na] **hon o** [kyôju kara], **sorezore karite kita**] no desu.
[[Hanako NOM] [library from] [psychology DAT relate such as] and [Taro NOM] [archaeology DAT relate such as] book ACC [professor from] individually borrow-GER came] NML COP
'Hanako borrowed psychology-related books from the library and Taro borrowed archaeology-related books from the professor, the two of them acting individually.'
<13, 2, 3, 1>

(6) ?[[Hanako ga] [toshokan kara] [shinrigaku ni kankei suru yô na], soshite [Tarô ga] [kyôju kara] [kôkogaku ni kankei suru yô na], [**gôkei jussatsu ijô no**] **hon o sorezore karite kita**] no desu.
[[Hanako NOM] [library from] [psychology DAT relate such as] and [Taro NOM] [professor from] [archaeology DAT relate such as] [in total ten or more] book ACC individually borrow-GER came] NML COP
'Hanako borrowed psychology-related books from the library and Taro borrowed archaeology-related books from the professor, borrowing ten or more books in total between them, and the two of them acting individually.'
<6, 5, 2, 6>

(7) ?*[[Hanako ga] [toshokan kara] [shinrigaku ni kankei suru yô na], soshite [Tarô ga] [kôkogaku ni kankei suru yô na], [**gôkei jussatsu ijô no**] **hon o** [kyôju kara], **sorezore karite kita**] no desu.
[[Hanako NOM] [library from] [psychology DAT relate such as] and [Taro NOM] [archaeology DAT relate such as] [in total ten or more] book ACC [professor from] individually borrow-GER came] NML COP
'(Same as (6))'
<2, 1, 4, 12>

The responses for these sentences were analogous to those for (2), (3), and (4) above. As indicated by the figures following each sentence, (5), (6), and (7) were respectively found to be almost perfect, acceptable if not perfect, and unacceptable, in accordance with the HPSG-based theory.

The low acceptability of (4) and (7), however, might be due to the presence of the word *sorezore* 'individually' in these sentences, and thus may not necessarily contradict the CG-based theory. The word emphasizes the distinctness of each event being described, and for that reason may be felt to be incompatible with the intended readings of (3), (4), (6), and (7).

Therefore, in the second questionnaire, experimental sentences which do not contain the word *sorezore* were used. None of the respondents of this second questionnaire had participated in the first questionnaire. (8), (9), and (10) are three of the sentences used in this second questionnaire, and they are variants of (2), (3), and (4) respectively.

(8) [Kyôko wa] [Pari de] [muji no] [masshiro na], soshite [Jirô wa] [aoi moyô no] **o-sara** [Honkon de], **kônyû shita no desu**.
[Kyoko TOP] [Paris in] [plain COP] [pure white COP] and [Jiro TOP] [blue pattern COP] plate ACC [Hong Kong in] bought NML COP
'Kyoko bought pure white plates without patterns in Paris, and Jiro bought plates with blue patterns in Hong Kong.'
<13, 4, 5, 0>

(9) ?[Kyôko wa] [Pari de] [muji no] [masshiro na], soshite [Jirô wa] [Honkon de] [aoi moyô no], [**gôkei jû-mai no**] **o-sara o kônyû shita no desu**.
[Kyoko TOP] [Paris in] [plain COP] [pure white COP] and [Jiro TOP] [Hong Kong in] [blue pattern COP] [in total ten] plate ACC bought NML COP
'Kyoko bought pure white plates without patterns in Paris, and Jiro bought plates with blue patterns in Hong Kong, buying ten plates in total between them.'
<5, 11, 6, 0>

(10) ?*[Kyôko wa] [Pari de] [muji no] [masshiro na], soshite [Jirô wa] [aoi moyô no], [**gôkei jû-mai no**] **o-sara o** [Honkon
[Kyoko TOP] [Paris in] [plain COP] [pure white COP] and [Jiro TOP] [blue pattern COP] [in total ten] plate ACC [Hong Kong

de], **kônyû shita no desu**.
in] bought NML COP
'(Same as (9))'
<4, 1, 8, 9>

As expected, (9) and (10) were judged to be slightly better than (3) and (4) respectively on average. However, the pattern of responses for these three sentences was roughly identical to the pattern of responses that was seen in the first questionnaire; (8) is acceptable, (9) is slightly unnatural but acceptable, and (10) is unacceptable.

(11), (12), and (13) are the other three experimental sentences in the second questionnaire, and they are variants of (5), (6), and (7), respectively.

(11) [[Hanako ga] [toshokan kara] [shinrigaku
[[Hanako NOM] [library from] [psychology
ni kankei suru yô na], soshite [Tarô ga]
DAT relate such as] and [Taro NOM]
[kôkogaku ni kankei suru yô na] **hon**
[archaeology DAT relate such as] book
o [kyôju kara], **karite kita**] no
ACC [professor from] borrow-GER came] NML
desu.
COP
'Hanako borrowed psychology-related books from the library and Taro borrowed archaeology-related books from the professor.'
<8, 8, 5, 1>

(12) ?[[Hanako ga] [toshokan kara] [shinrigaku
[[Hanako NOM] [library from] [psychology
ni kankei suru yô na], soshite [Tarô ga]
DAT relate such as] and [Taro NOM]
[kyôju kara] [kôkogaku ni kankei suru
[professor from] [archaeology DAT relate
yô na], [**gôkei jussatsu no**] **hon o**
such as] [in total ten] book ACC
karite kita] no desu.
borrow-GER came] NML COP
'Hanako borrowed psychology-related books from the library and Taro borrowed archaeology-related books from the professor, borrowing ten books in total between them.'
<8, 6, 7, 1>

(13) ?*[[Hanako ga] [toshokan kara] [shinrigaku
[[Hanako NOM] [library from] [psychology
ni kankei suru yô na], soshite [Tarô ga]
DAT relate such as] and [Taro NOM]
[kôkogaku ni kankei suru yô na], [**gôkei**
[archaeology DAT relate such as] [in total
jussatsu no] **hon o** [kyôju kara],
ten] book ACC [professor from]
karite kita] no desu.
borrow-GER came] NML COP
'(Same as (12))'
<3, 2, 6, 11>

The pattern of responses for this set was analogous to the pattern of responses for (8), (9), and (10); the first two sentences are acceptable and the third sentence is not.

To summarize the result of the two questionnaires, we had four sets of three sentences, and in each set, the third sentence, which involved meaning-changing medial RNR, was judged to be less acceptable on average than the minimally different second sentence, which involved meaning-changing non-medial RNR.

The difference in acceptability between the second sentence and the third sentence in each set is not likely to be due merely to the unnaturalness that often accompanies medial RNR even when it is not meaning-changing. If it were due to that factor alone, the ratings for the first, the second, and the third sentence, r_1, r_2, and r_3, should exhibit the following relationship: $r_3 - 1 = (r_1 - 1) + (r_2 - 1)$. In other words, the degree to which the third sentence deviates from perfect acceptability would be the sum of the degree to which the first sentence (involving non-meaning-changing medial RNR) deviates from perfect acceptability and the degree to which the second sentence (involving meaning-changing non-medial RNR) deviates from perfect acceptability, owing to what Sorace and Keller (2005) call *cumulative effects*. In fact, since the rating for a sentence cannot exceed 4, the rating for the third sentence would be predicted to be $1 + (r_1 - 1) + (r_2 - 1)$ or 4, whichever is smaller. However, in each set of sentences, the mean of the predicted ratings for the third sentence thus obtained was consistently smaller than the mean of the actual ratings for that sentence, and the one-sided exact Wilcoxon signed-rank test showed that the difference between the means of the predicted values and the actual values was statistically significant in two of the four sets, as shown in Table 1.

Thus, the result of the two questionnaires seems to warrant the conclusion that medial RNR in Japanese is semantically inert. This finding conforms to the predictions of the HPSG-based theory.

Example numbers of the three sentences	Mean of the actual ratings for the 3rd sentence	Mean of the predicted ratings for the 3rd sentence	Result of the Wilcoxon signed-rank test
(2), (3), (4)	3.58	2.74	$Z = 2.94, p < 0.01$
(5), (6), (7)	3.37	2.68	$Z = 2.18, p = 0.01$
(8), (9), (10)	3.00	2.55	$Z = 1.60, p = 0.07$
(11), (12), (13)	3.14	2.82	$Z = 1.01, p = 0.17$

Table 1: Assessment of the hypothesis that the low acceptability of the third sentence in each set is due merely to the unnaturalness that often accompanies medial RNR even when it is not meaning-changing

3 Revision of the HPSG-based theory

While the foregoing poses a problem for the CG-based account, the HPSG-based account as it is presented in Yatabe (2012) is not without its problems, either. It has been pointed out in Kubota (2014) and Warstadt (2015) that medial RNR in English is not semantically inert. The following is the example used in Warstadt (2015) to establish this point.

(14) Carl Philip Emmanuel Bach secretly hid or donated **every manuscript in his father's collection** to the library. (Many of the former type remain lost, while the latter are well preserved.)

Thus, the two theories are both in need of some revision.

Here, a revised version of the HPSG-based theory will be sketched, since the CG-based theory has an additional, possibly insurmountable problem. The problem concerns the type of medial RNR exemplified by the following sentence.

(15) Are you talking about a new or that ex-**boyfriend** you used to date?
(from Chaves (2014))

If we are to apply to this example the theory proposed in Whitman (2009), Kubota (2014), or Warstadt (2015), we need to view the prepositional object in this example as the result of combining a coordinate structure of the form *a new or that ex- you used to date* and a noun *boyfriend* and then phonologically infixing the latter into the former. Such an analysis requires the assumption that a sequence of prenominal modifiers like *that ex-* and a postnominal modifier like *you used to date* can form a constituent in English, and once we make such an assumption, it is no longer obvious how we can rule out a noun phrase like (16), which the theory predicts could be generated by combining [*a new* [*who you're dating now*]] *or* [*that ex-* [*you used to date*]] and *boyfriend* and then phonologically infixing the latter into the former.

(16) *a new [who you're dating now] or that ex-**boyfriend** [you used to date]

The HPSG-based theory of Yatabe (2012), on the other hand, has no problem explaining why (15) is possible while (16) is not. (16) is illicit because it involves ellipsis of a non-final part of the first conjunct and the grammar contains a constraint that bans such ellipsis. (15) is licit because it does not violate that or any other constraint in the grammar.

Figure 1 illustrates the way the proposed modified version of the HPSG-based theory analyzes the example in (14). The figure depicts the local subtree where two VPs, namely *secretly hid every manuscript in his father's collection* and *donated every manuscript in his father's collection to the library*, are conjoined by the conjunction word *or* to become a larger VP *secretly hid or donated every manuscript in his father's collection to the library*. Only the DOM value of each node is shown. The value of the DOM feature is an order domain, which is a list of domain objects, each of which has the PHON feature (shown in the figure) and the SYNSEM feature (not shown in the figure).

The first domain object in the order domain of the mother node is there to represent the meaning of disjunction, and has no phonological content. The second domain object (pronounced "secretly hid") is the result of compacting the first conjunct after removing its rightmost domain object (pronounced "every manuscript in his father's collection"). The third domain object (pronounced "or donated") is the result of compacting the second conjunct after removing its last two domain objects and then adding *or* as the first element of its PHON value. A conjunction word like *or* is assumed to be introduced into a syntactic structure by a linearization-related mechanism, and does not appear as a node in the syntactic tree (see Yatabe (2012)). The fourth domain object (pronounced "every manuscript in his father's collection") is the result of unifying a domain object coming from the first conjunct and one coming from the second conjunct (to use a procedural metaphor). Since in this theory each do-

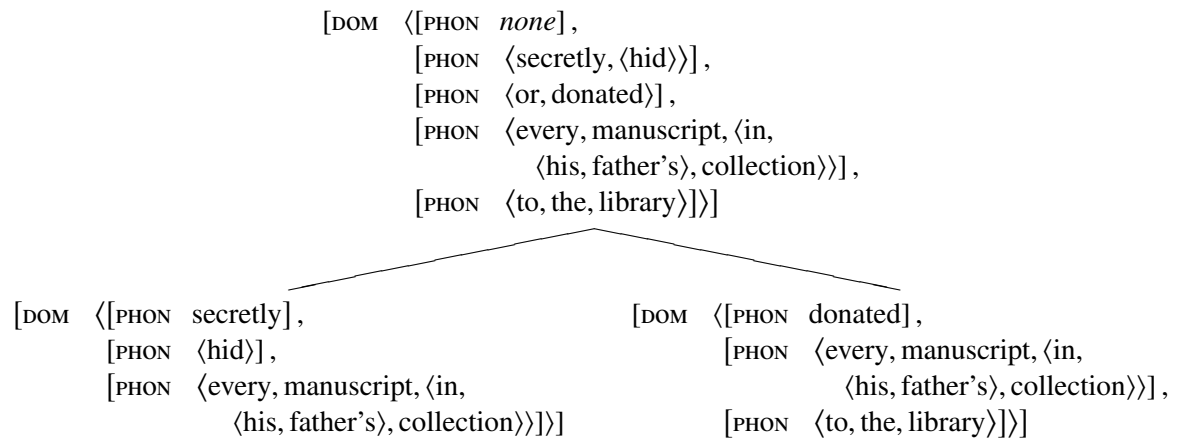

Figure 1: Part of the structure assigned to example (14)

main object rather than each syntactic node is assumed to be the carrier of semantic information, the fact that the order domain of the mother node contains only one domain object representing a universal quantifier means that the semantic representation of this sentence is going to contain only one instance of that quantifier, which is thus required to scope over the entire coordinate structure. Notice that what happens in the order domains automatically affects the semantic interpretation in this theory (see Yatabe (2001)). Finally, the fifth domain object in the order domain of the mother node (pronounced "to the library") is simply inherited from the order domain of the second conjunct.

The difference between the theory proposed here and the one proposed in Yatabe (2012) is that, in the latter, the part of a conjunct that is not right-node-raised or left-node-raised is required to undergo total compaction. In the analysis illustrated in Figure 1, the domain object representing the PP *to the library* in the second conjunct is neither right-node-raised nor left-node-raised but continues to be an independent domain object in the order domain of the mother node, without undergoing total compaction together with the domain object representing the verb *donated*, which is also not right-node-raised or left-node-raised.

One hypothesis that seems worth entertaining is that the part of a conjunct that is not right-node-raised or left-node-raised is required to undergo total compaction in Japanese but not in English. This hypothesis would capture not just the difference between the two languages that has been found in this paper but also the fact that conjuncts are scope islands in Japanese but not in English (see Yatabe (2007)). This is because, in this theory, when total compaction is applied to a phrase whose order domain contains a domain object representing a quantifier, that quantifier is required to take scope within that phrase.

4 Summary

Medial RNR in Japanese was found to be semantically inert unlike medial RNR in English. A revised version of the HPSG-based theory of RNR was then proposed which entails that medial RNR is semantically inert only in languages where conjuncts are scope islands.

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