

Remnant Movement, Radical Reconstruction, and Binding Relations*

Mamoru Saito

1. Introduction

Two major properties of Japanese scrambling are listed in (1).

- (1) a. A remnant created by scrambling can never move.
- b. A phrase preposed by scrambling is subject to radical (total) reconstruction.

(1a) was motivated initially by the fact that remnant movement of the form in (2) is always illicit.

- (2) $*[\beta \dots t_i \dots]_j [\dots \alpha_i [\dots t_j \dots] \dots]$, where α and β are preposed by scrambling.

In Saito (1985), I proposed to account for this in terms of Fiengo's (1977) proper binding condition, which requires that traces be bound. On the other hand, I argued in Saito (1989) for (1b), which implies that scrambling need not be represented at LF. If this is correct, (3a) can have the LF in (3b) as if scrambling never applied.

- (3) a. $\alpha_i [\dots t_i \dots]$, where α is preposed by scrambling.
- b. $[\dots \alpha \dots]$

This raises questions on the proper binding analysis of (2) if the condition applies at LF. With total reconstruction, the LF of (2) can be as in (4), where there is no trace and hence, clearly no violation of the proper binding condition.

- (4) $[\dots [\beta \dots \alpha \dots] \dots]$

Given this situation, a number of alternative analyses for (2) have been proposed in the

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literature. Among them is Takita's (2010) PF analysis. He adopts the theory of linearization proposed by Fox and Pesetsky (2005) and developed by Ko (2007), and demonstrates that it explains (1a). He then goes on to argue that the proper binding condition can be totally eliminated from the syntax.

The purpose of this paper is to examine the issues raised by (1a) and (1b) further. In the first part of the paper, I present supporting evidence for Takita's (2010) PF approach to (1a) and for his claim that there are no syntactic constraints on the movement of remnants created by Japanese scrambling. I argue in addition that the same piece of evidence, interestingly, provides strong support for (1b). Then, in the latter part of the paper, I explore some issues related to (1b). First, I consider the fact that movement creates new binding possibilities as in (5).

(5) John wonders which picture of himself Mary liked

As demonstrated by DeJima (1999) and others, Japanese scrambling exhibits the same effect. Given total reconstruction of scrambling, this poses a problem for the hypothesis that the Binding theory applies at LF. I assume Quicoli's (2008) phase-based Binding theory, and show that the theory, with a refinement on the interpretive mechanism of chains, accommodates examples of this kind, that is, both (5) and its scrambling counterpart. Then, I suggest that the theory leads to an explanation for the anti-reconstruction property of English wh-phrases in situ. (6) illustrates this property.

(6) ??[Which picture of whom]_j does John wonder who_i t_i bought t_j

This example can only be interpreted as a matrix multiple wh-question with *whom* taking matrix scope, and does not allow the wh-phrase to have embedded scope. The precise account for this is unclear if *picture of whom* or *of whom* reconstructs at LF as widely assumed. I suggest that the phase-based interpretation of chains employed in the analysis of (5) and its scrambling counterpart leads to a solution for this problem.

In the following section, I briefly review the proposals on (1a), including Saito's (1985) in terms of the proper binding condition, Kitahara's (1997) based on Attract, and Takita's (2010) in terms of linearization. Then, in Section 3, I present and discuss supporting evidence for Takita's approach. Section 4 concerns examples such as (5) and its scrambling counterpart. There, I suggest a refinement of Quicoli's (2008) theory with a phase-based interpretation of chains. In Section 5, I discuss the problem (6) poses in some detail, and suggest that it is resolved by the analysis presented in Section 4. Section 6 concludes the paper.

2. Proper Binding Effects with Japanese Scrambling

In Saito (1985), I argued that Japanese scrambling is nothing but an instance of Move- α (Move anything anywhere). This necessitated the demonstration that the illicit cases of scrambling are ruled out by independent principles. Examples of the following kind, which instantiate (2), were considered in this context:

- (7) *[[_{CP} Hanako-ga t_i iru to]_j [_{TP} Sooru-ni [_{TP} Taroo-ga t_j omotteiru]]] (koto)
 Hanako-NOM be C Seoul-in Taroo-NOM think fact
 ‘[That Hanako is t_i]_j, in Seoul_i, [Taroo thinks t_j]

This example can be derived from (8a) by first scrambling *Sooru-ni* ‘Seoul-in’ out of the embedded CP as in (8b) and then scrambling the embedded CP itself to the initial position of the matrix clause.

- (8) a. [_{TP} Taroo-ga [_{CP} Hanako-ga Sooru-ni iru to] omotteiru] (koto)
 Taroo-NOM Hanako-NOM Seoul-in be C think fact
 ‘Taroo thinks that Hanako is in Seoul’
 b. [_{TP} Sooru-ni [_{TP} Taroo-ga [_{CP} Hanako-ga t_i iru to] omotteiru]] (koto)
 Seoul-in Taroo-NOM Hanako-NOM be C think fact
 ‘In Seoul_i, Taroo thinks that Hanako lives t_i ’

The derivation should be allowed because (8b) is grammatical and further, CP scrambling and multiple scrambling are both possible as illustrated in (9a) and (9b) respectively.

- (9) a. [[_{CP} Hanako-ga Sooru-ni iru to]_i [_{TP} Taroo-ga t_i omotteiru]] (koto)
 Hanako-NOM Seoul-in be C Taroo-NOM think fact
 ‘[That Hanako lives in Seoul]_i, Taroo thinks t_i ’
 b. [Sono hon-o_i [Hanako-ni_j [_{TP} Taroo-ga [_{CP} Ziroo-ga t_j t_i watasita to] omotteiru]]] (koto)
 that book-ACC Hanako-DAT Taroo-NOM Ziroo-NOM handed C
 think fact
 ‘That book_i, to Hanako_j, Taroo thinks that Ziroo handed t_i t_j ’

What I proposed in Saito (1985) is that (7) is ruled out by the proper binding condition, which prohibits unbound traces (Fiengo 1977). In this example, the trace of *Sooru-ni* ‘Seoul-in’ is in

violation of this condition.

The analysis of (7) just mentioned implies that there is a constraint that prohibits remnant movement, i.e., the proper binding condition. However, as noted above, the radical reconstruction property of Japanese scrambling raises doubts on this analysis. In this section, I first illustrate this problem and then introduce the alternative analyses for (7) proposed by Kitahara (1997) and Takita (2010). I present supporting evidence for the latter in the following section.

Let us first consider the following examples, which provide the necessary background to illustrate the radical reconstruction property:

(10) a. [TP Taroo-ga [CP [TP dare-ga sono hon-o katta] ka] siritagatteiru] (koto)
Taroo-NOM who-NOM that book-ACC bought Q want to know fact
‘[Taroo wants to know [Q [who bought that book]]]’

b. *[TP Dare-ga [CP [TP Taroo-ga sono hon-o katta] ka] siritagatteiru] (koto)
who-NOM Taroo-NOM that book-ACC bought Q want to know fact
‘[Who wants to know [Q [Taroo bought that book]]]’

(10a) is a straightforward example with an embedded wh-question. The wh-phrase *dare* ‘who’ is contained within the question sentence, and the example is grammatical. (10b), on the other hand, is totally ungrammatical. In this example, *dare* is not contained within the question sentence it should be interpreted with. Given this contrast, Harada (1972) proposed the following generalization:

(11) A wh-phrase must be contained within the CP where it takes scope.

This generalization applies to English as well, as shown in (12).

(12) a. Who_i *t_i* wonders [which picture of whom]_j Mary bought *t_j*
b. ??[Which picture of whom]_j does John wonder who_j *t_j* bought *t_i*

As van Riemsdijk and Williams (1981) point out, (12a) is ambiguous. The wh-elements that moved to Spec, CP take scope at their surface positions. Thus, *who* takes matrix scope and *which* takes embedded scope. But *whom*, which was only pied-piped to the embedded Spec, CP, can take either embedded or matrix scope. This is consistent with (11) because the wh-phrase is contained within the embedded CP as well as the matrix CP. Although (12b) is a

Subjacency violation and hence is marginal, its interpretive property is clear. This example is not ambiguous, in contrast with (12a). *Whom*, which was pied-piped to the matrix Spec, CP, can only take matrix scope. This too is consistent with (11) because *whom* in this example is contained only in the matrix CP.¹

With this background, let us now consider the examples in (13).

(13) a. [TP Taroo-ga [CP [TP Hanako-ga dono hon-o yonda] ka] siritagatteiru]
 Taroo-NOM Hanako-NOM which book-ACC read Q want to know
 (koto)
 fact
 ‘[Taroo wants to know [Q [Hanako read which book]]]’

b. [Dono hon-o_i [TP Taroo-ga [CP [TP Hanako-ga *t_i* yonda] ka] siritagatteiru]]
 which book-ACC Taroo-NOM Hanako-NOM read Q want to know
 (koto)
 fact
 ‘[Which book_i, Taroo wants to know [Q [Hanako read *t_i*]]]’

(13a), like (10a), is a straightforward example with an embedded wh-question. In (13b), the wh-phrase *dono hon* ‘which book’ is scrambled out of the embedded question CP. The example is not only grammatical but also receives the same interpretation as (13a). This is unexpected because the wh-phrase is not contained within the question CP, just as in the totally ungrammatical (10b). I proposed then in Saito (1989) that a scrambled phrase can be placed back to its initial position before it receives interpretation at LF. This came to be called ‘radical reconstruction’ so that it is distinguished from ‘partial reconstruction’, which applies to the pied-piped elements in operator movement. It makes (13b) consistent with (11) if the generalization applies at LF. *Dono hon* in (13b), if it is reconstructed to the embedded object position, is contained within the embedded question CP at LF.

The same argument for radical construction can be constructed on the basis of (14).

¹ (12b) raises an interesting question as noted in Section 1. In the present context, if (11) holds at LF and *picture of whom* or *of whom* is reconstructed at this level, it is not obvious why the embedded scope of *whom* is disallowed. This question is discussed in Section 5.

- (14) a. [TP Taroo-ga [CP [TP minna-ga [CP Hanako-ga dono hon-o yonda to] Taroo-NOM all-NOM Hanako-NOM which book-ACC read C omotteiru] ka] siritagatteiru] (koto)
 think Q want to know fact
 ‘[Taroo wants to know [Q [everyone thinks [that Hanako read which book]]]]’
- b. ?[[CP Hanako-ga dono hon-o yonda to]_i [TP Taroo-ga [CP [TP minna-ga t_i Hanako-NOM which book-ACC read C Taroo-NOM all-NOM omotteiru] ka] siritagatteiru]] (koto)
 think Q want to know fact
 ‘[[That Hanako read which book]_i, Taroo wants to know [Q [everyone thinks t_i]]]’

(14a) is like (13a) but the wh-phrase is further embedded in an additional CP. (14b) is derived by scrambling the most deeply embedded CP to the matrix initial position. The wh-phrase is no longer contained within the question CP because of this scrambling, and yet, the example is only slightly marginal. This too is expected if the scrambled CP is reconstructed to its initial position at LF.

As I discussed in detail in Saito (1989), the radical reconstruction property of scrambling has implications for the proper binding account for (7), repeated below as (15).

- (15) *[CP Hanako-ga t_i iru to]_j [Sooru-ni [TP Taroo-ga t_j omotteiru]] (koto)
 Hanako-NOM be C Seoul-in Taroo-NOM think fact
 ‘[That Hanako is t_i]_j, in Seoul_i, [Taroo thinks t_j]

If the scrambled CP in (15) is reconstructed, then there is no unbound trace at LF. And if *Sooru-ni* ‘Seoul-in’ is also reconstructed, there is no trace at all at the level. The conclusion of Saito (1989) was that the proper binding condition applies at S-structure. But this cannot be maintained under the Minimalist approach, where S-structure is dispensed with as a level of representation. Thus, an alternative account for (15) becomes necessary.

Kitahara (1997) was the first to suggest an alternative analysis for examples such as (15). His aim was to propose an explanation for Müller’s (1996) generalization, shown in (16).

- (16) A phrase containing a trace of movement cannot undergo movement of the same type (operator movement, scrambling, NP-movement).

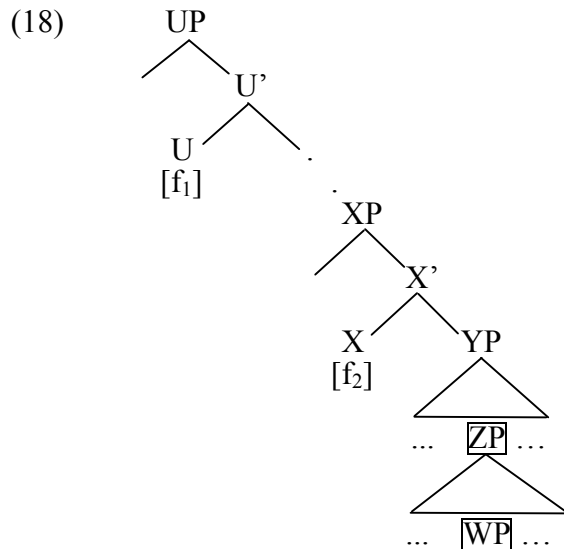
(16) states that remnant movement is illicit if it is of the same type as the movement that

produced the trace in the remnant. The following English examples illustrate the generalization:

- (17) a. * $[\text{Which picture of } t_i]_j$ does John wonder who_i Mary liked t_j
 b. $[\text{How likely } [t_i \text{ to win}]]_j$ is John; t_j

(17a) is ungrammatical because the movement of $[\text{which picture of } t_i]$ and the movement of who_i are both operator movement. (17b), on the other hand, is allowed because the remnant $[\text{how likely } [t_i \text{ to win}]]$ undergoes operator movement whereas t_i is produced by NP movement.

Kitahara (1997) argues that the generalization follows from the minimal link condition or Attract. Let us consider the configuration in (18).



Remnant movement obtains if f_2 attracts WP to Spec, XP and f_1 attracts the remnant ZP to Spec, UP. Suppose that WP and ZP undergo the same type of movement. Then, f_1 and f_2 are the same feature, and both WP and ZP qualify as the target for this feature. Consequently, f_2 should attract the closest ZP and should never be able to attract WP over ZP. Hence, Müller's (1996) generalization follows. Nothing prevents the attraction of WP by f_2 if WP and ZP undergo difference types of movement and hence, f_1 and f_2 are distinct features. Kitahara (1997) then suggests that the ungrammatical (15) may be explained in the same way because it is derived by two applications of scrambling and falls under Müller's generalization.

Although Kitahara's (1997) suggestion is quite attractive, I raised a couple of questions in Saito (2003). First, the account he suggested for (15) implies that Japanese scrambling is

feature-driven, but this, I argued, is dubious. Secondly, a similar prohibition on remnant movement is observed even in cases that do not fall under Müller’s generalization. (19) illustrates this.

- (19) *_{[TP [PRO t_i iku koto]-ga_j Sooru-made_i Taroo-ni t_j meizirareta]}
 go N-NOM Seoul-to Taroo-DAT ordered-was
 ‘[To go t_i]_j, to Seoul_i, was ordered Taroo t_j ’

This example is derived from (20a) by first scrambling *Sooru-made* ‘Seoul-to’ out of the control complement to the position following the matrix subject as in (20b).

- (20) a. Hanako-ga Taroo-ni [PRO Sooru-made iku koto]-o meizita
 Hanako-NOM Taroo-DAT Seoul-to go N-ACC ordered
 ‘Hanako ordered Taroo to go to Seoul’
- b. Hanako-ga Sooru-made_i Taroo-ni [PRO t_i iku koto]-o meizita
 Hanako-NOM Seoul-to Taroo-DAT go N-ACC ordered
 ‘Hanako, to Seoul_i, ordered Taroo to go t_i ’
- c. [PRO Sooru-made iku koto]-ga_j Taroo-ni t_j meizirareta
 Seoul-to go N-NOM Taroo-DAT ordered-was
 ‘[To go to Seoul]_j was ordered Taroo t_i ’

The control complement in (20a, b) is headed by a formal noun *koto* and is the object of the sentence. Because of this, it can move to the subject position once the sentence is passivized. (20c) is a passive counterpart of (20a). (19) obtains when (20b) is passivized in the same way. This example is derived by scrambling and NP-movement, and hence does not fall under Müller’s generalization. Yet, it is completely ungrammatical just like (15). It seems then that Kitahara’s (1997) suggestion does not quite succeed in accounting for the relevant facts.²

Another proposal to explain the proper binding phenomenon of traces produced by scrambling is made in Takita (2010). His analysis adopts the theory of linearization proposed by Fox and Pesetsky (2005) and developed by Ko (2007). The basic idea is that the linear order of constituents is fixed at each spell-out domain. Ko (2007), in particular, demonstrates

² It is desirable to pursue an alternative to Kitahara’s (1997) analysis on conceptual grounds as well if Chomsky’s (2008, 2013) proposal is adopted to dispense with Attract and assume that internal Merge, like external Merge, freely applies and simply forms a constituent out of two elements.

that the theory provides a solution to an outstanding problem in Japanese/Korean syntax. I first illustrate the theory by way of presenting Ko's analysis.

Kuroda (1980) examines the distribution of floating numeral quantifiers in Japanese and presents an argument for scrambling as a movement operation. In (21a, b), numeral quantifiers occur adjacent to the noun phrases they modify.

- (21) a. Gakusei-ga san-nin sake-o nonda
 student-NOM 3-person sake-ACC drank
 'Three students drank sake'
- b. Gakusei-ga sake-o san-bon nonda
 student-NOM sake-ACC 3-bottle drank
 'A student drank three bottles of sake'

The marginality of (22) indicates that the adjacency is indeed required of numeral quantifiers.

- (22) ??Gakusei-ga sake-o san-nin nonda
 student-NOM sake-ACC 3-person drank
 'Three students drank sake'

However, Kuroda notes that (23a) is perfectly grammatical even though the subject intervenes between *sake* and *san-bon* 'three-bottle'.

- (23) a. Sake-o gakusei-ga san-bon nonda
 sake-ACC student-NOM 3-bottle drank
 'A student drank three bottles of sake'
- b. [object_i [TP subject [VP t_i 3-bottle drank]]]

He then argues that (23a) is derived as in (23b) by scrambling, and the example is grammatical because the adjacency holds between the trace of the object and the numeral quantifier.

Kuroda's argument is persuasive, but one question remains in the analysis. That is, it is not clear why (22) cannot be derived by multiple scrambling as in (24).

- (24) [subject_j [object_i [TP t_j 3-person [VP t_i drank]]]]

The question is amplified with the VP-internal subject hypothesis. (22) can then be derived by simply scrambling the object to the edge of ν P as in (25).

(25) $[_{TP} \text{subject}_i [_{\nu P} \text{object}_j [t_i \text{ 3-person } [_{\nu P} t_j \text{ drank}]]]]]$

Ko (2007) shows that Fox and Pesetsky's (2005) theory of linearization provides a solution to this problem. The basic idea of the theory, as noted above, is that the relative word order is fixed once and for all at each spell-out domain, and Ko assumes that ν P is a spell-out domain in Korean and Japanese. Then, in the absence of scrambling, the subject-object-verb order is established as ν P is spelled out. This is illustrated in (26a).

(26) a. $[_{\nu P} \text{subject } [_{\nu P} \text{object } V]] \dots \text{subject} < \text{object} < \text{verb}$
 b. $[_{\nu P} \text{object}_i [\text{subject } [_{\nu P} t_i V]]] \dots \text{object} < \text{subject} < \text{verb}$

If the object is to precede the subject, it must be preposed to the edge of ν P before spell-out as in (26b). In either case, the order established at ν P must be maintained throughout the derivation. Given this, let us reconsider (25), which must be excluded to account for the ungrammaticality of (22). There are two possibilities at the point ν P is spelled out.

(27) a. $[_{\nu P} \text{subject } \text{3-person } [_{\nu P} \text{object } V]] \dots \text{subject} < \text{3-person} < \text{object} < \text{verb}$
 b. $[_{\nu P} \text{object}_i [\text{subject } \text{3-person } [_{\nu P} t_i V]]] \dots \text{object} < \text{subject} < \text{3-person} < \text{verb}$

(27a) obtains if the object is not scrambled to the edge of ν P, and (27b) if it is. Neither yields the order $\text{subject} < \text{object} < \text{3-person} < \text{verb}$. Consequently, if the derivation continues to yield the structure in (24) or (25), a contradiction with linearization arises. Thus, these structures are successfully ruled out.³

³ This account presupposes that the subject cannot be moved across the object to the outer edge of ν P as in (i).

(i) $[_{\nu P} \text{subject}_j [\text{object}_i [t_j \text{ 3-person } [_{\nu P} t_i V]]]]]$

In (i), the subject originates in Spec, ν P and moves to a higher Spec, ν P. Ko (2007) assumes that this type of movement is impossible because movement is attraction by a head. Spec is not included in the search domain of a head and as a result, ν cannot attract the subject to its Spec position. Takita (2010), on the other hand, appeals to Abels' (2003) anti-locality, which excludes movement that merges the moved item to the same head for the second time. In (i), the subject is merged with (a projection of) ν at the initial site and the movement merges it again with (a projection of) the same ν .

What Takita (2010) points out is that Ko’s (2007) analysis outlined above automatically rules out the illicit examples of “proper binding violations.” Let us consider again (15) and (19), repeated below as (28a, b).

- (28) a. * $[[_{CP} \text{Hanako-ga } t_i \text{ iru to}]_j [_{Sooru-ni} [_{TP} \text{Taroo-ga } t_j \text{ omotteiru}]]]$ (koto)
 Hanako-NOM is C Seoul-in Taroo-NOM think fact
 ‘[That Hanako is t_i]_j, in Seoul_i, [Taroo thinks t_j]
- b. * $[_{TP} [_{PRO} t_i \text{ iku koto}]\text{-ga}]_j \text{ Sooru-made}_i \text{ Taroo-ni } t_j \text{ meizirareta}]$
 go N-NOM Seoul-to Taroo-DAT ordered-was
 ‘[To go t_i]_j, to Seoul_i, was ordered Taroo t_j ’

The initial spell-out domain in (28a) may be the ν P in the preposed CP or the preposed CP itself. Whichever it is, the order *Sooru-ni* < *iru* is established at that point. The CP, for example, is as in (29) at the point of spell-out.

- (29) $[_{CP} \text{Sooru-ni}_i [_{TP} \text{Hanako-ga}_j [_{\nu P} [_{VP} t_i t_j \text{ iru}]]]] \text{ to}]$

The surface order is in contradiction with this order, and hence the example is predicted to be ungrammatical. The ungrammaticality of (28b) follows in the same way. The order *Sooru-made* < *iku* is established within the control complement, and the surface order contradicts this.

Takita (2010) demonstrates that the theory of linearization developed by Ko (2007) accounts for a number of other restrictions on Japanese scrambling as well. But even when we restrict our attention to the “proper binding” phenomenon, the analysis outlined above seems to be the only viable option at this point. As the analysis appeals to linearization to account for (28a, b), it denies that there is a syntactic constraint against unbound traces or remnant movement. In the following section, I present a piece of supporting empirical evidence for this approach.

3. Evidence for Takita’s PF Approach and the Generality of Remnant Movement

While the proper binding analysis attributes the ungrammaticality of (28a, b) to unbound traces, Takita’s (2010) PF approach implies that it is due to a failure of linearization between the moved constituent and its predicate. These two analyses could make different predictions with empty operator movement. Constraints on traces should apply in the same way whether

the trace is produced by movement of an overt constituent or by movement of an empty operator. On the other hand, as Takita points out, an empty operator may be exempted from linearization requirements as it lacks phonetic content. In this section, I discuss two cases of empty operator movement, clefts and comparatives, and show that only the PF approach can successfully accommodate the relevant facts.

The empty operator movement analysis of Japanese clefts was first proposed by Hoji (1990). The contrast in (30) shows that Subjacency effects are observed with this construction.

- (30) a. [CP [TP Taroo-ga [CP doroboo-ga e_i genkin-o nusunda to] itta] no]-wa
 Taroo-NOM thief-NOM cash-ACC stole C said C-TOP
 sono ginkoo-kara_i da
 that bank-from Cop.
 ‘It is from that bank that Taroo said that a thief stole cash’
- b. *[CP [TP [DP [TP e_i genkin-o nusunda] doroboo]-ga kinoo taihosareta] no]-wa
 cash-ACC stole thief-NOM yesterday arrested-was C-TOP
 sono ginkoo-kara_i da
 that bank-from Cop.
 ‘*Lit.* It is from that bank that the thief stole cash was arrested yesterday’

The gap is contained within a complex NP in (30b), and the ungrammaticality of the example already suggests that it is derived by movement. Hoji (1990) points out a further contrast between (30b) and (31).

- (31) [CP [TP [DP [TP e_i genkin-o nusunda] doroboo]-ga kinoo taihosareta] no]-wa
 cash-ACC stole thief-NOM yesterday arrested-was C-TOP
 sono ginkoo_i da
 that bank Cop.

The focus is a PP in (30b) whereas it is a DP in the grammatical (31). Hoji then proposes that the two examples have the structures in (32a, b) respectively.

- (32) a. [CP Op_i [TP ... t_i ...] C]-wa PP_i-da
 b. [CP [TP ... *pro*_i ...] C]-wa DP_i-da

That is, a cleft sentence is derived by empty operator movement when the focus is a PP, and it

can involve binding of *pro* when the focus is a DP.⁴

The analysis is confirmed by another contrast shown in (33).

- (33) [CP [TP [DP [TP soko-kara genkin-o nusunda] doroboo]-ga kinoo taihosareta]
 there-from cash-ACC stole thief-NOM yesterday arrested-was
no]-wa sono ginkoo(*-kara) da
C-TOP that bank -from Cop.

This example shows that an overt resumptive pronoun is allowed only with a DP focus. The *pro* in (32b) is then nothing but a covert counterpart of the pronoun in (33). Also, as a pronoun is disallowed in PP clefts, the gap in (32a) cannot be *pro* but must be produced by movement.

Another Japanese construction that involves empty operator movement is comparatives, as demonstrated by Kikuchi (1987). This construction too exhibits clear Subjacency effects, as shown in (34).

- (34) a. Taroo-wa [TP minna-ga [CP Hanako-ga e_i yonda to] omotteiru] yorimo
 Taroo-TOP all-NOM Hanako-NOM read C think than
ooku-no honi-o yonda
 many-GEN book-ACC read
 ‘Taroo read more books than everyone thinks that Hanako read’

⁴ More precisely, a bare DP. Hoji (1990) shows that Case-marked DPs pattern with PPs. The analysis in (32b) is refined by Murasugi (1991). She argues that the *no* in this case is not a C but a pronoun that occurs in examples like (i).

- (i) akai no
 red one
 ‘a red one’

Then, the example is an equative sentence of the form ‘DP = DP’. According to this analysis, the first DP contains a relative clause headed by *no* ‘one’. It is known since Perlmutter (1972) that Japanese relative clauses can have *pro* as the gap and hence, do not exhibit Subjacency effects. This structure is excluded when the focus is a PP or a Case-marked DP because an equative sentence of the form ‘DP = PP’ or ‘DP = DP-Case’ does not make sense. The structure must then be as in (32a) in these cases.

- b. *Taroo-wa [TP Hanako-ga [DP [TP e_i yonda] hito]-o sitteiru] yorimo
 Taroo-TOP Hanako-NOM read person-ACC know than
 ooku-no hon_i-o yonda
 many-GEN book-ACC read
 ‘Lit. Taroo read more books than Hanako knows a person who read’

The gap is contained within a complex NP in (34b), and the example is totally ungrammatical. (35) demonstrates that comparatives do not allow resumptive pronouns, just like PP clefts.

- (35) *Taroo-wa [TP Hanako-ga [DP [TP sore-o yonda] hito]-o sitteiru] yorimo
 Taroo-TOP Hanako-NOM it-ACC read person-ACC know than
 ooku-no hon-o yonda
 many-GEN book-ACC read
 ‘Lit. Taroo read more books than Hanako knows a person who read’

Kikuchi (1987) proposes that the complement of *yorimo* ‘than’ is a CP with an empty operator in its Spec. This is illustrated in (36).

- (36) [CP Op_i [TP ... t_i ...]] yorimo

Given that PP clefts and comparatives are derived by empty operator movement, I next examine examples with the following configurations:

- (37) a. [TP ... [CP₂ Op_i [TP₂ ... [CP₁ t_i ' [TP₁ ... t_i ...]]]]]
 b. [CP₁ t_i ' [TP₁ ... t_i ...]]_j [TP ... [CP₂ Op_i [TP₂ ... t_j ...]]]

In (37a), an empty operator is moved out of CP₁ to the Spec, CP₂ position. Then, in (37b), the lower CP₁ is scrambled out of the higher CP₂ so that the trace of the empty operator becomes unbound. If an unbound trace that results from two applications of scrambling, as in (15), repeated below as (38), is ruled out by the proper binding condition, examples of the form in (37b), which involve operator movement and scrambling, are expected to be illicit as well.

- (38) *[[CP Hanako-ga t_i iru to]_j [Sooru-ni [TP Taroo-ga t_j omotteiru]]] (koto)
 Hanako-NOM be C Seoul-in Taroo-NOM think fact
 ‘[That Hanako is t_i]_j, in Seoul_i, [Taroo thinks t_j ’

On the other hand, if (38) is ruled out because of conflicting linearization requirements, as

Takita (2010) argues, then it would not be surprising if (37b) turns out to be a legitimate configuration. Suppose that the operator is overt. Then, by the CP1 cycle, linear order is fixed so that the operator precedes everything within TP1. This order is preserved when the operator moves to Spec, CP2. But when CP1 is scrambled to the sentence-initial position as in (37b), a contradiction in linearization occurs. On the other hand, it is quite possible that a phonetically null operator does not participate in linearization, as Takita (2010) notes. If this is the case, no contradiction arises in (37b). CP1 can move successive-cyclically so that it is at the left edge in each spell-out domain. This would suffice to guarantee consistency in linearization.

(39b) is a concrete example instantiating (37b), and it is indeed far better than (38).

- (39) a. [TP Taroo-wa [CP [CP Op_i [TP minna-ga [CP Hanako-ga t_i itta to] omotteiru]
 Taroo-TOP all-NOM Hanako-NOM went C think
 no]-wa Sooru-e_i da to] hookokusita]
 C-TOP Seoul-to Cop. C reported
 ‘Taroo reported that it is to Seoul_i that everyone thinks [CP that Hanako went t_i]
- b. ?[CP Hanako-ga t_i itta to]_j [TP Taroo-wa [CP [CP OP_i [TP minna-ga t_j omotteiru]
 Hanako-NOM went C Taroo-TOP all-NOM think
 no]-wa Sooru-e_i da to] hookokusita]
 C-TOP Seoul-to Cop. C reported
 ‘[CP That Hanako went t_i]_j, Taroo reported that it is to Seoul_i that everyone thinks t_j ’

A cleft sentence is embedded in (39a). Then, the most deeply embedded CP, which is a remnant of operator movement, is scrambled to the matrix-initial position in (39b). The example is slightly off, but is in clear contrast with the totally ungrammatical (38).⁵ It then provides support for Takita’s (2010) PF approach to (38), and at the same time, indicates that an empty operator is indeed exempted from linearization.

The following examples with an embedded comparative sentence lead to the same conclusion:

⁵ The example is slightly off, I suspect, because a CP is scrambled out of a wh-island. It indeed has a status similar to (14b).

- (40) a. Taroo-wa [CP Op_i [TP minna-ga [CP Hanako-ga t_i yonda to] omotteiru]] yorimo
 Taroo-TOP all-NOM Hanako-NOM read C think than
 ooku-no hon-o yonda (= (34a))
 many-GEN book-ACC read
 ‘Taroo read more books than everyone thinks that Hanako read’
- b. ?[CP Hanako-ga t_i yonda to]_j [TP Taroo-wa [CP Op_i [TP minna-ga t_j omotteiru]]
 Hanako-NOM read C Taroo-TOP all-NOM think
 yorimo ooku-no hon-o yonda]
 than many-GEN book-ACC read
 ‘[CP That Hanako read t_i]_j, Taroo read more books than everyone thinks t_j ’

A CP remnant of operator movement is scrambled to the sentence-initial position in (40b). It is clearly in violation of the proper binding condition however the condition is formulated. On the other hand, it does not involve contradiction in linearization as long as the empty operator does not participate in the process. Once the empty operator is ignored, the example can be linearized in the same way as more straightforward examples with long-distance scrambling of CP.

It was argued above that (39b) and (40b) constitute evidence for Takita’s (2010) PF approach to (38) over the proper binding analysis of Saito (1985). They are consistent with Müller’s (1996) generalization and Kitahara’s (1997) explanation for it because the remnant CP is created and preposed by two distinct operations, operator movement and scrambling. However, as noted in the preceding section, (19), repeated below as (41), does not fall under Müller’s generalization.

- (41) *[TP [PRO t_i iku koto]-ga_j Sooru-made_i Taroo-ni t_j meizirareta]
 go N-NOM Seoul-to Taroo-DAT ordered-was
 ‘[To go t_i]_j, to Seoul_i, was ordered Taroo t_j ’

The example is produced by scrambling and passive. Hence, Takita’s (2010) analysis in terms of linearization is the only one that can successfully accommodate all the examples in (38)-(41). And the analysis implies that there is no syntactic constraint that prohibits movement of a remnant created by scrambling.

The examples (39b) and (40b), at the same time, provide additional evidence for the radical reconstruction property of Japanese scrambling. The empty operators in these examples clearly must bind their traces at LF for proper interpretation. This is possible only if

the scrambled CP is placed back to a position within the domain of the empty operator. In the following section, I discuss implications of radical reconstruction for the formulation of the Binding conditions and the interpretation of movement chains.

4. Radical Reconstruction and Binding

Sufficient evidence, I believe, was presented for the radical reconstruction property of Japanese scrambling in the preceding sections. Given this, it is somewhat curious that scrambling extends the binding possibility for anaphors as in (42), cited from DeJima (1999).

- (42) a. Taroo-ga_i [CP Hanako-ga_j [CP Ziroo-ga_k zibunzisin-o_{i*,j*,k} hihansita to]
 Taroo-NOM Hanako-NOM Ziroo-NOM self-ACC criticized C
 itta to] omotteiru (koto)
 said C think fact
 ‘Taroo_i thinks [that Hanako_j said [that Ziroo_k criticized self_{i*,j*,k}]]’
- b. Taroo-ga_i [CP Hanako-ga_j [CP zibunzisin-o_{i*,j,k} Ziroo-ga_k *t* hihansita to]
 Taroo-NOM Hanako-NOM self-ACC Ziroo-NOM criticized C
 itta to] omotteiru (koto)
 said C think fact
 ‘Taroo_i thinks [that Hanako_j said [that self_{i*,j,k}, Ziroo_k criticized *t*]]’
- c. Taroo-ga_i [CP zibunzisin-o_{i,j,k} Hanako-ga_j [CP Ziroo-ga_k *t* hihansita to]
 Taroo-NOM self-ACC Hanako-NOM Ziroo-NOM criticized C
 itta to] omotteiru (koto)
 said C think fact
 ‘Taroo_i thinks [that self_{i,j,k}, Hanako_j said [that Ziroo_k criticized *t*]]’

Nakamura (1996) argues that *zibun-zisin* ‘self-self’, as opposed to the long-distance reflexive *zibun* ‘self’, is a (subject-oriented) anaphor that requires a local antecedent. Although the claim is controversial, it is clear that only the local subject qualifies as its antecedent in standard examples like (42a). But when it is scrambled to the initial position of the most deeply embedded CP as in (42b), the middle subject also becomes a possible antecedent. And further scrambling to the initial position of the middle CP makes the antecedent of *zibun-zisin* three-ways ambiguous, including the matrix subject.

If scrambled phrases are reconstructed at LF and the binding conditions apply at this level,

the differences among (42a, b, c) are unexpected. The straightforward prediction is that all three examples are interpreted as (42a) because this is roughly the LF for those examples. (42b, c) clearly show that scrambling has effects on interpretation. Given these examples and (43), among others, I argued in Saito (2003) that Condition (A) is an anywhere condition, as proposed by Belletti and Rizzi (1988).

- (43) Zibunzisin-o_i Taroo-ga_i t_i semeta (koto)
 self-ACC Taroo-NOM blamed fact
 ‘Himself_i, Taroo_i blamed t_i’

The idea was that Condition (A) can be satisfied as the sentence is constructed and the scrambled phrase is preposed. Then, *zibunzisin* in (43) can satisfy the condition before scrambling applies. And in (42c), for example, it can satisfy the condition as it is scrambled and before reconstruction applies. But the conception of Condition (A) as an anywhere condition makes little sense once we accept the reformulation of the binding conditions as interpretive procedures as proposed in Chomsky (1993) and Chomsky and Lasnik (1993). Their formulation of Conditions (A), (B), (C) is shown in (44).

- (44) a. If α is an anaphor, interpret it as coreferential with a c-commanding phrase in D.
 b. If α is a pronominal, interpret it as disjoint from every c-commanding phrase in D.
 c. If α is an r-expression, interpret it as disjoint from every c-commanding phrase.

In this section, I suggest an analysis of the scrambling examples in (42) that is in line with (44). I first discuss Chomsky’s (1993) analysis of reconstruction based on the copy and deletion analysis of movement. Then, I present an analysis for (42), adapting this and Quicoli’s (2008) phase-based application of the binding procedures.⁶

Chomsky (1993) attempts to show that binding conditions apply at LF. In that process, he adopts the copy and deletion analysis of wh-movement, illustrated in (46) for (45a).⁷

- (45) a. Which picture of John did Mary buy

⁶ Reformulations of Binding theory in terms of phase are proposed in Lee-Schoenfeld (2008) and Charnavel and Sportiche (2013) as well. The analysis to be proposed in this paper is incompatible in some respects with the latter, which has many attractive consequences. I leave it for future research to examine whether these incompatibilities are only superficial or more fundamental in nature.

⁷ I ignore the intermediate landing site at the edge of vP for the ease of exposition when it does not play a role in the analysis.

b. Which_x did Mary buy [x picture of Mary]

- (46) a. [Which picture of Mary] John bought [which picture of Mary]
b. [Which [*t* picture of Mary]] John bought [which [*t* picture of Mary]]
c. [Which [~~*t* picture of Mary~~]] John bought [~~which~~ [*t* picture of Mary]]

(45a) is interpreted as in (45b). Wh-movement copies the wh-phrase as in (46a) as the first step toward this interpretation. Then, in each copy, covert raising applies in order to separate *which*, which serves as a wh-operator, and *t picture of Mary*, which is to be interpreted as the object argument of the verb *buy*.⁸ Finally, the argument part is deleted at CP Spec and the operator part is deleted at the object position as in (46c). He argues that this mechanism accounts for the well-known reconstruction phenomenon, illustrated by (47a, b).

- (47) a. Which picture of himself did John buy
b. *Which picture of John_i did he_i buy

These examples have the LFs in (48).

- (48) a. [Which [~~*t* picture of himself~~]] John bought [which [*t* picture of himself]]
b. [Which [~~*t* picture of John_i~~]] he_i bought [which [*t* picture of John_i]]

Consequently, (47a) satisfies Condition (A) and (47b) is in violation of Condition (C) at LF.

Chomsky (1993) extends this analysis to examples like (49a), where wh-movement creates a new binding possibility.

- (49) a. Which picture of himself does John think that Mary bought
b. [Which [~~*t* picture of himself~~]] John thinks [_{CP} [which [~~*t* picture of himself~~]] that Mary bought [which [*t* picture of himself]]]

The straightforward application of the copy and deletion analysis yields (49b), which

⁸ This covert movement itself should be analyzed in terms of copy and deletion. A wh-element contains two parts, one to be interpreted as a wh-operator and the other as a variable. Hence it occupies two positions by wh-movement. The wh-operator part is interpreted at Spec, CP and the variable part at the initial site. Then, the movement in (46b) can be construed as copying, followed by the deletion of the variable part at the landing site and the wh-operator part at the initial site. I continue to indicate a copy of a wh-element that is to be interpreted as a variable by *t*, when there is no room for confusion.

incorrectly predicts the example to be ungrammatical. Chomsky then adopts the anaphor movement analysis illustrated in (50).

- (50) a. [Which picture of himself] John thinks [_{CP} [which picture of himself] that Mary bought [which picture of himself]]
 b. [Which picture of himself] John-himself_i thinks [_{CP} [which picture of himself_i] that Mary bought [which picture of himself]]
 c. [Which [~~*t* picture of himself~~] John-himself_i thinks [_{CP} [~~which~~ [*t* picture of himself_i]] that Mary bought [~~which~~ [*t* picture of himself]]]]
 d. [Which [~~*t* picture of himself~~] John-himself_i thinks [_{CP} [~~which~~ [*t* picture of himself_i]]]_j that Mary bought *t*_j]

Wh-movement takes place successive-cyclically. Then, the wh-movement in (49a) creates (50a) with copying. When *himself* takes the DP *John* as its antecedent, its instance that is in local relation with *John* adjoins to the DP as in (50b). The copy of a wh-phrase in an intermediate Spec, CP is normally deleted as it has no contribution to interpretation. But the deletion is impossible in the case of (50b) because it would make the instance of *himself_i* adjoined to *John* a member of a singleton chain without a theta-position. Consequently, the intermediate copy is retained as in (50c) and then (50d), and the anaphor receives proper interpretation. Based on this analysis, Chomsky proposes that the deletion of intermediate copies and the pied-piped material in an operator position must apply as long as it does not create illicit chains. This guarantees that *John* in (47b) is deleted at Spec, CP and retained within the object so that the example is ruled out by Condition (C).

This analysis, interestingly, does not straightforwardly extend to the similar examples with scrambling in (42). The simpler example in (51) suffices to illustrate this point.

- (51) Taroo-ga_i [_{CP} zibunzisin-o_{i,j} Hanako-ga_j *t* hihansita to] itta (koto)
 Taroo-NOM self-ACC Hanako-NOM criticized C said fact
 ‘Taroo_i thinks [that self_{i,j} Hanako_j criticized *t*’]

Suppose that *zibunzisin* ‘self’ is at the edge of the embedded CP just like the intermediate wh-phrase in (50a). If it adjoins to the antecedent *Taroo*, the following structure is derived:

- (52) Taroo-zibunzisin_i [_{CP} zibunzisin_i [_{TP} Hanako-ga zibunzisin-o hihansita] to] itta

Here, the two instances of *zibunzisin_i* form an A-chain. But this chain does not contain a theta-position. The deletion of the instance in Spec, CP does not help. Further, if *zibunzisin* in

the embedded object position is included in the chain so that there is a theta-position, the chain will be an improper chain of the form A-A'-A. Hence, it is unclear how (51) can be analyzed with anaphor movement.

A more clearly problematic example can be constructed with a quantified DP. Japanese exhibits scope rigidity as in (53).

- (53) Dareka-ga [ni-satu-no hon]-o karidasita
 someone-NOM two-volume-GEN book-ACC checked.out
 'Someone checked out two books' (some > two)

At the same time, it is known since Kuroda (1971) that scrambling yields scope ambiguity. This is shown in (54).

- (54) a. [Ni-satu-no hon]-o_i dareka-ga *t*_i karidasita
 two-volume-GEN book-ACC someone-NOM checked.out
 'Two books, someone checked out *t*' (some > two, two > some)
- b. Nanika-o_i [hutari-no hito]-ga *t*_i katta
 something-ACC two-person-GEN person-NOM bought
 'Something, two people bought *t*' (two > some, some > two)

However, Oka (1990) points out that this effect is confined to clause-internal scrambling. In (55b), for example, *ni-satu-no hon* 'two books' cannot take wide scope over *dareka* 'someone' though it is scrambled to the matrix-initial position out of the embedded CP.

- (55) a. Dareka-ga [_{CP} Hanako-ga [ni-satu-no hon]-o karidasita to]
 someone-NOM Hanako-NOM two-volume-GEN book-ACC checked.out C
 itta
 said
 'Someone said [that Hanako checked out two books]' (some > two)
- b. [Ni-satu-no hon]-o_i dareka-ga [_{CP} Hanako-ga *t*_i karidasita to]
 two-volume-GEN book-ACC someone-NOM Hanako-NOM checked.out C
 itta
 said
 'Two books_i, someone said [that Hanako checked out *t*_i]' (some > two)

This indicates that *ni-satu-no hon* ‘two books’ in (55b) takes embedded scope even though it is scrambled into the matrix clause.

Given this background, let us now consider the crucial example in (56).

- (56) Taroo-ga_i [CP [zibunzisin-no_i ni-satu-no hon-o]_j dareka-ga
 Taroo-NOM self-GEN two-volume-GEN book-ACC someone-NOM
 [CP Hanako-ga t_j karidasita to] itta to] omotteiru (koto)
 Hanako-NOM checked.out C said C think fact
 ‘Taroo_i thinks [that [self’s_i two books]_j, someone said [that Hanako checked out t_j]]’
 (some > two)

The configuration of the example is shown in (57).

- (57) Taroo_i said [CP [self’s_i two books]_j] that [TP someone thinks [CP that Hanako checked out t_j]]]

Zibunzisin-no ni-satu-no hon ‘self’s two books’ is scrambled so that *Taroo* qualifies as the antecedent of *zibunzisin*. At the same time, *ni-satu-no hon* ‘two books’ takes embedded scope, and hence narrow scope with respect to *dareka* ‘someone’, just as in (55b). This state of affairs is not predicted by Chomsky’s (1993) analysis because the scope of ‘self’s two books’ implies that it is deleted at the landing site as in (58).

- (58) Taroo_i-self_i said [CP [~~self’s_i two books~~]] that [TP ... [self’s two books] ...

This deletion should result in a failure for ‘self_i’ to be assigned a theta-role. Then, an alternative analysis should be pursued for examples like (51) and (56).

An analysis of (49a), repeated below as (59), that is in line with Chomsky’s more recent works (2000, 2008) is proposed by Quicoli (2008).

- (59) Which picture of himself does John think that Mary bought

He proposes that the Binding theory applies cyclically at each phase. In the remainder of this section, I first outline his theory and then show that it successfully accommodates the examples of scrambling discussed above.

Let us first consider the simple examples in (60).

- (60) a. John_i recommended himself_i
 b. *John_i recommended him_i

The *vP* phases of these examples are as in (61a, b) respectively.

- (61) a. [_{vP} John_i [_{VP} recommend himself_i]]
 b. [_{vP} John_i [_{VP} recommend him_i]]

Both *himself* and *him* are bound internal to the phase. Hence, these examples can be accounted for if Condition (A) requires anaphors to be bound and Condition (B) prohibits pronouns from being bound within a phase. The analysis can be stated more precisely in terms of transfer operation to the C-I interface. When VP is transferred to the C-I interface upon the completion of the *vP* phase, an anaphor within the VP must be transferred with its reference specified and a pronoun within the VP is transferred with the information that it is disjoint from any c-commanding DP in the phase.^{9, 10}

⁹ I followed Ko (2007) and Takita (2010) above and assumed that when a *vP* phase is completed, all elements within the *vP* is linearized. On the other hand, I assume here as in Chomsky (2000, 2008) that only the complement VP is transferred to the C-I interface. This discrepancy makes sense because fixation of the relative order among the elements in *vP* has no grave consequences whereas phrases at the edge of *vP* can move on and receive interpretation at a position in a higher transfer domain.

¹⁰ Here, I do not discuss Condition (C) in any detail. But I suspect that it can most plausibly be formulated as in (i), departing from Quicoli (2008).

- (i) Condition (C): Interpret a DP α as disjoint from an R-expression β if α c-commands every instance of β in the amalgamated transfer domain of α .
 (the amalgamated transfer domain of α = the amalgamation of all transfer domains up to the one that includes α .)

This formulation successfully distinguishes between (ii) and (iii). (See Lebeaux 1988 and Chomsky 1993 for discussion of these examples.)

- (ii) *Which picture of John_i did [_{TP} he_i like (which picture of John_i)]
 (iii) [_{TP} The picture of John_i seemed to him_i [_{TP} (the picture of John_i) to be attractive]]

The amalgamated transfer domain that includes *he* in (ii) is the TP. As *he* c-commands every instance of *John* in this domain, it is disjoint from *John*. On the other hand, the relevant transfer domain is the matrix TP in (iii). *Him* does not c-command every instance of *John* in this domain and hence, there is no Condition (C) effect in the example.

Quicoli (2008) extends this analysis to (59). The embedded *vP* phase of the example looks like (62a).

- (62) a. [_{VP} [which picture of himself] [Mary [_{VP} buy [which picture of himself]]]]
 b. [_{VP} [which picture of himself] [John_i [_{VP} think [_{CP} [which picture of himself_i] [_{TP} ...

VP is transferred at this point.¹¹ But if the relevant requirement on *himself* is that its reference must be determined by the end of the derivation, it can be left pending because its copy appears in a higher transfer domain. At the matrix *vP* phase, *himself* within the embedded Spec, CP is bound by *John*. Thus, the information on the reference of *himself* can be sent to the C-I interface as the matrix VP is transferred.

Before applying this analysis to the scrambling examples, let us make it a little more precise by adding Chomsky's (1993) theory of chain interpretation to it. I assume, following Chomsky (1993) that *which* in *which picture of himself* is raised covertly as in (63) so that the operator *which* is separated from *t picture of himself*, which serves as an argument.

- (63) [which [*t* picture of himself]]

Then, the configuration in (64a) obtains when the wh-phrase moves to the edge of the embedded *vP*.¹²

- (64) a. [_{VP} [which [*t* picture of himself]] [Mary [_{VP} buy [which [*t* picture of himself]]]]]
 b. [_{VP} [which [*t* picture of himself]] [Mary [_{VP} buy [~~which~~ [*t* picture of himself]]]]]

At this point, the VP is transferred to the C-I interface with the reference of *himself* pending, as Quicoli (2008) proposes. But one more thing needs to be said to make this transfer successful as illustrated in (64b). That is, it is necessary to make sure that *t picture of himself* is interpreted as the object whereas *which* receives no interpretation in the VP. I simply state this as the interpretive procedure in (65).

- (65) a. An argument is interpreted only in a θ -position.

¹¹ In (62a) and subsequent examples, the shaded part indicates the domain that is transferred to the C-I interface.

¹² Here, I assume the single cycle model of Bobaljik (1995), where covert movement applies concurrently with overt movement as structures are constructed. Thus, the covert raising of *which* applies prior to the overt movement of the wh-phrase to the edge of *vP* in (64).

- b. An operator is interpreted only in a criterial operator position.

Given this, *which* receives no interpretation in the VP in (64) because it is not in a criterial position for a wh-operator in the sense of Rizzi (2010). On the other hand, *t picture of himself* is interpreted as the object of the verb *buy*.

The wh-phrase *which picture of himself* moves on to the edge of the embedded CP as in (66).

- (66) [CP [which [*t picture of himself*]]] [TP Mary [_{VP} [~~which [*t picture of himself*]]] [Mary [_{v'} v [_{VP} ...~~

The embedded TP is transferred to the C-I interface at this point. The wh-phrase at the edge of _{vP} receives no interpretation because *which* is not in a wh-operator position and *t picture of himself* is not in a θ -position. (67) obtains after the wh-phrase moves to the edge of the matrix _{vP}.

- (67) [_{VP} [which [*t picture of himself*]]] [John_i [_{VP} think [CP [~~which [*t picture of himself*]]_i]]] [TP ...~~

As the VP is transferred to the C-I interface, *himself* picks up its reference from *John* as Quicoli (2008) proposes. At the same time, neither *which* nor *t picture of himself* receives an interpretation at the edge of the embedded CP because of (65). Finally, the wh-phrase moves to the edge of the matrix CP as in (68).

- (68) [CP [which [~~*t picture of himself*~~]]] [TP John [_{VP} [~~which [*t picture of himself*]]] [John [_{v'} v [_{VP} ...~~

The wh-phrase at the edge of _{vP} receives no interpretation for reasons that should be clear by now. At the edge of the matrix CP, *t picture of himself* again receives no interpretation because it is not in a θ -position, but *which* is interpreted as a wh-operator according to (65b). It is in a criterial position for an interrogative operator. Thus, an operator-variable chain is successfully formed as illustrated in (69).

- (69) [CP [which [~~*t picture of himself*~~]]] [TP .. [CP .. [TP .. [_{VP} buy [which [*t picture of himself*]]]]]]]]]]

The analysis for (59) just illustrated is basically Quicoli's (2008). But the added (65) makes it possible to account for the scrambling example (51), repeated below as (70), in a

way that is consistent with the radical reconstruction property of scrambling.

- (70) Taroo-ga_i [CP zibunzisin-o_{i,j} Hanako-ga_j *t* hihansita to] itta (koto)
 Taroo-NOM self-ACC Hanako-NOM criticized C said fact
 ‘Taroo_i thinks [that self_{i,j} Hanako_j criticized *t*]

The embedded vP is formed as in (71).

- (71) [_{vP} zibunzisin-o [Hanako-ga [_{v'} [_{vP} zibunzisin-o hihansita] v]]]

The VP is transferred to the C-I interface at this point. *Zibunzisin* ‘self’ receives interpretation as the object of *hihansita* ‘criticized’ because it is an argument in a θ -position. It can pick up reference from *Hanako* at the same time, but can also leave the reference pending because a copy appears in a higher transfer domain. Next, *zibunzisin* moves to the edge of the embedded CP as in (72a) and then the matrix vP is formed as in (72b).

- (72) a. [CP zibunzisin-o [TP Hanako-ga [_{vP} zibunzisin [Hanako-ga [_{v'} [_{vP} ...] v] ...]
 b. [_{vP} Taroo-ga [_{v'} [_{vP} [CP zibunzisin-o [TP ...]] itta] v]]

Zibunzisin at the edge of vP in (72a) receives no interpretation when the shaded TP is transferred to the C-I interface, as it is neither in a θ -position nor in a criterial operator position. It does not receive an interpretation when the VP in (72b) is transferred, for the same reason. But it can pick up its reference from *Taroo* as part of the transfer. Thus, the ambiguity of *zibunzisin* in (70) follows.

The analysis of (70) outlined above is consistent with the radical reconstruction property of scrambling because *zibunzisin* can pick up its reference from *Taroo* and yet it is interpreted only at the initial site. Before concluding this section, I apply the mechanism to (13b), the original example that motivated radical reconstruction, in order to confirm this. (13b) is repeated below as (73).

- (73) [Dono hon-o_i [TP Taroo-ga [CP [TP Hanako-ga *t*_i yonda] ka] siritagatteiru]]
 which book-ACC Taroo-NOM Hanako-NOM read Q want to know
 (koto)
 fact
 ‘[Which book_i, Taroo wants to know [Q [Hanako read *t*_i]]]’

The derivation is illustrated phase by phase in (74).

- (74) a. [_{VP} [dono [*t* hon]]-o [Hanako-ga [_v [_{VP} [~~dono~~ [*t* hon]]-o yonda] v]]]
- b. [_{CP} [dono [*t* hon]]-o [C' [_{TP} Hanako-ga [_v [_{VP} [~~dono~~ [*t* hon]]-o [Hanako-ga [_v [_{VP} ...] v]]] ka]]]
- c. [_{VP} [dono [*t* hon]]-o [Taroo-ga [_v [_{VP} [_{CP} [dono [*t* hon]]-o [C' [_{TP} ...] ka] siritagatteiru] v]]]]]
- d. [_{CP} [~~dono~~ [*t* hon]]-o [_{TP} Taroo-ga [_v [_{VP} [~~dono~~ [*t* hon]]-o [Taroo-ga [_v [_{VP} ...] v]]]]]]]

In (74a), *dono hon-o* ‘which book-ACC’ moves to the edge of the embedded vP. Only the argument part, [*t hon-o*], is interpreted as the object of the verb *yonda* ‘read’. In (74b), the wh-phrase moves to the edge of the embedded CP. The copy receives no interpretation at the edge of the embedded vP as it is neither a θ -position nor a criterial operator position. The wh-phrase moves on to the edge of the matrix vP in (74c). At this point, *dono* ‘which’ is interpreted as a wh-operator at the edge of the embedded CP as it is in a criterial interrogative operator position.¹³ Finally, the wh-phrase reaches the final landing site, the edge of the matrix CP, in (74d). Neither the operator part *dono* nor the argument part *t hon-o* receives interpretation at the edges of the matrix CP and vP because these positions are not θ -positions or criterial interrogative operator positions. Thus, the scrambling from the edge of the embedded CP to the matrix initial position is semantically vacuous.

In this section, it was shown that Quicoli’s (2008) phase based binding theory, augmented by a mechanism of chain interpretation, successfully accounts for the fact that scrambling extends the binding possibility of local reflexives in a way that is consistent with its radical reconstruction property. In the following section, I suggest that the same mechanism provides an account for an outstanding problem with the scope of pied-piped wh-phrases in English.

5. The Anti-Reconstruction Phenomenon of Pied-Pied Wh-Phrases

In Sections 1 and 2, I touched on the apparent proper binding effects observed with English wh-movement. The relevant examples, (6) and (12b), are repeated below as (75a, b) respectively.

- (75) a. *[Which picture of t_i]_j does John wonder who_i Mary liked t_j
 b. ??[Which picture of whom]_i does John wonder who_j t_j bought t_i

¹³ This assumes, following Huang (1982), Lasnik and Saito (1984), Richards (2001), among others, that Japanese wh’s are interrogative operators. The analysis is in accord with the claim of Kuroda (1988) and Takahashi (1994) that scrambling of a wh-phrase to its scope position counts as wh-movement.

Although *who* fails to bind its trace in (75a), the example is interpreted as in (76) with reconstruction.

(76) Which_j John wonders who_i Mary liked [_{t_j} picture of _{t_i}]

As the operator-variable relations in (76) are legitimate, it is not obvious why (75a) should be totally ungrammatical. (75b) is a covert counterpart of (75a). The example is a Subjacency violation but it still allows the interpretation with *whom* taking matrix scope. What it resists is the reading in which *whom* takes embedded scope. This fact, too, is puzzling because *picture of whom* should reconstruct as in (77).

(77) Which_i John wonders who_j _{t_j} bought [_{t_i} picture of whom]

Both (75a) and (75b) appear to be illicit examples of remnant movement. A remnant [*which picture of t*] moves in (75a), and [*which picture of whom*] in (75b) is also a remnant of covert movement, if *whom* moves covertly to the edge of the embedded CP when it takes scope at that position. Thus, the examples pose a potential problem for the hypothesis that there are no constraints that specifically ban unbound traces or remnant movement. In this section, I suggest a solution to this problem. I argue that the ungrammaticality of (75a) as well as the scope property of (75b) can be analyzed on the basis of the chain interpretation mechanism considered in the preceding section.¹⁴

Let us first take a closer look at the derivation of (75b). The embedded *vP* phase is formed as in (78).

(78) [_{vP} [whom_i [which_j [_{t_j} picture of _{t_i}]]] [who [_v [_{vP} bought [whom_i [which_j [_{t_j} picture of _{t_i}]]]]]]]]]

¹⁴ The ungrammaticality of (75a) may follow from the linearization mechanism discussed in Section 2 under the plausible assumption that DP is a spell-out domain. As *who* is extracted out of [*which picture of who*], it first has to move to the edge of the DP as in (i).

(i) [_{DP} who_i [which [_{NP} picture of _{t_i}]]]

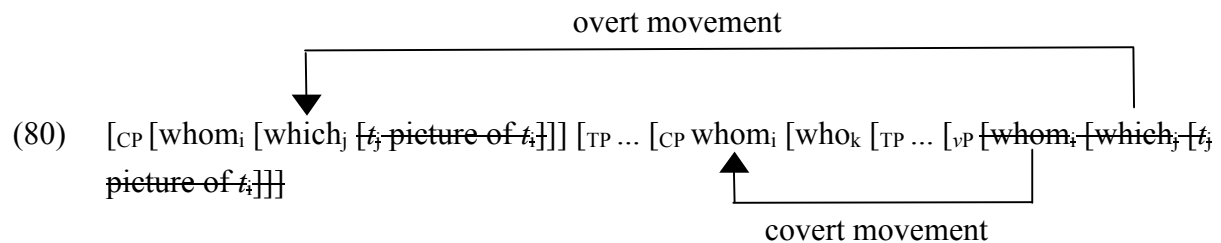
If linearization applies at this point, the order ‘*who* < *which*’ is established. As (75a) contradicts this, the example is ruled out exactly as the apparent proper binding violations with scrambling. However, I do not pursue this analysis because it does not extend to (75b). In this example, *whom* remains in situ and the order ‘*which* < *whom*’ is preserved throughout the derivation.

Whom and *which* are raised covertly so that the wh-operators and [*t picture of t*], which is interpreted as the object, are separated in the wh-phrase. Then, the wh-phrase moves to the edge of the embedded vP. As the VP is transferred to the C-I interface, only the argument, [*t picture of t_i*], is interpreted in the object position. The wh-phrase then moves to the edge of the matrix vP and on to the edge of the matrix CP. This yields the configuration in (79).

(79) [CP [whom_i [which_j [~~t_j picture of t_j~~]]] [TP John [vP [whom_i [which_j [~~t_j picture of t_j~~]]] [John
[v [VP ...

Here, note the interpretation that the wh-phrase receives at the edge of the CP. Since it is a criterial interrogative operator position, both *whom* and *which* should be interpreted as wh-operators whereas the argument, *t_j picture of t_i*, receives no interpretation. Thus, the chain interpretation mechanism entertained in the preceding section predicts correctly that *whom* takes matrix scope in (75b).

It should be noted that a slightly more complex analysis is required if covert movement is assumed for wh-phrases in situ. Under this assumption, the initial *whom* in (78) covertly moves to the edge of the embedded CP when it takes embedded scope. Then, the following configuration obtains:¹⁵

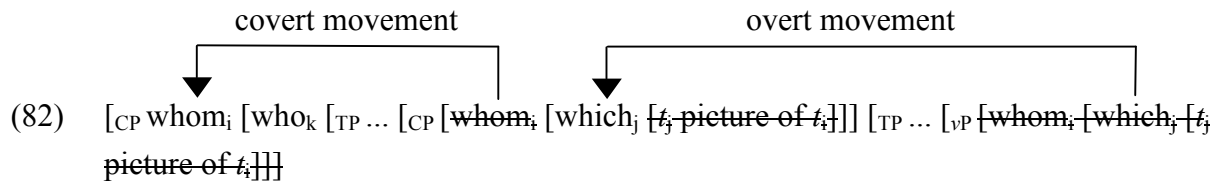


This configuration may be ruled out on the basis that *whom* receives interpretation as a wh-operator in two distinct positions, the edges of the matrix and embedded CPs. But a complication arises when the example is compared with van Riemsdijk and William’s (1981) (12a), repeated below as (81).

(81) Who_i t_i wonders [which picture of whom]_j Mary bought t_j

In this example, *whom* can take matrix scope as well as embedded scope. This indicates that the following configuration is legitimate:

¹⁵ More precisely, the wh-phrase moves overtly to the edge of the matrix CP through the edge of the matrix vP. I ignored the intermediate landing site in (80) because it is not important for the discussion.



That is, *whom* at the edge of the embedded CP can covertly move to the edge of the matrix CP and be interpreted only at the final landing site.

What distinguishes (80) and (82) is that the two instances of *whom* at the edges of the matrix and embedded CPs are parts of a single chain in the latter whereas they head their respective chains in the former. Then, (83) allows us to permit (82) and at the same time, to make the account for the illicit (80) precise.

(83) An operator must be interpreted in a criterial operator position if it heads a chain.

In (80), the two instances of *whom* head chains, and hence must both be interpreted as wh-operators. On the other hand, only *whom* at the edge of the matrix CP heads a chain in (82). The one at the edge of the embedded CP, then, need not receive interpretation.

Although (83) is a stipulation, it seems to be in line with the phase theory. Let us consider the two configurations in (84), where the edge of CP is a criterial interrogative operator position.

- (84) a. [VP wh_i ... [VP ... [CP wh_i [TP ...
 b. [VP [VP ... [CP wh_i [TP ...

In both cases, VP is transferred to the C-I interface. In the case of (84a), there is a copy of the wh in the higher transfer domain. Hence, the interpretation of the wh can wait and need not take place at the edge of the CP. On the other hand, there is no such option in the case of (84b). If the wh does not receive interpretation at the edge of the CP, it never will. Thus, it is plausible that (83) is part of the phase-based interpretive mechanism. The situation is in fact somewhat similar to that of anaphor interpretation discussed above.

- (85) a. [VP ... [... self ...]_i ... [VP ... [... self ...]_i ...
 b. [VP [VP ... [... self ...]_i ...

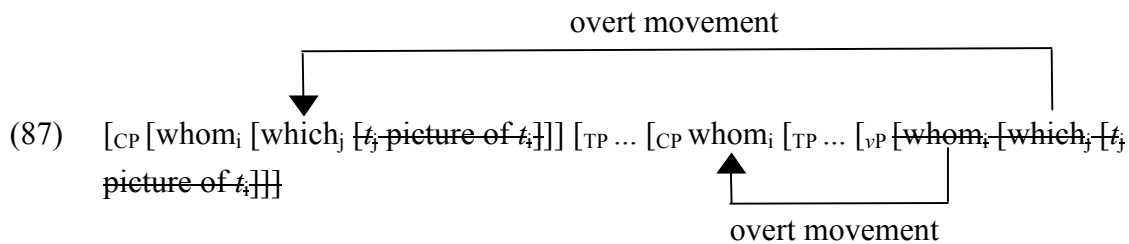
In the case of (85a), the reference of the anaphor can be left pending when the VP is transferred to the C-I interface because there is a copy in the higher transfer domain. On the

other hand, it must be determined in the case of (85b) as the anaphor will not be able to pick up its reference later in the derivation.

The analysis just outlined for (75b) also accounts for the ungrammaticality of (75a), repeated below as (86).

(86) *[Which picture of t_i]_j does John wonder who_i Mary liked t_j

The example is derived as in (87).



The only notable difference between (80), the derivation of (75b) for *whom* taking embedded scope, and (87) is that the movement of *whom* to the edge of the embedded CP is covert in the former whereas it is overt in the latter. But this difference does not affect the interpretation of *whom*. Just as in (80), *whom* receives interpretation as an interrogative operator at the edges of both the matrix and embedded CPs in (87). The example is excluded because a *wh* cannot take scope at two distinct positions. Thus, the ungrammaticality of (86) and the scope property of *whom* in (75b) receive a uniform analysis.

6. Conclusion

As reviewed in Section 2, there are abundant cases of illicit remnant movement that proposes a remnant created by scrambling. In Section 3, I presented a new piece of evidence for their analysis by Takita (2010) in terms of linearization. One of the crucial examples, (40b), is repeated below as (88).

(88) ?[CP Hanako-ga t_i yonda to]_j [TP Taroo-wa [CP Op_i [TP minna-ga t_j omotteiru]]
 Hanako-NOM read C Taroo-TOP all-NOM think
 yorimo ooku-no hon-o yonda]
 than many-GEN book-ACC read
 ‘[CP That Hanako read t_i]_j, Taroo read more books than everyone thinks t_j ’

I argued that examples of this kind can be accommodated under Takita's PF approach but not under the proper binding analysis. This supports his claim that there are no syntactic constraints, such as the proper binding condition, against remnant movement.

Examples like (88) provide additional evidence for the radical reconstruction property of Japanese scrambling. The preposed CP in (88) must reconstruct so that Op binds its trace. In Section 4, I presented an analysis for examples such as (51), repeated below as (89), where scrambling extends the binding possibility of a local reflexive.

- (89) Taroo-ga_i [CP zibunzisin-o_{i,j} Hanako-ga_j *t* hihansita to] itta (koto)
 Taroo-NOM self-ACC Hanako-NOM criticized C said fact
 'Taroo_i thinks [that self_{i,j} Hanako_j criticized *t*']

This is unexpected if *zibunzisin* 'self' reconstructs and the Binding theory applies at LF. I argued that Quicoli's (2008) phase-based Binding theory, augmented by a chain interpretation mechanism, allows the explanation of (89) in a way that is consistent with the radical reconstruction property of scrambling.

Finally, in Section 5, I considered the scope property of *wh*-in-situ in examples such as (75b), repeated below as (90).

- (90) ??[Which picture of whom]_i does John wonder who_j *t*_j bought *t*_i

As discussed in detail, *whom* can only take matrix scope and cannot have embedded scope in this example. This may be regarded as a "proper binding effect" because if *whom* covertly moves to the edge of the embedded CP, it fails to bind its trace. But the analysis is untenable if *picture of whom* is reconstructed as widely assumed. It appears then that a stipulation must be made to ban the movement of a remnant created by covert *wh*-movement. I suggested that the phase-based interpretive mechanism of chains, proposed in Section 4, makes it possible to provide an alternative account for the example without making this stipulation.

As noted at the outset of this paper, the apparent proper binding effects and the radical reconstruction property have been considered major characteristics of Japanese scrambling and have been discussed extensively in the literature. If the proposals in this paper are on the right track, the former provides important data for the examination of linearization as Takita (2010) argues, and the latter can be employed to investigate the precise formulation of the Binding theory and the chain interpretation mechanism.

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