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Complexity and Coreference in Grammar: A Study of Condition C Effects

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1. Introduction

Lakoff (1968) discovers the following important contrast:

(1) a. *Near John$_i$, he$_i$ saw a snake.
b. *In John$_i$'s room, he$_i$ smokes pot. (Lakoff 1968, p. 2)

(2) In the apartment, which John$_i$ rents, he$_i$ smokes pot. (Lakoff 1968, p. 3)

As shown above, the pronoun *he* cannot be coreferential with the R-expression *John* in (1a-b) (cf. Langacker 1966, Ross 1967). In (2), however, the subject pronoun *he* may be coreferential with the name *John*. Since Lakoff (1968), the nature of the data like these has been discussed by Wasow (1972, 1979), Reinhart (1976, 1981), van Riemsdijk and Williams (1981), Guéron (1984), Freidin (1986), Lebeaux (1988, 1990), Saito (1991), Chomsky (1993), Chomsky and Lasnik (1993), Lasnik (2009), among others.

In this paper, I aim to suggest that Reinhart's (1976, 1981) complexity-based analysis of the contrast between (1a-b) and (2) seems to have some interesting features, given recent proposals by Hawkins (1994, 2004, 2014), Phillips (1996), Kempson et al. (2001), Hofmeister and Sag (2010), etc. (cf. the Subjacency Condition). To attain this aim, first, I show how Saito (1991) accounts for examples such as (1a-b) and (2) based on a well-known generalization by van Riemsdijk and Williams (1981), etc. In section 3, however, I attempt to point out that although van Riemsdijk and Williams' (1981)/Saito's (1991) account based on the generalization appears to be plausible, there still remain some potential problems for it. In section 4, I try to suggest a complexity-based analysis of coreference possibilities which incorporates into Reinhart's (1976, 1981) account, Hawkins' (1994, 2004, 2014) insight into the nature of competence and performance (cf. Chomsky 1965, 1981, 1993, Phillips 1996, Kempson et al. 2001, Hofmeister and Sag 2010, etc.). In section 5, I conclude the discussion of this paper.

2. Generalizations by van Riemsdijk and Williams (1981), Saito (1991), etc.

Reinhart (1976, 1981) reinforces Lakoff's (1968) contrast between (1a-b) and (2) by showing the following data:

(3) a. *In Ben$_i$'s box, he$_i$ put his cigars.
b. *In Ben$_i$'s most precious Chinese box, he$_i$ put his cigars. (Reinhart 1976, 1981, p. 632, Saito 1991 p. 470)

(4) a. In some of Ben$_i$'s boxes, he$_i$ put cigars.
b. In which of Ben$_i$'s boxes did he$_i$ put cigars?

c. In the box that Ben$_i$ brought from China, he$_i$ put cigars. (Reinhart 1976, 1981, p. 632, Saito 1991 p. 470)

In (3a-b), the pronoun *he* cannot be coreferential with the R-expression *Ben*, as in (1a-b). In (4a-c), on the other hand, the pronoun *he* can be coreferential with the name *Ben*, as in (2).

Given the data like (1a-b), (2), (3a-b) and (4a-c), van Riemsdijk and Williams (1981), Saito (1991), among others, suggest a generalization like the one in (5). (5) is cited from Saito (1991, p. 471), and just for ease of exposition, I use generalization (5) in this paper. See van Riemsdijk and Williams (1981, p. 202, p. 204) for their generalization, which is basically the same as (5).

(5) The following S-structure configuration is ill-formed:
[$_{XP}$ … R-expression$_i$ …]$_j$ [$_{YP}$ … pronoun$_i$ … t_j …] (order irrelevant), where
(a) XP A'-binds the trace,
(b) the pronoun c-commands the trace, and
(c) the R-expression is not 'deeply embedded' in XP. (Saito 1991, p. 471)

To see how van Riemsdijk and Williams' (1981)/Saito's (1991) analysis accounts for the grammaticality of the data above under generalization (5), consider first the S-structure representations in (6a-b) and (7). (6a-b) and (7) are for Lakoff's (1968) examples in (1a-b) and (2), respectively:

(6) a. *[Near John$_i$]$_j$, he$_i$ saw a snake t_j. (for 1a)
b. *[In John$_i$'s room]$_j$, he$_i$ smokes pot t_j. (for 1b)

(7) [In the apartment, which John$_i$ rents]$_j$, he$_i$ smokes pot t_j. (for 2)

In (6a-b), the preposed constituents, [*Near John*] and [*In John's room*], A'-bind their traces, satisfying the condition in (5a). In addition, the pronoun *he* in (6a-b) binds the trace in accordance with condition (5b). Furthermore, the R-expression *John* is not 'deeply embedded' inside the preposed constituents in (6a-b), meeting the condition in (5c). Consequently, (6a-b) are both correctly ruled out under generalization (5).

On the other hand, in (7), the fronted constituent [*In the apartment, which John rents*] binds its trace in an A'-position, in line with the condition in (5a). Moreover, the subject pronoun *he* binds the trace, meeting condition (5b). In (7), however, the name *John* is 'deeply embedded' in the preposed constituent. Hence, (7) does not satisfy the condition in (5c) unlike (6a-b). Under van Riemsdijk and Williams' (1981)/Saito's (1991) generalization in (5), it is thus correctly predicted that (7) is well-formed, and the pronoun *he* is allowed to be coreferential with the R-expression *John*.

Examine next the S-structure configurations in (8a-b) and (9a-c). (8a-b) and (9a-c) are for Reinhart's (1976, 1981) examples in (3a-b) and (4a-c), respectively.

(8) a. *[In Ben$_i$'s box]$_j$, he$_i$ put his cigars t_j. (for 3a)
b. *[In Ben$_i$'s most precious Chinese box], he$_i$ put his cigars t_j. (for 3b) (Saito 1991, p. 471)
(9) a. [In some of Ben$_i$'s boxes], he$_i$ put cigars t_j. (for 4a)
b. [In which of Ben$_i$'s boxes] did he$_i$ put cigars t_j? (for 4b)
c. [In the box that Ben$_i$ brought from China], he$_i$ put cigars t_j. (for 4c) (Saito 1991, p. 471)

In (8a-b), the preposed elements, [*In Ben's box*] and [*In Ben's most precious Chinese box*], A'-bind their traces, meeting the condition in (5a). The pronoun *he* in (8a-b) binds the trace of the fronted PP as well, in accordance with

(5b). Moreover, the R-expression *Ben* is not 'deeply embedded' inside the preposed constituents in (8a-b), meeting the last condition in (5). Hence, under the generalization by van Riemsdijk and Williams (1981)/Saito (1991), (8a-b) are correctly ruled out.

In contrast, in (9a-c), the preposed constituents, [*In some of Ben's boxes*], [*In which of Ben's boxes*] and [*In the box that Ben brought from China*], bind their own traces in A'-positions, in keeping with condition (5a). In addition, the pronoun *he* in the subject position in (9a-c) binds the trace, in line with (5b). In (9a-c), however, the R-expression *Ben* is 'deeply embedded' inside the preposed PPs without meeting the final condition in (5). Under generalization (5), it is thus correctly predicted that (9a-c) are all grammatical, and that the subject pronoun *he* is permitted to be coreferential with the name *Ben*, as desired.

Furthermore, Saito (1991) claims that the generalization in (5) can also account for the contrast below, discovered by Reinhart (1976, 1981):

(10)a. *After days of search, they finally found him$_i$ in Dr. Levin$_i$'s hotel room.
b. After days of search, they finally found him$_i$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name. (Reinhart 1976, 1981, p. 633, Saito 1991, p. 472)

Observe that in (10a), the R-expression *Dr. Levin* is not deeply embedded within the PP [*in Dr. Levin's hotel room*] as the R-expression in (1a-b) and (3a-b). As in (1a-b) and (3a-b), the object pronoun *him* cannot be coreferential with the full NP. In (10b), however, the name *Dr. Levin* is 'deeply embedded' inside [$_{PP}$ *in a sleazy hotel room that Dr. Levin had rented under a false name*] as the name is in (2) and (4a-c). Significantly, as in (2) and (4a-c), the pronoun *him* may be coreferential with the name in (10b).

To explain the contrast between (10a) and (10b) under generalization (5), Saito (1991) adopts another generalization in (11) which concerns the nature of rightward movement.

(11) In the configuration, [$_{IP}$ NP [$_{VP}$ V NP XP]],
(a) the XP can be moved rightward string-vacuously, and
(b) by such rightward movement, the XP can escape the c-command domain of the object NP, but not that of the subject NP. (Saito 1991, p. 470, p. 473)

Keeping generalizations (5) and (11) in mind, consider now the S-structures below that Saito (1991) proposes for examples (10a-b):

(12)a. *After days of search, [$_{IP}$ they finally [$_{VP}$ found him$_i$] t_j [$_{PP}$ in Dr. Levin$_i$'s hotel room]$_j$]. (for 9a)
b. After days of search, [$_{IP}$ they finally [$_{VP}$ found him$_i$] t_j [$_{PP}$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name]$_j$]. (for 9b) (Saito 1991, p. 473)

Given (11a), [$_{PP}$ *in Dr. Levin's hotel room*] in (10a) and [$_{PP}$ *in a sleazy hotel room that Dr. Levin had rented under a false name*] in (10b) are both allowed to undergo string-vacuous rightward movement as illustrated in (12a-b). Consequently, the PP [*in Dr. Levin's hotel room*] in (12a) and the PP [*in a sleazy hotel room that Dr. Levin had rented under a false name*] in (12b) are located outside the c-command domain of the object pronoun *him*, in accordance with (11b).

Under Saito's (1991) proposal, generalization (5) then rules out (12a) and rules in (12b). This is so, because in (12a), [$_{PP}$ *in Dr. Levin's hotel room*]$_j$ A'-binds the trace t_j, and the object pronoun *him* also binds the trace, satisfying the conditions in (5a-b). Furthermore, the R-expression *Dr. Levin* is not 'deeply embedded' inside the PP, in line with

(5c). Saito's analysis thus accounts for the ungrammaticality of (12a) under generalizations (5) and (11).

On the other hand, in (12b), [$_{PP}$ *in a sleazy hotel room that Dr. Levin had rented under a false name*]$_j$ A'-binds the trace t_j in keeping with condition (5a). Moreover, the pronoun *him* in the object position binds the trace in (12b). However, in (12b), the name *Dr. Levin* is 'deeply embedded' inside the PP, and thus, (12b) does not satisfy condition (5c). Accordingly, Saito's account rules in (12b) as desired, by appealing to generalizations (5) and (11).

Saito's (1991) analysis based on generalizations (5) and (11) also correctly rules out the following example discovered by Reinhart (1976, 1981):

(13) *After days of search, he$_i$ was finally found in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name. (Reinhart 1976, 1981, p. 633, Saito 1991, p. 473)

In (13), the R-expression *Dr. Levin* is 'deeply embedded' inside the PP as in (10b/12b). However, in (13), the subject pronoun *he* is not allowed to be coreferential with the R-expressoin *Dr. Levin* (cf. 1a-b vs. 2; 3a-b vs. 4a-c; 10a vs. 10b). A question thus arises as to why (13) is ill-formed (cf. 10b).

Saito (1991, pp. 473-474) accounts for the ungrammaticality of (13) as follows:

(14)a. *After days of search, [$_{IP}$ he$_i$ was finally [$_{VP}$ found [$_{PP}$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name]]

b. *After days of search, [$_{IP}$ he$_i$ was finally [$_{VP}$ found t_j]
[$_{PP}$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name]]

If the prepositional phrase [*in a sleazy hotel room that Dr. Levin had rented under a false name*] does not move in (13), the S-structure configuration of (13) is the one in (14a). In this case, generalization (5) has nothing to do with (14a), because there is no A'-binder of its own trace (see 5a). In (14a), the subject pronoun *he* A-binds the name *Dr. Levin*. Consequently, representation (14a) is ruled out by Condition C of the Binding Theory, which bans an R-expression from being A-bound (Chomsky 1981, p. 188).

If, on the other hand, [$_{PP}$ *in a sleazy hotel room that Dr. Levin had rented under a false name*] undergoes string-vacuous rightward movement in line with (11a), the S-structure configuration of (13) is the one in (14b). According to condition (11b), by such rightward movement, the PP can get out of the c-command domain of the object NP (see 12a-b), but cannot be outside the c-command domain of the subject pronoun *he* in (14b). Hence, generalization (5) is irrelevant to representation (14b), either, because the A'-binder does not c-command the pronoun *he* (see the configuration in 5). In (14b), the pronoun *he* in the subject position also A-binds the R-expression *Dr. Levin* as in (14a), violating Condition C of the Binding Theory. Consequently, Saito (1991) successfully accounts for the ungrammaticality of Reinhart's example in (13) as well, under generalizations (5) and (11).

In this section, I have shown how Saito (1991) accounts for the data such as (1a-b), (2), (3a-b), (4a-c), (10a-b) and (13) by appealing to the well-known generalizations in (5) and (11) (cf. Wasow 1972, 1979, van Riemsdijk and Williams 1981, etc.). In the following section, however, I attempt to show that there appear to be some potential problems for the analysis presented in this section.

3. Potential Problems for van Riemsdijk and Willams' (1981)/Saito's (1991) Analysis

As I have shown in the previous section, Saito's (1991) analysis based on generalizations (5) and (11) appears to be a plausible one. The account, however, does not seem to be free from problems. First, consider the examples in (15) and (16), which are derived from Reinhart (1976, 1981, p. 633).

(15)a. *He$_i$ finally divorced Sonya, [$_{PP}$ since Hirschel$_i$'s favorite dish was the only one she did not know how to cook].

b. He$_i$ finally divorced Sonya, [$_{PP}$ since the dish Hirschel$_i$ liked most of all was the only one she did not know how to cook]. (Reinhart 1976, 1981, p. 633)

(16)a. *He$_i$ was considered divine [$_{PP}$ in the Maharaj Ji$_i$'s hometown].

b. He$_i$ was considered divine [$_{PP}$ in all the towns the Maharaj Ji$_i$ visited]. (Reinhart 1976, 1981, p. 633)

Reinhart (1976, 1981, p. 633) observes that the pronoun in the subject position cannot be coreferential with the full NP *Hirschel* in (15a), but that such coreference between the subject pronoun *He* and the R-expression *Hirschel* is possible in (15b). In (15a), the R-expression *Hirchel* is not 'deeply embedded,' whereas in (15b), the name is 'deeply embedded.' Similarly, Reinhart (1976, 1981, p. 633) observes that the pronoun *He* in the subject position cannot be coreferential with the name *the Maharaj Ji* in (16a), but such coreference is allowed in (16b). In (16a), the full NP *the Maharaj Ji* is not 'deeply embedded,' while it is 'deeply embedded' in (16b). Reinhart (1976) thus points out that the contrast between (15a)/(16a) and (15b)/(16b) is the same one between (10a) and (10b).

Here, notice that it does not seem to be possible for us to extend Saito's (1991) analysis of (10a) and (10b) directly to (15a)/(16a) and (15b)/(16b): (i) (10a-b) contain the pronoun in the object position, whereas (15a-b) and (16a-b) involve the pronoun in the subject position; (ii) as Reinhart (1976, 1981, p. 633) suggests, [$_{PP}$ *in Dr. Levin's room*] in (10a) and [$_{PP}$ *in a sleazy hotel room that Dr. Levin had rented under a false name*] in (10b) are constituents inside VP. On the other hand, [$_{PP}$ *since Hischel's favorite dish was the only one she did not know how to cook*] in (15a) and [$_{PP}$ *since the dish Hirschel liked most of all was the only one she did not know how to cook*] in (15b) are constituents at the sentential level. Likewise, [$_{PP}$ *in the Maharaj Ji's hometown*] in (16a) and [$_{PP}$ *in all the towns the Maharaj Ji visited*] in (16b) are constituents at the sentential level.

Notice further that Saito's (1991) generalization in (11) concerns XP, which is a constituent within VP. Hence, in order to extend Saito's (1991) rightward movement analysis of (10a)/(10b) to the contrast between (15a)/(16a) and (15b)/(16b), we have to revise generalization (11) in such a way that rightward movement could apply to sentential level elements as well. However, it does not seem that there is any independent evidence for such a rightward movement operation by subordinate clauses such as the *since* clauses in (15a-b).

Second, consider the data below, discovered by Lakoff (1968) and Akmajian and Jackendoff (1970) (cf. Wasow 1972, 1979, Reinhart 1976, 1981, pp. 629-630, etc.).

(17)a. *[In John$_i$'s apartment], he$_i$ smokes pot.

b. [In John$_i$'s apartment near the railroad tracks in the Pamrapo district of Bayonne, N.J.], he$_i$ smokes pot. (Lakoff 1968, p. 13)

(18)a. *[Bill$_i$'s apartment], he$_i$ always talks to Mary about it.

b. [Bill$_i$'s apartment in that neighborhood of the Bronx where so many important literary figures grew up], he$_i$ always talks to Mary about it. (Lakoff 1968, p. 13)

Lakoff (1968) observes that in (17a) and (18a), the pronoun *he* cannot be coreferential with the R-expression within the constituent at the sentence initial position. By contrast, in (17b) and (18b), such coreference is allowed between the pronoun and the name in the 'lengthened' constituent placed at the sentence initial position. Significantly, the contrast between (17a)/(18a) and (17b)/(18b) is not expected under an analysis based on generalization (5). This is because the R-expression *John* in (17a) is as 'deeply embedded' as the one in (17b). Similarly, the full NP *Bill* in (18a)

is as 'deeply embedded' as that in (18b). In other words, the account based on generalization (5) cannot distinguish ungrammatical examples (17a)/(18a) from grammatical ones (17b)/(18b).

The contrast between (17a/18a) and (17b/18b), however, seems to indicate rather clearly that performance factors such as 'lengthening' affect significantly the possibilities of coreference in the left to right on-line processing of a sequence of words (cf. Wasow 1972, 1979, Hawkins 1994, 2004, 2014, Phillips 1996, Kempson et al. 2001, Hofmeister and Sag 2010, etc.). The analysis presented in the previous section, however, regards only the 'depth of embedding' as a crucial factor to determine corefernce options (see 5c), and does not take the 'lengthening' factor into any consideration.

Last, examine the following data, discovered by Lakoff (1968, p. 5, pp. 7-8), Reinhart (1979, 1981, p. 609), van Riemsdijk and Williams (1981, p. 203), etc.

(19)a. *[In Mary$_i$'s apartment], she$_i$ was assaulted by a thief.
b. [In Mary$_i$'s apartment], a thief assaulted her$_i$. (Lakoff 1968, p. 5)

(20) a. *[Bill$_i$'s apartment], he$_i$ always talks to Mary about (it). (Lakoff 1968, p. 7)
b. [Bill$_i$'s apartment], Mary always talks to him$_i$ about (it). (Lakoff 1968, p. 8)

(21)a. *[For Ben$_i$'s car], he$_i$'s asking three grand.
b. [For Ben$_i$'s car], I'm willing to give him$_i$ two grand. (Reinhart 1981, p. 609)

(22)a. *[Ben$_i$'s problems], he$_i$ won't talk about.
b. [Ben$_i$'s problems], you can't talk to him$_i$ about. (Reinhart 1981, p. 609)

Lakoff (1968, p. 5, pp. 7-8), Reinhart (1976, 1981, p. 609), van Riemsdijk and Williams (1981, p. 203), among others, observe that the examples in (19a-b), (20a-b), (21a-b) and (22a-b) show an asymmetry between coreference options of subjects and those of objects (or nonsubjects). That is, in (19a), (20a), (21a) and (22a), the subject pronoun cannot be coreferential with the R-expression within the constituent at the sentence initial position. In contrast, in (19b), (20b), (21b), and (22b), the pronoun in the object position is allowed to be coreferential with the R-expression within the constituent on the left peripheral position.

The subject-object asymmetries in (19a-b), (20a-b), (21a-b) and (22a-b) are problematic for the analysis based on van Riemsdijk and Williams (1981)/Saito's (1991) generalization in (5). To see this, let us consider the S-structure representations below for Lakoff's (1968) examples in (19a) and (19b):

(23)a. [$_{PP}$ In Mary$_i$'s apartment]$_j$, she$_i$ was assaulted by a thief t_j. (for 19a)
b. [$_{PP}$ In Mary$_i$'s apartment]$_j$, a thief assaulted her$_i$ t_j. (for 19b)

In (23a), the preposed constituent [$_{PP}$ *In Mary's apartment*] A'-binds its trace, meeting the condition in (5a). In addition, the pronoun *she* in the subject position binds the trace in line with (5b). Furthermore, the name *Mary* is not 'deeply embedded' within the PP in accordance with the condition in (5c). Hence, under the analysis based on generalization (5), the S-structure configuration in (23a) is correctly ruled out.

In (23b) as well, the fronted element [$_{PP}$ *In Mary's apartment*] A'-binds its own trace, in keeping with (5a). The pronoun *her* also binds the trace, meeting the condition in (5b). Finally, as in (23a), the R-expression *Mary* is not 'deeply embedded' in the PP, in accordance with (5c). It is thus incorrectly predicted under the analysis based on generalization (5) that the pronoun *her* cannot be coreferential with the full NP *Mary* in (23b), contrary to fact.

That is, van Riemsdijk and Williams' (1981)/Saito (1991) account based on generalization (5) cannot differentiate a-examples from b-examples in (19), (20), (21) and (22), and rules out not only a-examples, but also b-examples.

Importantly, the same asymmetry between subject and object with respect to coreference possibilities does seem to exist in Japanese as well.

(24)a. *[$_{PP}$ Mary$_i$ -no heya -de], kanozyo$_i$-ga hebi -o mi -ta.
Mary -Gen room-in, she -Nom snake-Acc see-Past
'*In Mary$_i$'s room, she$_i$ saw a snake.'

b. [$_{PP}$ Mary$_i$ -no heya -de], John-ga kanozyo$_i$ -o hihansi -ta.
Mary -Gen room-in, John-Nom she -Acc criticize-Pst
'In Mary$_i$'s room, John criticized her$_i$.'

As in (19a), (20a), (21a), and (22a), the subject pronoun *kanozyo* 'she' cannot be coreferential with the R-expression *Mary* in the preposed PP in (24a). By contrast, as in (19b), (20b), (21b), and (22b), the object pronoun *kanozyo* 'her' can be coreferential with the name *Mary* in (24b). (See, however, Guéron 1984 for an important objection to this type of subject-object asymmetry regarding coreference options. I leave a detailed examination of her objection for my future research.)

In this section, I have tried to show that although van Riemsdijk and Williams' (1981)/Saito's (1991) analysis based on generalizations such as (5) is a plausible one, there are some potential problems for it. In the following section, I attempt to suggest an account which subsumes under Reinhart's (1976, 1981) analysis, Hawkins' (1994, 2004, 2014) insight with respect to the relationship between competence and performance (cf. Chomsky 1965, 1981, 1993, Phillips 1996, Kempson, et al. 2001, Hofmeister and Sag 2010, etc.).

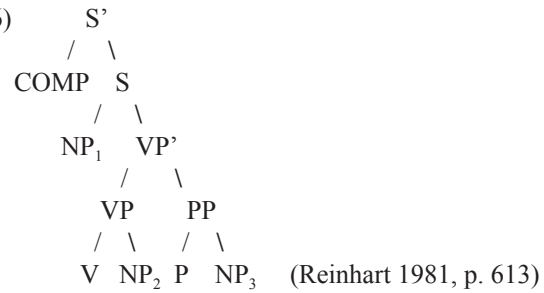
4. An Analysis in terms of 'Strong' and 'Weak' Binding

In this section, I aim to suggest a complexity-based analysis which heavily relies on both Reinhart's (1976, 1981) analysis of coreference and Hawkins' (1994, 2004, 2014) insight into the nature of competence and performance. More specifically, to account for all the data in the previous sections, first, I adopt Reinhart's (1976, 1981) definition of c-command in (25), exactly as it is.

(25) Node A c(onstituent)-commands node B
iff the branching node α_1 most immediately dominating A
either dominates B
or is immediately dominated by a node α_2 which dominates B, and α_2 is the same category type as α_1. (Reinhart 1976, 1981, p. 612)

Given the definition of c(onstituent)-command in (25), consider the following configuration cited from Reinhart (1981):

(26)



(Reinhart 1981, p. 613)

Under the definition in (25), the branching node most immediately dominating NP_1 is S, and S dominates both NP_2 and NP_3 in (26). Hence, NP_1 c-commands both NP_2 and NP_3 in representation (26). Furthermore, the branching node most immediately dominating NP_1 is S, and S is also dominated by S' which dominates COMP in (26). In addition, S' is the same category type as S in (26). Consequently, NP_1 also c-commands COMP in configuration (26). Similarly, the branching node most immediately dominating NP_2 is VP, and VP is also dominated by VP' which dominates NP_3 in (26). Moreover, VP' is the same category type as VP in (26). Hence, NP_2 c-commands NP_3 in representation (26).

To attain the aim of this section, I would like to propose that there are two types of binding, i.e. 'strong' binding and 'weak' binding, defined as follows:

(27)a. α 'strongly' binds β iff the binder α is in a 'higher' syntactic domain than the bindee β.

b. α 'weakly' binds β iff the binder α and the bindee β are within the 'same' syntactic domain.

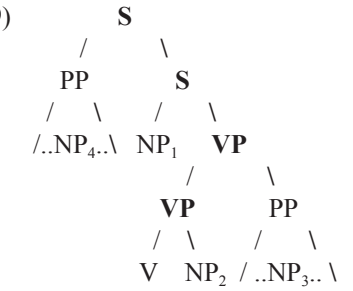
Furthermore, in line with Hawkin's (1994, 2004, 2014) proposal that performance shapes competence in a significant manner, I would also like to propose the following:

(28)a. 'Strong' binding is not subject to performance factors.

b. 'Weak' binding is subject to performance factors such as the 'depth of embedding' of the bindee, the 'linear distance' from the binder to the bindee, etc..

Given Reinhart's (1976, 1981) definition in (25) and the proposals in (27a-b)/(28a-b), consider finally the following representation:

(29)



As I have explained using configuration (26), NP_1 c-commands NP_2 and NP_3 in (29). Given (27a), NP_1 'strongly' binds NP_2 and NP_3. This is so, because the binder NP_1 is in the domain of S, whereas NP_2 and NP_3 are both within the domain of VP. Hence, NP_1 is in a 'higher' syntactic domain than NP_2 and NP_3. Since this is an instance of 'strong' binding, the binding relation between NP_1 and NP_2/NP_3 is not blocked by performance factors according to (28a).

Given (27b), on the other hand, NP_1 'weakly' binds NP_4, and NP_2 also 'weakly' binds NP_3. Notice that given Reinhart's definition of c-command in (25), NP_1 c-commands NP_4, and NP_2 c-commands NP_3. Notice further that

both the binder NP_1 and the bindee NP_4 are within the 'same' syntactic domain, namely S domain, in configuration (29). NP_1 is the subject of S, and NP_4 is contained within PP which adjoins to the same S. Likewise, the binder NP_2 and the bindee NP_3 are both within the 'same' syntactic domain, i.e. VP domain, in (29). NP_2 is the VP complement, and NP_3 is within PP which adjoins to the same VP. Hence, according to (27b), these binding relations are instances of 'weak' binding and thus, are subject to performance factors. Consequently, such binding relations could be broken by performance factors such as the 'depth of embedding' of the bindee, the 'linear distance' from the binder to the bindee, etc..

Given the proposal above, let us now see how the suggested analysis accounts for the data discovered by Lakoff (1968), Reinhart (1976, 1981), etc. Consider first the representations for Lakoff's (1968) examples in (1a-b) and (2) below:

(30)a. *[$_{\mathbf{IP}}$ [$_{PP}$ Near John$_i$]$_j$, [$_{\mathbf{IP}}$ he$_i$ saw a snake t_j]]. (for 1a)
b. *[$_{\mathbf{IP}}$ [$_{PP}$ In John$_i$'s room]$_j$, [$_{\mathbf{IP}}$ he$_i$ smokes pot t_j]]. (for 1b)

(31) [$_{\mathbf{IP}}$ [$_{PP}$ In the apartment, which John$_i$ rents]$_j$], [$_{\mathbf{IP}}$ he$_i$ smokes pot t_j]]. (for 2)

Given Reinhart's (1976, 1981) definition of c-command in (25), the subject pronoun *he* c-commands the R-expression *John* in (30a-b) and (31). Notice that both the binder *he* and the bindee *John* are within the same syntactic domain, IP/TP domain. This is so, because the binder *he* is in the subject position of IP, and the R-expression *John* is contained within PP which adjoins to the same IP. Hence, all the binding relations in (30a-b) and (31) are instances of 'weak' binding according to (27b). Accordingly, these binding relations are subject to performance factors such as the 'depth of embedding' of the bindee, etc., in accordance with (28b). As expected under the proposed analysis, the subject pronoun *he* indeed A-binds the name *John* in (30a-b), inducing a violation of Condition C. This is because the full NP bindee *John* is not deeply embedded. On the other hand, the subject pronoun *he* cannot A-bind the R-expression *John* in (31), and does not cause a violation of Condition C of the Binding Theory. This is so, because the bindee *John* is 'deeply embedded' inside the preposed PP. I thus take (31) as an instance which shows that performance factors block A-binding in competence grammar.

Examine next the configurations for Reinhart's (1976, 1981) examples in (10a-b) in (32a-b).

(32)a. *After days of search, [$_{IP}$ they finally [$_{\mathbf{VP}}$ found him$_i$ [$_{PP}$ in Dr. Levin$_i$'s hotel room]]]. (for 10a)
b. After days of search, [$_{IP}$ they finally [$_{\mathbf{VP}}$ found him$_i$ [$_{PP}$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name]]]. (for 10b)

Given Reinhart's (1976, 1981) definition of c-command in (25), the pronoun *him* c-commands the R-expression *Dr. Levin* in both (32a) and (32b). In this case as well, the pronoun 'weakly' c-commands the name, because both the binder *him* and the bindee *Dr. Levin* are within the same syntactic domain, i.e. VP domain, in line with (27b). Observe that the binder *him* is a VP complement, and the R-expression *Dr. Levin* is inside PP which adjoins to the same VP in (32a-b). Hence, under the proposal suggested in this section, it is predicted that performance factors such as the 'depth of embedding' affect binding possibilities. This prediction is indeed borne out: in (32a), the object pronoun *him* A-binds the full NP *Dr. Levin*, violating Condition C, because the name is not 'deeply embedded.' On the other hand, in (32b), the pronoun *him* cannot A-bind the R-expression *Dr. Levin* within the PP, because 'weak' binding is affected by performance factors such as the 'depth of embedding.' Consequently, *Dr. Levin*, which is 'deeply embedded' inside the PP, is exempt from Condition C of the Binding Theory. (32b) is therefore another case where Condition C is cancelled due to performance factors under the proposed analysis.

Consider now the configuration for Reinhart's (1976, 1981) example in (13) below:

(33) *After days of search, [$_{IP}$ he$_i$ was finally [$_{VP}$ found [$_{PP}$ in a sleazy hotel room that Dr. Levin$_i$ had rented under a false name]]]. (for 13)

In structure (33), the subject pronoun *he* 'strongly' binds the R-expression *Dr. Levin*. This is because the binder *he* is in the domain of IP, while the bindee *Dr. Levin* is located inside the domain of VP. Consequently, *he* is in a syntactically 'higher' position than the bindee in accordance with (27a). According to (28a), performance factors such as structural complexity do not matter for 'strong' binding. Hence, in (33), the subject pronoun *he* A-binds the name *Dr. Levin*, inducing a clear Condition C violation, as desired. (The ungrammaticality of (33) is a potential problem for Reinhart's (1976, 1981) analysis, because Condition C is always subject to the Subjacency Condition under her account. See Reinhart (1976, 1981, pp. 632-633), Guéron (1984), Saito (1991), etc. for detailed discussions of this problem.)

Examine next the structures in (34a-b) for Reinhart's (1976, 1981) examples in (15a-b).

(34)a. *[$_{IP}$ [$_{IP}$ He$_i$ finally divorced Sonya], [$_{PP}$ since Hirschel$_i$'s favorite dish was the only one she did not know how to cook]]. (for 15a)

b. [$_{IP}$ [$_{IP}$ He$_i$ finally divorced Sonya, [$_{PP}$ since the dish Hirschel$_i$ liked most of all was the only one she did not know how to cook]]. (for 15b)

In the configurations above, the subject pronoun *He* 'weakly' binds the R-expression *Hirchel*, according to (27b). This is because the pronoun *He* is the subject of IP. The name *Dr. Levin* is contained within PP which adjoins to the same IP. Consequently, the pronoun and the full NP are within the 'same' syntactic domain, IP/TP domain in (34a-b). According to (28b), these binding relations must be subject to performance factors. This prediction is also borne out. In (34a), the R-expression is not 'deeply embedded,' and thus, the subject pronoun *He* successfully A-binds *Dr. Levin*, inducing a violation of Condition C of the Binding Theory. In contrast, in (34b), the name *Dr. Levin* is 'deeply embedded' inside the *since* subordinate clause. The pronoun *He* thus cannot A-bind the R-expression. In other words, the name in (34b) escapes from Condition C of the Binding Theory in competence grammar due to performance factors.

Let us next consider the representations in (35a-b) for Lakoff's (1968) examples in (17a-b).

(35)a. *[$_{IP}$ [$_{PP}$ In John$_i$'s apartment], [$_{IP}$ he$_i$ smokes pot]]. (for 17a)

b. [$_{IP}$ [$_{PP}$ In John$_i$'s apartment near the railroad tracks in the Pamrapo district of Bayonne, N.J.], [$_{IP}$ he$_i$ smokes pot]]. (for 17b)

In (35a-b) as well, the binder *he* and the R-expression *John* are within the 'same' structural domain, i.e. IP/TP domain, because the binder is the subject of IP, and the name *John* is contained inside PP which adjoins to the same IP. Consequentely, the binder *he* 'weakly' binds the name *John* in (34a-b) according to (27b). Given (28b), such binding relations are predicted to be affected by performance factors. This is also the case. In (35a), the R-expression *John* is not 'linearly far' from the bindee *he*. Hence, the binder *he* A-binds the name *John*, inducing a violation of Condition C of the Binding Theory. In (35b), on the other hand, the name *John* is 'linearly very far' away from the subject binder *he*. Hence, the R-expression *John* successfully escapes from Condition C in (35b), as desired.

Finally, examine the configurations in (36a-b) for Lakoff's (1968) examples in (19a-b).

(36)a. *[**IP** [PP In Mary$_i$'s apartment]$_j$, [**IP** she$_i$ was assaulted by a thief t_j]]. (for 19a)

b. [IP [PP In Mary$_i$'s apartment]$_j$, [IP a thief [VP assaulted her$_i$ t_j]]]. (for 19b)

The proposed analysis based on Reinhart's (1976, 1981) and Hawkins' (1994, 2004, 2014) insight accounts for the contrast between (36a-b) in the following way: In (36a), the pronoun *she* in the subject position 'weakly' binds the name *Mary*, according to (27b). This is because *she* is the subject of IP and the R-expression *Mary* is inside PP which adjoins to the same IP. According to (28b), 'weak' binding is subject to performance factors. However, the name in (36a) is not 'deeply embedded,' and the binder *she* successfully A-binds the name, violating Condition C. In contrast, in (36b), the binder *her* is in the object position. As Reinhart (1976, 1981) argues, the object pronoun *her* thus cannot c-command or bind the R-expression *Mary* within the preposed PP. Consequently, *Mary* is A-free in (36b), and the grammaticality of (36b) is also accounted for.

5. Conclusion

In this paper, I have shown how Saito (1991) accounts for Condition C effects based on generalizations such as (5) and (11) (cf. van Riemsdijk and Williams 1981, etc.). In so doing, I have attempted to show that although his analysis is plausible, there still remain some potential problems. Finally, to account for all the data in this paper in an adequate way, I have set forth a proposal which incorporates into Reinhart's (1976, 1981) grammatical analysis of coreference, Hawkins' (1994 2004, 2014) important insight into the nature of competence and performance. Namely, performance shapes competence, i.e. grammatical conventions, in a significant manner.

To be concrete, in this paper, I have proposed that there are two types of binding, i.e. 'strong' binding and 'weak' binding. Furthermore, I have tried to argue that 'strong' binding is not affected by performance factors, whereas 'weak' binding is subject to performance factors such as the 'depth of embedding' of the bindee, the 'linear distance' from the binder to the bindee, etc.. This dichotomy between 'strong' binding and 'weak' binding might indeed be on a right track, because Lokoff (1968, pp. 21-23) seems to observe that there is much dialectal variation with respect to 'weak' binding, as expected under the proposed complexity-based analysis. I would, however, like to leave for my future research a question as to if we can indeed maintain the proposed distinction between 'strong' grammatical conventions and 'weak' ones in terms of performance factors.

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