

Respectively* construction in English: A constraint- and construction-based approach

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Cho, Sae-Youn. 2013. *Respectively* construction in English: A constraint- and construction-based approach. *Linguistic Research* 30(2), 273-291. Postal (1998) and Gawron & Kehler (2004) have argued that *Respectively* Construction (RC) involving filler-gap constructions should be harder to account for under non-transformational approaches. Against their arguments, Chaves (2012), however, has claimed that the RC can be explained in HPSG without any difficulty. In doing so, Chaves proposes an HPSG account of the RC, assuming that sentences with ‘respectively’ will not differ in semantic and syntactic structure from those without it. In this paper, we argue that on the basis of the various properties of the RC, Chaves’ assumption seems to be too strong or inaccurate, though most of his proposals on the RC can be accepted. To support our claim, we provide attested data such as RNRed RC from the corpus or the previous work and seek to give a proper account of RC in HPSG. (Kangwon National University)

Keywords *Respectively* Construction (RC), respectively, Filler-Gap Construction, HPSG Non-transformational Approach, RNRed RC

1. Data & issues

It is well-known that *respectively* construction (RC) in English invites various difficulties in explaining its linguistic properties. As illustrated in (1), RC such as sentence (1a) should be understood as (1b). More specifically, the two NPs, *Sam* and *Tom*, syntactically function as subject as we may see that they agree with the plural verbs, *walk* and *run*. Semantically, the first NP *Sam*, however, is construed as the

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agent of the first verb *walk* while *Tom* is understood as that of *run*.

- (1) a. Sam and Tom walk and run respectively.
 b. Sam walks and Tom runs.

Another data of RC like (2a) is interpreted as (2b). In this case, the first NP of the conjoined subject and that of the conjoined object are construed as the arguments of the predicate *liked* so that they constitute an event and the second NPs of the conjoined subject and object with the predicate form another independent event.

- (2) a. Sam and Tom liked Kim and Lee respectively.
 b. Sam liked Kim and Tom liked Lee.

To account for the idiosyncratic behavior of RC above, there have been at least two approaches: Syntactic approach and Semantic & Pragmatic approach. Semantic and Pragmatic approach including Kay (1989), Link (1991), Okada (1999), Gawron & Kehler (2004) mainly focused on the Semantic and Pragmatic functions of *respectively* comparing to the adjective *respective*. On the other hand, Syntactic approach sought to catch the relationship between (1a) & (2a) and (1b) & (2b) in numerous ways (Cf. Goodall, 1987, Kay, 1989, McCawley, 1989).¹

In doing so, Postal (1998) and Gawron & Kehler (2004) presented cases of RC involving Wh-extraction like (3a) and argued that such cases should be problematic under non-transformational approaches.

- (3) a. [What book and what magazine] did John buy ___ and Bill read ___
 respectively? (Chaves (2012, 2))
 b. What book did John buy? And what magazine did Bill read?

Sentence (3a) interpreted as in (3b) seems to be problematic in the sense that the first NP, *what book*, should be the filler for the first gap while the second NP, *what magazine*, that for the second one, which violates the so-called Across-The-Board (ATB) constraint (Cf. Ross 1967).

¹ The detailed explanations on the previous analyses under the transformational frameworks will be omitted deliberately because the main purpose of this paper is to pursue an HPSG account of RC. For the detailed explanations on the previous analyses, refer to Chaves (2012).

Similarly, RC including Right Node Raising (RNR) like (4a) also appears to face difficulties in accounting for how (4a) understood as (4b) can be acceptable even though it violates the ATB constraint.

- (4) a. Ernest sold cocaine and George sold heroin [to the first nurse and to the second dental assistant] respectively. (Chaves (2012, 22))
b. Ernest sold cocaine to the first nurse and George sold heroin to the second dental assistant.

Against Postal (1998) and Gawron & Kehler (2004), Chaves (2012) argues that the representative RC data like (1-2) as well as the newly added data like (3-4) can be accounted for within the slightly modified Head-driven Phrase Structure Grammar (HPSG), which is one of the non-transformational frameworks. In so doing, Chaves (2012, 1) hypothesizes and claims that “respectively readings may be special cases of more general phenomena which happened to create interpretations compatible with the semantics of the VP adverb *respectively*.” Hence, RC will not be syntactically and semantically different from sentences without a *respectively* reading.

The purpose of this paper is to provide a theoretically and empirically proper analysis of RC in HPSG. To do so, we argue here that though most of Chaves’ proposals on semantic conditions and the modification of the constraints on Conjunction construction in current HPSG can be accepted, the claim he made above would be either too strong or inaccurate when scrutinizing the data in the previous work and the corpus data presented later. Unlike Chaves (2012), we claim here that some syntactic properties of RC should be dealt with independently from sentences without an overt *respectively*.

This paper is organized as follows: Section 2 introduces Chaves (2012) to see what his key idea on RC is and how his analysis works for the construction. In section 3, we provide the various properties of RC found either in the corpus data or the data in the previous work, which point to the fact that Chaves’ (2012) hypothesis or assumptions appear to be untenable. On the basis of the observations, we propose a revised constraint- and construction-based analysis of English RC in section 4, adopting his proposals on some syntactic constraints and semantic idea on conjunction. Finally, we conclude with the implications of this paper and remaining issues.

2. A previous constraint-based analysis of RC: Chaves (2012)

Chaves (2012), first of all, proposes an interesting intuitive idea on sentences with a respectively reading. Basically, he suggests that the representative RC data with an overt *respectively*, (1a) and (2a), still may have a respectively reading even though *respectively* does not appear in the sentence final position as shown in (5a-b).

- (5) a. Sam and Tom walk and run (respectively).
 b. Sam and Tom liked Kim and Lee (respectively).

The only difference in meaning between sentences with *respectively* and without it is that the former delivers a respectively reading only while the latter conveys ambiguous readings including a respectively reading. On the basis of this observation, Chaves (2012) hypothesizes that a respectively reading can be regarded as a case of cumulative readings and assumes that sentences with *respectively* are the salient cases of the sentences without *respectively*, delivering a respectively reading. Under this hypothesis, he employs the informal version of the Shared Dependent Condition for Conjunction in (6) which will be generalized to other kinds of dependencies.

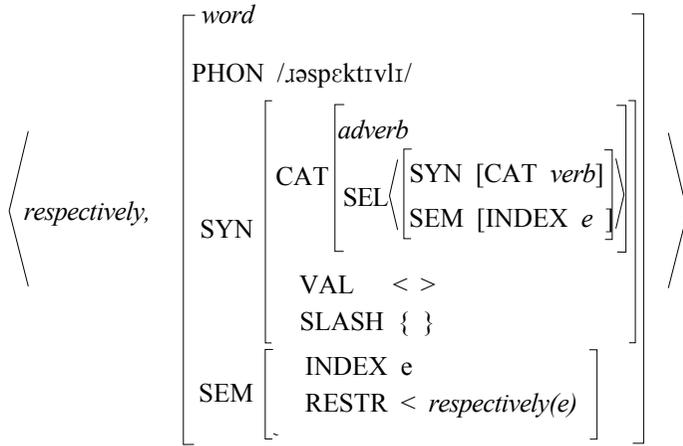
- (6) Shared Dependent condition for Conjunction (Informal)
 Predication dependencies shared by conjuncts are combined via ' \oplus '.
 Chaves (2012, 12)

Assuming (6), he proposes the lexical entry *and* in (7). According to his explanation (Chaves (2012, 12)), “the two conjuncts $P[x_0, \dots, x_n]$ and $Q[y_0, \dots, y_n]$ are two conjuncts with exactly n free variables, each corresponding to a shared dependent. The variables corresponding to the shared dependents are combined via ' \oplus '”. This operation enables us to get a respectively reading like (1b) and (2b) from (1a) and (2a).

- (7) Conjunction (preliminary)
 $and : \lambda P.\lambda Q.\lambda z_0..\lambda z_n.P[x_0, \dots, x_n]\wedge Q[y_0, \dots, y_n]\wedge z_0 = (x_0 \oplus y_0) \wedge \dots$
 $\wedge z_n = (x_n \oplus y_n)$ Chaves (2012, 12)

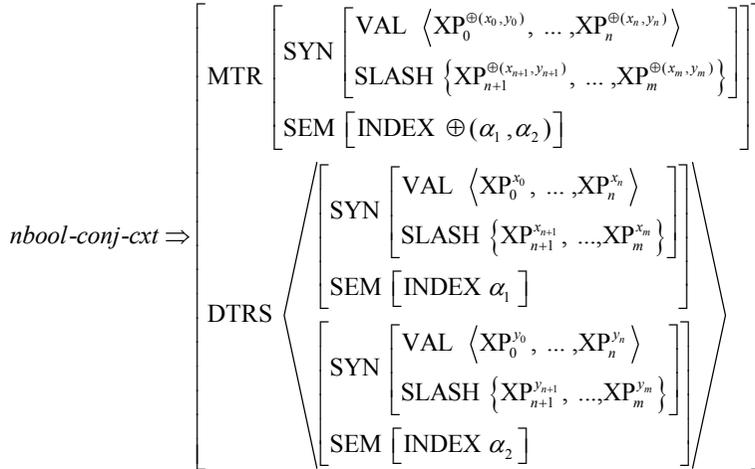
In addition to (6) and (7), which we adopt here, he posits the lexical entry for *respectively* as in (8) and the Non-Boolean Conjunction construction as in (9).

(8)



Chaves (2012, 37)

(9) Non-Boolean Conjunction ($m \geq 0$)



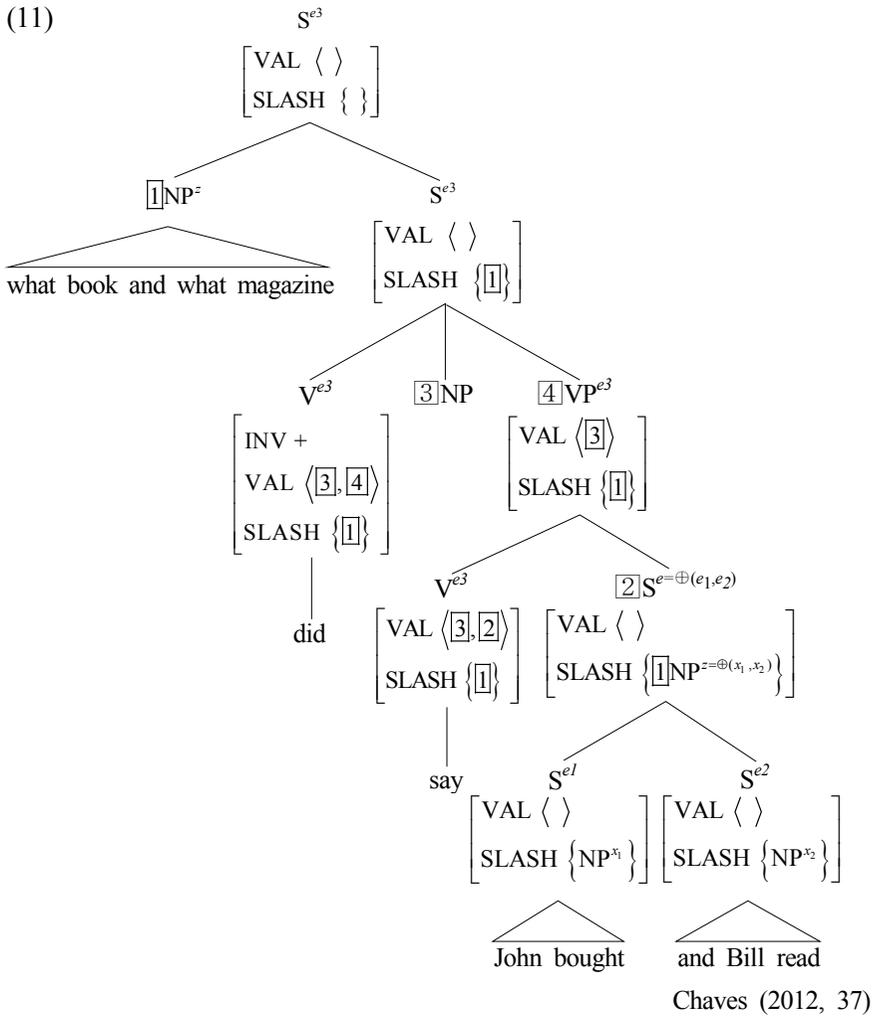
Chaves (2012, 35)

The key role of the Non-boolean Conjunction construction is to define how the SLASH value of the Mother node is determined. By the definition of (9), the

SLASH value of the Mother is the combined sum ‘ \oplus ’ of the SLASH values of the Daughters. This allows us to explain why Wh-interrogative RC, where it appears to violate the ATB constraint, can be allowed. For readers’ comprehensibility, consider the RC data (10) involving Wh-extraction out of the conjuncts, which consequently violates the ATB.

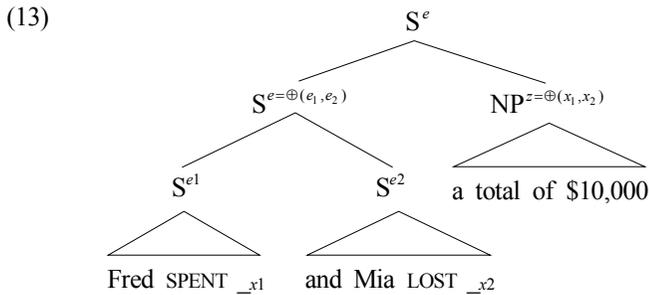
(10) What book and what magazine did you say John bought and Bill read?

To account for how (10) can be accepted, Chaves (2012) presents an analysis as in (11).



The crucial part of the analysis is the bottom part of the local tree in (11) showing that the two SLASH values of the conjunct Daughters are combined via \oplus and hence the SLASH value of the Mother is a single $\boxed{1}$ NP. Thus, (10) can be predicted to be acceptable. Similarly, he assumes the RNRed RC like (12) to be analyzed as in (13):

(12) Fred spent and Mia lost a total of \$10,000 (respectively).



Chaves (2012, 39)

He suggests that RNRed RC (12) should be treated exactly like the Wh-extracted RC as illustrated in (13).

So far we have shown how Chaves (2012) accounts for the representative RC like (1a) and (2a) as well as the newly added RC data in (3a) and (4a). In explaining such RC data in HPSG, we could observe that he holds the following positions:

(14) **The assumptions of Chaves (2012)**

- a. The lexical item ‘respectively’ is an S or VP adverb.
- b. Sentences with *respectively* are the salient cases of the sentences without *respectively*, delivering a *respectively* reading. Hence, they will not be syntactically different.
- c. RCs undergoing the Leftward movement (ex. Wh-extraction, Topicalization, etc) and the Rightward movement (ex. RNR) can be treated by the same fashion.

- c. We may call these *respectively* longitudinal and lateral correlations.
(BNC: J12 348)
- d. This would make them *respectively* the first and fifth most popular
tourist attractions in the world, ... (BNC A2V 191)
- e. Tom and Dick gave Susan and Harriet *respectively* their respective
class rings.

The distributional behaviors of ‘respectively’ above point out that the assumption in (14a) by Chaves (2012) is partially true or inaccurate. In other words, if ‘respectively’ cannot occur in the sentence-initial position like (15b), Chaves’ assumption that the word is an S adverb needs some stipulation.² Furthermore, the fact that ‘respectively’ may occur immediately before or after the right dislocated element in (17) whereas it may not occur immediately before or after the topicalized element in (16) makes it unclear how Chaves (2012) can provide an explanation for the grammatical discrepancy. The worst cases are the data (18), since the positions between a main verb and its object or in between two complements are not for either a VP or a S adverb. Hence, the claim in (14a) that ‘respectively’ is a S or VP adverb should be not good enough to explain the distributional behaviors of ‘respectively’.³

Secondly, RNR construction appears to behave differently depending on the existence of ‘respectively’. When the right dislocated element in RNR involves ‘respectively’, each filler and its corresponding gap must be identical with respect to the CATEGORY value as shown in (19). The right dislocated element as a filler and its gap in the RNR without ‘respectively’ may not be totally identical with respect to the CATEGORY value as in (20a-b).

- (19) John will ____, but Mary probably was ____ **play>(*playing) in the gym and working in her office, respectively.**

² Chaves (2012) also admits that some LP rules will be required to deal with RC in his footnotes, but he does not postulate LP rules for RC. We believe LP constraints are not trivial in RC and therefore posit an informal LP constraint in the later section.

³ In fact, the CAT value in the lexical entry (8) can be understood as a V in HPSG. However, Chaves (2012, 37) explains that its intended meaning is a S or VP. Further, though it means a lexical V, there are lots of counter-examples, which we will not deal with due to the lack of space.

- (20) a. Greg captured and Lucille trained [312 frogs between them].
Chaves (2012, 21)
- b. John will ~~sleep in her office~~, but Peter already has ___ **slept in her office**.
Park (2006, 179)

Both RCs involving RNR above can deliver a respectively reading regardless of the existence of ‘respectively’, but they syntactically behave differently as to whether they require sloppy or strict identity between a filler and its gap. The difference in the distributional behaviors above between sentences with ‘respectively’ and those without it shows that the assumption in (14b) that sentences with ‘respectively’ will not be syntactically different from those without it should be either too strong or inaccurate. In addition, in considering that the filler and its gap in Topicalization and Wh-extraction must have the same CATEGORY value in English, the syntactically different behaviors between (19) and (20a-b) suggest us that RNR with and without ‘respectively’ should be treated differently from the Leftward movement phenomena, against the assumption in (14c).⁴

Semantically, ‘respectively’ cannot co-occur with collective words such as *co-promote* and *both*, as in (21).

- (21) a. *Intel and Microsoft will *co-promote* their hardware and software *respectively*.
- b. **Both* Tom and Dick love Jane and Mary *respectively*. (Okada 1999)

This co-occurrence restriction could be not that difficult to handle but it is suggested, we believe, that the lexical information on ‘collectivity’ and ‘distributivity’ should be specified in the lexicon in any grammar theory to exclude sentences like (21), which will be discussed later.

So far we have shown syntactic and semantic distributional properties of RC, critically reviewing Chaves’ assumptions in (14). In so doing, we could observe the following facts:

⁴ It is frequently claimed that RNR may not observe the so-called island constraints (cf. Merchant (2001)). In that sense, our analysis can be supported.

(22) I. Syntactic Observations

- (a) *Respectively* can occur in the sentence or VP final position, but not in the sentence-initial position.
- (b) In Topicalization or WH questions, *respectively* immediately before or after the filler is disallowed while it can be allowed in RNR.
- (c) *Respectively* can occur between a main verb and its complements or in between Complements.
- (d) The grammatical status of *respectively* must be an adjunct modifying **either** a VP/S **or** (Nominal) Complements

II. Semantic & Pragmatic Observations

- (a) ‘Respectively’ cannot co-occur with collective words.

In the next section, we present a constraint and construction-based analysis of English RC on the basis of the observations above, adopting the semantic parts and some syntactic proposals such as the Non-boolean Conjunction Construction of Chaves (2012).

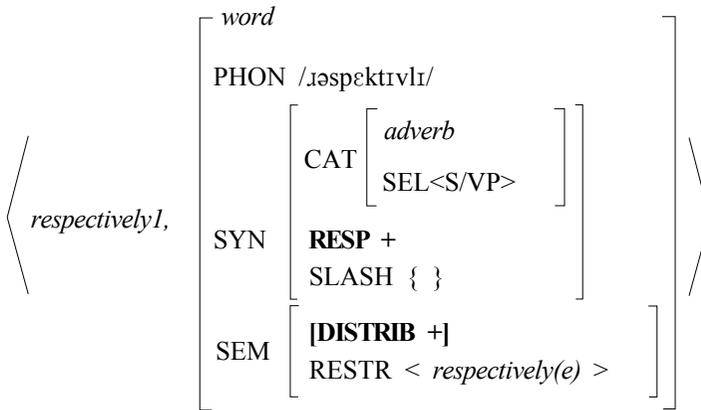
4. A constraint- and construction-based analysis

Chaves (2012) proposes an interesting analysis of RC under the non-transformational grammar framework which we believe is the first serious work on the construction in HPSG. In that paper, it is assumed that if the arguments are pragmatically ranked, a *respectively* reading can be derived as a special case of cumulative readings. Basically, we adopt this assumption and further want to extend that idea. All number sensitive words such as nouns and verbs should be encoded on DISTRIB(utivity) as a semantic AGREEMENT feature whose value is *boolean*, i.e. + or -, when the NUM(ber) value is *plural*. Again, once the DISTRIB value is +, a *respectively* reading can be possible depending on whether a given independent lexical item or a phrase formed by the Non-boolean conjunction is pragmatically ranked or not. More specifically, when the DISTRIB value is +, the sentence with an element having [DISTRIB +] can get either a *respectively* reading or a non-*respectively* distributive reading depending on the context. If arguments are pragmatically ranked, the whole

sentence can get a respectively reading, whereas if not, that can deliver non-respectively readings. It is important note that all these specifications need not to be specified in the lexeme. Rather, they should be fully specified when a given lexeme is realized as an independent word or words in a coordinated structure in syntax.

Given the idea above, we can present the two different lexical entries for ‘respectively’, i.e. a S or VP adverb and a Nominal adjunct. First of all, *respectively1* as a S/VP adverb in (23) differs from that in (8) Chaves (2012) proposed in the sense that the adverb with [DISTRIB +] has a RESP feature and its value ‘+’ in the CATEGORY part, which are assumed to be percolated up to S node.

(23) *respectively1* :



In addition, we postulate a Linear Precedence (LP) Constraint only for this adverb as follows:

(24) LP Constraint for *respectively* (informal)

Respectively cannot precede S.

Given these, the fact that *respectively* and collective words such as *co-promote* and *both* cannot co-occur as in (21a) and (21b) just follows only if a predicate and its adjunct (selector) are assumed to be identical with respect to the relevant semantic

feature and value, namely DISTRIB +/- . In this theory, *co-promote* and *both* inherently have a piece of information as in (25a) and (25b) respectively and *respectively* has [DISTRIB +] in the lexicon shown above so that they cannot be unified.

- (25) a. *co-promote* : [AGR|DISTRIB -]
 b. *both* : [DISTRIB -]

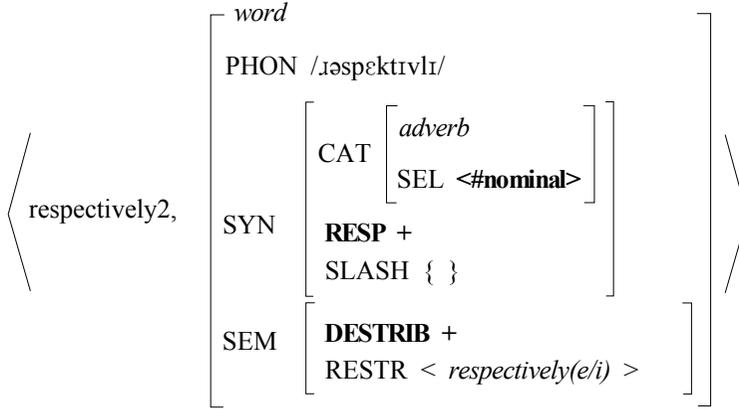
Moreover, this system enables us to provide a simple explanation for how the sentences like (26) can deliver a respectively reading regardless of the existence of ‘respectively’.

- (26) a. They love us, (respectively).
 b. The three best students received the three highest scores,
 (respectively). Kay (1989)

The pronouns such as *they* and *us* inherently have the information like [Plural +] and when they are realized in a sentence, the DISTRIB value is encoded either as + or - depending on the context. Hence, when ‘respectively’ does not show up, both sentences in (26) can be ambiguous, though they still may have a respectively reading. Once ‘respectively’ appears in sentences, they, however, are not ambiguous anymore.

Though the LP constraint in (24) is only a stipulation for ‘respectively’, it allows us to exclude (15b) and (16). As for the data in (18) found in the corpus data, we introduce the following lexical item ‘respectively2’ which functions as a nominal adjunct:

(27) *respectively*₂ :



(Where #nominal stands for the abbreviated AVM, i.e. [CAT [^{nominal} [AGR [NUM plural]]]])

This lexical item allows us to account for why *respectively* can occur between a main verb and its complement or in between complements which can be observed in (18). Though it is not that desirable to posit two lexical items for *respectively*, this analysis seems to be further supported by the fact that the two lexical items may appear in a single clause as follows:⁵⁶

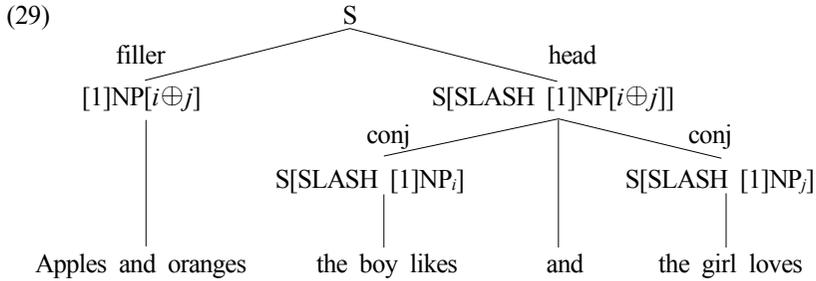
(28) I want and expect to like and to dislike *respectively* this and this *respectively*.
Kac (1987)

As Kac (1987) suggested, the presence of two occurrences of *respectively* is possible even though (28) is not highly acceptable. If so, it seems to us that the claim that ‘respectively’ may have two lexical items can be an option.

Finally, we have observed that there is some discrepancy between the right dislocated elements with ‘respectively’ in (19) and those without it in (20a-b) in English RNR construction, on the contrary to Chaves’ assumption in (14b). Among various ways to account for the differences in such cases, we suggest that rightward

⁵ The presence of two occurrences of *respectively* itself can be accounted for in various ways.
⁶ One of anonymous reviewers points out that the analysis on *respectively* as a nominal adjunct can be problematic because it is rare in English. However, we assume that *respectively*₂ should be similar to *even* in *even John*. Hence, our analysis, we believe, is not that problematic.

and leftward movements should be distinguished in the top part of the sentences, holding the Non-boolean conjunction construction Chaves (2012) proposed. More specifically, the topicalization construction (17) as a case of leftward movement can be analyzed under our analysis as follows:



In (29), the top local tree can be licensed by the head-filler construction in HPSG while the SLASH value, i.e. [1]NP, in the middle part can be percolated up to the S node via the SLASH Inheritance Principle and the Non-boolean Conjunction Principle we adopt here. As a result, we can get a respectively reading regardless of the existence of ‘respectively’.

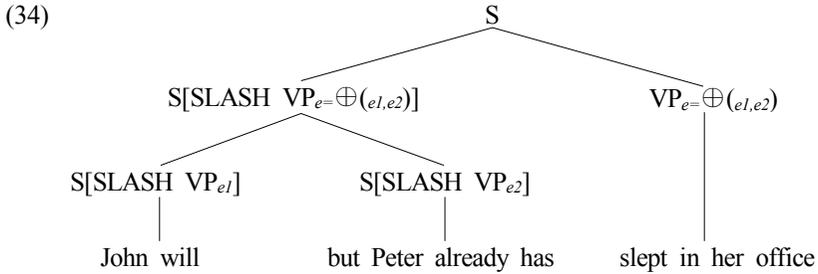
On the other hand, both RCs involving RNR in (19) and (20a-b) can deliver a respectively reading regardless of the existence of ‘respectively’, but they syntactically behave differently as to whether they require sloppy or strict identity between a filler and its gap. To distinguish strict identity cases like (19) from sloppy ones like (20a-b), we propose a RNRed RC with a conjunction filler like (30):

- (30) RNRed RC with a Conjoined Filler (Strict Identity)⁷
 $S \rightarrow \text{HEAD } [\text{SLASH } XP[1], (\text{RESP } +)] \text{ FILLER } [XP[1], \text{RESP } +]$
 (Where $XP[1] = XP_1[\text{Form } \alpha] \oplus XP_2[\text{Form } \beta] \oplus \dots$)

The intended key function of the rule (30) is to define that the SLASH values of the head and the right dislocated filler should be identical with respect to CATEGORY value. Of course, RNR without ‘respectively’ can be licensed by the following rule

⁷ In fact, we want to allow the ATB violation for this case. As mentioned above, RNR often tends to violate island constraints, unlike Topicalization.

value unlike (30). Hence, (20b) can be represented under our analysis as in (34).



The tree configuration above can be predicted to be well-formed under this analysis because RNR without ‘respectively’ is licensed in terms of (9) and (31) which allow the so-called sloppy identity cases so that the SLASH values in the head and its filler syntactically should have the same CAT value only but need not be identical with respect to their forms such as VFORM. Under the assumption that sentences with ‘respectively’ might be syntactically different from those without it, we have shown how RNR with and without ‘respectively’ could be treated differently in HPSG, adopting the semantics of ‘respectively’ and the Non-Boolean Conjunction construction in (9) proposed by Chaves (2012).

5. Concluding remarks

Postal (1998) and Gawron & Kehler (2004) have argued that RC involving filler-gap constructions should be harder to explain under non-transformational approaches such as HPSG. Against their claims, Chaves (2012) proposes an HPSG account of RC which is fully compatible with unification-based theories, assuming that sentences with ‘respectively’ will not differ in semantic and syntactic structure from those without it.

To check whether his assumption above is empirically sound, we present various properties of RC closely related to the assumption, collecting the RC data from the BNC corpus or the previous work. From the properties of RC, we could observe that RNRed RC with a conjoined filler may be syntactically different from RNR without ‘respectively’. Furthermore, we also could observe we need an LP constraint as well

as features such as DISTRIB and RESP for ‘respectively’ to give a complete explanation of RC in any grammar theories. Even though the rules and constraints we proposed here are not fully formalized, we believe they could be enough to demonstrate what our intended solutions are. In that sense, this paper at least suggests that our analysis, adopting semantics of ‘respectively’ and the Non-Boolean conjunction construction proposed by Chaves (2012), will lead to achieving a little bit better account of RC in non-transformational theories.

In considering that RC has posed serious challenges for any grammar theory, it is natural to say that our analysis needs lots of work to do in order to provide a full picture of RC. However, we believe that an account of RC we proposed here would be on the right track, though Chaves’ assumption on the syntactically isomorphic relationship between RC with ‘respectively’ and without it seems attractive.

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