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# External Remerge and linearization in ATB, RNR and PG constructions*

[1]Jong Un Park** · [2]Michael Barrie · [3]Myung-Kwan Park***
([1,3]Dongguk University · [2]Sogang University)

**Park, Jong Un, Michael Barrie, and Myung-Kwan Park. 2019. External Remerge and linearization in ATB, RNR and PG constructions.** *Linguistic Research* 36(2), 141-181. We claim that across-the-board (ATB) and right node raising (RNR) constructions in English should be analyzed in a uniform way, but neither of them can be on a par with parasitic gap (PG) constructions. To support this claim, we demonstrate that only the former two can license additive coordination (AC) and interwoven dependency (ID). We then offer a novel derivational analysis of the (un)availability of AC and ID in the three constructions. Specifically, we propose that cross-clausal conjunction via External Remerge (ER) constructs parallel coordinate structure in ATB and RNR while illegitimate linear ordering in the resulting multidominance structure is constrained by PF constraints; by contrast, ER does not yield the same kind of coordinate structure for PGs since subordination is required for the PG construction. **(Dongguk University • Sogang University)**

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## 1. Introduction

This paper is concerned with across-the-board (ATB) constructions as in (1), right node raising (RNR) constructions as in (2), and parasitic gap (PG) constructions as in (3).

(1) Who$_1$ will the police arrest $e_1$ and the prosecutor indict $e_1$ for this crime? (ATB)

(2) John loves $e_1$, but Mary hates $e_1$, oysters$_1$. (RNR)

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* We wish to thank the anonymous reviewers of the journal for their valuable feedback.
** First author
*** Corresponding author

(3) Who$_1$ will the police arrest $e_1$ after interrogating $e_1$? (PG)

These three constructions appear to be similar, in that they are made up of two clauses and the gaps inside the two clauses are simultaneously bound by one element at the left- or right-edge position. Because of this apparent similarity, researchers have attempted to unify the three constructions one way or another: first, Ross (1967) and Postal (1974, 1998) take the RNR construction to involve rightward movement in an ATB fashion; second, Haïk (1985) and Williams (1979, 1990) analyze the PG construction by adopting the ATB-fashion extraction, while Hornstein and Nunes (2002) and Nunes (2001, 2004) pursue an analysis unifying both ATB and PG constructions via sideward movement; third, Munn (1998, 2001) takes the opposite track to Haïk and Williams, arguing that the ATB construction is an instance of the PG construction.

Against this backdrop, the primary goal of this paper is to argue, along the lines of Park (2006), that the ATB and RNR constructions should receive a unified analysis, while neither of them can be dealt with in a parallel way to the PG construction. The secondary goal is to propose a novel derivational analysis of the three constructions, focusing on why the ATB and RNR constructions do not pattern with the PG construction.

In Section 2 we will first present hitherto neglected data mostly drawn from Postal (1998). The importance of those data lies in the fact that elements at the left edge in the ATB construction or at the right edge in the RNR construction allow for interwoven dependency (ID) and additive coordination (AC), but these two construals are not available to the PG construction. Meantime, we will show that none of the previous approaches is successful in providing a proper account for why only the former two constructions can license those readings.

In Section 3, answering how to derive ID and AC in the ATB and RNR constructions, we will suggest that External Remerge (ER), developed by de Vries (2009), plays a crucial role in structure building in syntax for all the three constructions. However, we will argue that the role of ER in the ATB and RNR constructions is different from its role in the PG construction. More specifically, the ATB-moved and RNR-ed element undergo cross-clausal conjunction, which yields parallel coordinate structure headed by a visible or invisible conjunction. Another ancillary claim to ensure the availability of AC and ID via cross-clausal

conjunction only in ATB and RNR is that clauses conjoined with coordination, not subordination, are subject to a PF constraint for linearization, namely the Principle of Cyclic Linearization (PCL) adapted from Fox and Pesetsky (2005). Simply put, the ATB and RNR constructions, unlike the PG construction, are made up of two coordinate conjuncts, so the linear order in each conjunct prior to ER has to be parallel to that at the left or right edge after ER. Section 4 summarizes and concludes the paper.

## 2. Interwoven dependency and additive coordination

While the ATB or RNR construction should be differentiated from the PG construction (see Postal (1993) and Niinuma (2010), among others, for differences between ATB and PG), there are not many studies that compare the three constructions altogether. Postal (1998) and Vicente (2015) present a few exceptions. Notice that Vicente's main interest lies in ATB and RNR while PG is touched on as part of the empirical data supporting the claim that there are cases where ATB or RNR can be licensed even without involving coordination.

Postal (1998), as well as Postal (1974), provides a number of arguments in favor of his claim that RNR can be treated in the same way as leftward movement ('L-extractions' in his term). Furthermore, Postal (1993) disputes Williams's (1990) claim that the ATB construction can be assimilated to the PG construction. This being said, we can draw a conclusion from Postal's (1974, 1993, 1998) series of works that the ATB and RNR constructions can be viewed in a similar way, while they should be kept apart from the PG construction.

Our standpoint parallels Postal's view on the three constructions, and in Sections 2.1 and 2.2, we will rehearse Postal's (1998) two empirical arguments for the unity of ATB and RNR, which appeal to the so-called interwoven dependency (ID) and additive coordination (AC). We will go on to examine whether the two phenomena are available in the PG construction, an issue not directly addressed by Postal (1998).

### 2.1 Interwoven dependency

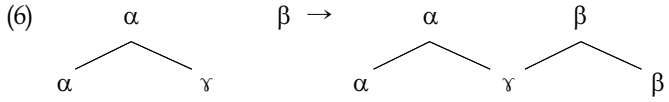
Let us begin with canonical ATB sentences like (4) below. What features the construction is that one element at the left edge is linked to two gaps in the following two conjuncts.

(4) [Which book]$_1$ did Mary read $e_1$ and Bob skim $e_1$?

Among those that adopted the ATB-format movement, Williams (1978, 1990) deserves a special attention. Although he is not explicit in analyzing how the elements from more than one position wind up being reduced into a single element, he implicitly assumes that two identical elements start out in their base position in each conjunct, later being unified into one element and placed at the left periphery in the course of movement. On the ATB-fashion movement analysis, (4) can be schematized as follows:

(5) [[Which book]$_1$ did Mary read $e_1$ and Bob skim $e_1$? (= (4))

On the other hand, Citko (2005) suggests under the multidominance view that an identical element is shared by both conjuncts via Parallel Merge, as in (6) (a couple of other variants of multidominance approach to ATB will be discussed in Section 3).

(6) 

(Citko 2005: 476)

According to her, after a certain node γ is first combined with a root α via Merge, it can later be merged with another root β by an additional instance of Merge. More specifically, *which book* in (4) experiences Merge with *skim* in the second conjunct while another application of Merge makes the same element combined with *read* in the first conjunct. As a result, the single *wh*-phrase

establishes a relation with the two predicates in both conjuncts. After that, the *wh*-phrase is dislocated to the Spec, CP position by Move (viz. Internal Merge) at the end of the derivation.

Notice, however, that there is another type of ATB construction. In this type, the ATB-format movement can target a different *wh*-phrase generated inside each conjunct of the coordinated clauses. The two distinct *wh*-phrases then end up being at the left edge after being conjoined together by the coordinating conjunction, as in (7), modelled after Postal (1989: 134).

(7) Interwoven dependency in ATB
   a. [[Which book]$_1$ and [which magazine]$_2$]$_3$ did Mary read $e_1$ and Bob skim $e_2$, respectively?
   b. [[Which phonetician]$_1$ and [which syntactician]$_2$]$_3$ will (respectively) Joan invite $e_1$ and Fred talk to $e_2$, (respectively)?

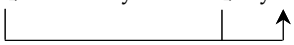
In (7a), *which magazine* is associated with a gap in the second conjunct, while which book is linked to a different gap in the first conjunct. Notably, the two *wh*-phrases are conjoined together by *and*. Postal (1998) suggests that the elements at the left edge in (7) establish interwoven dependency (ID), since the two chains have overlapping dependencies that are typically found in English respectively constructions. On the other hand, ATB-ed elements that occupy the left edge in canonical ATB constructions like (1) and (4) are referred to as sharing elements.

However, it seems hard to see how the ATB sentences exhibiting ID can be derived under either the ATB-fashion movement analysis or the multidominance analysis by Citko (2005). First, according to the chain condition under the standard copy theory of movement (e.g. Chomsky 1995), every single copy in the same chain is required to be non-distinct, but the non-distinctness among the copies cannot be maintained in (7a,b) as the highest copy at the left edge is not identical with any of the two gaps in both conjuncts. Second, a multidominance relation can be established only if there is an element shared by two conjuncts at the initial stage of a derivation. But since the gap in each conjunct cannot be the same as the conjoined *wh*-phrase at the left periphery, the ATB sentences with ID in (7) are incorrectly ruled out.

Turning to RNR, in analyzing the canonical type of RNR in (2), Ross (1967)

and Postal (1974, 1998) note that RNR-ed elements are dislocated by rightward ATB-fashion movement to their surface position at the right edge. According to this view, sentence (2) can be roughly schematized in the following way:

(8) John loves $e_1$, but Mary hates $e_1$, oysters$_1$. (= (2))



More importantly, whether we take this kind of ATB-format movement analysis at face value or not, if the unified view on the RNR and ATB constructions is correct, we would expect the same kind of ID to be allowed in the former as well. This prediction turns out to be true, as in (9).

(9) Interwoven dependency in RNR
   a. John loves $e_1$ and Mary hates $e_2$ – [[oysters]$_1$ and [clams]$_2$]$_3$, respectively.
   b. Marsha argued for $e_1$ on Tuesday and Louise argued against $e_2$ on Thursday [[communism]$_1$ and [fascism]$_2$]$_3$, respectively.

(Postal 1998: 134)

Just as in ATB of the type in (7), the right-edge elements in (9) consist of two constituents each of which originates from inside a different conjunct clause in the pre-RNR-ed part, and the constituents undergo coordination by the overt conjunction head. One can easily see that the rightward ATB-format movement analysis of the RNR construction has difficulty explaining the availability of ID in (9). For instance, if the coordinate DP *[oysters$_1$ and clams$_2$]$_3$* forms a chain with the gap $e_1$ in the first conjunct and another gap $e_2$ in the second conjunct in (9a), the copies in the chain fail to be non-distinct from one another.

Note also that there are several works attempting to analyze the RNR construction in English and other languages under the multidominance view (e.g. McCawley (1982, 1987, 1988), Wilder (1999), Bachrach and Katzir (2007, 2009) and Gracanin-Yuksek (2007) for English). But it wouldn't be difficult to see that most studies adopting the multidominance view cannot capture the ID in the RNR sentences in (9a,b) either, since the coordinate DP at the right edge exists in neither of the two conjuncts in the pre-RNR-ed part in both sentences.

A final question to address is whether ID is permitted in the PG

construction, an issue which Postal (1998) does not directly touch on. As in (10), the ID between the leftmost elements and two gaps in the main and subordinate clause cannot be established. This fact obviously supports our position that distinguishes both the ATB and RNR constructions from the PG construction (cf. Postal (1993) and Niinuma (2010) for the differences between ATB and PG).

(10) No Interwoven Dependency in PG
  a. *[[Which paper]$_1$ and [which book]$_2$]$_3$ did (respectively) John copy $e_1$ before Mary read $e_{PG2}$, (respectively)?
  b. *[[Which food]$_1$ and [which drink]$_2$]$_3$ did (respectively) John eat $e_1$ on Thursday after Mary had $e_{PG2}$, (respectively)? (Park 2006: 304)

Recall that we argued in the introduction that PG, as opposed to ATB and RNR, fails to license ID (let alone AC) probably because only the former does not involve coordination, thus preventing ER from yielding the ID. We also suggest that the impossibility of ID in the PG construction is attributed to the fact that parasitic gaps are identical to real gaps (Taraldsen 1981; Pesetsky 1982; Sag 1983; Nunes 2001, 2004, inter alia). The different behavior of the PG construction from the ATB and RNR constructions as regards the availability of ID strongly indicates that a real gap and parasitic gap in the former construction can't be distinct in reference, while gaps in two conjuncts in the latter two may be. The following examples where the PG construction co-occurs with the ATB or RNR construction lend support to our suggestion.

(11) Interwoven dependency in ATB and PG
  [[Which reporter]$_1$ and [which writer]$_2$]$_3$ did Jerome respectively fire $e_1$ after finding $e_{PG1}$ drunk and hire $e_2$ after finding $e_{PG2}$ sober?

(12) Interwoven dependency in RNR and PG
  Jerome fired $e_1$ after finding $e_{PG1}$ drunk, and Bill hired $e_2$ after finding $e_{PG2}$ sober – [[this tall young reporter]$_1$ and [that tall young writer]$_2$]$_3$, respectively. (after Postal 1998: 136)

In (11), two complex sentences each of which subordinates a temporal

adjunct containing a parasitic gap are coordinated, and two *wh*-phrases associated with real gaps in the following conjuncts can appear as a coordinate DP at the left periphery. Likewise, in (12), two elements referentially dependent on real gaps in the preceding two conjuncts can appear as a coordinate DP in the rightmost position, even though each conjunct subordinates a temporal adjunct with a parasitic gap. Notice that the parasitic gaps in (11) and (12), as opposed to those in (10a,b), are not directly linked to the coordinate DPs at the left or right edge but to the real gaps in the main clauses inside each conjunct. This difference seems to be what makes it possible for the real gaps to be interpreted as different in reference without contradicting the requirement of the identity between real and parasitic gaps. Thus, what we can learn from the contrast between (10) and (11)-(12) is that ID can be established only if two gaps inside conjuncts are different in reference, an option which is precluded in canonical PG constructions like (10) as the identity between the two gaps in reference is obligatorily required.

**2.2 Additive coordination**

As Gawron and Kehler (2004) observe, in the ATB construction, whether gaps in the two conjunct clauses in the post-ATB-ed part can be construed as identical in reference depends on whether an element at the left edge is singular or plural. Consider the two sentences below.

(13) A: Which man/what man did John kill e on Tuesday and Fred kill e on Wednesday?
B: #John killed Bruno and Fred killed Arno.

(14) A: Which men/what men did John kill e on Tuesday and Fred kill e on Wednesday?
B: John killed Bruno and Fred killed Arno.

When the ATB-moved *wh*-word is singular, as in (13), the gaps in the following conjunct clauses cannot be construed as different in reference, which

explains the anomaly of B's utterance as an answer to A's question. The only acceptable answer, of course, is the absurd scenario where the same person is killed on two different days. On the other hand, when the *wh*-phrase at the left edge is plural, as in (14), the two gaps in the following conjuncts may be interpreted as different in reference, which makes B's answer sound natural.

Let's now assume with Williams (1978, 1990) that the leftmost element in the ATB construction is derived by movement. We can then say that the *wh*-phrases originating from inside the two conjuncts in (13) are unified into a singular one, while those extracted out of the two conjuncts in (14) are fused into a plural one. It is noteworthy that the case in (14) is analogous to the case of interwoven dependency (ID), except that the two *wh*-phrases are unified without being conjoined by the overt conjunction. This way of looking at the contrast between (13) and (14), sheds light on how the singularity/plurality of *wh*-phrases at the left edge correlates with the identity/difference in reference between gaps in the following conjuncts.

Notice, though, that there are in fact two different types of readings available when *wh*-phrases at the left edge are plural. For example, in sentence (15) with the plural *wh*-phrase, the two gaps left in the two conjuncts can be construed as either identical or different in reference.

(15) [How many frogs] did Greg capture e and Lucille train e?
  a. How many x, x frogs, is such that Greg captured x and Lucille trained x.
  b. How many x and y, x and y frogs, is such that Greg captured x and Lucille trained y. (Postal 1998: 136)

As Postal (1998) reports, the *wh*-phrase in the plural form can semantically distribute over each of the conjuncts in the same way. However, depending on the context, another interpretation can arise where the *wh*-phrase denotes the sum of the number of the first gap and that of the second gap. Postal (1998) refers to the first type of coordination as distributive coordination (DC) and the second type of coordination as additive coordination (AC). More specifically, if the ATB sentence in (15) employs DC, which is found in most cases of coordination, we can construe it as a question asking about both the number of frogs captured by Greg and that of frogs trained by Lucille. So the appropriate

interpretation of the question in this case looks like (15a). On the other hand, in the case of AC, the same sentence can be regarded as a question about the total number of frogs that results from the addition of the number of frogs captured by Greg to that of frogs trained by Lucille. In this second case, the question can be roughly paraphrased as in (15b).

A generalization from the discussion above is that when an ATB sentence involves DC, gaps inside conjuncts are required to be identical in reference, whereas when it involves AC, gaps inside conjuncts may have different reference. Furthermore, the type of coordination is constrained by the singular/plural distinction of a left-edge expression. In other words, a plural expression at the left edge allows for both DC and AC, as in (15), while a singular expression only allows for DC, as shown by the contrast between (13) and (14). Given this generalization, the infelicity of B's answer to the ATB question in (13) naturally follows. That is, the question should preclude DC, since it would yield an interpretation such that the same person was killed more than once on multiple days, which is pragmatically bizarre. Nor should AC be possible for the same question, as the left-edge expression which man/what man takes a singular form. However, rather than accounting for the absence of the distributive type of coordination for (13), this paper will focus on answering how the additive type of coordination in ATB sentences like (15) is syntactically derived. The core idea we propose is that *wh*-expressions extracted out of two conjuncts are unified into a plural one during derivation after they undergo cross-clausal conjunction, yielding parallel coordinate structure headed by a covert union operator.

Now let us consider if AC is possible in the RNR construction. To begin with, given our previous conclusion about the parallel behavior of the ATB and RNR constructions, the RNR construction is expected to pattern with the ATB construction regarding the correlation between the singular/plural distinction of a right-edge expression and the identity/difference in reference between gaps. As shown by the contrast between (16a) and (16b), whether gaps in the preceding two conjuncts can be interpreted as different in reference is determined by the singular/plural distinction of an RNR-ed element.

(16) a. John met on Tuesday e and Fred met on Wednesday e – a businessman from Saudi Arabia.
b. John sang e, and Mary recorded e – two (quite different) songs (between them).

In (16a), where the RNR-ed expression is singular, the two gaps must be construed as identical in reference. Thus, the sentence can be felicitous only when the person John met on Tuesday is the same person as Fred met on Wednesday. On the other hand, in (16b), where the RNR-ed element is plural, the two gaps can be interpreted as different in reference. Accordingly, the sentence can be true even when the song sung by John is different from the one recorded by Mary.

It is to be emphasized that just as in the ATB construction, AC is also allowed in the RNR construction when an RNR-ed expression is plural. This is clearly shown in (17).

(17) Additive coordination in RNR
Greg captured $e_1$ and Lucille trained $e_2$ – $[312\ frogs]_{1+2}$ between them.
(Postal 1998: 137)

The most natural reading from this sentence is that the total number of frogs is 312, and this number is obtained by adding the number of frogs captured by Greg up to that of frogs trained by Lucille. Put differently, the sentence can be true as long as the sum of the number of frogs captured by Greg and that of frogs trained Lucille is as many as 312. By contrast, the sentence cannot be construed as 'Greg captured 312 frogs and Lucille trained 312 frogs,' as pointed out by Postal (1998: 137). As a first step towards an analysis to capture this fact, we assume that in RNR sentences like (17), DPs generated inside two conjunct clauses are unified into a plural one in the course of derivation. Recall that the same unification process applies to *wh*-expressions at the left edge in the ATB equivalents involving AC. Just as in the case of the ATB construction, the additive type of coordination can be said to be analogous to the interwoven type of dependency in the RNR construction, except that the unification of RNR-ed elements in the former type utilizes the invisible conjunction head, as will be

elaborated on in Section 3.

Finally, it would be revealing to examine if the same type of coordination is available to the PG construction. In the PG construction, unlike the ATB and RNR constructions, whether an element at the sentence edge is singular or plural, two gaps in the main and subordinate clauses cannot be construed as different in reference, as shown in (18)-(19).

(18) A: Which man/what man did Bill kill e before Fred killed e?
B: #John killed Bruno before Bill killed Arno.

(19) A: Which men/what men did Bill kill e before Fred killed e?
B: #John killed Bruno before Bill killed Arno. (Park 2006: 307)

Thus, the PG construction, which requires a real and parasitic gap to be identical, is predicted not to allow for AC, since the non-identity between the two gaps in reference should be possible for establishing this type of coordination. This prediction is borne out by (20). This sentence is judged ungrammatical if it is construed as a question asking about the total number that is obtained by adding the number of frogs captured by Greg to that of frogs trained by Lucille.

(20) No additive coordination in PG
*[How many frogs]$_{1+2}$ did Greg capture $e_1$ before Lucille trained $e_2$?
(Park 2006: 308)

Now a brief comment is in order on whether any of the previous approaches can explain why the ATB and RNR constructions, but not the PG construction, allow for AC. First, under the leftward or rightward ATB-fashion movement analysis (Ross (1967) and Postal (1974, 1993, 1998) for ATB and RNR), it seems unclear how the movement operation can capture the way in which an expression from one conjunct is added to that of another expression from the other conjunct, yielding a cumulative reading. Second, the multidominance analysis (Citko 2005 for ATB; McCawley 1982, 1987, 1988, Wilder 1998, Bachrach and Katzir 2007, 2009 for RNR; de Vos and Vicente 2005 for both ATB and

RNR) appears to pose a problem in deriving the additive type of coordination too. According to the multidominance analysis of RNR, for example, both gaps in the first and second conjunct should be 312 frogs in (17). Then, it would be incorrectly predicted that the sentence can be interpreted as 'Greg captured 312 frogs and Lucille trained 312 frogs,' a reading reported to be unavailable by Postal (1998).

To sum up this section, we have shown that the ATB and RNR constructions allow for ID and AC, while the PG construction does not. These facts buttress our claim that the former two cannot be treated in a parallel way to the latter. We suggest that the different behavior of the three constructions with respect to the two types of coordination is tied to the generalization, namely that two gaps in the ATB and RNR constructions can be interpreted as different in reference, while those in the PG construction cannot. Since it has turned out that neither the movement analysis nor the multidominance analysis is successful in dealing with this issue, we will advance an alternative analysis, arguing that External Remerge (ER) (de Vries 2009) should be added to the inventory of elementary structure-building operations.

## 3. Towards an analysis

### 3.1 Cross-clausal conjunction and External Remerge in RNR

Focusing on the RNR construction in this section, we begin to lay out our model for capturing those constructional properties. Let us first consider the canonical RNR construction in (2), repeated as (21), where a single element is shared by the two preceding conjuncts.

(21) Sharing tye of RNR
John loves $e_1$, but Mary hates $e_1$, $oysters_1$. (= (2))

The RNR sentences involving ID are suggestive in finding a clue to the question of how such kind of sharing can be derived. Recall that when the construction involves ID, as in (22), repeated from (9a), an element extracted

from the first conjunct and another element from the second conjunct are conjoined together by coordination using the overt conjunction and.

(22) RNR with interwoven dependency
John loves $e_1$ and Mary hates $e_2$ – [[oysters]$_1$ and [clams]$_2$]$_3$, respectively. (= (9a))

Given this fact, we suggest that elements at the right edge, which are provided by the preceding conjunct clauses in an across-the-board fashion, have undergone cross-clausal conjunction in the course of structure building. We now go on to suggest that the same conjunction process works both for the sharing type of RNR-ed elements in (21) above, and for RNR-ed elements involving AC like (17), repeated in (23) below.[1]

(23) RNR with additive coordination
Greg captured $e_1$ and Lucille trained $e_2$ – [312 frogs]$_{1+2}$ between them. (= (17))

It is worth noting that three subtypes of RNR construction can be divided into two according to whether the conjunction head for cross-clausal conjunction is overt or not. That is, the RNR-ed elements in the case of ID like (22) undergo cross-clausal conjunction involving the overt conjunction head *and*. The overt conjunction is obligatory only in the ID type because the respective reading does not simply require the plural subject but also the coordinate structure with the overt conjunction. On the other hand, both the AC type and the sharing type of RNR-ed elements go through the same conjunction process employing the invisible conjunction head.[2] Crucially, we take the latter kind of coordinating conjunction head, symbolized as & here, to be equivalent to the union operator ∪. This operator enables us to explain how a cumulative interpretation can arise from the RNR-ed elements that have different reference in the case of AC in

1 An anonymous reviewer casts a doubt on how our ER-based analysis handles countless ways of combining the number of frogs in the two conjuncts. We will return to this issue shortly.

2 In the latter two types of RNR that employ the indivisible conjunction, two DPs in the pre-RNR-ed part are supposed to be morphologically fused into one. Along the lines of Distributed Morphology (Halle and Marantz 1993), we suppose that the unification of those two DPs takes place in post-syntactic morphological component. See the related discussion below and Park (2011) for more comprehensive discussion.

(23), as the major function of the operator is to add up the members of the two sets that it combines together. But there is one caveat: that is, two DPs in the preceding conjuncts are assumed to enter the derivation with the forms, x-frogs and y-frogs, later being fused into the surface form after their values determined by the context.

Unlike in the AC type, however, two identical DPs extracted from the preceding conjuncts are reduced into a single one in the sharing type of RNR as in (21). We assume that the identity for two conjunct DPs to be morphologically reduced into one in this sharing type is not strict identity but sloppy identity, the similar kind of identity found in sentences like *John likes, and Bill dislikes, his father* (cf. Park 2011). Then, how can the two DPs end up having the denotation of only one DP in the sharing type? We suggest that the semantic nature of the invisible operator & makes it possible: that is, if the union operator combines a set A with an identical set A, it returns the same set—simply put, A ∪ A = A.

One may question the derivation of distributed numbers. Given our proposal the sentence in (24a) should be derived from the structure in (24b).

(24) a. By gameday 13 of the previous season, the three main strikers of Barcelona had only scored 19 goals.
b. ⋯ the three main strikers of Barcelona had only scored 8 and 7 and 4 goals.

One could argue that this is problematic for our overall approach and we may want to adopt a purely semantic approach to additive readings (e.g., Winter 2001); however, we make the admittedly controversial claim that this is indeed the derivation. The proposal we are about to present is speculative as the grammar of numbers is poorly understood.

Just as roots are argued to sit at the interface of language and real world knowledge (Borer 2005), we suggest that numerals sit at the interface of language and our mathematical competence. As such, we hasten to point out that the forthcoming suggestion is not tantamount to endowing the grammar with the capacity to compute arithmetic. Rather, the grammar produces the underlying structure in (24b) above, and the part of cognition responsible for arithmetic (which we dub the arithmetic faculty for convenience) calculates the sum. To

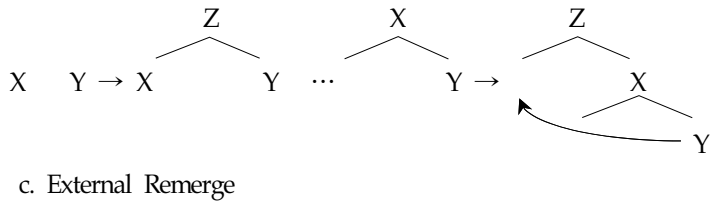
flesh out the metaphor, in a sentence such as *Bill has a poodle at home* the choice of the root √POODLE (versus √COLLIE or √TORTOISE) relies on our knowledge about animals rather than our grammatical knowledge. Nevertheless, roots are sensitive to grammatical information, too. For instance, the correct allomorph between *go* and *went* must be inserted depending on tense. Numerals are much the same. Assume that the grammar inserts a numeral root, $\aleph$, in the relevant position in the DP. The choice of numeral and any computations is done by the arithmetic faculty. Furthermore, like lexical roots, the phonetic form of numerals is sensitive to grammatical information (such as Case in some languages, or the choice of suppletive forms, such as *fifteen*).

We do not make a full proposal here as it would take us too far afield; however, we lay out the groundwork for how this might be accomplished. Ionin and Matushansky (2006) propose that additive numerals, such as *twenty-five* are formed by a coordinate structure conjoining *twenty* and *five* in separate phrases. We suggest that numerals devoid of phonetic content, $\aleph$, are merged in the overt syntax, and their overt form is determined by morphology. Thus, if *twenty* and *five* are conjoined, it is spelled out as *twenty-five*; however, if *ten* and *five* are conjoined, it is spelled out by the suppletive form *fifteen*. Note that if we assume that *fifteen* is simply a single lexical item (while *twenty-five* is two lexical items), then the grammar would have to take arithmetic into account in building phrase structure, as it would have to build a conjoined structure for *twenty-five* but not for *fifteen*. Thus, once the arithmetic faculty computes the final value of $\aleph$ to be inserted, PF inserts the corresponding phonetic form. In the example above, some kind of union operator could be an instruction to the arithmetic faculty to calculate the sum. This operator is assumedly optional, as the numerals can be spelled out individually as in the example (24b) (with the addition of the adverb *respectively*).

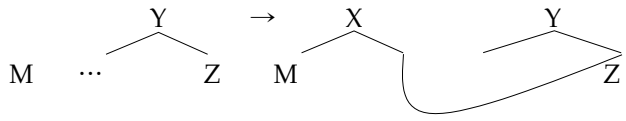
The next question that we need to tackle is which operation makes it possible for such cross-clausal conjunction to occur in the RNR construction. To answer this question, we first assume that elements at the right edge in this construction are base-generated in each of the preceding conjuncts. More importantly, we propose that at some point when an element to be RNR-ed occupies the rightmost position in each conjunct, they are destined to experience External Remerge (ER), an operation originally suggested by de Vries (2009). The

essential role of this operation is to make possible cross-clausal conjunction with a coordinate structure that is being built in a parallel fashion. ER is not a completely new operation but a hybrid one that shares the properties with widely accepted structure-building operations, such as External Merge and Internal Merge, both of which meet the Strong Minimalist Thesis (Chomsky 2000, 2001, 2004). Note, first, that External Merge (EM) is an operation that selects two roots, X and Y, at least one of which is taken from the so-called numeration (a separate storage space for a minimal unit of structure called phase), and combines the two roots, creating a new root (Z) that dominates them, as illustrated in (25a). Second, Internal Merge (IM) is another structure-building operation that corresponds to what is traditionally known as movement and combines a root (X), with a term (Y) from inside it, producing a larger root (Z), as shown in (25b).

(25) a. External Merge b. Internal Merge




c. External Remerge



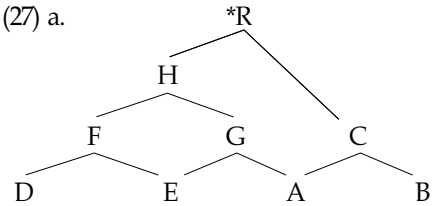

Turning to ER, it can be said to exhibit not only the property of IM but also that of EM. That is, the operation is similar to IM, as it targets two roots, Y and M, at an initial step; but it is analogous to EM, as it combines the root M with a term inside Y (i.e., Z) at the next step, yielding a bigger root (X). As a result of the application of ER, the term (Z) ends up being doubly dominated not only by Y but also by the newly projected root (X), as schematized in (25c) above. However, it is important to notice that ER does not work in an unconstrained way, instead being subject to the following constraints. In particular, as a way to restrict the syntactic environments where the operation ER can apply, we adopt

de Vries's (2009) Root Condition in (26), which stipulates that ER targets two elements at least one of which must be a root.

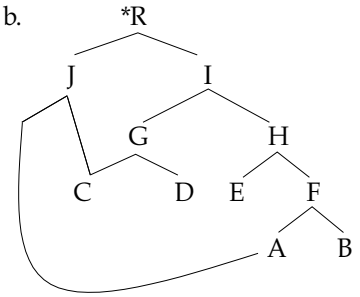
(26) Root condition
If α and β are selected as input for Merge, then α or β (or both) must be a root.

Let us demonstrate how this condition rules out instances where the application of ER is not allowed. For example, in (27a), a non-root term (E) is combined with another non-root term (A) to project a bigger element (G). In (27b), C and A (and G and F, their respective mother nodes), which are not roots, are targeted by ER to produce a bigger element (J). In both cases, however, the node J that is produced by the application of ER is not acceptable since the Root Condition is not respected in the course of derivation.

(27) a.




b.




As mentioned in passing in the previous section, in the literature, researchers have advanced different versions of multidominance structure or structure-building operation in one way or another. As reviewed in de Vries (2009), among those are 'multidominance' (McCawley 1982; Wilder 1999; Citko 2005; de Vos and Vicente 2005) and 'sharing' (Bachrach and Katzir 1997; Gracanin-Yusek 2007). Parallel structure has also been suggested in some studies that can be grouped by the name a 'multidimensional' approach (Williams 1978). Although not targeting ATB or RNR, 'interarboreal movement' is also suggested for head movement (Bobaljik 2005) while 'sideward movement' for PG (Nunes 2001, 2004). Admittedly, we will not do justice to all these existing studies here because it is beyond the scope of this paper.

One might think that our model which adopts ER looks similar to Citko's (2005) multidominance analysis of the ATB construction, which relies on the notion of Parallel Merge. But there are two things in favor of our approach, as opposed to her analysis: first, unlike the case of ER, Parallel Merge is not constrained by such a condition as the Root Condition, so it would be difficult to rule out cases where two subparts (i.e., non-roots) are combined (Citko 2005: fn. 2); and second, as pointed out in Section 2, Citko assumes that elements at the left edge in the ATB construction should be shared by both conjuncts at the initial stage of a derivation, which makes it difficult to capture the ID and AC available in both the ATB and RNR constructions.

However, one may think that comparing Citko's (2005) Parallel Merge (PM, henceforth) to the ER approach is irrelevant, especially to the ID-type ATB construction, since the coordinate elements are not identical. To our understanding, however, PM can also apply to non-identical elements conjoined with a coordinating conjunction. Indeed, de Vos and Vicente (2005) examine a possibility of extending PM to the ID contexts, which they call 'W & W sentences.'

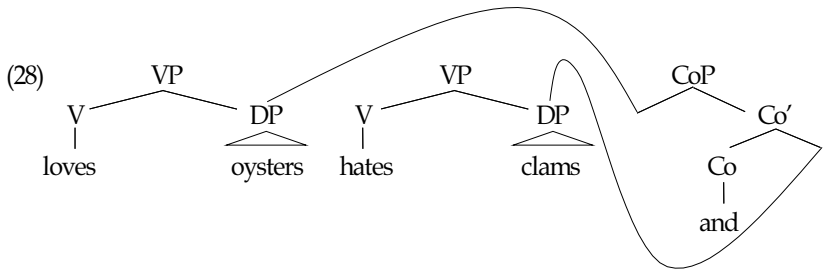
Regarding RNR, on the other hand, PM does not seem to be easily extended to the construction, as already revealed in the literature. According to de Vos and Vicente (2005) and de Vries (2009), for example, unlike ATB, the shared (i.e., multirooted) elements are not displaced from their base position in RNR, and as such, the resulting structure cannot be properly linearized in the latter. We suggest that the same line of reasoning applies concerning the invalidity of our comparison between ER and PM for the ID dependency.

Not only does Citko's PM fail to be extended to RNR but it also confronts a couple of more issues to be fixed in ATB as well as RNR. First, if two predicates end up sharing a single argument in the two constructions, it seems dubious how a theta role from each predicate can be discharged, and thus how the traditional Theta Criterion can be respected. Second, Citko's analysis in terms of PM can be said to be representational, while our ER-based system is derivational in its nature. These issues seem to confirm our conclusion that ER works better than PM. Finally, Ciko's system should assume a construction-specific PF constraint to rule out illegitimate strings of words that are inevitable outputs of multirooted structures. But in our approach, we do not

need to postulate such a constraint since the parallel coordinate structure CoP, which is assumed to be an independent domain for Spell-Out, helps to ban the word order contradiction on a par with a very general PF condition, namely the Principle of Cyclic Linearization adopted from Fox and Pesetsky (2005).

Having said this, let us see how the suggested analysis derives the interwoven type of coordination in the RNR sentence in (22). The postulation of the operation ER makes it natural to assume that while two conjuncts are being built up in the pre-RNR-ed part, there is another coordinate structure being constructed in parallel. We assume that this parallel coordinate structure is labeled Co(ordinate)P or &P, depending on whether the conjunction head is visible or invisible: a CoP is headed by the overt conjunction *and*, while an &P is by the invisible conjunction &. So our proposal amounts to saying that RNR-ed elements are in fact those that occupy a specifier and complement position of the CoP or &P. These parallel coordinate structures are constructed by multiple applications of ER, which are followed by deletion for linearization at the PF interface. Specifically, in the course of structure building for (22), two VPs in the pre-RNR-ed and the CoP headed by the overt conjunction are to be built simultaneously. That is, at the initial stage of a derivation, ER applies twice after two object DPs *oysters* and *clams* are merged with their respective predicate, and it results in the representation in (28).

(28)




To derive this structure, the object DP clams dominated by the VP in the second conjunct is first merged by ER with and under the root node Co, projecting Co'. Then, another object DP oysters, which is dominated by the VP in the first conjunct, is combined with the root node Co' by another instance of ER, producing the CoP. As a result, the DP in the first conjunct and another DP in

the second conjunct are dominated by each VP, while also being dominated by the CoP and Co', respectively. Notice that the Root Condition is respected in both instances of ER. An acute reader might wonder why the object DP in the second conjunct should be first merged with Co before another DP in the first conjunct is combined with Co', not the other way around. This is because, if ER worked in the reversed sequence, we would end up with a contradiction between the word order in each VP and its realization in the final output.

At the next step, each of the two VPs is merged with the TP, after which the two TPs are conjoined together by coordination employing the overt conjunction *and*, just as in the case of normal TP coordination. But we assume that unlike the case of ordinary TP coordination, the lower CoP, a parallel conjunction structure, is adjoined to the second VP, as depicted in (29).

(29) John loves oysters and Mary [$_{VP}$ [$_{VP}$ hates clams], [$_{CoP}$ [$_{CoP}$ ____ and ____],
respectively]] ER ER

One reason for us to treat CoP, which is a locus of the RNR-ed elements, as an adjunct attached to the VP in the second conjunct in (29) comes from anaphor binding. For example, in ID-type RNR sentences like *John$_i$ loves and Mary$_j$ hates, himself$_i$ and herself$_j$, respectively*, the anaphors *himself* and *herself* in the RNR-ed part are bound by their respective antecedent. If the rightmost CoP hosting the RNR-ed element is assumed to be attached to the VP of the second conjunct, why the anaphor can respect Principle A immediately falls out from our suggested structure like (29), where CoP at issue is c-commanded by the specifiers of both TPs.

Secondly, the same cross-clausal conjunction that builds up a parallel coordinate structure for the RNR sentence with ID also plays a crucial role in deriving the sharing type of RNR sentence like (21) *John loves, but Mary hates, oysters*. However, unlike the former type of RNR sentence, the coordinate structure in the RNR-ed part in the latter type is not a CoP but an &P, since the coordinating conjunction head is an invisible one. At some point in the derivation when the object DP *oysters* is combined by EM with the predicate and ends up being at the right edge in each conjunct, the DP in the second conjunct is first merged by ER with the root node &, projecting a bigger node

&′. Then, the resulting root node &′ experiences another instance of ER to be merged with the DP in the first conjunct, yielding an &P. Provided in (30) is what can be obtained by the two applications of ER, and the first and second DP are multiply dominated by each VP, as well as by the &P and &′, respectively.

(30) loves oysters, and hates oysters, [$_{\&P}$ _____ & _____].
ER ER

After that, each VP grows into a TP through two applications of EM or IM, and the two TPs are conjoined by the conjunction head in the same way as the ordinary TP coordination. Note again that the &P created by the cross-clausal conjunction is adjoined to the second VP, as in (31).[3]

(31) John loves oysters, and Mary [$_{VP}$ [$_{VP}$ hates oysters], [$_{\&P}$ _____ & _____]].

Recall that &, the head of the parallel coordinate structure, corresponds to the union operator ∪. Given the nature of this operator, it follows that when two elements to undergo ER with & or &′ have the same reference/meaning in the sharing type, the operator yields an outcome where the two elements it combines are unified into one in their meaning. On the other hand, when two elements do not have the same reference, as in the case of AC (which we will turn to shortly), what can be obtained by the operator is the sum of the references/meanings of the two elements. Note further that for the purpose of linearization, one of the two DPs under the &P is deleted in the sharing type at the PF interface, while both DPs under the &P are replaced with a single DP denoting the sum of the meanings of the two DPs in the AC type. By contrast, neither of these operations at PF is necessary in the ID type, as both of the RNR-ed elements are pronounced.

Now turning to the last subtype in (23) that exhibits AC, we assume that

3 One reviewer asks whether sentences with the disjunction 'or' like *John likes or dislikes, oysters and clams, respectively* give rise to the same readings as the ones with the conjunction. We believe that the former do not pattern with the latter, restricting our discussion to those with the coordinating conjunction. We do not discuss comitative type of coordination, either (cf. An 2017).

this type of RNR undergoes almost the same procedure as the sharing type, except that the head of an &P semantically adds the reference of the DP in the Spec, &P position to that of the DP in the complement position. Suppose that the situation for sentence (23) to be true is that the number of frogs captured by Greg is 200 and that of frogs trained by Lucille is 112. At the initial stage of a derivation, two instances of ER for cross-clausal conjunction yield the following structure.

(32) captured [$_{DP}$ 200 frogs] and trained [$_{DP}$ 112 frogs], [$_{\&P}$ _____ & _____].
ER ER

The coordinated TP is constructed later, after which the two DPs in the parallel coordinate structure &P are reduced into one on the PF side. On the semantics side, the surviving DP ends up having 312 frogs as its meaning, owing to the nature of the invisible union operator &.

### 3.2 Constraints for linearization in RNR: CSC, CAC and cyclic linearization

So far we have simply assumed that when structure building is completed for each type of RNR construction, deletion takes place at PF for linearization. However, we have not clarified how illegitimate strings of words are constrained, so that a correct word order string can be obtained under the current model. In this subsection, we will address three conspicuous questions which are crucial in understanding the linearization process in the proposed model here.

The first question is how elements multiply dominated by more than one node via cross-clausal conjunction can be turned into a correct word order string in the RNR construction. As shown in (29) above, the object DPs in two conjuncts are in a sister relation with more than one node as a result of two instances of ER. For example, the DP *oysters* in the first conjunct is a sister of both the verb *loves* and the non-terminal node Co'. Likewise, another DP *clams* is in a sister relation with both the verb *hates* and the terminal node Co. Therefore, it appears that the following four strings of words are in principle obtainable at

the PF interface.

(33) a. John loves, and Mary hates, oysters and clams, respectively. (= (22))
b. *John loves oysters, and Mary hates, and clams, respectively.
c. *John loves, and Mary hates clams, oysters and, respectively.
d. *John loves oysters, and Mary hates clams, and, respectively.

As indicated above, however, other options than the first one are in fact not admissible. We attribute the illegitimacy of three sequences in (33b)-(33d) to a violation of the Coordinate Structure Constraint (CSC), prohibiting extraction of any conjunct or any element out of a conjunct. A generalization from all those inadmissible sequences seems to be that the coordinate conjunction and in the RNR-ed part is not adjacent to one conjunct or both conjuncts. Indeed, this generalization has been reflected in de Vos and Vicente's (2005: 102) Conjunct Adjacency Constraint (CAC), requiring the conjunction to be linearly adjacent to (parts of) both conjuncts. We assume, following de Vos and Vicente, that this constraint is operative at PF. The linear order in (33a) is well-formed since both the first and second conjunct in the pre-RNR-ed part provide a DP in an ATB manner for the parallel coordinate structure to be constructed. By contrast, the sequences in (33b)-(33d) are prohibited by the CAC, as one or both of the conjuncts in the RNR-ed part are not adjacent to the conjunction.

Recall that among the previous multidominance approaches, Citko (2005), which appears to be similar to ours, would experience difficulty explaining how to derive ID (let alone AC) in RNR. This is because, as mentioned by de Vos and Vicente (2005), the shared node (i.e., the multirooted node) fails to be properly linearized unless movement applies, and RNR, as opposed to ATB, is assumed not to involve movement in Citko's system. For this reason, de Vos and Vicente suggest a PF deletion approach to RNR (and CoRNR in their term), but their idea does not seem to be as clearly fleshed out as expected in their paper, which precludes a possibility to take their approach as a compelling alternative to RNR and ATB.

Likewise, we can also explain how strings of words in the sharing type of RNR like (21) and the case of additive coordination (AC) like (23) can be guaranteed. Notice that these two types do not pattern with the case employing

interwoven dependency (ID) regarding the way the CAC works. That is, in the former two types, elements undergoing RNR cannot be phonologically realized in both conjuncts in the RNR-ed part, but the resulting sequences do not make the CAC in trouble as there is no overt conjunction. Instead, the elements provided by the preceding conjuncts are reduced into a single element in the RNR-ed part, as in (34a) and (35a).

(34) a. John loves, but Mary hates, oysters. (= (21))
b. *John loves, but Mary hates, oysters & oysters.

(35) a. Greg captured and Lucille trained, 312 frogs between them. (= (23, 32))
b. *Greg captured and Lucille trained, 200 frogs & 112 frogs between them.

Then, one may ask why the sequences in (34b) and (35b), where the CAC is apparently satisfied, are not acceptable. We simply assume that it is unnatural for two DPs to appear in a row without being conjoined together by the overt conjunction. The unnaturalness of such kind of coordination can now be ascribed to Richards' (2010) distinctness condition on linearization. To circumvent this situation, two DPs in the RNR-ed part undergo readjustment post-syntactically during Spell-Out. There is no doubt that this kind of post-syntactic operation is already well justified in the Distributed Morphology framework.

As for the second question, we need to explain why RNR-ed elements should be aligned in the final position of a sentence or at least after the two conjunct clauses. In other words, why is it that the parallel coordinate structure created by clausal-conjunction via the applications of ER should be adjoined to the second conjunct, not to the first conjunct? Consider (36) below, a hypothetical structure of (22), where the lower coordinate structure, CoP, is adjoined to the VP in the first conjunct. Notice that there is nothing wrong with the applications of ER in (36), as the Root Condition is satisfied in each instance of ER.

(36) John [$_{VP}$ [$_{VP}$ loves oysters], [$_{CoP}$ [$_{CoP}$ ___ and ___], respectively]] Mary hates clams.
ER └──────┘ └──────────────────────┘ ER

Given this structure, the following string of words should be admissible when all the linearization process ends. But as indicated below, the resulting sequence is not allowed.

(37) *John loves oysters and clams, respectively, but Mary hates.

Along the lines of Wilder (1999) and Park (2005), we suggest that the above sequence is not acceptable because the word order of each conjunct clause is not preserved in its realization in the final output. In other words, in addition to the CAC, there is another principle that constrains the output of cross-clausal conjunction through the applications of ER. This principle, which we call the Principle of Cyclic Linearization (PCL), requires the word order in each conjunct in the RNR (and ATB) construction not to be altered in the final output. This principle is based on the assumption that just as structures are built up cyclically, linearization is executed in a cyclic manner. The guiding idea of the suggested principle here is actually rooted in Fox and Pesetsky's (2005) Linearization Preservation in (38).

(38) Linearization Preservation
The linear ordering of syntactic units is affected by Merge and Move within a Spellout Domain, but is fixed once and for all at the end of each Spellout Domain.

Returning to the RNR cases, we take each conjunct clause in the pre-RNR-ed part to be a minimal domain where linearization can apply. Given this, at the initial stage where two TPs and the parallel CoP are completed, if the object DPs are realized in the domain of VP, not of the CoP, each conjunct comes to have the following sequence.

(39) a. First conjunct: John < loves < oysters.
b. Second conjunct: Mary < hates < clams

However, at the later stage where the larger CoP is completed, the linearization process produces the following sequences for each conjunct clause of (37).

(40) a. First conjunct: John < loves < oysters.
b. Second conjunct: clams < Mary < hates.

Observe that although the word order of the first conjunct in (39a) remains the same in (40a), the linear order of the second conjunct clause in (39b) fails to be preserved in (40b), which renders the PCL violated. Therefore, it becomes straightforward why the structure in (29), not in (36), leads to the admissible string of words for (22). In short, the former structure, where the parallel coordinate structure CoP is adjoined to the second VP, yields the sequences in (41) by linearization at the final stage. More import, the word order of the first conjunct in (41a) and that of the second conjunct in (41b) are the same as their equivalents in (39a) and (39b), respectively.

(41) a. First conjunct: John < loves < oysters.
b. Second conjunct: Mary < hates < claims

Finally, regarding the third question, as mentioned in Section 3.1, we should clarify why the DP in the second conjunct should undergo ER to be combined with the root node Co or & before the DP in the first conjunct is merged with Co′ or &′ by another instance of ER. Consider the following structure for (22), which is identical to the structure in (29), except that the DP in the first conjunct is merged with Co and the DP in the second conjunct is with the node Co′.

(42) John loves oysters, and Mary [$_{VP}$ [$_{VP}$ hates clams], [$_{CoP}$ [$_{CoP}$___ and ___], respectively]].
ER ER

At first blush, it might look as if the PCL is respected by the output yielded by linearization from the above structure. This is because if we only look at the sequences of the two conjuncts at the initial stage in (43a,b) and compare them with their counterparts at the final stage in (44a,b), there does not seem to be any contradiction between them in linear order.

(43) a. First Conjunct: John < loves < oysters.
b. Second Conjunct: Mary < hates < clams.
c. oysters < clams

(44) a. First Conjunct: John < loves < oysters.
b. Second Conjunct: Mary < hates < clams.
c. clams < oysters.

However, if we zoom in on the relative order of the object DPs in the two conjuncts at each stage of the derivation, the problem with the structure in (42) becomes evident. That is, when the two conjuncts are initially linearized, the DP *oysters* precedes the DP *clams*, as in (43c), but the order between the two DPs is reversed at the later stage, as in (44c). Accordingly, what is obtained by linearization from a structure like (42) does not comply with the PCL. This gives us a natural account for why the DP in the first DP must be paired with Co', while the DP in the second conjunct should be merged with Co, not the other way around.

One brief comment about the position of RNR-ed elements before they undergo cross-clausal conjunction via ER is that according to the PCL, the word order of each conjunct clause must be identical to its equivalent after the entire sentence is linearized. This in turn imposes a restriction that the position of any element to be RNR-ed is confined to the right edge of each conjunct before it goes though ER for the purpose of cross-clausal conjunction.

### 3.3 Cross-clausal conjunction via External Remerge in the ATB construction

We argue that the proposed analysis of the three subtypes of RNR construction can be readily extended to the ATB construction, since it has turned out that the latter is the mirror image of the former. As in Section 2, the ATB construction also has at least three subtypes: they are the sharing type in (45), repeated from (4), the type involving interwoven dependency (ID) in (46), repeated from (7a), and the type exhibiting additive coordination (AC) in (47), repeated from (15).

(45) [Which book]$_1$ did Mary read $e_1$ and Bob skim $e_1$? (= (4))

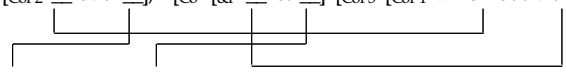
(46) [[Which book]$_1$ and [which magazine]$_2$]$_3$ did Mary read $e_1$ and Bob skim $e_2$, respectively? (= (7a))

(47) [How many frogs] did Greg capture e and Lucille train e? (= (15))

Just as in the case of RNR, to provide a proper account for how each subtype of ATB construction is derived under the current model, it is very important to figure out how structural sharing can be obtained in the three subtypes. We suggest that all the three types of ATB construction involve leftward cross-clausal conjunction via ER, but they are divided into two depending on the form of the coordinating conjunction. In the ID type, elements at the left edge provided by the following two conjuncts via ATB movement are conjoined together by the overt conjunction head and, the head of CoP. In both the sharing and AC type, by contrast, elements at the left edge are conjoined by the covert conjunction &, the head of &P.

Let us begin by examining the ID type of ATB sentence in (46). As shown in (48) below, the *wh*-phrase is first displaced to the Spec, CP position in each conjunct by *wh*-movement, an instance of Internal Merge. After that, they are conjoined together by the overt conjunction head at the left periphery through two applications of ER. As a result, which book is multiply dominated by both the CP in the first conjunct and the parallel coordinate structure, $CoP_2$, while which magazine is doubly dominated by both the CP in the second conjunct and $Co_2'$. Note also that the inverted auxiliary verb did in each conjunct is conjoined together by the invisible conjunction head & under the head of $CoP_1$ via two instances of ER. The coordinated auxiliary verbs are later unified into one at the PF interface.

(48) [$_{CoP1}$ [$_{CoP2}$ __ and __], [$_{Co'}$ [$_{\&P}$ __ & __] [$_{CoP3}$ [$_{CoP4}$ which book did Mary read, and



which magazine did Bob skim, respectively]]]]? (ER x 4)

$CoP_4$ hosts two conjuncts, $CP_1$ and $CP_2$, in its specifier and complement position, respectively; and *respectively* that seems to have a close relationship with *which book* and *which magazine* in its reading is attached to the $CoP_4$ via Pair Merge (i.e., adjunction). Then, the Pair-Merged $CoP_3$ and $CoP_4$ are taken as the complement of the topmost head, $Co_1$, and the ATB-ed elements via ER are located in the Spec, $CoP_1$. One may wonder how come '&P' multiply dominating the auxiliary head in $CP_1$ and $CP_2$ can be a head. To evade a possible problem that a head is dominated by a phrasal unit, we tentatively suggest, following Chomsky (2013: 43), that a coordinating conjunction and a construction that it heads are not available as a label. Therefore, it would not be untenable to assume that the &P, which looks like a phrasal unit, is able to function as the head of the topmost $CoP_1$ in (48) as the conjunction does not have a label.

Just as in the case of RNR, not only the CAC but also the PCL constrains the way the structure constructed by cross-clausal conjunction is linearized in the ATB construction. For example, the CAC forces the two *wh*-phrases to be present on both sides of $Co_2$ in (48), but it prevents one or both of the *wh*-phrases from appearing in any of the following two conjunct clauses. The occurrence of the inverted auxiliary verbs is also restricted by the same constraint. On the other hand, the PCL requires the word order of each conjunct to be preserved in its realization in the final output of the entire ATB sentence. But due to the space reason, we will not discuss in detail how the principle rules out other possible strings of words than the one in (46).

Recall that one of the consequences of the PCL bears on the derivation of the RNR construction is that elements to be RNR-ed should appear at the right periphery of each conjunct clause before they experience ER for cross-clausal conjunction. It seems that this ancillary restriction also holds for ATB-moved elements in the ATB construction, forcing them to occupy the left edge inside each conjunct before ER applies. To understand why this matters, let us suppose that TPs, rather than CPs, are conjoined together, precluding the option where the two *wh*-phrases move to the left periphery inside each conjunct. After that, the *wh*-phrases are conjoined together after they undergo sideward movement (in Hornstein & Nunes's (2002) and Nunes's (2001, 2004) sense) to the domain of the parallel coordinate structure in the Spec, CP position. Zhang (2007) suggests this kind of alternative derivation for sentences like (46), and what can be created by

this option is illustrated in (49).

(49) [$_{CP}$ [$_{CoP1}$ __ and __] [$_{C'}$ did [$_{CoP2}$ [$_{CoP3}$ Mary read which book, and Bob skimmed which magazine]]], respectively]?

Observe that this structure does not cause any problem for the application of ER, nor is there any problem that keeps sideward movement from taking place. However, on a close inspection, it would not be difficult to see that the word order of each conjunct fails to be kept consistent when the entire CP is linearized, giving rise to a violation of the PCL. More specifically, if elements in each conjunct clause in (49) are linearized, what we can obtain is the following strings of words.

(50) a. First Conjunct: Mary < did < read < which book
b. Second Conjunct: Bob < did < skim < which magazine

Once the entire clause is linearized, on the other hand, the sequences of words in (51a) and (51b) become available, but neither the sequence of the first conjunct nor that of the second conjunct obtained at the earlier stage is preserved. Thus, sentence (46) should be ruled out due to a violation the PCL, contrary to fact.

(51) a. First Conjunct: which book < did < Mary < read
b. Second Conjunct: which magazine < did < Bob < skim

In short, the restriction forcing ATB-moved elements to occupy the left edge inside each conjunct, an important consequence of the PCL, leads us to favor the current analysis based on (48) against the alternative analysis based on (49).

As for the sharing type of ATB construction in (45), what distinguishes this type from the ID type is that the coordinate conjunction head for ATB-moved elements such as *wh*-phrases and auxiliary verbs is the invisible &, and the ATB-moved elements conjoined together by this kind of head are later phonologically reduced into one. Furthermore, since the *wh*-phrases inside the

two conjuncts have the same reference in the sharing type, the invisible head &, which is assumed to be equivalent to the union operator ∪, unifies them into one in their meaning. Given this, when (45) reaches the final stage of the derivation, the structure of the sentence can be represented as follows:

(52) [$_{CoP1}$ [$_{CoP2}$ ___ & __], [$_{Co'}$ [$_{\&P}$ __ & __] [$_{CoP3}$ [$_{CoP4}$ which book did Mary read, and
which magazine did Bob skim, respectively]]]]? (ER x 4)

Notice that just as in the case of the ID type, both *wh*-phrases are first displaced by IM to the left periphery of each conjunct, and then, they are combined via ER together with &′ or &. Otherwise, after the linearization process for the entire sentence is completed, a violation of the PCL would be triggered. Remember that on Citko's (2005) multidominance analysis of the sharing type of ATB construction, a single *wh*-phrase should be shared by both conjunct clauses via Parallel Merge at the beginning of a derivation before it undergoes *wh*-movement to the specifier position of the entire CP, which can be roughly represented as in (53) (cf. Citko 2005: 483).

(53) [$_{CP}$ ___ [$_{C'}$ [$_{\&P}$ [$_{\&'}$ Mary read ___] [$_{TP}$ Bod skimmed which book]?
Parallel Merge *Wh*-Move

It seems that Citko's approach to the sharing type resembles Zhang's (2007) analysis of the ID type, in that TPs are conjoined and elements to be ATB-moved stay in situ before being incorporated into the CP domain of the entire clause. Recall, however, that unless the ATB-moved element is positioned at the left periphery of each conjunct, we end up violating the PCL. In this respect, the PCL clearly tells us what problems Citko's multidominance analysis would face in deriving not only the sharing type but also the ID type, the latter of which is not directly addressed by her.

Finally, the AC type of ATB construction in (47) can be derived by almost the same way as the sharing type, except that the invisible conjunction head semantically adds the reference of the *wh*-phrase in the first conjunct up to that

of another in the second conjunct.

To sum up, it has been shown that the current analysis, which was developed for the three subtypes of RNR construction in 3.1 and 3.2, can also explain the structure building and linearization processes for the three subtypes of ATB construction.

### 3.4 What makes the PG construction differ from ATB and RNR?

We have seen that while the PG construction allows for the sharing type in (54), repeated from (3), neither the interwoven dependency (ID) type in (55), repeated from (10a), nor the additive coordination (AC) type in (56), repeated from (20), is permitted in the same construction.

(54) Who will the police arrest e after interrogating e? (= (3))

(55) *[[Which paper]$_1$ and [which book]$_2$]$_3$ did (respectively) John copy $e_1$ before Mary read $e_{PG2}$, (respectively)? (= (10a))

(56) *[How many frogs]$_{1+2}$ did Greg capture $e_1$ before Lucille trained $e_2$? (=(20))

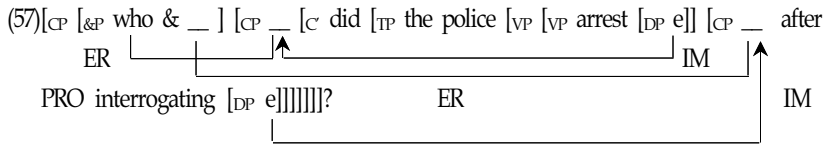
So the question is what prevents the latter two subtypes of coordination from being available in the PG construction. It has been shown in Section 2 that unlike the ATB and RNR constructions, the PG construction never allows a real and parasitic gap to be interpreted as different in reference. We ascribed this contrast to the nature of the parasitic gap obligatorily dependent on the real gap in reference for licensing. For this reason, we suggest that by means of External Remerge, the real gap chain in the matrix clause and the parasitic gap chain in the subordinate clause in fact make up a single chain, an idea similar to the one pursued by the sideward movement approach (Hornstein and Nunes 2002; Nunes 2001, 2004, among many others) despite the difference in technical details. In the PG construction, the function of ER is basically to combine independent *wh*-expressions extracted out of super- and subordinate clauses for cross-clausal conjunction as in the ATB construction, but unlike the latter, the real and the

parasitic gap always end up being members of a single chain in PG. Crucially, the applications of ER to the head of a real gap chain and the one of a parasitic gap chain associate the former to the specfier of &P and the latter to its complement, respectively. The &P, which is not parallel but auxiliary (viz., adjoined in a structural term) in PG, invariably requires the strict identity between the two copies in its specifier and complement, yielding an effect of turning them into a shared DP just as in the shared type of ATB (and RNR as well). Notice, on the other hand, that the conjunction phrase &P in ATB and RNR, as opposed to PG, may also allow for sloppy identity between the copies in its specifier and complement.

In relation to the unparallel structural property of two clauses in PG, we further suggest that the PG construction is not subject to the two PF conditions, the Conjunction Adjacency Constraint (CAC) and the Principle of Cyclic Linearization (PCL), which we have argued filter out illegitimate strings of words after linearization. We particularly attribute the lack of the CAC and cyclic linearization effects to the structural property inherent to the PG construction discussed above, namely that clauses in the PG construction, as opposed to those in the ATB and RNR constructions, are not conjoined by coordination but subordination since they are not structurally parallel. This structural property works in tandem with the non-distinctness of the real and parasitic gaps in preventing AC and ID from being created in the PG construction.

Returning to the sharing type of PG construction in (54), consider the structure in (57) below. As illustrated in the structure, the *wh*-phrase *who*, whose movement licenses both a real and parasitic gap, is first base-generated as the complement to the subordinate predicate *interrogate*. Subsequently, it moves up to the Spec, CP position of the subordinate clause by IM in order to check a property as an operator. When the *wh*-phrase lands in the subordinate CP domain, ER combines it with the conjunction head &, which requires the strict identity. Note that this step of derivation faces no problem with respect to the Root Condition, and that the application of ER at this stage would not trigger an island effect, just as in the case of sideward movement (cf. Hornstein and Nunes 2002; Nunes 2001, 2004). In the meantime, the *wh*-phrase selected as a complement to the matrix verb *arrest* reaches the left edge of the entire clause by

another instance of IM. Subsequently, the *wh*-phrase displaced to the matrix Spec, CP is associated by ER to the specifier of the conjunction phrase &P, which has already host the head of a parasitic gap chain out of the subordinate Spec, CP. This second instance of Root Condition is respected again. At the final stage, we tentatively suppose, the resulting &P is adjoined to the entire CP by Pair-Merge. The reason we assume that &P in PG is adjoined to the entire CP is that two clauses are combined by subordination, not coordination.




Notice also that even though the head of each chain undergoes IM to the left periphery of each conjunct, the pattern also found in ATB, ER results in only a strictly identical DP in the PG construction, unlike the ATB construction. We attribute this difference between ATB and PG to the property exhibited only in the latter: that is, two clauses to which ER applies for cross-clausal conjunction involve subordinate conjunction in PG. We have also argued that both this unparallel structural property and the strict identity requirement imposed by & collaborate in banning AC and ID in the PG construction.

We are now left with the question of how the structure driven by the syntactic operations, including ER, undergoes linearization in the PG construction. As shown above, in this construction, gaps created by the applications of IM and ER are in effect turned into members of a single chain headed by a *wh*-phrase in the CP domain of the matrix clause. Therefore, in the PG construction in (58), the chain of *who* at the left edge consists of the *wh*-phrase itself, the real gap, the gap in the subordinate Spec, CP position, and the parasitic gap. Notice that the *wh*-phrase has experienced overt movement in this sentence in accordance with the generalization that only overt movement, such as *wh*-operator movement, topicalization and Heavy NP Shift, etc., can license PGs (Engdahl 1983; contra Nissenbaum 2000). Accordingly, the highest copy in the chain formed via IM and ER of *who* is forced to be pronounced, just as in other cases of chain formation for overt A'-movement.

One might wonder how the proposed analysis captures the anti-c-command condition for parasitic gap licensing, which requires a real gap not to c-command a parasitic gap, as shown in the above structure (Chomsky 1982, Engdahl 1983, inter alia). We argue that this property simply follows from a non-controversial assumption that an adjunct clause containing a parasitic gap is adjoined higher than vP that immediately dominates a real gap. Under this assumption, a real gap is unable to c-command any elements inside the adjunct clause. Note further that our assumption about the attachment site of an adjunct clause does not cause any problem for a movement condition that an element should move up to a c-commanding position (Chomsky 1995). This is because ER is an operation that normally connects two nodes across a clause boundary even though they are not in a c-command relation. Under the sideward movement approach, however, since movement from the lower operator position to the matrix vP domain is an instance of IM, they need to stipulate that the adjunct can be adjoined to the vP only after sideward movement takes place (Nunes 2001, 2004).

To summarize Section 3, we have argued that in the ATB and RNR constructions, cross-clausal conjunction takes place via ER to construct a parallel coordinate structure that hosts the ATB-moved and RNR-ed element. In particular, ID is obtained when the left-edge or right-edge elements inside the conjuncts are combined by ER with CoP headed by the overt conjunction. On the other hand, sharing and AC are derived in the similar way to the ID type, but the former is different from the latter in two respects: first, the parallel coordinate structure is headed by the invisible conjunction &; and second, the ATB-moved and RNR-ed elements that have undergone cross-clausal conjunction with &P via ER are unified into one. It has also been shown that the Conjunction Adjacency Constraint and the Principle of Cyclic Linearization are at work to constrain the strings of words produced by linearization of the already built-up structures. By contrast, we have suggested that the impossibility of ID and AC in the PG construction can be attributed to the long-standing finding that parasitic gaps are referentially dependent on real gaps for licensing, given that the two types of coordination at issue require two gaps to be able to have different reference. We have also argued that since two clauses containing a real and parasitic gap are not coordinated but subordinated in PG, only an auxiliary

conjunction phrase &P, which requires the strict identity between two conjuncts, is available. As a consequence, the PG construction is not subject to the CAC and the PCL at the PF interface. Instead, the chain of the real gap in the matrix clause and the chain of the parasitic gap in the adjunct clause make up a single chain with the aid of ER. This analysis readily captures the typical identity requirement for the two gaps in this construction. Another benefit is that we can explain why only the highest copy should be pronounced.

## 4. Conclusion

We have claimed that while the ATB and RNR constructions pattern together, they cannot be dealt with in the similar way to the PG construction. In support of this claim, only the former two constructions have been shown to allow for ID and AC. The generalization emerging from the ATB and RNR constructions is that two gaps inside conjuncts can be interpreted as different in reference, which is not available for a real and parasitic gap in the PG construction as the two gaps are mutually dependent in reference. None of the previous approaches has successfully captured the difference between the PG construction and the other two in this regard, so we have suggested adopting an operation called External Remerge (ER), originally proposed by de Vries (2009), as a first step to develop a derivational analysis. We have then suggested that in the case of ATB and RNR constructions, the ATB-moved and RNR-ed elements are first displaced to the left or right edge of each conjunct clause, undergoing ER for cross-clausal conjunction with a parallel coordinate structure, CoP or &P.

In the case of ID, the ATB-ed and RNR-ed elements end up being in the specifier and complement position of the CoP whose head is the overt conjunction and. In the case of the sharing and AC type, on the other hand, the ATB-ed and RNR-ed elements combined with &P by cross-clausal conjunction are unified into one. It was also shown that these structural properties of the two constructions bear on direct consequences on linearization. More specifically, when structures constructed by syntactic operations including ER are linearized, two constraints such as the Conjunct Adjacency Constraint and the Principle of Cyclic Linearization are at work at PF to rule out illegitimate strings of words.

In particular, the PCL prohibits any strings of words at the final stage if the linear order determined at the previous stage fails to be preserved.

By contrast, in the case of PG construction, cross-clausal conjunction results in only an auxiliary conjunction phrase &P whose head imposes the strict identity, since two structurally unparallel clauses are not coupled by coordination but by subordination. Instead, given the typical nature of a parasitic gap required to be identical with a real gap in reference for its licensing, it was suggested that the chain of the real gap and that of the parasitic gap must form a single chain. That's why we have argued the function of ER in the PG construction differs from that of ER in the ATB and RNR constructions: that is, its major function in the former is to combine the highest copy of the parasitic gap chain with the highest copy of the real gap chain. As a consequence of the lack of structural parallelism, the two major constraints for linearization, the CAC and PCL, are not operative in the PG construction.

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**Jong Un Park**
Associate Professor
Dept. of English, College of Humanities
Dongguk University-Gyeongju
123, Dongdae-ro
Gyeongju 38066, Rep. of Korea
E-mail: jupark90@gmail.com

**Michael Barrie**
Associate Professor
Dept. of English, School of Humanities & Int'l Cultures
Sogang University
35, Baekbeom-ro, Mapo-gu
Seoul 04107, Rep. of Korea
E-mail: mikebarrie@sogang.ac.kr

**Myung-Kwan Park**
Professor
Division of English, College of Humanities
Dongguk University
30, Pildong-ro 1-gil, Jung-gu
Seoul 04620, Rep. of Korea
E-mail: parkmk@dgu.edu

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