(Non-)Cyclicity of Copy Deletion

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Abstract

This paper proposes that Copy Deletion should apply representationally and demonstrates that Fox and Pesetsky's (2005) (F&P) *cyclic linearization* is unviable under the copy theory of movement. First, I introduce Copy Deletion and explain its trigger. Then, I demonstrate that this operation cannot be applied phase-by-phase by utilizing the data with in-situ *wh*. What is crucial is that the computational system cannot know which copy should be (un)realized at a phase. This discussion leads to a consequence that F&P's cyclic linearization cannot hold under the copy theory of movement because two copies cause a linearization contradiction, and Copy Deletion cannot solve this problem.

Keywords: Copy Deletion, Phase Theory, In-situ *Wh*, Lower Copy Realization, Cyclic Linearization

1. Introduction

The goal of this paper is to propose that Copy Deletion should apply representationally and to show that Fox and Pesetsky's (2005) (henceforth F&P) proposed *cyclic linearization* is unviable. This research leads us to support Chomsky, Gallego and Otto's (2019) (henceforth, CGO) view that syntax-phonology mapping applies representationally.

It has traditionally been assumed that (narrow) syntax is connected to the phonological/semantic components. Within the Minimalist Program, the syntax-phonology mapping is regarded as an interface-level operation *Spell-Out* (or *Transfer*), and its application is proposed in various ways. For example, Chomsky (1995) argues that syntactic representations are spelled-out representationally, as illustrated below:

(1) NS: [$_{CP}$ C John [$_{TP}$ T [$_{vP}$ John v-like [$_{VP}$ like Mary]]]] →
Phon: John T-s John v-like like Mary

On the other hand, Uriagereka (1999) and Chomsky (2000, 2001) argue that phonological mapping applies step-by-step on the basis of a phase-based derivation. Phase is a subunit of derivations proposed by Chomsky (2000, 2001), and a phase-based derivation proceeds step-by-step in terms of the chunk of structure building, as follows:

(2) a. [$_{vP}$ John v-like [$_{VP}$ like Mary]] → like Mary
b. [$_{CP}$ C [$_{TP}$ John T]] → John T-s John v-like

Since the outset of the phase-theory, according to which structure building and syntax-phonology (and syntax-semantic) mapping apply in a cyclic fashion, a lot of phase-based analyses have been proposed toward constraints on syntactic operations or interface-level operations. This is because the phase theory is consistent with the latest framework called the *Minimalist Program* (henceforth, MP), which assumes that the faculty of language (FL) is a perfect computational system for providing sound/meaning pairs accessed by performance systems (sensorimotor systems/conceptual-intentional systems). Within this model, FL is assumed to obey the principle of efficient computation and several conditions imposed by the performance systems (*bare output conditions* or *interface conditions*). The phase-based approaches assume computationally efficient structure building and mapping on the basis of some step-by-step (not representational) building/mapping systems, and hence they fit the MP.

However, recently, this is argued against by CGO, which supports some representational mapping system on the basis of mapping of moved elements. More specifically, they point out that some phase-based derivation may yield illegitimate phonological representations if syntax-phonology mapping applies in terms of the chunk of phase. Their argument is based on a sentence with movement of a constituent larger than a phase (3a), which may be mapped onto the phonological representation in (3b) (I will put aside the details of some phase-based syntax-phonology mapping of (3a)).

(3) a. Which argument that John is a genius did Mary believe?
b. *which argument that did Mary believe John is a genius

As shown above, cyclic mapping would yield illegitimate linear order, in which the constituent spelled-out before the movement is linearized in the base position of the moved phrase. To avoid this kind of problem, CGO assume some representational mapping system, according to which all constituents of a moved phrase are linearized in the sentence-initial position.

However, CGO's discussion is not conclusive. It is certain that the phase-based approaches face the linearization problem, but in fact some phase-based solutions have already been proposed by Dobashi (2003) and Obata (2010). That is, the linearization problem is insufficient to reject phase-based approaches. However, CGO's argument gives light on an issue of syntax-phonology mapping. More concretely, we have to reconsider a problem of whether mapping applies representationally or phase-by-phase. In order to determine which is better, it is beneficial to examine phonological operations (or phenomenon) because they are applied on the course of syntax-phonology mapping and hence reflect mapping process. For example, if mapping applies phase-by-phase, applications of phonological operations will be limited to a phase domain. On the other hand, such locality will not exist if mapping applies to the whole syntactic structure representationally.

This paper focuses on a phonological operation called *Copy Deletion*, and demonstrate that this operation should be applied representationally. Copy Deletion is the operation, by which copies are eliminated except for the prominent one. The important prerequisite of applications of this operation is that the computational system knows which copy is pronounced and which ones are not. If the computational system can judge which copy is pronounced (or deleted) within a phase domain, Copy Deletion may apply phase-by-phase. However, if such judgment is impossible within a phase domain, the operation should be applied representationally. This paper will show that some syntactic covert-movement requires the computational system to determine a pronounced copy after the completion of the whole structure. The analysis of the (non-)locality of Copy Deletion leads us to reconsider the adequacy of F&P's (2005) *cyclic linearization*, which assumes that a syntactic structure is mapped onto a linear order phase-by-phase. This theory assumes *Linearization Preservation*, which requires cyclically determined relative order to be unchanged with the implicit premise that lower copies are ignored. This is a seminal theory but has a crucial problem if Copy Deletion cannot be applied cyclically.

This paper is organized as follows. In section 2, I will introduce Copy Deletion and point out that it should be a representational operation. In section 3, I will consider F&P's cyclic linearization. Section 4 is a conclusion.

2. The (Non-)Locality of Copy Deletion

2.1 Copy Deletion

One of the most important topic of syntactic literature is *displacement*, according to which some syntactic constituent is moved from an originally introduced position to a surface position. For example, in (4) *John* is originally introduced into the object position and then it is moved to the subject position.

(4) John was arrested.

This phenomenon is captured by the *Government and Binding Theory* in terms of the *trace theory of movement*, according to which a movement operation leaves behind a *trace* co-indexed with the moved element. Under this view, traces are regarded as phonetically unrealized categories, forming a discontinuous object (i.e. (nontrivial) chain) with a moved element. Within this theory, sentence (4) has the derivation in (5).

(5) John_i was arrested t_i

The trace is a null element and hence never pronounced. Therefore, trace theory explains that the moved element is not pronounced in its base-generated position, as shown in (4).

However, since the inception of the new framework MP, trace theory is replaced by a new theory of movement called *the copy theory of movement*. The shift occurs based on the idea that replacement with a trace is conceptually problematic because introduction of the new element gives the computational system a heavy burden. Chomsky (1993) argues that the trace theory should actually be abandoned in favor of an interpretation of movement as copying. More specifically, he proposes that a movement operation leaves behind a copy of the moved element which eventually gets *deleted* in the phonological component. From this perspective, the derivation of (4) proceeds along the lines of (6), where the crossed material represents lack of phonetic realization at PF.

(6) John_i was arrested ~~John~~$_i$

The trigger of Copy Deletion has been analyzed in various ways. For example, Chomsky

(2013) attributes this operation to the principle of the Minimal Computation, which is illustrated in (7).

(7) Pronounce as little as possible.

On the other hand, Nunes (2004, 2011) argues that Copy Deletion is required in order to observe the conditions on linearization in (8).

(8) a. The Irreflexivity Condition
If α precedes β, then it must be the case that $\alpha \neq \beta$.

b. The Asymmetry Condition
If α precedes β, then it must be the case that β does not precede α.
(Nunes (2004: 24))

Following Nunes, let us consider the representation of (4) under the copy theory of movement. The sentence has the phonological representation (9a), which violates the two conditions on linear orders as illustrated in (9b, c).

(9) a. $John_1$ was arrested $John_2$
b. $John_1$ » $John_2$, $John_1 = John_2$ → *the irreflexivity condition
c. $John_1$ » was arrested » $John_2$ → *the asymmetry condition

The representation of (9a) violates the irreflexivity condition since $John_1$ precedes $John_2$ but they are non-distinct. In addition, the representation also violates the asymmetry condition since the copy $John_1$ precedes the sequence *was arrested* but the sequence in turn precedes the copy $John_2$, which is not distinct from $John_1$. In order to avoid such violations, Copy Deletion must be applied to $John_2$ in the phonological component.

Thus, Copy Deletion is assumed to apply on the course of mapping to phonological representations in order to make the linearization legitimate. This paper takes this phonological operation as an important clue to examine the mapping system. In the next section, I will introduce another case of Copy Deletion where this operation targets higher copies.

2.2 Lower Copy Realization and the (Non-)Locality of Copy Deletion

Copy Deletion typically applies to all copies except for a structurally prominent one. However, this operation sometimes applies to higher copies for some reason. In this section, I demonstrate that English in-situ *wh* requires lower copy realization, which results from deletion of higher copies.

English *wh*-interrogatives requires a *wh*-copy to be pronounced in the sentence-initial position as in (10a). Under the view of the copy theory of movement with Copy Deletion, this is caused by the movement of *wh*-element (and copy generation) in (10b) and deletion of the lower copy in (10c).

(10) a. Who do you like?

b. who$_1$ do you like who$_2$

b. who$_1$ do you like ~~who~~$_2$

In English, the *wh*-movement within narrow syntax is obligatory because the *wh*-phrase must be related with the complimentizer of the matrix clause. This relation is traditionally regarded as the *agreement* between the two element, and it is recently assumed in terms of *labeling algorithm* (cf. Chomsky (2013, 2015)). Put aside the details of the analysis of the *wh*-movement, *wh*-interrogatives necessarily yield multiple copies of *wh*-words, and requires succeeding Copy Deletion to apply to lower copies.

However, the derivation proceeds differently in multiple *wh*-interrogatives. English is a language which allows only a single *wh*-phrase to be pronounced in the sentence-initial position. Therefore, if a question involves two or more *wh*-phrases, only one of them is pronounced in the sentence-initial position and the other ones are realized in their A-positions, as exemplified in (11).

(11) a. Who likes what?
b. *Who what likes?

The sentence involves two *wh*-phrases *who* and *what*. Among these *wh*-phrases, only the former is pronounced in the sentence-initial position while the latter is pronounced in the object position. One might wonder whether the in-situ *wh*-phrase moves (covertly) or stays in the object position. In fact, this has been one of the most important topics about multiple *wh*-interrogatives. The crucial clue to this problem comes from Nissenbaum's (2000) observation that an in-situ *wh*-phrase licenses a parasitic gap that is licensed only by syntactic A'-movement.

(12) ? Which senator$_1$ did you persuade ~~which senator~~$_1$ to borrow which car$_2$ after getting an opponent of pg$_1$ to put a bomb in pg$_2$?

(Nissenbaum (2000: 542))

It is well-known that parasitic gap is licensed only if its licensor syntactically A'-moves across it. In (12), a parasitic gap that has the same interpretation as the in-situ *wh*-phrase is licensed. This means that the in-situ *wh*-phrase is syntactically A'-moves across the parasitic gap. The data is very meaningful not only for the nature of covert movement but also for Copy Deletion because the in-situ *wh*-phrase suggests the lower copy realization and the higher copy deletion, as roughly illustrated in (13).

(13) which senator$_1$ ~~which car~~$_2$ C-did you persuade ~~which senator~~$_1$ to borrow which car$_2$ after getting an opponent of pg$_1$ to put a bomb in pg$_2$

Thus, the in-situ *wh*-phrase in English multiple *wh*-interrogatives suggests the presence of syntactic (covert) movement and higher Copy Deletion.

Furthermore, the data has a consequence about the timing of Copy Deletion. Given that lower copy realization is required only in multiple *wh*-interrogatives, the computational system should judge lower copy realization only after finding multiple *wh*-phrases. Is it possible to make the decision in the phase-based derivation of (12)? Following the predominant assumption that CPs and vPs function as a phase, the lower *wh*-phrase of the question (12) first moves to an edge of a vP phase, as schematized below:

(14) [$_{vP}$ [$_{DP}$ which car] PRO to v-√borrow √borrow [$_{DP}$ which car]]

At this stage, the computational system finds two copies of a single *wh*-phrase *which car*. That is, the computational system cannot know at this point that the sentence has two *wh*-phrases. If Copy Deletion is applied at each phase-level, the computational system should delete the lower *wh*-copy in (14) because lower copies are obligatorily deleted in a single *wh*-question. However, such application is incorrect because it is the lower copy that is actually pronounced. This means that Copy Deletion must not be applied phase-by-phase but should be applied at least after a higher phrase domain includes two *wh*-phrases. In other words, the lower copy realization suggests that Copy Deletion should not apply on the course of the phase-based syntax-phonology mapping, and that it is consistent with the representational syntax-phonology mapping.

In this section, I introduced a phonological operation called Copy Deletion, and demonstrated that this operation should apply not phase-by-phase but representationally. This discussion leads us to a consequence for another phonological operation *linearization*. In the next section, I will demonstrate that the current discussion eliminates F&P's (2005) cyclic linearization.

3. Consequence for Linearization

Syntactic structures are mapped onto linear orders through the operation called linearization. Fox and Pesetsky (F&P) (2000) propose a cyclic linearization in relation to phase-based derivation. First, F&P propose that the relative orderings of syntactic units are established at each Spell-Out. They further propose that the resulting order information is added to an *Ordering Table*. Given that Spell-Out applies phase-by-phase, i.e. at each CP phase and vP phase (Chomsky (2000, 2001)), an Ordering Table cumulatively receives ordering information at each of the stage. Then, F&P argue that as a consequence of cyclic Spell-Out, once a linear order is established at a particular point of a derivation, it may not be revised or contradicted in a later step of the derivation. This property is termed *Linearization Preservation*.

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

As a result of Linearization Preservation, if an Ordering Table contains two contradicting orderings, the derivation crashes at PF. For instance, suppose that it contains the ordering statements $\alpha<\beta$ ('<' means 'precede') and $\beta<\alpha$. Then, because neither of the ordering statements can be deleted due to Linearization Preservation,α is α forced to precede and follow β simultaneously, which is impossible by assumption. Thus, linear orderings of constituents are cyclically fixed and preserved at the end of each cycle.

To see how the cyclic linearization works, let us consider the schematized derivation in (16).

(16) a. Construction of D → Spell-Out of D
$[_{D}\ X\ Y\ Z]$ Ordering Table: X<Y<Z
b. Introduction of α into the derivation
$\alpha\ [_{D}\ X\ Y\ Z]$ Ordering Table: X<Y<Z
c. Movement of X across α → Spell-Out of the next domain D'
$[_{D'} \ldots X\ \alpha\ [_{D}\ t_{X}\ Y\ Z]]$ Ordering Table: X<Y<Z
X<α<Y<Z
d. Movement of Y across α and X → Spell-Out of the next domain D'
$*[_{D'} \ldots Y\ \alpha\ [_{D}\ X\ t_{Y}\ Z]]$ Ordering Table: X<Y<Z
Y<α<X<Z

S'uppose that Spell-Out applies to D, which consists of X, Y, and Z, as in (16a). Then, the Ordering Table gets the ordering information X<Y<Z. Suppose further that a new element α is introduced into the derivation, as in (16b). Given that Spell-Out does not apply at this step, the Ordering Table does not receive new ordering information. In (16c), X moves across α, and the next domain D' is mapped onto the linear order. Suppuse that Spell-Out pays attention only to the head of a chain, and ignores traces. Then, the Ordering Table gets a new ordering statement X<α<Y<Z, which is totally consistent with the previously established ordering. Hence, the representation can be legitimate. On the other hand, in (16d), Y moves across α and X, and D' is spelled-out. As a consequence, the ordering information Y<α<X<Z is added to the Ordering Table, which leads to a contradiction: Y precedes and follows X. Following Linearization Preservation, the derivation with the step of (16d) crashes at PF. F&P argue that successive-cyclic movement of Y within D allows it to move to a higher domain. Let us consider the following derivation.

(17) a. Movement of Y within D → Spell-Out of D
$[_{D}\ Y\ X\ t_{Y}\ Z]$ Ordering Table: Y<X<Z
b. Movement of Y across α → Spell-Out of D'
$[_{D'} \ldots Y\ \alpha\ [_{D}\ t'_{Y}\ X\ t_{Y}\ Z]]$ Ordering Table: Y<X<Z
Y<α<X<Z

In (17a), Y moves to the edge of D. At this stage, the ordering information Y<X<Z is added to the Ordering Table. Then, Y moves further, and the ordering statement Y<α<X<Z is established at the Spell-Out of D', as shown in (17b). Since this does not lead to a contradiction, the derivation can eventually converge with the movement of Y. Thus, F&P explains cyclic linearization under the phase-based view.

However, their analysis of cyclic linearization is clearly problematic because they adopt the view of the trace theory of movement. Adopting the copy theory of movement, MP assumes that movement (more precisely, internal Merge) leaves behind a copy, which is identical with a moved element. This means that the copy left behind has some phonetic information which a moved constituent has. As a result, derivations with successive-cyclic movement always crash because of the contradiction between a copy moved to the edge of a domain and a copy left behind by the movement (remember the Asymmetry Condition in (8b)). If we attempt to adjust the cyclic linearization system to the copy theory of movement, we should assume that Copy Deletion cyclically applies to a lower copy at each phase. However, I reject this possibility in section 2 by referring to the case of covert movement. Therefore, F&P's cyclic linearization is unviable.

Notice that this discussion does not mean that phase-by-phase syntax-phonology mapping is impossible. In literature, there are some proposals about cyclic linearization consistent with the copy theory of movement (cf. Dobashi (2003) and Obata (2010)). Furthermore, it might be possible to modify the F&P's cyclic linearization in some way. This paper just gives a consequence of the non-locality of Copy Deletion toward a previously proposed theory.

4. Conclusion

This paper proposed that Copy Deletion cannot apply cyclically, and demonstrated that F&P's cyclic linearization is unviable under the copy theory of movement. First, I introduced Copy Deletion and its trigger. Then, I demonstrated that this operation cannot be applied phase-by-phase because the computational system cannot know which copy should be (un)realized at a phase. This discussion further told that F&P's cyclic linearization cannot hold under the copy theory of movement because two copies cause a linearization contradiction and Copy Deletion cannot solve this problem.

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