# Phonological Effects of Silent Elements*

## Shogo Saito

**Abstract**

In the literature, it has been proposed that some deleted copies have such a phonological effect as an intervention effect on contraction. This paper explains the phonological effect by proposing a new Copy Deletion system. Concretely, modifying Chomsky's (2013, 2015) Labeling Algorithm (LA), I propose that copies are deleted within Narrow Syntax when they cause labeling problems. Since these copies are already lost at the stage of Transfer (the timing of LA), they are not mapped into the phonological component. In contrast, copies necessary for labeling are not deleted within Narrow Syntax and sent to the phonological component (but they may be also deleted at a later stage if the operation is required). As a result, only the latter copies exist in the phonological component and therefore have a phonological effect. The proposed Copy Deletion system also explains restriction on exceptional lower copy realization, the distribution of VP-Ellipsis in infinitival clauses, and restriction on auxiliary reduction.

*Keywords*: Copy Deletion, Labeling Algorithm, Contraction, Lower Copy Realization,

## 1.    Introduction

In the literature, silent elements such as a deleted copy (what was analyzed as

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*trace* before) have been sometimes supposed to have a phonological effect at the PF. One of the most famous phenomena is an intervention effect on *contraction*, which is a sandhi phenomenon where a word is reduced and affixed to another word.  For example, if an infinitive marker *to* is reduced and affixed to a verb *want*, a contracted form *wanna* is obtained, as illustrated in (1).

(1)  I wanna/want to meet John.

Here, *want* and *to* are linearly adjacent (that is, there is no phonological element between them), and therefore contraction can take place.  In contrast, the *wanna*-contraction is blocked when *want* and *to* are separated by a silent copy of an embedded subject, as shown in (2).

(2) a.  Who do you *wanna/want to meet John?
    b.  who do you want who to meet John

The prevention of the contraction in (2a) is sometimes taken to suggest that the silent copy exists between *want* and *to* so that it has a phonological effect to disturb *wanna*-contraction, as illustrated in (2b).

However, not all silent elements seem to have the effect.  For instance, a PRO subject, an empty C-head and a copy of a non-subject *wh*-phrase do not disturb *wanna*-contraction as exemplified in (3).

(3) a.  Who do you wanna/want to meet?
    b.  who do you want who C PRO to meet who

The difference between (2a) and (3a) suggests that silent elements differ in their phonological properties.

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In order to explain the distribution of contraction, many proposals have been made. Some of them try to explain the phonological difference among silent elements but others attempt to attribute the relevant fact to other factors. Although all the previous approaches can capture the observed pattern of contraction, they are not without problems.

In this paper, I try to explain the phonological effect of silent elements by proposing a new Copy Deletion system. Specifically, modifying Chomsky's (2013, 2015) Labeling Algorithm (LA), I propose that copies are deleted within Narrow Syntax when they cause labeling problems. Since a copy is deleted before Transfer (the timing of LA), it is not mapped into the phonological component. On the other hand, if a copy is necessary for labeling, it is not deleted before Transfer and sent to the phonological component (but some of them may be deleted in the phonological component if the deletion is required). As a result, only the latter kind of copies exist in the phonological component, and therefore have phonological effects. Thus, the proposed Copy Deletion system distinguishes two kinds of copies, and explains whether or not they yield their phonological effects. In addition, my proposal also accounts for restriction on exceptional lower copy realization, the distribution of VP-Ellipsis in infinitival clauses, and restriction on auxiliary reduction.

This paper is organized as follows. In section 2, I roughly review some previous approaches to the distribution of contraction, and point out their problems. Section 3 introduces a new LA-based Copy Deletion system, and provides my analysis of contraction data. In section 4, I show further consequences with regards to exceptional copy realization, ellipsis phenomenon and auxiliary reduction. Section 5 is a conclusion.

## 2.    Previous Analyses and their Problems
In the literature, there are many approaches to the distribution of *wanna-*

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contraction (see Goodall (2017)).　In this section, I roughly review some of them and point out their problems.

To begin with, let me show a phonological approach which divides deleted copies into two groups.　I review Jaeggli's (1980) analysis, which assumes that contraction requires PF-adjacency between a reduced word and its prosodic host, and that only Case-marked copies (traces) block contraction.　On the basis of these assumptions, he attempts to explain the A/A′-asymmetry exemplified in (4).

(4)　a.　Who do you *wanna/want to meet John? (=(2a))
　　　b.　John seemsta like pickles.　　　　　　　(Kroch (1987: 164))

These examples show that a trace of A′-movement blocks *to*-contraction while that of A-movement does not.　Each of these sentences is analyzed as in (5).　Here, a Case-marked copy is expressed with [+Case], while a Case-less one is marked with [-Case].

(5)　a.　who$_{[+Case]}$ do you want who$_{[+Case]}$ to meet John
　　　b.　John$_{[+Case]}$ seem John$_{[-Case]}$ to like pickles

Among these sentences, the silent Case-marked copy (*who$_{[+Case]}$*) blocks *wanna*-contraction in (5a), while the Case-less copy (*John$_{[-Case]}$*) does not prevent *to*-contraction in (5b).

Thus, the Case-based approach distinguishes two kinds of silent copies with regards to their Case property and phonological effect.　However, the approach is insufficient in that it is unclear why and how Case-marking has influences on PF phenomena.　In addition, it cannot account for the grammaticality of *wanna*-contraction in (6), repeated from (3a), where *want* and *to* are separated by a PRO subject and an intermediate *wh*-copy (and an empty C-head).[1]

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(6) a. Who do you wanna/want to meet?

b. who do you want [$_{CP}$ who$_{[+Case]}$ C PRO$_{[+Case]}$ to meet who$_{[+Case]}$]

A PRO subject has been recently analyzed as a (null) Case-marked element (cf. Chomsky and Lasnik (1993) and Martin (1996, 2001)). Furthermore, an object *wh*-phrase receives accusative Case. According to the Case-based approach, both of the Case-marked elements should block contraction in (6a), contrary to fact. One might avoid the problem by assuming that a PRO is in fact a copy of A-movement (see Boeckx (2000) for the Movement Theory of Control and its consequence for *wanna*-contraction), or that a PRO is an inherently null element and has no phonological effect. However, this assumption cannot be extended to the intermediate *wh*-copy.

In addition to the phonological approach, different approaches attempt to derive the distribution of contraction from other various factors. For example, some analyses propose a certain structural condition on contraction. In the *Government and Binding* framework, it has been proposed that *to*-contraction is possible if a host governs a reduced word (cf. Aoun and Lightfoot (1984), Lobeck and Kaisse (1984), Bouchard (1986), and others). More recently, Sato (2012) proposes that a contracted form can be realized if a reduced word and its host co-occur within the same Spell-Out domain. Given this proposal, *wanna*-contraction takes place if *want* takes non-phasal TP and the verb and an infinitive marker are located within the same Spell-Out domain, as in (7a). On the other hand, the contracted form cannot be realized if *want* selects a phasal complement CP and the relevant two words are separated into different Spell-Out domains, as in (7b).

(7) a.    Spell-Out

.../want [$_{TP}$ PRO to    →    wanna

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  b.    Spell-Out

    want [$_{CP}$ C $/$ $_{TP}$ PRO to → *wanna


That is, the (in)applicability of *wanna*-contraction in (2a, 3a) is attributed to the phasehood of embedded clauses. The structural difference has sometimes been assumed but it is problematic regarding movability of embedded clauses: various infinitival clausal complements differ in their movability as in (8).


 (8) a. ?It was to win the race that we wanted.   (O'Flynn (2008: 19))

    b. *It was to be winning the race that she seemed.   (ibid.)


The complement clause of *wanted* can move into the focus position of the cleft sentence in (8a), while that of *seemed* cannot move in (8b). The contrast has often been accounted for by assuming that control verbs take a movable CP complement whereas raising verbs take an immovable TP complement. If so, the data poses a problem with Sato's analysis which assumes control clause of *want* to be TP.[2]

  Next, let us move on to another analysis which appeals to the subcategorization property of *wanna*. Bolinger (1981), Brame (1984), Sag and Fodor (1994) and Pullum (1997) assume that *wanna* as an independent lexical item which subcategorizes for a bare subject-less infinitival clause. As a consequence, the contrast in (2a, 3a) regarding *wanna*-contraction is attributed to the following selectional restriction.


 (9) wanna/ __ [PRO v-V …]

     (* __ [(for) Subject to v-V …])


However, as Pullum himself admits and Goodall (2017) points out, a complement of *wanna* behaves differently from other bare infinitives, as illustrated in (10).

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(10) a. *I said I'd help wash the dishes, and wash them I helped.

(Goodall (2017: 1166))

b.   I said I'd feel like climbing the mountain, and climb it I wanna.

c.   I said I'd feel like climbing the mountain, and climb it I want to.

(ibid.)

As shown above, it is impossible to move the bare infinitival complement of *helped* in (10a) but it is possible to front the complement of *wanna* in (10b).    The contrast poses a problem with the assumption that a lexical item *wanna* selects a bare subject-less infinitive.    In contrast, the grammaticality of (10b) is straightforwardly explained if (10b) is derived from (10c), which permits VP-fronting.

In this section, I have reviewed previous approaches to the distribution of contraction phenomena, and pointed out that all of them have problems.    In the next section, on the basis of the phonological approach to contraction, I will account for contraction data without causing the problems by proposing a new Copy Deletion system.

## 3.    Proposal and Analysis

In this section, modifying Labeling Algorithm (LA) proposed by Chomsky (2013, 2015), I will propose a new Copy Deletion system, and then explain the contraction data given in the previous sections.

## 3.1.  Assumptions and Proposal

Chomsky (2013, 2015) argues that labels are required for the interpretation at interfaces, and that they are determined by Labeling Algorithm (LA) in (11).

(11)    Labeling Algorithm (LA)

a.   $[_\alpha \text{ H XP}]$     $\alpha = \text{H}$

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b. [α XP YP]    (i)  [XP [α XP YP]]   α = YP

(ii) [α XP$_F$ YP$_F$]      α = <F, F>

H = Head,   XP, YP = Phrase,   F = Feature

Chomsky assumes that a label of a syntactic object (SO) is determined by a minimal search algorithm.   When a head and a phrase (H and XP) are merged as in (11a), the former is selected as a label of the resulting SO because H is the closest head from the top of the SO and located by the minimal search algorithm.

On the other hand, when two phrases (XP and YP) are merged as schematized in (11b), the label of the resulting SO cannot be determined because minimal search ambiguously locates two heads (X and Y): this is called "XP-YP problem."   In order to avoid the problem, Chomsky proposes two solutions.   One is raising either XP or YP (11bi): if one of the merged phrases raises, it is invisible to LA and the other serves as a label.   This assumption is based on the idea that Internal Merge (IM) yields a chain, and it is the whole chain, but not each copy, that is visible for LA.   The other solution is the labeling by a shared prominent feature (11bii): if merged phrases are in an agreement relation, the agreement feature serves as a label like <F, F>.   Since IM of a phrase yields an XP-YP problem at its landing site, such a phrase must finally stop and take part in labeling at an agreement position.   As for the timing of labeling, Chomsky (2015: 6) notes that, "since the same labeling is required at CI and for the processes of externalization (…), LA must apply at the phase level, as part of the Transfer operation."   In this paper, I adopt this assumption about the timing of LA.

The original version of LA is very insightful and has many consequences, but it has a problem for labeling SOs with movement out of an argument position. Chomsky (2013, 2015) assumes that a subject and an object must take part in labeling in their argument (agreement) positions even if they further raise from there. This is because (i) heads of their merge-mates (T-head and root-head) are too weak

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to serve as a label by themselves, and (ii) the weak heads require an Agree-mate in order to label an SO with an agreement feature, as shown in (12).

(12) a. $[[_{DP} \text{ subject}]_i \ldots [_{<\varphi, \varphi>} [_{DP} \text{ subject}_{[\varphi]}]_i \text{ T}_{[\varphi]} \ldots]]$

b. *$[[_{DP} \text{ subject}]_i \ldots [_{??} [_{DP} \text{ subject}]_i \text{ T}_{[\varphi]} \ldots]]$

If a DP copy in an argument position is visible for labeling, label $<\varphi, \varphi>$ can be formed, as in (12a). In contrast, if a lower copy is invisible to LA as expressed by outlined character in (12b), the label of the resulting SO cannot be determined because the T-head cannot serve as the label of the resulting SO. Therefore, Chomsky assumes that raising from an argument position must take the labeling pattern in (12a).

However, if we strictly follow LA in (11) and its timing, such labeling should be impossible. The labeling pattern of (11bi) denotes that IM makes lower copies invisible to LA. This means that lower copies in argument positions are invisible to LA, and hence it is impossible to form label $<\varphi, \varphi>$. To solve this problem, Chomsky assumes that raising from an argument position takes place after labeling. Specifically, he assumes somewhat complex rule order in (13), which starts with raising of a subject DP to an argument position and contains some processes other than labeling and raising.

(13) Who do you think read the book?

a. $[C [_\alpha [_{DP} \text{ Subject-DP}] \text{ T } [vP \ldots]]]$

→ Inheritance of $\varphi$-features, tense, phasehood from C to T

b. $[C [_\alpha [_{DP} \text{ Subject-DP}] \text{ T}_{[\varphi][Tns][Phase]} [vP \ldots]]]$

→ **Labeling α as $<\varphi, \varphi>$** on the basis of agreement relation

c. $[C [_{<\varphi, \varphi>} [_{DP} \text{ Subject-DP}] \text{ T}_{[\varphi] [Tns][Phase]} [vP \ldots]]]$

→ C-deletion

    c.   $[\in [_{<\varphi, \varphi>} [_{DP} \text{Subject-DP}] \text{T}_{[\varphi] [Tns][Phase]} [vP \ldots]]]$

→   Transfer of vP triggered by the remaining phasehood of T

    d.   $[\in [_{<\varphi, \varphi>} [_{DP} \text{Subject-DP}] \text{T}_{[\varphi] [Tns][Phase]} [vP \ldots]]]$

→   **Further Raising of subject-DP**

    e.   $[[_{DP} \text{Subject-DP}] \ldots [\in [_{<\varphi, \varphi>} [_{DP} \text{Subject-DP}] \text{T}_{[\varphi] [Tns][Phase]} [vP \ldots]]]]$

Here, the subject-DP takes part in labeling before it undergoes further IM (and becomes invisible to LA). The movement is possible because of C-deletion, as a result of which phasehood is activated on the remaining head T. Since the DP is in the edge of the phase head, it is still movable even after the Transfer.

However, this assumption has a problem in that it contradicts with another assumption that LA applies as part of the Transfer. Given the latter assumption, it is unclear why the subject-DP can take part in labelling even though it is outside the transferred domain. Strictly speaking, when an argument takes part in labeling, it should be transferred and hence cannot undergo further IM, as schematized in (14).

(14)  a.   Application of LA as part of the Transfer

$$\text{H (=Phase Head)} \diagup .. [_{<\varphi, \varphi>} [_{DP} \text{subject}_{[\varphi]}] \text{T}_{[\varphi]} \ldots]$$

Transfer Domain

    b.  *IM of an Argument

$$[_{DP} \text{subject}_{[\varphi]}]_i \ldots \text{H (=Phase Head)} \diagup .. [_{<\varphi, \varphi>} [_{DP} \text{subject}_{[\varphi]}]_i \text{T}_{[\varphi]} \ldots]$$

Transfer Domain

That is, if an argument raises before labeling, a lower copy is invisible for LA and hence cannot take part in labeling, but if labeling takes place before raising, the movement is prohibited because a transferred expression cannot undergo further syntactic operations. Thus, the original version of LA does not work well.[3]

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Now, we need another way to distinguish copies regarding whether they are visible for labeling or not.   As a reasonable strategy, I assume that copies which causes a labeling problem are deleted and lost before application of LA, and hence they never take part in labeling.   Given the Copy Deletion-approach to LA, it is the deletion operation, but not IM, that makes copies invisible to LA.   This means that unlike the original version, we assume that each copy, but not the whole chain, is the target of LA (as Emoto (2013) implicitly assumes).   In order to affect labeling, the deletion should be assumed to apply before application of LA, that is, before Transfer. In this paper, I call this operation "NS-Copy Deletion."[4]

As a consequence of the modification, I propose that silent copies are distinguished in whether or not they are deleted within Narrow Syntax for labeling. Concretely, copies which cause a labeling problem are deleted before Transfer (the timing of LA) so that a label of an XP-YP structure can be determined, as schematized in (15).   Such a deleted copy cannot be mapped into the phonological component and hence lacks phonological effects.

(15)   *Narrow Syntax*          *Application of LA*          *PF*

XP…[$_{??}$ XP, YP]       →   XP…[$_{YP}$ ~~XP~~, YP]   ⇒   XP…YP

In contrast, copies required for labeling must not be deleted at the same stage so that they can be visible for LA.   Since they keep their phonological features at the timing of Transfer, they are mapped into the phonological component as phonologically interpretable elements.   Consequently, they have phonological effects such as an intervention effect on contraction.

(16)   *Narrow Syntax*          *Application of LA*          *PF*

XP…[$_{??}$ XP$_{[F]}$, YP$_{[F]}$]   →   XP…[$_{<F, F>}$ XP$_{[F]}$, YP$_{[F]}$]   ⇒   XP…XP YP

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Note that, although some copies are necessary for labeling, they are phonologically empty.   To capture the case, I assume that Copy Deletion also applies in the phonological component in order to obey the conditions on linear ordering illustrated in (17, 18) (cf. Nunes (2004: 24)).

(17)    The Irreflexivity Condition

If $\alpha$ precedes $\beta$, then it must be the case that $\beta$ does not precede $\alpha$.

(18)    The Asymmetry Condition

If $\alpha$ precedes $\beta$, then it must be the case that $\alpha \neq \beta$.

To explain the two conditions, let us see the illegitimate PF representation in (19). Here, two *wh*-phrases (*who$^1$* and *who$^2$*) express non-distinct copies but each copy is numbered differently just for the purpose of exposition.

(19)   *who$^1$ do you think who$^2$ is a genius

( who$^1$ do you think ~~who$^2$~~ is a genius)

(19) violates the irreflexivity condition since *who$^1$* precedes the sequence of *do you think* but the sequence precedes *who$^2$*.    In addition, the representation also violates the asymmetry condition since *who$_1$* precedes *who$_2$* but they are non-distinct.    In order to avoid such violations, Copy Deletion must be applied in the phonological component.    In this paper, I name it "PF-Copy Deletion."

Given PF-Copy Deletion, we have a problem of how to determine a pronounced copy (and deleted one) in the phonological component.    In this paper, I do not pursue this problem deeply but simply follow Bobaljik and Wurmbrand's (2012) proposed principle *Scope Transparency* (see also Bobaljik (2002)).

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(20)    Scope Transparency (Bobaljik and Wurmbrand (2012: 373))

If the order of two elements at LF is A»B, the order at PF is A»B.

According to this condition, a pronounced copy and an interpreted copy must be matched if possible.    Therefore, a *wh*-phrase is generally pronounced at the sentence-initial position where it takes scope, and lower copies are deleted.

Following the conditions on linear order and Scope Transparency, copies in argument positions (not in operator-scope position) are mapped into the phonological component but deleted at a later stage.    As a consequence of the above discussion, I propose the following rule order.

(21)    Rule Order regarding Copy Deletion

(i)   NS-Copy Deletion (Narrow Syntax)

(ii)  Application of LA (Transfer)

(iii) PF-Copy Deletion (Phonological Component)

(21) indicates that the Copy Deletion may apply twice and that the timing is regulated by LA as part of the Transfer: the first application is before LA and the second is after that.

## 3.2. Analysis

Now, we are ready to analyze the distribution of contraction.    My analysis is based on the phonological approach to contraction, according to which contraction requires the PF-adjacency between a reduced word and its prosodic host.[5]    Suppose that contraction applies at the first stage of the phonological component (immediately after Transfer) (cf. Ackema and Neeleman (2003) and Sato (2012)). If so, the sandhi phenomenon is prevented by limited silent copies, which are mapped as overt elements into the phonological component.

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First, I show my analysis of the basic case of *wanna*-contraction.    Sentence (1), repeated here as (22a), has the structure of (22b) and the linear order of (22c). In the schema, *want*, a clause-selecting verb, is formed by External Pair Merge of the *v*-head with the root (cf. Epstein, Kitahara and Seely (2016)), and the PRO subject agrees with the embedded T (cf. Martin (1996, 2001)).

(22) a.  I wanna/want to meet John

b.  $[_{CP}$ C $[_{<φ, φ>}$ I$_{[φ]}$ T$_{[φ]}$ $[_{vP}$ ~~I~~ $\sqrt{}$want-*v* $[_{CP}$ C $[_{<φ, φ>}$ PRO$_{[φ]}$ T$_{[φ]}$-to $[_{vP}$ ~~PRO~~ $\sqrt{}$meet-*v* $[_{<φ, φ>}$ $\sqrt{}$meet$_{[φ]}$ John$_{[φ]}$]]]]]]]]

c.  I want to meet meet John

Here, lower copies of the subjects (*I, PRO*) are deleted within Narrow Syntax so that an XP-YP problem can be solved, while two copies of $\sqrt{}$*meet* must be undeleted because they are both required for labeling.[6]    I assume that the C-head of the embedded clause and the PRO subject are inherently null, and hence they are not mapped into the phonological component.    Since *want* and *to* are adjacent in the linear order of (22c), contraction is possible.

Second, consider the ungrammatical case of *wanna*-contraction, where a *wh*-copy in the embedded subject position intervenes between *want* and *to*.    In analyzing this kind of construction, I assume that a *wh*-subject takes part in an agreement relation within an infinitival clause (cf. Martin (2001)).

(23) a.  Who do you *wanna/want to meet John?

b.  $[_{<Q, Q>}$ who$_{[Q]}$ C$_{[Q]}$-do $[_{<φ, φ>}$ you$_{[φ]}$ T$_{[φ]}$-do $[_{vP}$ ~~you~~ $\sqrt{}$want-*v* $[_{CP}$ ~~who~~ C $[_{<φ, φ>}$who$_{[φ]}$ T$_{[φ]}$-to $[_{vP}$ ~~who~~ $\sqrt{}$meet-*v* $[_{<φ, φ>}$ $\sqrt{}$meet$_{[φ]}$ John$_{[φ]}$]]]]]]]]

c.  who do you do want who to meet meet John

In (23b), the *wh*-copy in the argument position cannot be deleted within Narrow

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Syntax because it is necessary to form the label <φ, φ>.    Consequently, in the early PF representation of (23c), the relevant *wh*-copy intervenes between *want* and *to*, and therefore blocks *wanna*-contraction.

Next, let us move on to the case of *wanna*-contraction with IM of a *wh*-object. Sentence (24a) has the structure of (24b) and the linear order of (24c).

(24)  a.  Who do you wanna/want to meet?

b.  [<Q, Q> who[Q] C[Q]-do [<φ, φ> you[φ] T[φ]-do [vP ~~you~~ √want-*v* [CP ~~who~~ C [<φ, φ> PRO[φ] T[φ]-to [vP ~~who~~ ~~PRO~~ √meet-*v* [<φ, φ> √meet[φ] who[φ]]]]]]]]

c.  who do you do want to meet meet who

Since intermediate *wh*-copies are all deleted before Transfer for labeling, they are not mapped into the phonological component.    As a result, *want* and *to* are adjacent, and hence contraction is possible.

Last, let us turn to the absence of the blocking effect in A-movement environment, which Jaeggli (1980) tries to explain.    Sentence (25a) has the structure of (25b) and the linear order of (25c).    In analyzing this construction, I adopt Mizuguchi's (2016) proposal that the head of an embedded clause is formed by External Pair-Merge of C with T.

(25)  a.  John seemsta like pickles.

b.  [CP C [<φ, φ> John[φ] T[φ] [vP √seem-*v* [·T-C·P ~~John~~ T-C-to [vP ~~John~~ √like-*v* [<φ, φ> √like[φ] pickles[φ]]]]]]]]

c.  John seem to like like pickles

In (25b), a copy of *John* is merged with the phrase headed by *to*.    The two phrases are not in any agreement relation because the embedded C-head is pair-merged and

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its uninterpretable φ-features (agreement feature) are invisible.    This means that it is impossible to form a label with the agreement feature.    Then, we must rely on the other solution to an XP-YP problem: NS-Copy Deletion.    In the embedded clause of the raising construction, the copy of *John* is deleted within Narrow Syntax, and the remaining phrase (*'T-C'P*) serves as a label.    (Here, I assume that the amalgam of *T-C* has the ability to label like the amalgam of $\sqrt{-v}$).    As a result of the NS-Copy Deletion, *seem* and *to* are adjacent in the mapped PF representation, and thus *to*-contraction is allowed.[7]

## 4.    Consequences

In this section, I will provide an account of three phonological phenomena as consequences of my proposal.    The first one is exceptional copy realization where a particular lower copy is realized for some phonological reason.    The second is VP-Ellipsis (VPE) in infinitival clauses, which strands an infinitive marker *to*.    The last is auxiliary reduction, which is restricted in a particular circumstance.

### 4.1.  Lower Copy Realization

In the literature, many approaches to Copy Deletion attempt to capture the fact that a head of a chain is generally realized (cf. Nunes (1995, 2000, 2011), Bobaljik (1995, 2002), Landau (2006) and others).    In contrast, Franks (1998), Bošković (2002) and many others propose that a lower copy can be realized if some phonological factor prevents pronunciation of the copy at the head of a chain.    Such exceptional copy realization can be observed in various multiple *wh*-fronting languages.    To set the stage for the discussion, I first introduce run-of-the-mill *wh*-questions in Bulgarian (26) and Romanian (27).

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(26) a. Koj  kakvo e  kupil?                                    (Bulgarian)

      who  what   is bought

      ' Who bought what?'

   b. *Koj e kupil kakvo?                         (Bošković (2002: 355))

(27) a. Cine ce    a    spus?                                  (Romanian)

      who  what has said

      ' Who said what?'

   b. *Cine a spus ce?                              (Rudin (1988: 14))

In these sentences, all *wh*-phrases must be fronted.   What is important here is that these *wh*-phrases are different words (the counterparts of '*who*' and '*what*').   In contrast, if multiple *wh*-phrases are homophonous, one of them is realized in the sentence-initial position while the other is not, as shown in the following examples.

(28) a. Kakvo  obuslavlja   Kakvo                          (Bulgarian)

      what      conditions    what

      ' Who conditions what?'

   b. *Kakvo kakvo obuslavlja?                    (Bošković (2002: 364))

(29) a. Ce   precede  ce?                                    (Romanian)

      what precedes  what

      ' Who precedes what?'

   b. *Ce ce precede?                                   (ibid.: 365)

Sentences in (28, 29) show that the second *wh*-phrases are realized in their base positions.   To capture this fact, Bošković proposes that these languages have a phonological constraint against consecutive homophonous strings (such as *kakvo-kakvo* or *ce-ce*), and that a lower copy is realized in order to avoid such an illegitimate sequence.[8]   According to this, each of the second *wh*-phrases in (28,

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29) are realized not at the highest positions, but at the lower positions.[9]

    Thus the phonological constraint explains the observed patterns of copy realization but it is not without a problem in that it cannot capture the restricted distribution of the exceptional realization: if one of homophonous *wh*-phrases is not realized at the head of a chain, it must be realized in an argument position, not in its intermediate positions.   In the following examples, I roughly schematize *wh*-movement constructions, and use the symbol "%" to mark variation on judgment.

(30)    Kakvo  (* kakvo)  misli  Ivan  (%kakvo)  če  ( kakvo)  obuslavlja

          what        what     thinks  Ivan    what     that  what     conditions

          (kakvo)?

          what

          'What does Ivan think conditions what?'          (ibid.: 373)

(31)    Ce  (* ce)  crede  Ion  (*ce)  că    (%ce)    a    determinat

          what    what thinks Ion  what  that     what    has determined

          (ce)?

          what

          'What does Ion think determined what?'          (ibid.)

These sentences show that, among the two *wh*-phrases, one is realized in the sentence-initial position and the other is desired to be realized in argument positions (either a subject position or an object position).   This realization pattern raises a problem with Bošković's proposed constraint, which just blocks a homophonous sequence.   If lower copy realization is required by the constraint, then intermediate copies are also candidate for copy realization, contrary to fact.   That is, the constraint explains unrealization of the head of a chain but it cannot capture why lower copy realization is limited to an argument position.

    The LA-based Copy Deletion system can make up for the shortcoming.   What

is crucial is that pronounced copies are necessary for labeling but unpronounced ones are not (rather, they cause labeling problems).　Consider the structures of (29, 30), which are illustrated in (32, 33) respectively.

(32)　[Kakvo kakvo misli Ivan [$_{CP}$ ~~kakvo~~ če [$_{<φ, φ>}$ kakvo$_{[φ]}$ T$_{[φ]}$ [$_{vP}$ $v$-√obuslavlja [$_{<φ, φ>}$ √obuslavlja$_{[φ]}$ kakvo$_{[φ]}$]]]]]

(33)　[Ce ce crede Ion [$_{CP}$ ~~ce~~ că [$_{<φ, φ>}$ ce$_{[φ]}$ a$_{[φ]}$ [$_{vP}$ $v$-√determinat [$_{<φ, φ>}$ √determinat$_{[φ]}$ ce$_{[φ]}$]]]]]

Analyzed in a similar way to English, lower copies in argument (agreement) positions are undeleted within Narrow Syntax while intermediate copies undergo NS-Copy Deletion for labeling.　Since the latter copies are never mapped into the phonological component, they cannot be candidate for copy realization (and lower copy realization is limited to argument positions).

## 4.2.　Explanation for *to*-Stranding VP-Ellipsis

English allows VP-Ellipsis (VPE) in infinitival clauses.　Sentences in (34) show that VPE can apply in an infinitival complement clause of a raising predicate (34a) and that of a control predicate (34b).

(34)　a.　They say that Mary doesn't know French, but she seems to.

(Wurmbrand (2005: 14))

　　　b.　Kim isn't sure she can solve the problem, but she will try to.

(Martin (2001: 154))

In contrast, an ECM verb blocks VPE in its infinitival complement clause, as exemplified below (cf. Emoto (2007)).[10]

(35)  *I consider Pam to like soccer, and I believe Rebecca to as well.  (ibid.)

These observations pose a question about the distribution of VPE: why only ECM verbs prohibit VPE in their complement clause.   In this subsection, I address this question.

To set the stage for my analysis, I introduce a phonological analysis of VPE proposed by Zwicky (1982).   In his paper, he assumes that an infinitive marker (*to*) is phonologically too weak and requires a prosodic host.   He observes that the phonological dependency is usually established between an infinitive marker and an overt element on its right, as indicated in (36), where square bracket "[   ]" marks a phonological unit.

(36)    [we want] [to leave]

In this sentence, the infinitive marker can form a legitimate phonological unit with the following verb, and hence the sentence is phonologically licensed.   However, the phonological dependency cannot be established once VPE (or VP-fronting) removes the prosodic host.   Zwicky observes that, if an infinitive marker loses the prosodic host on its right, then it is incorporated into the phonological unit on its left through prosodic restructuring, as shown in (37).

(37)    [we want to] __

Here, the infinitive marker has a new host within the restructured phonological unit, and hence the phonological output can be legitimate again.   Zwicky formulates this prosodic restructuring operation as follows.

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(38)　*To* Reattachment (Zwicky (1982: 29))

　　When it does not form a VP constituent with an immediately following VP, the English infinitive marker *to* attaches to the constituent immediately to its left, to form a phonological phrase with it.

According to Zwicky's analysis, the grammaticality of VPE in infinitival clauses depends on whether a stranded infinitive marker has its prosodic host or not.

　　Now, we are ready to analyze VPE in infinitival clauses.　First, consider the case of VPE in a raising construction.　(As I assume in section 3.2, a clause-selecting verb is formed by External Pair-Merge of root with $v$, and the head of an embedded clause in a raising construction is formed by Pair-Merge of C with T.) (39a) has the structure in (39b) where elided part is marked by double lines.

(39)　a.　They say that Mary doesn't know French, but she seems to.

　　b.　…but [$_{CP}$ C [$_{<φ, φ>}$ she$_{[φ]}$ T$_{[φ]}$ [$_{vP}$ she̶ $\sqrt{}$seem-$v$ [$_{·T-C'P}$ she̶ T-C-to [$_{vP}$ she̶ $\sqrt{}$know̶ ̶v̶ [$_{<φ, φ>}$ $\sqrt{}$know$_{[φ]}$ French$_{[φ]}$]]]]]

　　c.　… but she seems to

Here, the intermediate copies undergo NS-Copy Deletion.　As a result, the infinitive marker depends on a raising verb in the phonological component, and they form a legitimate phonological constituent.　The VPE is phonologically licensed, and hence possible in this kind of construction.

　　Next, let's turn to the case of control verbs:

(40)　a.　Kim isn't sure she can solve the problem, but she will try to.

　　b.　… but she will [$_{vP}$ $\sqrt{}$try-$v$ [$_{CP}$ C [$_{<φ, φ>}$ PRO$_{[φ]}$ T$_{[φ]}$-to [$_{vP}$ P̶R̶O̶ $\sqrt{}$solve̶ ̶v̶ [$_{<φ, φ>}$ $\sqrt{}$solve$_{[φ]}$ the problem$_{[φ]}$]]]]]

　　c.　but she will try to

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In (40), the C-head and PRO subject are inherently null and hence not mapped into the phonological component.    The infinitive marker can form a legitimate phonological unit with the control verb in the phonological representation, and hence VPE is phonologically licensed.

Finally, let us move on to the case of ECM verbs.    Following Chomsky (2013, 2015), I assume that ECM verbs have a raising-to-object construction schematized in (41b).

(41)  a.  *I consider Pam to like soccer, and I believe Rebecca to, as well.

  b.  … and I [$_{vP}$ ~~I~~ √believe-$v$ [$_{<φ, φ>}$ Rebecca$_{[φ]}$ √believe$_{[φ]}$ [$_{TP}$ ~~Rebecca~~ T-to [$_{vP}$ ~~√like-$v$~~ ~~√like$_{[φ]}$-soccer$_{[φ]}$~~] as well]]]…

  c.  and I believe Rebecca believe to as well → PF-Copy Deletion

  ⇒  and I believe Rebecca ~~believe~~ to as well

Here, two copies of √believe are mapped into the phonological component. Therefore, the infinitive marker finds the root as its prosodic host in the mapped linear order.    However, at a later stage, the prosodic host is deleted via PF-Copy Deletion, and hence the established phonological dependency is destructed.    This means that, the phonologically weak element does not have its host in the phonological component.    Since the resulting PF output is illegitimate, VPE is impossible in ECM complement clauses.

## 4.3.  Extension to Head-Movement

In the previous sections, I have analyzed the phonological effects of silent copies created by A-movement or A´-movement.    In this subsection, I demonstrate that the current analysis also applies to copies created by head-movement.    See examples (42), which involve cliticization of a reduced auxiliary.

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(42) a. John should've left.

　　 b. Should you have/*'ve hit Harry?　　　　(Lakoff (1970: 632))

Lakoff (1970) suggests that a reduced infinitival auxiliary verb (*'ve*) must cliticize onto a prosodic host on its left, and that this phonological operation is impossible when T-to-C movement applies.[11]　 Sentence (42b) has the structure (43a) and the linear order of (43b).

(43) a. [CP C-should [<φ, φ> you[φ] T[φ]-should have [vP ~~you~~ √hit-v* [<φ, φ> √hit[φ] Harry[φ]]]]]

　　 b. should you should have hit hit Harry → PF-Copy Deletion

　 ⇒ should you ~~should~~ have hit ~~hit~~ Harry

In (43a), the copy of *should* cannot undergo NS-Copy Deletion.　 If it is deleted and invisible to LA, then it is impossible to form the label <φ, φ> with the subject, and an XP-YP problem is caused by the subject DP and its merge mate.　 Consequently, at the first stage of the phonological component, the reduced auxiliary criticizes onto the lower copy of the finite auxiliary.　 However, the copy is later deleted through PF-Copy Deletion.　 Since this results in the illegitimate PF representation where the reduced auxiliary (*'ve*) does not have its host, sentence (42b) is ungrammatical.

## 5.　 Conclusion

　　 In this paper, I have proposed a new Copy Deletion system to explain various phonological effects of copies.　 I have first shown that not all deleted copies have an intervention effect on contraction.　 Then, I have proposed a Copy Deletion system which is regulated by LA.　 The proposed Copy Deletion system deletes copies within Narrow Syntax when they cause labeling problems, while it does not delete copies necessary for labeling and sent them to the phonological component.

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Consequently, only the latter copies have a phonological effect, and prevent contraction (even if they are finally deleted based on the conditions on linear order). My proposal also accounts for restriction on lower copy realization, the (un)grammaticality of VPE in various infinitival clauses, and restriction on auxiliary reduction.
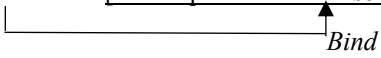
**Notes**

1)　Given the standard view that successive-cyclic movement goes through the edge of a phase, some previous studies assume that control complement clauses form TP, a non-phasal constituent and hence *wh*-movement does not leave a copy at the clausal edge position.  This approach explains that an object *wh*-phrase never blocks the PF-adjacency between *want* and *to*.  However, I argue against the structural assumption of control clause, based on the discussion introduced in section 2.

2)　Roberts (1997) also attributes the (un)grammaticality of *wanna*-contraction to the same structural assumption from the different perspective.  He proposes that *wanna*-contraction requires head-movement of the embedded T (to) to the matrix V (want), and that the presence of a C-head blocks the operation.

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3)    The same problem holds for labeling an SO with root-to-*v* head-movement, which Chomsky (2015) assumes takes place within Narrow Syntax.    He assumes that the lower copy of the root takes part in labeling and forms the label <φ, φ> with an object. However, if each copy of a chain is invisible for LA, such labeling should be impossible because the lower copy cannot be located by LA.

4)    One might think that the NS-Copy Deletion approach cannot capture the semantic interpretation of intermediate copies.    For example, sentence (i) has anaphor binding interpretation, which requires a *wh*-copy with an anaphor to be interpreted at an intermediate position.

   (i)  a.    Which picture of himself$_i$ did John$_i$ think Mary likes?
        b.    [which picture of himself] did **John** think [which picture of **himself**]
              └──────────────────────────────────────────────┘
                                                            *Bind*

        Mary likes [which picture of himself]

A possible solution to this problem is that such interpretation is obtained not within the semantic component, but within Narrow Syntax, and hence it does not require intermediate copy at the LF representation (see Hicks (2008) and references therein).    I leave for future research how far this solution holds.

5)    More precisely, I adopt a more recent phonological approach proposed in Ackema and Neeleman (2003) and Anderson (2008), which requires a reduced word and prosodic host to be adjacent "within the same phonological domain."    This is because Jaeggli's (1980) simple adjacency-based analysis incorrectly predicts that contraction is possible in sentence (i).

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(i)     One must *wanna/want (in order) to become an over-effective consumer

(Goodall (2017: 1163))

As shown above, although *want* and *to* are adjacent, the infinitive marker of purpose clause cannot be used for *wanna*-contraction.   For the phonological-domain-based analysis, this sentence has been assumed to have the following phonological structure, where square brackets express phonological units.

(ii)    [One] [must want] [(in order) to become] [an over-effective consumer]

Since *want* and *to* are separated into different phonological units, contraction is prevented. The more recent phonological approach is necessary to explain a broader range of data, but I do not assume it to analyze the contraction data in this paper.   This is because the goal of the paper is to explain the phonological difference among silent elements and the simple adjacency-based is enough to do the job.

6)     I assume that, among the two copies of √*meet* (just a root and a part of an amalgam √meet-v), the latter is pronounced because this copy can be unambiguously realized as a verb.   In contrast, the lower copy lacks categorial information and therefore the phonological component cannot realize it since it is unclear whether it should be realized as a verb or another category.

7)     One might think that the *wh*-copy does not have to intervene between *want* and *to* in (23) (the ungrammatical *wanna* contraction with *wh*-subject) if the T-head can serve as a label like the case of raising verbs.   However, I omit this possibility because the T-head must form a label $<\varphi, \varphi>$ with a subject in non-movement contexts, and accordingly it seems that an embedded C c-selects $<\varphi, \varphi>$ in the construction.

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8)    Bošković (2002) shows that, in Romanian, syntactic *wh*-movement of the second homophonous *wh*-phrase is confirmed by a parasitic gap.

   (i)    Ce    precede    ce    fără    să        influențeze?

          what precedes what    without   SUBJ.PART influences

          'What precedes what without influencing?'        (Bošković (2002: 374))

9)    In (28, 29), the highest copies of the second *wh*-phrases take scope at the sentence-initial position at LF since these sentences are .interpreted as multiple-*wh*-questions. Therefore, I assume that the head copies of the second *wh*-phrases undergo PF-Copy Deletion, but not NS-Copy Deletion.

10)    Wurmbrand (2014) observes that ECM verbs also allow VP-Ellipsis.

   (i)    ? They say that Mary doesn't like raisins but Bill believes her to.

                                            (Wurmbrand (2014: 406))

However, among various infinitival complement clauses she observes, VPE is slightly degraded only in ECM complement clauses.   I think that there is a possibility that her observation rather suggests that VPE in ECM complement clauses is disallowed.

11)    Some authors argue against Lakoff's suggestion by pointing out that a reduced finite auxiliary verb does not need its host on its left (cf. Sato (2012), Anderson (2008)). For example, in (i), the reduced finite auxiliary (*'s*) immediately follows a gap created by *wh*-movement.

   (i)    What do you think's happening?                    (Sato (2012: 302))

However, the argument is unreasonable because finite auxiliary verbs and infinitival ones behave differently.   One of the differences is that the former cannot precede a gap while the latter can.


(ii) a. *I will finish work at 5 and you'll too.

b.   I will have finished work at 5 and you will've too.

(Aelbrecht and Harwood (2015: 77))


This difference suggests that reduced finite auxiliaries are proclitics while infinitival ones are enclitics (see also Bresnan (1978) and Wilder (1997)).   Therefore, I believe that Lakoff's suggestion is correct.


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Shogo Saito

Department of English Linguistics

Graduate School of Arts and Letters

Tohoku University

27-1 Kawauchi, Aoba-ku, Sendai, Miyagi, 980-8576

E-mail: hannnari4405@hotmail.co.jp