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## Labeling through Spell-Out

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**Abstract:** This paper proposes that a particular conception of the Spell-Out operation provides a hitherto unnoticed way of determining a label of otherwise unlabeled syntactic objects. It is shown that this proposal simplifies the grammar and gains several theoretical and empirical consequences, eliminating certain unnecessary complications in Chomsky's (2013) framework where some instances of movement are forced by the need to label. More specifically, we point out that Chomsky's basic idea behind the implementation of labeling through movement, which assumes that a copy left behind by movement is invisible to minimal search, is not only incompatible with the copy theory of movement but also violates the No Tampering Condition. We also point out that his claim that movement is required for labeling has a redundancy problem regarding the motivation of movement, which should be avoided in the Minimalist Program. Then, we argue that the problems are easily solved if we ensure that a singleton set left after the application of Spell-Out is automatically converted into its single member. The proposed system of labeling that makes use of Spell-Out not only removes some unnecessary complications of Chomsky (2013) but also gives several novel answers to classical questions concerning the binarity of phrase structures and the structures of small clauses and *there*-constructions.

**Keywords:** labeling, Spell-Out, minimal search, binary branching

## 1 Introduction

20 years have passed since the advent of the *Minimalist Program* (MP) (Chomsky 1995). MP aims to clarify the concept of simplicity in language by eliminating stipulations, redundancy, and other complications of Universal Grammar (UG). It has been guided by the *Strong Minimalist Thesis* (SMT), which seeks to formulate a perfect solution to the conditions that language must meet (see Chomsky's 2015a recent reflection of MP). The constant pursuance of that program by generative linguists has brought about a lot of significant achievements and contributions not only in linguistics but also in other fields (cf. Sakai

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2005). Specifically, notions such as *X-bar*, *D-structure*, *S-structure*, *trace*, *index*, and the like have been all shown to be eliminable from the grammar (for an overview of some results of MP, see Hornstein et al. 2005 among others). As a result, it has become possible to minimize UG with only conceptually necessary components, such as *Merge*, *phase*, *minimal search*, *Spell-Out*, etc., in order to interact in an optimal way with two indispensable interfaces, *conceptual-intentional* (C-I) and *sensorimotor* (SM).

However, there is a controversial notion that is still obscure in MP, namely *labels*. From the outset of generative grammar, it has been explicitly or implicitly assumed that labels are necessary for syntactic derivations to proceed in narrow syntax (NS) and for syntactic objects (SOs) to be interpreted at the interfaces (Chomsky 1957, 1995, 2013 among others), but the question still remains as to how labeling takes place before SOs are transferred to the interfaces. Chomsky (1995), for instance, treats labeling as a part of the definition of Merge (see Section 2 below). On the other hand, Collins (2002), and Seely (2006) argue against this position by showing that such complications are unnecessary and, in fact, avoidable under the theory of *bare phrase structure* (Chomsky 1994, 1995), where structure building done via Merge takes place without recourse to labels.

More recently, Chomsky (2013) reaches the conclusion that Merge is just a set-formation operation that combines two SOs with no label projection, as in  $\text{Merge}(\alpha, \beta) \rightarrow \{\alpha, \beta\}$ . That said, since SOs need to be interpreted at the interfaces, he assumes a fixed *labeling algorithm* that makes SOs interpretable at the interfaces, operating at the phase level along with other operations. Specifically, for Chomsky, “[...] [labeling algorithm] is just minimal search, presumably appropriating a third factor principle, as in Agree and other operations (Chomsky 2013: 43)”, an indispensable process to find the relevant information of  $\{\alpha, \beta\}$ .

In this paper, building on Chomsky’s (2013) conception of labeling, we aim to further elaborate on its mechanism, by eliminating potential flaws in his actual implementation of what we may call *labeling through movement*, and shed new light on the process of labeling by making use of one of the essential NS operations. More specifically, we propose that a particular conception of the Spell-Out operation provides a hitherto unnoticed way of determining a label of otherwise unlabeled SOs. By doing so, we show that this proposal simplifies the grammar and gains several theoretical and empirical advantages, eliminating certain unnecessary complications in Chomsky (2013).

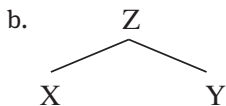
The paper is organized as follows: Section 2 briefly reviews Chomsky’s (2013) proposals about labeling and identifies some of their potential theoretical flaws. Section 3 proposes *labeling through Spell-Out* and investigates its consequence for optimal use of Merge. Section 4 concludes the paper and makes some suggestions for future work.

## 2 Background and the problems

### 2.1 Chomsky (2013) on labeling

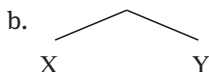
In MP, Merge, an elementary recursive operation that combines two SOs into a set, has been assumed to be a primitive operation to ensure the discrete infinity of human language. In the early Minimalism (Chomsky 1993, 1995), it was assumed that the operation Merge itself takes care of labeling, with labeling taking place as a part of the definition of Merge. Thus, under the definition in (1a), Merge takes  $X$  and  $Y$  as its input and yields a set of  $\{X, Y\}$ . If neither  $X$  nor  $Y$  is part of the other, we have *External Merge* (EM), and if either  $X$  or  $Y$  is part of the other, we have *Internal Merge* (IM). In either case, the resulting set is then labeled as  $Z$  upon the application of Merge, inheriting the relevant properties of  $X$  or  $Y$  (see Chomsky 1995: 396–399) (informal tree notations like (1b) and those to be provided below are added just for the sake of illustration).

- (1) a.  $\text{Merge}(X, Y) \rightarrow \{Z, \{X, Y\}\}$ , where  $Z = X$  or  $Y$



However, building on the study of a label-free syntax (Collins 2002; Seely 2006; see also Narita 2014), Chomsky (2013) reaches the conclusion that labeling is not built into Merge, and the resulting set has no label projection as in (2a).

- (2) a.  $\text{Merge}(X, Y) \rightarrow \{X, Y\}$



As is obvious from (2), outputs of Merge are simply sets with no label, so an immediate question raised by the simplest Merge-based system is: How can SOs be labeled?

As for the labeling problem, Chomsky (2013) assumes that a label is required for interpretation at the interfaces.<sup>1</sup> Hence, for SOs to be labeled, there must be a fixed labeling algorithm that makes them interpretable at the interfaces, operating at the

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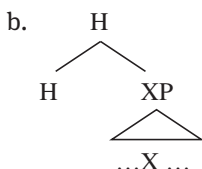
<sup>1</sup> An anonymous reviewer wonders exactly why labels are necessary at the interfaces. The following case discussed in Chomsky (2008) may be relevant.

(i) [ <sub>$\alpha$</sub>  what [C [you wrote]]]

Chomsky points out that if  $\alpha$  is labeled as C, the whole constituent is interpreted as an interrogative clause while if *what* projects (i. e.  $\alpha$  is labeled as N/D), the constituent is interpreted as a nominal (i. e. free-relatives). If so, this indicates the necessity of labels at the interfaces.

phase level along with other operations. Under this assumption, he then argues that labeling is just minimal search as in Agree, and the relevant information about a SO is provided by a single designated element within it: a lexical item LI, a head. Thus, given  $SO = \{H, XP\}$ , H a head and XP not a head as in (3b), it is claimed that the label of the SO is straightforwardly determined as the label of H as in (3a).

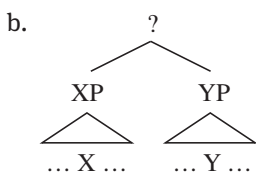
- (3) a.  $\text{Label}(\{H, XP\}) = H$



This is because H is a single designated element within it so that minimal search can unambiguously select it as the label of the SO.

As already noted by Chomsky (2008: 160, note 34), however, one potential problem with this analysis of labeling is that it cannot easily determine a label of  $SO = \{XP, YP\}$ , as illustrated in (4).

- (4) a.  $\text{Label}(\{XP, YP\}) = ?$

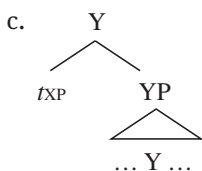


In this structure, which is sometimes called an *XP-YP structure*, neither is a head, and minimal search is ambiguous in that either X or Y is a potential candidate. Hence, the label of the SO cannot be straightforwardly determined. Then, Chomsky proposes the following two ways in which the SO can be labeled:

- (5) (A)  $\{XP, YP\}$  can be labeled by raising either XP or YP so that there is only one visible head.  
 (B)  $\{XP, YP\}$  can be labeled by sharing prominent features of XP and YP.

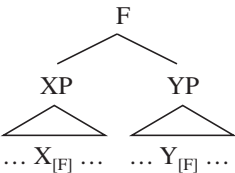
Under (5A), the relevant SO of the form  $\{XP, YP\}$  is labeled as follows:

- (6) a.  $XP_i \dots \{t_i, YP\}$   
 b.  $\text{Label}(\{t_i, YP\}) = Y$



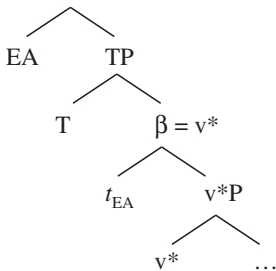
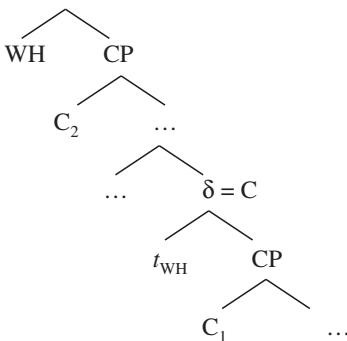
If, say, XP undergoes movement as in (6a), then only YP becomes visible to labeling; hence the SO is labeled as Y as in (6b). As emphasized in Chomsky (2013: 44), what is important to note in this analysis of labeling, which we may call *labeling through movement*, is that we need to assume that a copy left behind by movement is invisible to labeling; otherwise the lower XP copy would remain visible to labeling, contrary to the intent, to which we return.

Under (5B), on the other hand, the SO is labeled as follows:

- (7) a.  $\{XP_{[F]}, YP_{[F]}\}$   
 b.  $\text{Label}(\{XP_{[F]}, YP_{[F]}\}) = F$   
 c.
- 

If XP and YP share a prominent feature F as in (7a), minimal search can take that to be the label of the SO; hence the SO is labeled F as in (7b). To put (5B) into practice, Chomsky crucially assumes the notion of feature-sharing (Chomsky 2013: 45), so let us call this *labeling through feature-sharing*. According to Chomsky, labeling through feature-sharing operates on final landing sites of movement, namely *critical positions* in the sense of Rizzi (1997), giving rise to Q-feature-agreement in cases of wh-movement and  $\varphi$ -feature-agreement in cases of subject-raising, for instance.

On the other hand, labeling through movement operates on departure and intermediate landing sites of movement. Significantly, Chomsky claims that the obligatory nature of subject raising (i. e. the EPP effect) and the successive-cyclic nature of wh-movement follow from the necessity of labeling. Thus, consider the following schematic derivations in (8a/a') and (8b/b'), each representing the EPP effect and successive-cyclicity.

- (8) a.  $[_\alpha EA_i [T [_\beta t_i v^*P]]]$   
 a'.  $\alpha = \varphi$
- 
- b.  $[_\gamma WH_i [C_2 [... [_\delta t_i [C_1 [...]]]]]]]$   
 b'.  $\gamma = Q$
- 

As seen in (7),  $\alpha$  in (8a/a') and  $\gamma$  in (8b/b') are labeled  $\varphi$  and  $Q$ , respectively, through feature-sharing of the agreement features. Importantly, as for the labels of  $\beta$  and  $\delta$ , Chomsky (2013) suggests the following: In (8a/a'), "[...] if EA raises to surface subject [...] then  $\beta$  will be labeled  $v^*$ , as required, [...]. Therefore EPP is forced [...]. (Chomsky 2013: 44)" Similarly, in (8b/b'), "[i]f [WH] raises, then [ $\delta$  in (8b/b')] will be labeled [C], as required. Therefore [WH] must raise, and successive cyclic movement is forced. (Chomsky 2013: 44)" To put it in other words, phrases in intermediate positions must raise in order to permit labeling of the remaining structure. Therefore, for Chomsky, movement is required for labeling.

Chomsky's (2013) proposals about labeling are summarized as in (9).

- (9) A label is required for interpretation at the interfaces and assigned by a minimal search algorithm applying to an SO at the phase level. A label of  $\{H, XP\}$  is  $H$ , and a label of  $\{XP, YP\}$  is determined through (A) or (B):
- (A) a.  $XP_i \dots \{t_i, YP\}$   
       b.  $\text{Label}(\{t_i, YP\}) = Y$   
            $\approx$  successive-cyclic movement  
            $\approx$  other symmetric structures
- (B) a.  $\{XP_{[F]}, YP_{[F]}\}$   
       b.  $\text{Label}(\{XP_{[F]}, YP_{[F]}\})$   
            $\approx$  criterial positions.

Of particular importance of this system is that movement is required for labeling.

## 2.2 Problems with labeling through movement

Chomsky's (2013) eradication of labeling from the definition of Merge and its reduction to minimal search seems to be theoretically welcomed in favor of the simplest Merge. Nonetheless, we would like to point out that there are (at least) two theoretical problems in his system (see also Bošković in press).

First, Chomsky's (2013: 44) idea that the lower XP copy is invisible to minimal search is incompatible with the *copy theory of movement*, which has been assumed in the literature since Chomsky (1993). In implementing labeling through movement, he assumes that a copy left behind by movement is invisible to minimal search. It is not clear why this would hold, however, since the original, lower copy should behave exactly like the moved copy for the purpose of serving as a label. Under the copy theory of movement, the trace  $t_i$  in (6) is in fact a copy of XP as shown in (10).

- (10) XP... {<XP>, YP} (<XP> = the lower copy)

Hence, to label the remaining set, some additional assumption is required so as to render the lower XP copy invisible to minimal search. How is it possible, though? In fact, Chomsky (2005) clearly states a close connection between the *No Tampering Condition* (NTC) and the copy theory of movement as follows: “The no-tampering condition also entails the so-called copy theory of movement, which leaves unmodified the objects to which it applies [...]. (Chomsky 2005: 13)” It then follows that an ad hoc assumption about the invisibility of copies clearly violates the NTC.<sup>2</sup> Thus, labeling through movement is not only incompatible with the copy theory of movement, but also complicates the definition of Merge.

Note that, as illustrated in (11) and (12), there are cases in which lower copies look invisible to minimal search. In the case of (11a), the lower copy of *what* in the *v*\*P-edge is located between T and *they* as in (11b), without blocking their relation (Chomsky 2007, 2008; Epstein et al. 2014). Similarly, in the case of (12a) the lower copy of *Jóni* in the *v*\*P-edge is located between T and *sokkar* as in (12b), but it does not block an agreement between T and the nominative object in Icelandic (Jónsson 1996; Bobaljik 2008).

- (11) a. *What do they like?*  
 b. [<sub>CP</sub> what C [<sub>TP</sub> T [<sub>v\*P</sub> <what> they v\* [<sub>VP</sub> like <what>]]]]
- (12) a. *Jóni líkuðu þessir sokkar*  
 Jon.DAT like.PL these socks.NOM  
 ‘Jon likes these socks’  
 b. [<sub>TP</sub> Jon<sub>DAT</sub> T [<sub>v\*P</sub> <Jon<sub>DAT</sub>> v\* [<sub>VP</sub> like these socks<sub>NOM</sub>]]]

However, it is important to notice that there do exist cases where lower copies appear to be visible to minimal search. Consider the following contrast in Icelandic agreement:

- (13) a. *Mér virðast t<sub>NP</sub> [hestarnir vera seinir]*  
 me.DAT seem.PL the.horses.NOM be slow  
 ‘It seems to me that the horses are slow’

<sup>2</sup> Chomsky (2013: 44) postulates the notion of *domain* to ensure the invisibility of lower copies. As an anonymous reviewer points out, however, it is a stipulation at best. The analysis to be proposed does not have to make such a stipulation. We thank the reviewer for this point.

- b. *Hvaða manni veist þú að virðist/\*virðast*  $t_{wh}$   
 which man.DAT know you that seem.3SG/seem.PL  
 [*hestarnir vera seinir*]  
 the.horses be slow  
 ‘To which man do you know that the horses seem to be slow’  
 (adopted from Holmberg and Hróarsdóttir 2003: 998)

The contrast between (13a) and (13b) shows that with the T-nominative agreement, while the lower copy left behind by NP-movement (notated as  $t_{NP}$ ) is invisible to minimal search, the lower copy left behind by wh-movement (notated as  $t_{wh}$ ) is visible to minimal search. Hence, the embedded plural subject *hestarnir* ‘the horses’ can agree with the higher T only in (13a). This suggests then that merely being a copy is not sufficient for ensuring the invisibility for minimal search.

Second, Chomsky’s (2013) claim that movement is required for labeling seems to have a redundancy problem, which should be avoided in MP. Recall that in analyzing successive-cyclic wh-movement, he argues that the intermediate step of movement is required for labeling (cf.  $\delta$  in (8b)). It is not clear to what extent the same motivation is involved in the initial step of movement, however. For example, when an object wh-phrase ( $XP_{wh}$ ) is merged with a verb (V) in English as in (14), the label of this set can be unambiguously determined by minimal search to V. Nonetheless, wh-movement to the  $v^*P$ -edge is required under the standard assumption.

- (14) {V,  $XP_{wh}$ }

This means that a movement of the wh-phrase from the object position requires a motivation other than labeling, say, certain uninterpretable features (Bošković 2007, 2008; see also Pesetsky and Torrego 2001, 2007). Then, it would not be unreasonable to assume that such features motivate successive-cyclic wh-movement in intermediate positions as well, as in fact argued for in Bošković (2007), which makes the claim that labeling triggers movement redundant.<sup>3</sup>

<sup>3</sup> Building on Chomsky’s (2013) labeling theory, Chomsky (2015b) argues that an object undergoes obligatory raising to the SPEC of V, which is indeed taken as R(oot) in the sense of Marantz (1997; Embick and Marantz 2008), and Borer (2005a, 2005b, 2013), along with that of a subject to the SPEC of T. According to this *generalized EPP approach*, T and R are too weak to serve as a label and with an overt subject/object, the SOs { $DP_{Subj}$ , TP} and { $DP_{Obj}$ , RP} are labeled  $\langle \varphi, \varphi \rangle$  by the agreeing features. Hence the problem raised in the text may not arise in all cases under the more recent labeling theory. However, as noted by Chomsky (2015b), given that there is evidence that shows object-raising is optional (see, e.g., Lasnik 1999), Chomsky’s (2015b) generalized EPP approach is inconclusive. Hence, the problem still remains.



Similarly, the examples in (15) indicate that predicate-internal subjects should raise regardless of whether the predicate is a head (i. e. *good* as in (15a)) or a phrase (i. e. *good at math* as in (15b)):

- (15) a. *The student<sub>i</sub> seems* [<sub>SC</sub> *t<sub>i</sub> good*]  
 b. *The student<sub>i</sub> seems* [<sub>SC</sub> *t<sub>i</sub> good at math*]

If the subject is forced to move even in (15a), where the predicate is a head (hence the label of the small clause (SC) can be determined by minimal search), the same motivation, independent of labeling, should hold for the movement in (15b) as well. Thus, labeling as the motivation of movement seems to be redundant, both for A- and A'-movement.

In sum, in Chomsky's (2013) system, it is not clear exactly how the idea that movement is motivated by labeling accommodates the copy theory of movement (problem 1), and the idea also faces a redundancy regarding the motivation of movement (problem 2).

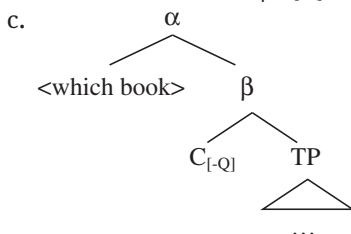
### 3 Proposals and consequences

#### 3.1 Proposals

In order to overcome the problems pointed out in the previous section, we propose that a particular implementation of Spell-Out provides a way to determine a label of an otherwise unlabeled SO. Since this idea, which we call labeling through Spell-Out, is originally explored in Goto (2013a), let us start the discussion by reviewing his proposal. In the derivation of a sentence like (16a), which involves long-distance wh-movement, there is a point where a copy of the wh-phrase *which book* is merged with the SO  $\beta$ , whose label is provided by the non-interrogative C (notated as  $C_{[-Q]}$ ) as in (16b/c).

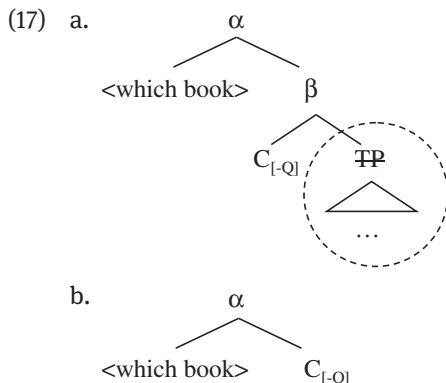
- (16) a. *I wonder which book Bob thinks John bought.*

- b. ... [ <sub>$\alpha$</sub>  <which book> [ <sub>$\beta$</sub>   $C_{[-Q]}$  [TP...]]]



The label of the resultant SO  $\alpha$  remains unlabeled, because there is no feature-sharing between the wh-phrase and  $C_{[-Q]}$ .

Goto (2013a) then suggests that the Spell-Out process applying to the TP as in (17a) changes the SO  $\{C_{[-Q]}, TP\}$  ( $=\beta$  in (16b/c)) into a single head  $C_{[-Q]}$  as in (17b), following Narita (2011, 2014).

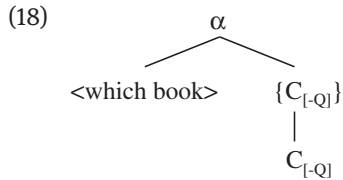


Goto (2013a) points out that the label of the SO  $\alpha$  in (17b) can be determined by minimal search, since  $\alpha$  now consists of a head and a phrase.<sup>4</sup>

Let us now elaborate Goto's (2013a) idea by working out what exactly happens from the step in (17a) to (17b). The question is: What does Spell-Out do? According to Narita (2011, 2012, 2014), Spell-Out applies so as to remove a constituent from the workspace. For him, this means that what remains in the workspace after Spell-Out is just a phase-head. Hence, Spell-Out applied to Y of the SO  $\{X, Y\}$  yields just X. This is not the only possibility explored in the literature, however. Epstein (2007: fn.6), for instance, argues that an application of Spell-Out to one constituent of a set of the form  $\{X, Y\}$  yields a singleton set  $\{X\}$ .

<sup>4</sup> In fact, Goto (2013a) considers why many of apparently unlabelable XP-YP structures created by scrambling in Japanese do not cause a labeling problem and how they overcome it. Then he shows that the label of such structures can, in fact, be determined by the architecture of the narrow syntax, together with Chomsky's (2013: 46) analysis of double objects, Koizumi's (2000) approach to multiple scrambling, and Narita's (2014) analysis of Transfer. Specifically, one of the conclusions in that paper is that labels are necessary for XP-YP structures at intermediate positions, but unnecessary for the ones at the edge of root CP. For further discussion of the labeling theory and related notions like minimal search, Merge, and syntactic visibility, see Goto (2013b, 2015).

Applied to the case under discussion, Epstein's (2007) conception of Spell-Out changes the SO  $\{C_{[-Q]}, TP\}$  (which corresponds to  $\beta$  in (17a)) into  $\{C_{[-Q]}\}$  after Spell-Out of TP. We may informally represent the result of the Spell-Out process as in (18), which is significantly different from (17b).



The point is that the resultant singleton set  $\{C_{[-Q]}\}$  is set-theoretically different from its unique element  $C_{[-Q]}$ , which we wish to have, so that labeling by minimal search may not be applicable. This is so because the elements of the SO  $\alpha$  in (18) are both sets, namely  $\{\text{which, book}\}$  and  $\{C_{[-Q]}\}$ , and if a phrase is defined as a set consisting of lexical items, then it follows that  $\alpha$  in (18) still count as an XP-YP structure.

The question boils down to: How should we treat a singleton set in the current theory of phrase-structure building? In fact, this problem is more general and important in the theory of phrase structure employing the simplest formulation of Merge where  $\text{Merge}(X, Y) \rightarrow \{X, Y\}$ . Epstein (2007) correctly points out that a singleton set of the form  $\{X\}$  does not qualify as a legitimate SO, given the following definitions of SOs in Chomsky (1995: 243): SOs are (i) lexical items (LIs) or (ii) of the form  $\{\alpha, \beta\}$  where both  $\alpha$  and  $\beta$  are SOs. Hence, something must be said if Spell-Out generates a singleton set.

Chomsky (2012), on a different ground, suggests the necessity of “taking a singleton set to be identical to its member (Chomsky 2012: 66)”.<sup>5</sup> In order to formally implement it, we propose the convention in (19), which states that in natural language, a singleton set is automatically converted into its single member.

$$(19) \quad \{X\} \rightarrow X$$

Let us illustrate how (19) works, by considering the point of derivation in (16b), repeated as (20a). At the step in (20b), Spell-Out applies to the TP, and as a result, it is completely removed as in (20c). Since  $[_{\beta} C_{[-Q]}]$  represents a singleton

<sup>5</sup> Chomsky (2012: 66) in fact suggests that movement of  $X$  from the set  $\{X, Y\}$  renders the lower copy of  $X$  invisible to the labeling algorithm, as a result of which  $\{Y\}$ , and the most prominent member  $Y$ , namely the single element of  $\{Y\}$ , counts as the label of the singleton set.

set  $\{C_{[Q]}\}$ , the convention (19) applies, returning its unique element  $C_{[Q]}$ . Then, we are left with the SO in (20d), whose label can now be determined by minimal search, as  $C_{[Q]}$ , an LI, is a member of the set in question.

- (20) a.  $[_\alpha <\text{which book}> [_\beta C_{[Q]} [_{TP}\dots]]]$   
 b.  $[_\alpha <\text{which book}> [_\beta C_{[Q]} [_{FP}\dots]]]$   
 c.  $[_\alpha <\text{which book}> [_\beta C_{[Q]}]]$   
 d.  $[_\alpha <\text{which book}> C_{[Q]}]$

In this way, we can complete the idea of labeling through Spell-Out.<sup>6</sup>

Having laid out the details of our proposals, let us consider how the problems mentioned in Section 2 can be overcome. Recall that the first problem of Chomsky's (2013) system has to do with the inconsistency with the copy theory of movement (problem 1). Notice that under our proposals, it is not necessary to manipulate the intermediate copy of the *wh*-phrase in the SPEC of non-interrogative C. Hence, there is no inconsistency with the copy theory of movement.

Recall that we pointed out that Chomsky's (2013) idea of labeling through movement is not compatible with NTC. Then, it is fair to ask whether our analysis is compatible with it if Spell-Out creates a singleton set  $\{X\}$  from a SO  $\{X, Y\}$ .<sup>7</sup> Given that  $\{X\}$  and  $\{X, Y\}$  are set-theoretically different, it is indeed the case that Spell-Out somehow manipulates SOs created by Merge. Hence, strictly speaking, it appears to be incompatible with NTC. It is, however, worth pointing out here that there is a reason to believe that Spell-Out, or more generally Transfer, is not subject to NTC, so that no compatibility issue arises. The essential role of Spell-Out/Transfer is to map SOs to the interfaces. Given that each interface can interpret only the subset of the information contained in the SOs, Spell-Out/Transfer must be able to manipulate SOs so as to remove ineligible information on the way to each interface. Put differently, Spell-Out/

<sup>6</sup> One of the important differences between Chomsky's (2013) system and ours is the following: For Chomsky (2013), a copy left behind by movement is invisible to minimal search, but for ours, an element removed by Spell-Out is invisible to minimal search. One may then wonder how our approach derives the nominative object agreement phenomenon found in, for instance, Icelandic, where agreement apparently takes place beyond the phase-boundary. We suggest that such cases can well be treated by the notion of successive-cyclic agreement, which has been advocated by Polinsky et al. (2014) and Béjar and Rezac (2009). We thank Lilian Haegeman (p.c.) for bringing this issue to our attention.

<sup>7</sup> We thank Hisatsugu Kitahara (p.c.) for raising this question.

Transfer should be able to modify SOs by its nature. Then, it must be exempt from NTC, otherwise no derivation can converge.<sup>8</sup>

The second problem is that if labeling is conceived as a potential trigger of movement, a redundancy arises in certain cases. Representative cases involve movement of an object wh-phrase to the v\*P-edge and subject-raising from predicate-internal positions (problem 2). Our proposals simplify the grammar because it is not necessary to assume that movement is sometimes driven by the need of labeling but sometimes not. Rather, it becomes possible to maintain the idea that there is a unique driving-force for movement (whatever it turns out to be), so the redundancy problem disappears. It is worth emphasizing here that the idea of labeling through Spell-Out does not offer the *third* way of labeling: In fact, it just broadens the applicability of labeling by minimal search, by reducing an XP-YP structure to an H-XP structure via Spell-Out. In this sense, our proposals further simplify the grammar since labels of SOs can be determined either by minimal search or by feature-sharing, which have already existed in Chomsky's (2013) system.

Before exploring some consequences of the proposed theory, let us discuss one important theoretical issue of the proposed analysis, which has to do with the theoretical status of the convention (19). Although it looks like a stipulation at this point, we argue that it can receive justification which is totally independent from the issue of labeling, by showing that it provides a novel way of removing a restriction on Merge.

The restriction in question has to do with the number of the input, or operand, of Merge. Recall that under the standard definition of Merge (cf. (1a) and (2a)), Merge takes *two* SOs and returns a set consisting of them. Suppose then that there is no restriction on the number of elements that Merge can take as its input, which is desirable given that Merge is a free, set-forming operation. That is, it is in principle possible to apply Merge in the ways illustrated in (21b), which is an instance of a *ternary* operation, along with the standard *binary* application given in (21a). It then follows that even *n*-ary Merge illustrated in (21c) is allowed.<sup>9</sup>

- (21) a. Merge(X, Y) → {X, Y}  
       b. Merge(X, Y, Z) → {X, Y, Z}  
       c. Merge(X, Y, Z, ...) → {X, Y, Z, ...}

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<sup>8</sup> If the convention (19) is taken as a part of the Transfer operation, it also follows that no violation of NTC arises. Although this possibility is worth exploring, it seems to have different implications from the ones to be shown in the text. For reasons of space, we do not explore this possibility any further.

<sup>9</sup> Sorida (2014) in fact explores some consequences of *n*-ary Merge.

Nonetheless, we can maintain the idea that natural language allows only binary Merge, which is at least implicitly assumed under the standard definition of Merge, in the following way: Suppose that a binary application of Merge pre-empts a ternary one because the former is simpler than the latter; then it follows that any  $n$ -ary Merge is blocked by the presence of  $(n-1)$ -ary Merge. The virtue of this analysis is that it is not necessary to specify the number of the operands in the definition of Merge. Computational efficiency, which is among the third factor principles in the sense of Chomsky (2005), dictates how many inputs Merge can take.

In order to complete this argument, however, there must be a way of restricting Merge from applying to a unique element so that it returns a singleton set as in (22).

$$(22) \text{ Merge}(X) \rightarrow \{X\}$$

This possibility is also available under the current assumptions that Merge is a set-forming operation without any restriction on the number of its operands. The problem is why this *unary* Merge in (22) does not preempt binary Merge; otherwise natural language cannot yield a hierarchical structure. Here the convention (19) plays a crucial role. Since it reduces a singleton set to its unique member, the result of unary Merge is always nullified. In other words, the convention makes an application of unary Merge completely vacuous, being excluded by computational efficiency.<sup>10</sup>

In this way, we can ensure that Merge is always binary, without restricting the number of the input elements in its definition. Ternary and higher-order instances of Merge are *too* complex, while unary Merge is in fact simpler but not possible. Hence, we are left with binary Merge because it is the simplest *possible* application of Merge.<sup>11</sup>

To summarize, we argued that Spell-Out provides a novel way of labeling otherwise unlabeled SOs, offering a solution to remove some problems and unnecessary complications in Chomsky's (2013) system of labeling. In Section

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**10** Adger (2013) develops a framework where Merge can form a singleton set. This instance of Merge, called *Self Merge*, is in fact *binary* in the sense discussed here, however, because Self Merge takes two operands that happen to be identical to each other (i. e.  $\text{Merge}(X, Y)$ , where  $X = Y$ ). We leave it for future work how the convention in (19) and Self Merge interact with each other.

**11** The logic behind the argument for binary Merge is reminiscent of the idea of (anti)-locality, where locality prohibits movement from targeting too far while anti-locality bans too short a movement (see Bošković 1994; Saito and Murasugi 1999; Abels 2003; Grohmann 2003; Kayne 2005, among others). It is then tempting to unify these two notions, which we should leave for future research.

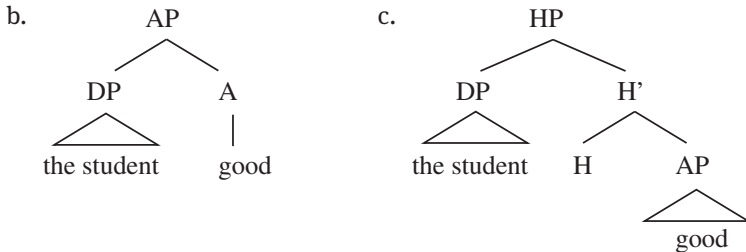
3.2, we discuss some empirical consequences of the proposed idea of labeling through Spell-Out.

## 3.2 Consequences

### 3.2.1 The structure of small clauses

The first consequence has to do with the structure of small clauses. As for their structure, at least two varieties of analyses have been proposed. The first one, initiated by Stowell (1981), assumes a structure like (23b) for the relevant part of (23a), where a predicative element such as *good* directly takes its subject DP *the student*. On the other hand, several researchers including Kitagawa (1985) and Bowers (1993), among others, have argued that there must be a functional head H mediating the predicate and its subject as in (23c).

(23) a. *John considers* [<sub>sc</sub> *the student good*]



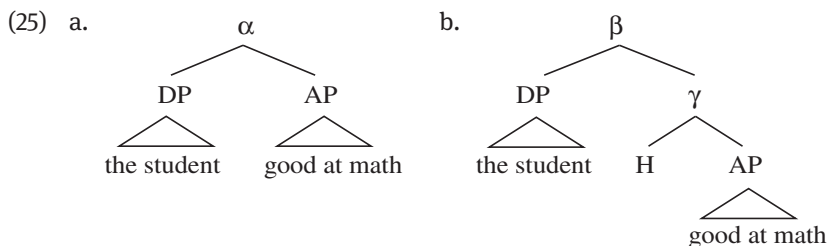
More recently, den Dikken (2006), and Ko (2011) argue that the functional head H in (23c) serves as a phase-head. Significantly, our proposal provides a novel theoretical *rationale* for this idea.

To see this, let us consider the examples in (24), which involve phrasal predicates.

(24) a. *The student<sub>i</sub> seems* [<sub>i</sub> *good at math*].

b. *The student<sub>i</sub> seems* [<sub>i</sub> *a genius*].

Suppose then that the phrasal predicate *good at math* in (24a) takes its subject directly, along the line with the approach in (23b) as in (25a). In this structure, the label of SO  $\alpha$  cannot be determined, since movement of *the student* does not help under our proposal and there is no head that triggers Spell-Out. On the other hand, if we admit the head H in (23c), the relevant part of (24a) is assigned a structure like (25b).



The label of the SO  $\gamma$  raises no problem, since it has an H-XP structure. How about the label of the SO  $\beta$ ? In order to determine its label, it suffices to assume that H is a phase-head that triggers Spell-Out. As a result of Spell-Out, AP is removed, hence the SO  $\gamma$ , which has the form of {H, AP} is turned into {H}, which is then converted to H itself under the proposed mechanism. Hence, minimal search can determine the label of  $\beta$ .

What is novel here is that our proposal offers the reason why H is a phase-head. Otherwise Spell-Out is not available so that the label of the SO remains undetermined. In other words, there *must* be a phase-head H that triggers Spell-Out. One may think that postulating H also solves the problem for Chomsky's (2013) idea regarding (15), repeated as (26), because it eliminates the difference between (26a) and (26b), namely the distinction between lexical and phrasal predicates.

- (26) a. *The student<sub>i</sub> seems* [<sub>SC</sub> *t<sub>i</sub> good*]  
 b. *The student<sub>i</sub> seems* [<sub>SC</sub> *t<sub>i</sub> good at math*]

For Chomsky (2013), however, movement offers a way of determining the label of the SC in (26), no matter whether H is present or not. In this sense, the necessity of the phase-head H in small clauses is not justified. On the other hand, our proposal provides a theoretical rationale for why we need H and also why it must be a phase.

### 3.2.2 *There*-constructions

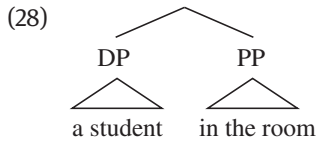
The consequence regarding small clauses provides a further consequence for *there*-constructions. Let us consider the pair of examples in (27), where (27b) instantiates a typical example of *there*-constructions.

- (27) a. *A student<sub>i</sub> is* [*t<sub>i</sub> in the room*].  
 b. *There is* [*a student in the room*].

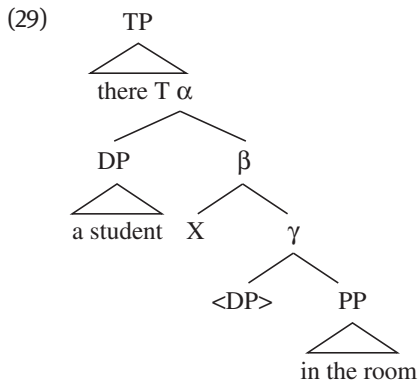


One of the properties that we focus on here is the fact that the thematic subject such as *a student* seems to stay in the predicate-internal position in *there*-constructions.

If the bracketed part of (27b) has a structure like (28), the problem is clear: The label of the SO of the form {DP, PP} cannot be determined. Under Chomsky's (2013) system, it is the movement of the DP that can resolve the labeling problem in question.

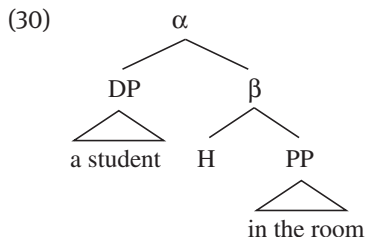


Suppose then that the associate of the expletive *there* in fact undergoes short movement as in (29) (see Lasnik 1995). Given Chomsky's (2013) framework, the labeling problem for  $\beta$  and  $\gamma$  can be resolved: For  $\beta$ , minimal search can dictate X as its label, and for  $\gamma$  the invisibility of lower copies enables to  $\gamma$  to inherit the label of the SO we are calling PP.



In order to determine the label of  $\alpha$ , there must be feature-sharing between the DP *a student* and  $\beta$ , whose label is X. Given that the DP agrees with T, however, such a feature-sharing is doubtful. Hence, the labeling problem in *there*-constructions with in-situ subjects remains.

On the other hand, once we admit small clauses are equipped with a phase-head, in-situ subjects are no longer problematic. The relevant part of (27b) has a structure like (30), where H serves as a phase-head that also mediates the predication-relation between the subject *a student* and the PP *in the room*.



Spell-Out triggered by H in (30) allows the otherwise unlabeled SO  $\alpha$  to get labeled. If the expletive *there* is introduced into the structure in a later step, the subject remains in-situ; otherwise it raises to the SPEC of T. What is crucial is that no labeling problem arises in either case.<sup>12</sup>

In this way, the proposed analysis featuring labeling through Spell-Out can accommodate a potentially problematic configuration for Chomsky's (2013), offering a novel theoretical rationale for the necessity of postulating a phase-head in small clauses.<sup>13</sup>

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**12** The discussion in the text has another implication for the contrast in (i), which Chomsky (2013: 44–45) attributes to the issue of labeling.

- (i) a. They thought JFK was assassinated in which Texas city?  
 b. \*They thought [ $\alpha$  in which Texas city [C [JFK was assassinated]]]?

In (ia), the wh-phrase *in which Texas city* remains in-situ, but it is grammatical in a particular context such as a quiz show. The ungrammaticality of (ib), where the wh-phrase remains in the intermediate landing site is captured as an instance of the labeling problem: The label of  $\alpha$  in (ib) fails to be determined because there is no feature-sharing between the wh-phrase and the intermediate CP, which must be non-interrogative to be selected by verbs like *thought*.

Under the idea of labeling through Spell-Out, however, the label of  $\alpha$  can be determined. This is because the complement of C (= the SO [JFK was assassinated]) undergoes Spell-Out, changing  $\alpha$  to the form {[in which Texas city], C}. Then, minimal search detects C as its label. Nonetheless, there are various ways for our proposal to capture the ungrammaticality of (ib). One possibility is to assume that in-situ wh-phrases in a quiz show context are licensed by unselective binding (Reinhart 1998). If so, (ib) can be excluded in terms of economy, because nothing requires its movement to the intermediate position.

**13** The conclusion that no labeling problem arises when subjects remain in the predicate-internal position can be generalized beyond *there*-constructions. To be more specific, although for Chomsky (2013) subjects cannot remain in-situ (unless feature-sharing between the subject and  $v^*$ ), our theory allows in-situ subjects as a possible point of linguistic variation, which is indeed attested.

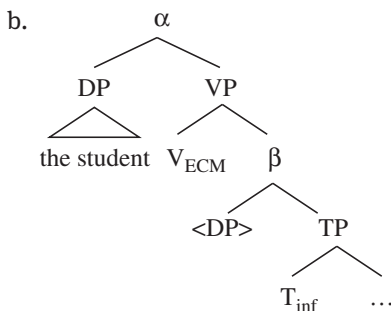
## 4 Summary and further prospectus

In this paper, we have argued that Spell-Out can provide a novel way of labeling under the assumptions that (i) Spell-Out yields a singleton set  $\{X\}$  from a set of the form  $\{X, Y\}$ , and (ii) natural language is equipped with a mechanism that regards a singleton set  $\{X\}$  as its unique element  $X$ . We have also shown that this proposal removes some unnecessary complications from Chomsky (2013), giving several novel answers to classical questions concerning the binarity of phrase structures and the structures of small clauses and *there*-constructions.

The goal of the present study is to reduce the three ways of labeling in Chomsky (2013) to two by dropping labeling through movement. Labeling through Spell-Out is nothing but a new way of exploiting labeling by minimal search for XP-YP structures by changing them to H-XP structures via Spell-Out. In this way, our proposal significantly simplifies the grammar.

There are however some remaining issues. As far as we can tell, there are four cases where labeling through movement seems to play a role; successive-cyclic A'-movement, small clauses, predicate-internal subjects, and ECM constructions. Among these constructions, ECM constructions (and more generally raising constructions) resists a straightforward treatment under the idea of labeling through Spell-Out, hence they constitute one of the main empirical issues. Let us consider the example in (31a), which is a typical example of the ECM construction. In (31b), the final landing site of the accusative subject ( $\alpha$  in (31b) or some higher position) causes no labeling problem as there must be a feature-sharing for the sake of accusative-Case licensing. What is problematic is the label of the SO  $\beta$ .

(31) a. *John believes the student to be smart.*



Since the infinitival  $T$  is not a phase-head under the standard assumption, there is no possibility of Spell-Out that changes the SO  $\beta$ , namely  $\{<DP>, TP\}$  into an H-XP structure. Then, there are at least two possible ways to explore: The first

one is that there is indeed no successive-cyclic A-movement, as discussed by Epstein and Seely (2006), among others. The second way is to follow Bošković (2014, in press) and Wurmbrand (2013), who argue that a raising infinitive indeed constitutes a phase (as the highest clausal projection). Adopting either possibility would allow us to accommodate ECM constructions in our framework.

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