Reconstruction and the directionality of syntactic derivations

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Abstract

Taking as a starting point the reconstruction restriction known as Barss' Generalization, this paper advances that (i) derivations proceed in a top-down fashion, (ii) the internal structure of movement gaps is calculated by appealing to anaphoric mechanisms, and (iii) reconstruction is subject to earliness. These interconnected hypotheses allow to account for the distribution of reconstruction and anti-reconstruction patterns in a much more parsimonious way than traditional bottom-up derivations and copying procedures.

1 Introduction

A Merge-based derivation (Chomsky, 1995) generates sentences in a bottom-up and roughly "right to left" fashion. While linguists have successfully exploited bottom-up derivations to account for a plethora of phenomena, it has also been observed that this type of grammatical formalism is difficult to adapt to current psycholinguistic models (e.g., Ferreira 2005), as there is considerable consensus that real-time language processing proceeds incrementally (e.g., Gibson 1991; Crocker 1996). In this context, several scholars have proposed to adopt derivations that proceed in a top-down direction (e.g., Phillips 2003; Chesi 2007; Zwart 2009; Bianchi & Chesi 2014; Georgi & Salzmann 2016; den Dikken 2018). Interestingly, while some of these proposals are explicitly aimed to bridge the gap between grammatical and processing models, many of them are founded on rather traditional grammatical arguments based on criteria of descriptive adequacy. In other words, there seems to be a number of grammatical phenomena that supports a change in the way syntax is assumed to generate hierarchical structures.

The aim of this paper is to add another empirical domain to the list of phenomena that motivates this shift: *syntactic reconstruction*.

2 The starting observation

Within current minimalism, syntactic displacement is usually understood in terms of the copy theory of movement (Chomsky, 1995). Most versions of copy theory (e.g., Nunes 2004) incorporate a copying procedure that operates in a bottom-up fashion in interaction with Merge. This type of procedure determines that (i) gaps are generated before their fillers, and (ii) fillers are duplicate versions of their gaps. For instance, in generating a wh-question, the element functioning as the gap is merged early in the derivation, e.g., (1a); the filler is a copy of the gap that gets merged in Spec,C, e.g., (1b).[1]

(1) a. [$_{VP}$ arrested who^{2}]
b. [$_{CP}$ who^{1} [$_{C'}$ C [$_{TP}$ was [$_{VP}$ arrested ~~who^{2}~~]]]]

Evidence against postulating a copying procedure comes from anti-reconstruction effects, i.e., cases in which a moved constituent cannot be interpreted in the position of a gap. The well-formed sentence in (2), for example, indicates that there is no identical copy of the filler in the position of the gap, as this would produce a Condition C violation with respect to the pronoun *him*.

(2) [$_{filler}$ The claim that Cosmo$_i$ was asleep] seems to him$_i$ e_{gap} to be correct.

Takahashi & Hulsey (2009) advanced an account of anti-reconstruction effects in terms of a copying operation. They propose that what is merged in the position of the gap is a bare determiner (e.g., *the*) that lacks a nominal phrase as complement

[1] Numerical indexes on copies are for explanatory purposes only; strikethrough words represent unpronounced constituents.

(3a). The copying operation targets this incomplete constituent and generates a copy of it, which is merged at the root of the main structure (3b). Finally, the NP complement of the bare determiner is merged countercyclically within the filler (3c). As there is no referential expression inside the gap, no Condition C violation arises.

(3) a. seems to him_i [$_{\text{gap}}$ the] to be correct
b. [$_{\text{filler}}$ the] seems to him_i [$_{\text{gap}}$ the] to be correct
c. [$_{\text{filler}}$ the [$_{\text{NP}}$ claim that Cosmo_i was asleep]] seems to him_i [$_{\text{gap}}$ the] to be correct

While this theory is capable of dealing with a variety of anti-reconstruction phenomena, it is contended here that its bottom-up nature prevents it from accounting for the restriction described by Barss' Generalization (Barss, 1986; Sauerland & Elbourne, 2002): reconstruction of a filler to its gap is impossible if the filler does not c-command the gap in the surface representation.

Take the sentence in (4). It is ambiguous in the sense that it could be the case that (i) there is a single young lady dancing with all the senators, or (ii) each senator dances with a different young lady. Semantic scope ambiguities like this are known to involve two quantifying expressions in the same clause. That implies that the existential DP *some young lady* is being reconstructed in the position of its gap, so it can be interpreted in the same clausal domain as the universal DP *every senator*.

(4) [$_{\text{filler}}$ Some young lady] seems to be likely e_{gap} to dance with every senator.

Such an ambiguity disappears if the clause containing the universal DP moves over the existential DP. That is, the sentence in (5) can only mean that there is a single lady dancing with all the senators. As the reading that is no longer available is the one that requires interpreting the existential DP in the position of its gap, it may be concluded that this configuration blocks reconstruction effects as described by Barss' Generalization.

(5) [$_{\text{DegP}}$ How likely e_{gap} to dance with every senator] does [$_{\text{filler}}$ some young lady] seem to be?

The reason Takahashi & Hulsey (2009) system cannot capture this restriction is simply because in bottom-up derivations a constituent functioning as a gap is generated before anything moves to the left periphery. That is, at the point of the derivation where the internal structure of the gap is formed, there is no hint that a constituent dominating the gap would move to the left. Therefore, there is no mechanism through which such a movement operation could affect the lexico-syntactic properties of the gap.

Conversely, examples like (5) show that the internal structure of movement gaps may depend on operations that apply at the root of the tree. In derivational terms, this implies that constituents at the top must be generated earlier than gaps. This paper exploits this observation to motivate the development of a novel approach to reconstruction phenomena based on top-down derivations.

3 The system

This paper aims to sketch a framework for the study of reconstruction phenomena. The expected outcome is a system that captures the functioning of anti-reconstruction effects in more parsimonious ways than current alternatives (e.g., Sauerland & Elbourne 2002; Takahashi & Hulsey 2009). At a more general level, the approach is expected to support the theoretical shift from bottom-up to top-down structure building processes, in consonance with most results in language processing.

The proposal is based on three interconnected and mutually necessary hypotheses, which will be developed in the following subsections.

3.1 Top-down derivations

The leading conjecture of the paper is that syntactic derivations starting from the root of the tree have an important role at predicting the internal structure of movement gaps. Adapting aspects from previous work on top-down derivations (e.g, Georgi & Salzmann 2016), the following three assumptions are adopted.

(6) a. syntactic structure unfolds incrementally from the root of the tree;
b. overt constituents are base-generated in their surface position;
c. overt constituents form movement dependencies, i.e., *chains*, with null syntactic objects, i.e., gaps, to discharge formal features and comply with *Full Interpretation*.

To illustrate the functioning of this sketchy system, consider the sample derivation in (7). The process starts at the top of the tree with the TP node unfolding into the DP *George* and an element of type T (7a). In (7b), the T element unfolds into the auxiliary *will* and a node introducing a VP. Then, the VP node unfolds into the verb *see* and a complement DP node (7c). Finally, the DP node unfolds into the proper noun *Elaine* (7c).

(7) a. [$_{TP}$ [$_{DP}$ George] T]
b. [$_{TP}$ [$_{DP}$ George] [$_{T'}$ will VP]]
c. [$_{TP}$ [$_{DP}$ George] [$_{T'}$ will [$_{VP}$ see DP]]]
d. [$_{TP}$ [$_{DP}$ George] [$_{T'}$ will [$_{VP}$ see [$_{DP}$ Elaine]]]]

As Phillips (2003) observes, geometrical relations may change throughout the derivation, e.g., the DP *George* is the sister of T in (7a), but becomes its specifier after the VP node is introduced in (7b).

As for movement, consider the example in (8). The wh-pronoun *who*^{1} enters the derivation with a quantificational feature Q and a nominative feature NOM that need to be discharged. The former gets satisfied through *Agree* (Chomsky, 2000, 2001) with the null complementizer C; the latter remains active as it cannot be discharged in the position occupied by *who*^{1}. Therefore, a gap *who*^{2} must be formed in the specifier of the auxiliary, position in which the NOM feature can be discharged. Finally, a gap *who*^{3} is generated in the complement position of arrested to provide a thematic interpretation for the interrogative pronoun and satisfy Full Interpretation (Chomsky, 1986). The three occurrences of *who* form the chain CH = {who^1, who^2, who^3}, from which only the highest member, i.e., *who*^{1}, is spelled-out.

(8) [$_{CP}$ Who^1 $_{\{\langle\omega,Q\rangle,\langle\kappa,NOM\rangle,\ldots\}}$ [$_{C'}$ C [$_{TP}$ ~~Who^2~~ $_{\{\langle\omega,\emptyset\rangle,\langle\kappa,NOM\rangle,\ldots\}}$ [$_{T'}$ was [$_{VP}$ arrested ~~who^3~~ $_{\{\langle\omega,\emptyset\rangle,\langle\kappa,\emptyset\rangle,\ldots\}}$]]]]]

3.2 Gaps are anaphoric

Departing from proposals that adopt copying procedures within top-down formalisms (e.g., Chesi (2015); Georgi & Salzmann (2016)), the system advanced here explores the hypothesis that isomorphism between filler and gap is the result of a natural tension between representational economy and interpretability. That is, the lexico-syntactic structure of movement gaps is as minimal as possible to produce a syntactic structure that satisfies formal and semantic requirements.

The first step in pursuing this hypothesis is constraining the type of constituent that may function as a movement gap. As noticed as early as Chomsky (1964), an unavoidable requirement on unpronounced constituents is that the information encoded in them must be recoverable. This is expressed in (9).

(9) The lexico-syntactic structure of a gap cannot contain information that is not available in its filler.

The economy consideration that is taken to minimize the structure of gaps is based on Schlenker's (2005) account of Condition C. The basic intuition is that the distribution of restrictors in determiner phrases is regulated by a principle of non-redundancy that applies over anaphoric expressions.

(10) Given a DP^1 that c-commands an anaphorically dependent DP^2, the restrictor in DP^2 must be as little redundant as possible with respect to the restrictor in DP^1.

Take the sentence in (2). According to (10), the structure of the gap must be "as little redundant as possible" with respect to the restrictor in the filler. As there are no particular semantic conditions on gaps of A-movement (i.e., they are taken to be placeholders for θ-assignment), a bare determiner with no restrictor is selected to occupy the gap position. Notice that the output representation is the same one that is obtained by applying the derivation in (3), and therefore offers an equivalent explanation for the anti-reconstruction effect displayed in the sentence.

When gaps manifest the same internal structure as their filler, it is due to interpretative requirements that override the economy principle in (10). Take the unacceptable interrogative sentence in (11), which exhibits a violation of Condition C through reconstruction.

(11) * Which picture of Cosmo$_i$ did he$_i$ buy?

A salient property of wh-movement is that it needs to be interpreted as an operator-variable dependency, in which the gap must function as a bound variable. This can be accomplished if (i) there is isomorphism between the NPs in filler and gap, and (ii) the wh-determiner within the gap is covertly replaced with a definite determiner (e.g., Fox 2002; Elbourne 2005). This allows the gap to

be interpreted as an anaphoric definite description, i.e., a sort of variable.

(12) [$_{DP^1}$ Which picture of Cosmo$_i$] did he$_i$ buy [$_{DP^2}$ *which picture of Cosmo*$_i$]?
For what x, x a picture of Cosmo$_i$, he$_i$ bought the picture x of Cosmo$_i$

This approach to reconstruction allows for an elegant treatment of many problematic cases. Consider the following. It has been observed that adjuncts modifying nouns do not reconstruct for Condition C (e.g., van Riemsdijk & Williams 1981; Freidin 1986; Lebeaux 1988.

(13) Which argument that Cosmo$_i$ made did he$_i$ believe?

While this pattern is difficult to capture if filler and gap are related through a copying procedure, it follows straightforwardly from the interaction of (10) and the interpretability requirements on wh-movement. In (14), the gap DP^2 is required to be the smallest possible anaphoric definite description. Therefore, it will not include the optional clausal adjunct within its structure.

(14) [$_{DP^1}$ Which argument [$_{ADJ}$ that Cosmo$_i$ made]] did he$_i$ believe [$_{DP^2}$ *which argument*]
For what x, x an argument that Cosmo$_i$ made, he$_i$ believed the argument x

The hypothesis developed through this section has a number of interesting aspects, but maybe its most appealing trait is that the explanation it offers is based on the observation that gaps are anaphoric in nature, i.e., reconstruction phenomena receive a parsimonious analysis if the condition stated in terms of anaphora in (10) applies to gaps. While the anaphoric relation between filler and gap was an integral part of many implementations of *trace theory*, such a connection was lost under copy theory as this framework maintains that filler and gap are linked merely through formal identity, i.e., filler and gap are copies. In fact, the economy principle in (10) goes further beyond trace theory in analyzing gaps as anaphora, as it collapses the distinction between syntactic movement and construal relations. At this point, it could be conjectured that the only factor distinguishing both realms is chain formation.

3.3 Earliness in reconstruction

There is an aspect of reconstruction phenomena that is often neglected: gaps exhibiting internal structure are structurally closer to their filler than gaps that function simply as placeholders. Such a distribution follows elegantly from a top-down system that accounts for the internal structure of gaps in terms of representational economy.

As discussed, isomorphism between filler and gap is taken to follow from interpretative requirements. This logic makes a clear prediction for contexts of successive cyclic movement: if an intermediate gap is interpreted as a variable bound by the filler, then there is no need to reconstruct in lower positions. That is, reconstruction applies as early as possible from top to bottom. This is schematized in (15), where DP^1 is the filler that functions as a wh-operator, and DP^2 is interpreted as its variable. As can be seen, the gaps DP^3 and DP^4 that come later in the derivation consist of bare determiners, as the relevant requirement on wh-movement has been previously satisfied by DP^2.

(15) [$_{DP^1}$ D [$_{NP}$ N]] ... [$_{DP^2}$ D [$_{NP}$ N]] ... [$_{DP^3}$ D] ... [$_{DP^4}$ D]

There is a number of patterns supporting this prediction. For instance, Thoms (2010) provides examples in which there is no reconstruction in the base position of a wh-chain.

(16) a. * Morag helped him$_i$ with most of Tam's$_i$ homework.
b. Which of Tam's$_i$ assignments did Morag help him$_i$ with?

(17) a. * I introduced him$_i$ to four of Tam's$_i$ friends.
b. Which of Tam's$_i$ friends did you introduced him$_i$ to?

Both (16b) and (17b) exhibit reconstruction patterns as the one sketched in (15).

(18) a. [$_{DP^1}$ Which of Tam's$_i$ assignments] did Morag [$_{DP^2}$ *which of Tam's$_i$ assignments*] help him$_i$ with [$_{DP^3}$ *which*]?
b. [$_{DP^1}$ Which of Tam's$_i$ friends] did you [$_{DP^2}$ *which of Tam's$_i$ friends*] introduced him$_i$ to [$_{DP^3}$ *which*]?

Consider now the pair in (19), modeled after Huang (1993).

(19) a. How many pictures of Cosmo$_i$ do you think he^i will like?

b. * How many pictures of Cosmo_i does he^i think you will like?

The acceptability of (19a) follows from the system introduced so far, as sketched in (20a). The gap DP^2 is isomorphic with respect to its filler, and functions as its variable, while the economy principle in (10) dictates that DP^3 must lack an NP restrictor as it is not required for interpretability.

(20) a. $[_{CP}\ [_{DP^1}$ How many pictures of $\text{Cosmo}_i]$ ... $[_{CP}\ [_{DP^2}$ how many pictures of $\text{Cosmo}_i]$ ... he_i ... $[_{CP}\ [_{DP^3}$ how many] ...]]]

b. $[_{CP}\ [_{DP^1}$ How many pictures of $\text{Cosmo}_i]$ ... he_i ... $[_{CP}\ [_{DP^2}$ how many pictures of $\text{Cosmo}_i]$ ... $[_{CP}\ [_{DP^3}$ how many] ...]]]

Further research is necessary to elucidate the precise nature of the conditions ruling the distribution of gaps interpreted as bound variables. For the moment, the condition in (21) will be assumed.

(21) Given an A′-chain $CH = \{DP^1, ..., DP^n\}$, interpret as an anaphoric definite description a chain-member within the clause in which the chain receives its θ-role.

This condition together with the earliness logic of the system explain why reconstruction must take place within DP^2 in the examples in (19). Evidence for this type of restriction comes from sentences like (22), in which reconstruction seems to be mandatory as late as within the clause containing the verb *saw*, i.e., at least DP^3 must be isomorphic to DP^1.

(22) * $[_{CP}\ [_{DP^1}$ Which picture of $\text{George}_i]$ did Elaine say $[_{CP}\ DP^2$ that he_i thinks $[_{CP}\ DP^3$ that Carol saw $DP^4]]]$?

While the basic pattern in (15) can also be captured by appealing to Takahashi & Hulsey's (2009) proposal, the condition formulated in (21), or something equivalent, seems to be independently required. That is, there must be some kind of principle ruling the distribution of gaps that are interpreted as anaphoric definite descriptions.

4 Back to Barss' Generalization

The mechanisms introduced so far allow to sketch a promising account of Barss' Generalization. The key intuition is that these derivations involve movement gaps that are created earlier than their fillers, so no complex structure can be part of a gap without violating the recoverability condition in (9) at that point in the derivation.

Consider the sample top-down derivation in (23) for the sentence in (5). As shown in (23a), the infinitival clause containing the gap is generated at the top of the tree in Spec,C. At that derivational point, there is no filler in the phrase marker that may allow to recover any lexico-syntactic structure within the gap. Therefore, the gap must be the simplest element that may occupy that position: a bare determiner D, an element that functions as a placeholder for a filler to come later in the derivation. As can be seen, the relevant constituent is introduced after the nodes C and TP are unfolded in (23b) and (23c), respectively.

(23) a. $[_{CP}\ [_{DegP}$ How likely $[_{gap}$ D] to dance with every senator] C]

b. $[_{CP}\ [_{DegP}$ How likely $[_{gap}$ D] to dance with every senator] $[_{C'}$ does TP]]

c. $[_{CP}\ [_{DegP}$ How likely $[_{gap}$ D] to dance with every senator] $[_{C'}$ does $[_{TP}\ [_{filler}$ some young lady] T]]]

5 Conclusions

At a general level, this paper can be seen as an attempt to further support the shift from bottom-up to top-down derivations, and to consider the implications of such a change for a particular empirical domain: reconstruction phenomena. This exploration alone is already valuable, as a top-down formalism seems to be necessary to bridge the gap between theoretical and experimental linguistics.

The point of departure for such an approach to reconstruction is based on Barss' Generalization. It was observed that in bottom-up derivations there is no way in which movement of an XP can bleed reconstruction of a constituent within XP. On the contrary, the relevant blocking relation is easily implemented in a top-down framework.

Moreover, the proposal makes use of minimalist principles as economy and interpretability to advance a bold conjecture: the copying procedure that is taken to be part of movement operations within copy theory is not necessary to account for reconstruction, and it must be abandoned in order to offer a more parsimonious explanation of anti-reconstruction effects.

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