A Local Encoding of Syntactic Dependencies and its Consequences for the Theory of Movement

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(Version 4 December 2007)

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1. Abstract

In this paper we consider the impact of the theory of phrase structure for the encoding of syntactic dependencies and in particular the way movement is represented. We show that the conception of movement as copying plus deletion (the so-called 'copy theory of movement') is incompatible with well-motivated conditions on phrase structure. The alternative we develop is a local encoding mediated by percolation of selectional requirements comparable to the slash features of HPSG, although it is different in its underlying principles and analytical details. The proposed local encoding of movement is superior to the copy theory in at least three respects. (i) It explains why movement must target a c-commanding position, (ii) it can account for surprising restrictions on scope reconstruction, and (iii) it can capture patterns of interaction between different types of movement. In the first two cases, the copy theory falls short of the mark; in the third, the theory proposed here seems more parsimonious. We begin by considering the theory of phrase structure.

Keywords: Movement, reconstruction, c-command, Barss's Generalization, UCOOL

2. Background: Inclusiveness and the encoding of dependencies

One interpretation of the base component of early versions of generative grammar is as a set of instructions to rewrite a string to a single nonterminal symbol. For example, standard context-free phrase structure rules would rewrite the initial string in (1) as indicated. This is an example of a bottom-up derivation; a top-down derivation would start with the sentence symbol and derive the terminal yield (see Chomsky 1957, chapter 4).

(1) The + man + hit + the + ball
D + man + hit + the + ball
D + N + hit + the + ball
NP + hit + the + ball
NP + V + the + ball
NP + V + D + ball
NP + V + D + N
NP + V + NP
NP + VP
S

This procedure can be understood as one that assigns a representative symbol to certain substrings, which is then used for further computation. In a tree structure, the representative symbol is the mother of the elements that make up the substring.

Although current grammars differ substantially in the kind of structures they assign to sentences, the idea that a node represents the structure it dominates for the purpose of further computation remains unchanged. In view of this, perhaps the most fundamental question in phrase structure theory is what determines the features of a domain's representative.

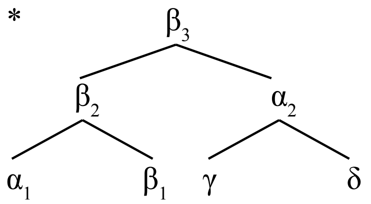
Rewrite rules do not provide an answer to this question, as the formal properties of such rules do not constrain the relation between the symbols on the left-hand side and right-hand side of the arrow. For example, in *S → NP (Aux) VP*, it is unclear how properties of the S-node relate to the material it is a representative for. It stands to reason that a node can only represent a syntactic domain if it carries properties of constituents in its domain that are relevant for further computation. In other words, features must be copied from nodes in the domain to the representative node.

$\bar{X}$-theory enshrined this process of inheritance for categorial features: the category of a head is copied to its projections. But in the best case, all properties of a representative are acquired through copying. This ideal has been adopted explicitly by Chomsky (1995). His Inclusiveness condition states that features in the syntactic computation must ultimately have their source in the lexicon. If this condition holds of every subtree, as one would expect on conceptual grounds, it follows that any feature of a nonterminal node must be recoverable from the structure it dominates. The formulation of Inclusiveness we adopt is given below. By a pointer we mean a link to information contained in a different representation. In the standard case, a terminal contains a pointer to a lexical entry.

(2) *Inclusiveness*
The syntactic properties of a nonterminal node are fully recoverable from the structure it dominates; the syntactic properties of a terminal node are fully recoverable through a pointer.

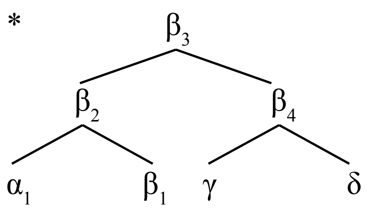
It follows from Inclusiveness that projection requires domination. Thus, the sequence β_1-β_2-β_3 in (3) is a well-formed projection, but the sequence α_1-α_2 is not. The reason is that, if α_2 inherits its categorial features from α_1, then α_2 is not a proper representative of the domain consisting of γ and δ.

(3) *



It also follows that projection cannot be downward. If β_4 in (4) below is an extension of the projection line of β_1, Inclusiveness is violated because the categorial features of β_4 cannot be said to represent the structure it dominates.

(4) *



The effects of Inclusiveness extend beyond projection. To give one example, the widespread occurrence of pied-piping can be understood in terms of the upward copying of the features that motivate movement. Thus, the pied-piping of prepositional structures under WH-movement, as in (5b), can be analyzed as resulting from the percolation of a WH-feature.

(5) a. $[_{[D,\ WH]}$ Who$]_1$ did Mary buy that book $[_P$ for t_1 $]$?
b. $[_{[P,\ WH]}$ For whom$]_1$ did Mary buy that book t_1?

By contrast, we are not aware of cases in which movement targets the *sister* of a category carrying the features that trigger it. For example, there no languages in which WH-movement targets the sister of a WH-expression. Structures like (6) are unattested.

(6) *[Of these men]$_1$ did you prefer [who t_1]

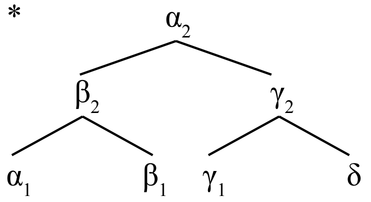
This follows from Inclusiveness, because WH-movement of the sister would require either copying in the absence of domination (on a par with (3)) or upward copying followed by downward copying (on a par with (4)).

The purpose of creating a representative node is to limit the amount of information that needs to be considered by the computational system. The flip side of this strategy is that information that is not represented is inaccessible for further computation. Assuming, as before, that conditions on phrase structure do not just apply to some nodes, but uniformly to every nonterminal category, this line of argumentation leads to the following principle:

(7) *Accessibility*
Relations between nodes require immediate domination.

Like Inclusiveness, this principle is uncontroversial for categorial projection. Projection is assumed never to be discontinuous. Thus, the structure in (8), where α_1 projects α_2, is ungrammatical even though it satisfies Inclusiveness.

(8) *



The empirical effects of Accessibility that go beyond projection can again be illustrated using features that trigger movement. In particular, it can be demonstrated that percolation of the features that give rise to pied-piping must follow a continuous path. Consider once again WH-questions. As we have already seen, prepositions can be pied-piped (see (9b)). So can DPs, but only if the WH-operator occupies the specifier of D (see (9c)). If it is contained in the complement of the noun, pied-piping is impossible (see (9d)). This is presumably because NPs cannot host WH-features and thereby block percolation to DP (see Grimshaw 1991, 2000 for discussion).[1]

(9) a. Who$_1$ did you meet many friends of t_1?
b. [$_{[\text{P, WH}]}$ Of whom]$_1$ did you meet many friends t_1?
c. [$_{[\text{D, WH}]}$ Whose many friends]$_1$ did you meet t_1?
d. *[$_{\text{DP}}$ Many [$_{\text{NP}}$ friends [$_{[\text{P, WH}]}$ of whom]]]$_1$ did you meet t_1?

Consistent with this, WH-movement cannot pied-pipe NP. This is true of English, but also of languages like German that in general allow stranding of quantifiers like *many*:

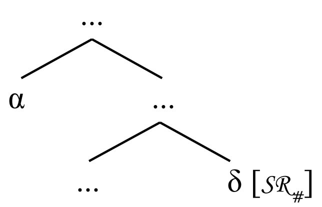
(10) *[$_{\text{NP}}$ Friends [$_{[\text{P, WH}]}$ of whom]]$_1$ did you meet many t_1?

[1] It seems that examples parallel to (9d) are grammatical in contexts that resemble those of echo questions. For example, *Many of WHOSE friends did you meet?* is acceptable alongside its in situ variant, in reaction to a statement like *I met many of xxx's friends*, where *xxx* is inaudible. We abstract from these poorly understood cases here.

Notice that an account of the ungrammaticality of (9d) depends crucially on Accessibility. If percolation did not require immediate domination, the example should be grammatical, as the WH-feature of the PP could be copied to DP across NP.

The consequences of Inclusiveness and Accessibility in the realm of projection of categorial and other features are entirely uncontroversial. Indeed, it is fair to say that these conditions have been implicitly assumed in phrase structure theory from a very early date (initially with the S- and S'-categories as exceptions). However, as argued at length in Neeleman and Van de Koot 2002, Inclusiveness and Accessibility also have profound consequences for the theory of syntactic dependencies, because the standard chain-like encoding of dependencies necessarily violates these conditions. In order to see why, consider the tree in (11), where δ is a syntactic dependent (such as an anaphor or a predicate), and α the antecedent with which it is associated. For explicitness' sake, let us assume that the fact that δ must be linked to an antecedent is encoded by a selectional requirement $\mathcal{SR}$. In (11), $\mathcal{SR}$ is satisfied by α (we use '#' to indicate this, but the reader should be aware that this is merely a notational convenience).

(11)

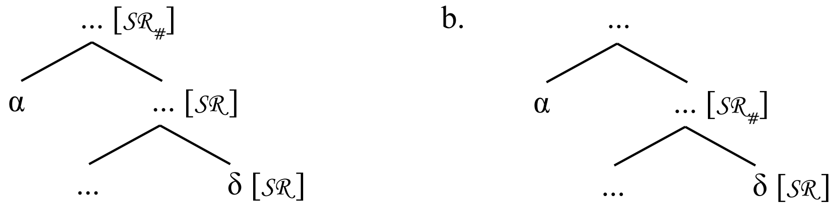


The problem is that as a result of the relation established between them, properties of both α and δ seem to change. Since neither node dominates the other, these changes cannot be recovered from the internal structure of α or δ, or from their lexical entries. Hence, Inclusiveness is violated. Moreover, given that α and δ are not in relation of direct domination, Accessibility is violated as well.

That syntactic relations, if conceived of as chains, induce changes in antecedent and dependent can be demonstrated in various ways. Suppose that δ is a predicate, and $\mathcal{SR}$ a θ-role. Once $\mathcal{SR}$ is satisfied by α, δ no longer qualifies as dependent; it cannot be linked to an antecedent any more, due to the θ-criterion. Similarly, α cannot serve as the antecedent of a second θ-role once it satisfies $\mathcal{SR}$. Although syntactic relations vary in their properties, comparable considerations hold of other dependencies (such as binding).

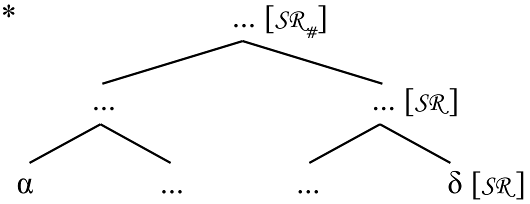
The problem can be stated in different terms. If a nonterminal category in a tree represents the material it dominates for further computation, it seems reasonable to assume that elements in the representative's domain cannot be accessed directly by elements external to the domain. But this implies that once a representative is constructed for δ, satisfaction of $\mathcal{SR}$ in δ becomes impossible. This formulation of the problem suggests where we should look for a solution. Unsatisfied selectional requirements in a domain must be part of the representative of that domain. In other words, $\mathcal{SR}$ should be copied upwards until it is sufficiently close to the antecedent α. Inclusiveness and Accessibility dictate what 'sufficiently close' means. Only if $\mathcal{SR}$ is copied upward recursively to the node that immediately dominates α, as in (12a), can it be satisfied without violation of these principles. Notice in particular that satisfaction under sisterhood, as in (12b), violates Inclusiveness, because the fact that $\mathcal{SR}$ is satisfied cannot be recovered from material dominated by the node in which it is satisfied. The structure in (12b) also violates Accessibility, because there is no relation of direct domination between α and the node in which $\mathcal{SR}$ is satisfied.

(12) a. b.



So, Inclusiveness and Accessibility force a decomposition of grammatical dependencies into two primitive operations: the upward copying and downward satisfaction of a selectional requirement. Two key properties of grammatical dependencies follow from this proposal. The first is that syntactic dependencies may span fairly large distances. This is because the copy operation can be applied recursively: a copied selectional requirement can itself be copied. As a result, the path along which a selectional requirement travels up the tree can in principle be indefinitely long (as long as independent locality conditions are satisfied). On the other hand, the relation between the antecedent and the highest node that contains $\mathcal{SR}$ must be extremely local, due to Accessibility (and the fact downward copying of $\mathcal{SR}$ would violate Inclusiveness). For example, the structure in (13) is ungrammatical because the node that contains $\mathcal{SR}_{\#}$ does not immediately dominate α.

(13) *



This is an important result. Inclusiveness and Accessibility are restrictions on phrase structure, but, interestingly, they do not only capture central properties of feature percolation; they also explain the condition that a dependent must be c-commanded by its antecedent.

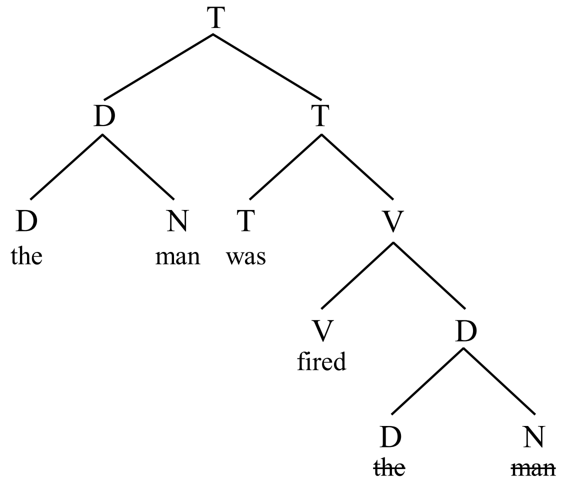
3. The issue: The copy theory of movement

The view of grammatical dependencies sketched in the previous section is incompatible with the standard analysis of movement in minimalism. The accepted view in that framework is that the trace of a moved constituent is a copy of that constituent. In recent versions of the theory, which take movement to be 'internal merge', the idea that traces are copies is presented as the null hypothesis:

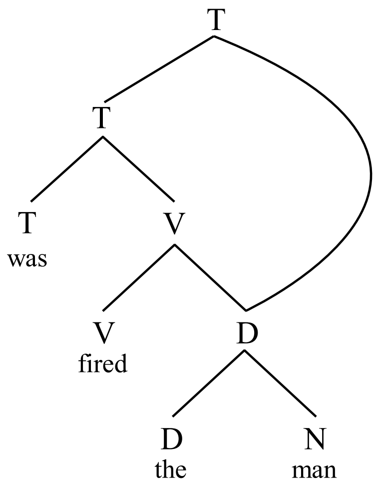
> Suppose that X and Y are merged [...]. Either Y is not part of X (external merge) or Y is part of X (internal merge). In both cases, merge yields {X, Y}. Internal merge yields two copies of Y in {X, Y}, one external to X, one within X. [...] Unless there is some stipulation to the contrary [...], both kinds of merge are available for the faculty of language and internal merge creates copies.
> (Chomsky 2005: 6, with minor editing)

There are two ways of implementing the idea in the quote given above, depending on whether internal merge creates a copy of the 'moved' subtree. If it does, as suggested in Chomsky's quote, NP raising in a passive example like *the man was fired* results in a tree like (14a); if it does not, internal merge amounts to 're-merger' of one and the same subtree, as shown in (14b). This latter implementation is advocated in Starke 2001. (The structure in (14b) does not represent linear order; the specifier of T precedes this head.)

(14) a.



b.

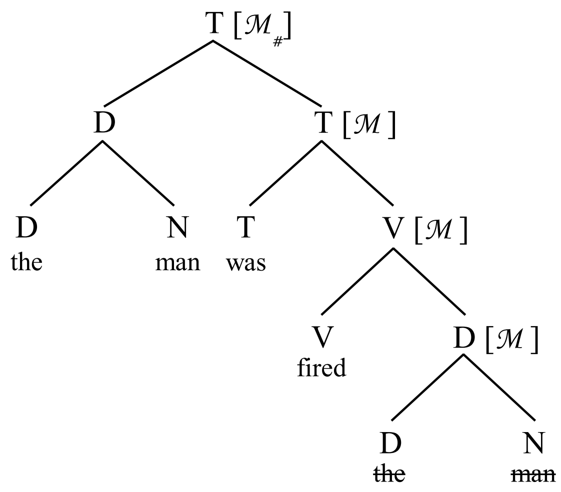


Interestingly, these theories of movement are motivated by aims similar to our own: movement is analyzed as resulting from the same mechanisms that are responsible for phrase structure. This is apparent from the title of Starke's dissertation – "Move Dissolves into Merge: A Theory of Locality". Chomsky emphasizes the same point in the following quote:

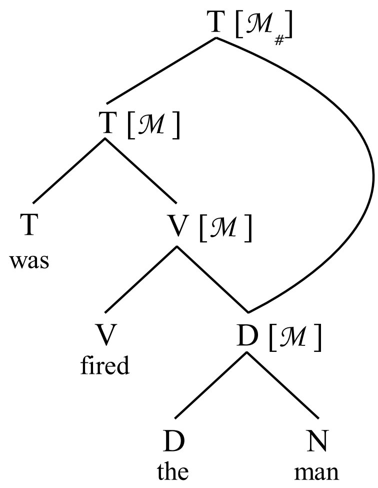
> Internal merge, in contrast, has been regarded (by me, in particular) as a problematic operation, an "imperfection" of language [...] A few years ago, it became clear that this is a misunderstanding. Internal merge [...] can only be blocked by stipulation. The absence of the operation would be an imperfection that has to be explained, not its use in deriving expressions.
> (Chomsky 2005: 7, with minor editing)

However, neither Chomsky's nor Starke's implementation of internal merge is compatible with the theory of syntactic dependencies forced by Inclusiveness and Accessibility. Consider why. Since there is a syntactic relation between a moved category and its trace, Inclusiveness and Accessibility imply that movement must be analyzed as involving a selectional requirement, say $\mathcal{M}$, introduced by the trace and satisfied by the moved category. A combination of this proposal with the conception of movement as internal merge requires an enrichment of the representations in (14a) and (14b) as in (15a) and (15b), respectively.

(15) a.



b.

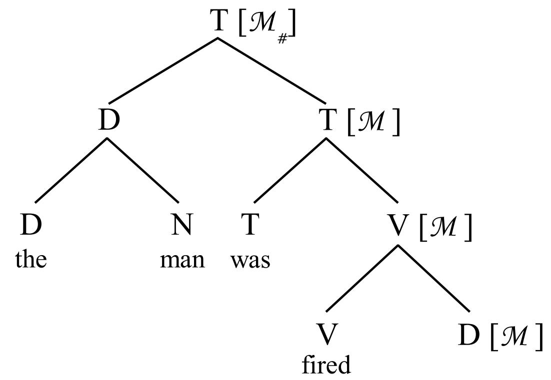


One immediate objection to the representations in (15) is that they duplicate the relationship between copy and moved category: it is encoded through satisfaction of a selectional requirement, as well as through repeated merger of the same subtree. However, the structures in (15) also violate Inclusiveness and Accessibility. They violate Inclusiveness because $\mathcal{M}$ is introduced in a nonterminal node, while this condition requires that properties of nonterminals are recoverable from the structure they dominate. They violate Accessibility because the only reasonable interpretation of $\mathcal{M}$ on the copy theory of movement is as a selectional requirement satisfied by a copy of the subtree that introduces it. This will rely on inspection of the internal structure of the trace and its antecedent, even though that internal structure is not accessible to $\mathcal{M}$ under direct domination. We are therefore obliged to reject either the analysis of movement as internal merge or the encoding of movement through a selectional requirement.

This is true a fortiori for Starke's conception of internal merge. The representation in (14b) is a departure from traditional theories of phrase structure because it is not an acylic rooted graph (a 'standard' linguistic tree): it involves multiple direct domination (in other words, nodes with more than one mother). This means that it is incompatible with our proposals at a more fundamental level than the implementation in (14a). The intuition underlying Inclusiveness and Accessibility is that a mother node acts as a representative for its daughters for further computation. From this perspective it makes no sense for a node to have multiple mothers. The point of representation is that a set of nodes is reduced to a single node. Multiple domination requires the opposite: a single node is expanded to a set. Again, we must conclude that either the idea of ‘representatives’ must be given up, or the multi-dominance analysis.

We will argue in favour of the idea of representatives and the encoding of movement through selectional requirements. We will therefore argue against any conception of movement as internal merge. Our alternative to the copy theory of movement is based on the idea that traces are terminals. For example, we propose to encode NP-raising as in (16).

(16)



This structure satisfies Inclusiveness and Accessibility, as long as the selectional requirement in D is recoverable from the lexicon and the properties that satisfy this selectional requirement are located in the root of the DP that acts as the antecedent.

Of course, this theory of movement must be combined with a theory of reconstruction. We will assume, following some precedents in the literature that a distinction should be made between reconstruction for syntactic properties and reconstruction for scope-related phenomena (for related discussion see Lebeaux 1998, Lechner 1998, and Boeckx 2001). We take the latter to include both the scope of quantifiers and the interpretive position of scope-sensitive elements, such as pronouns interpreted as variables. In what follows, we will use the term ‘scope reconstruction’ in this broader sense.

Our view on syntactic reconstruction is that the selectional requirement $\mathcal{M}$ may license shared properties in a trace and the top node of its antecedent. This is an obvious difference with the copy theory of movement, which makes the entire antecedent – including its internal structure – available in the position of the trace. In other words, the theory we advocate imposes a restriction on syntactic reconstruction absent in the copy theory.

Our view on scope reconstruction is that in the mapping between syntax and semantics a moved constituent may be assigned as its scope any node dominated by $\mathcal{M}_\#$ that contains $\mathcal{M}$, the selectional requirement that encodes movement. Again, this differs substantially from the copy theory of movement, which restricts scope reconstruction to positions occupied by traces. In other words, the copy theory imposes a restriction on scope reconstruction absent in our proposal.

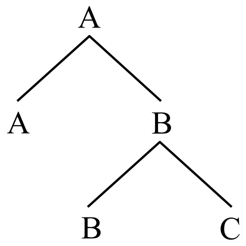
Needless to say, these ideas will need to be developed in more detail, a task that will be at least partly carried out in later sections of this paper. First, however, we present two arguments that support our outlook on movement.

4. Against the copy theory of movement: C-command

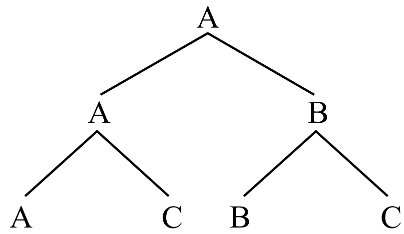
Chomsky’s argument for the existence of internal merge is that it is unavoidable given that there can be no structural conditions on the input of merge. This is so because in the case of external merge the two elements to be merged are not part of the same tree prior to application of the merge operation. Therefore, any condition that requires that the subtrees to be merged are in some structural configuration prior to merger will rule out external merge.

The only structural conditions that can be imposed on merge must therefore be stated over its output. For example, Chomsky (1993) adopts the Extension Condition, according to which merger must create a new root. (In later work within the minimalist program this condition is replaced by more permissive variants; see Svenonius 2004 for an overview. This does not affect our argumentation.) The Extension Condition has a number of purported consequences, one of which is that movement to a non-c-commanding position is excluded. The following derivation is ruled out because (17b) is related to (17a) by an application of internal merger that does not create a new root. Thus, sideward movement of C is ruled out.

(17) a.

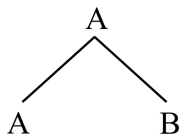


b. *



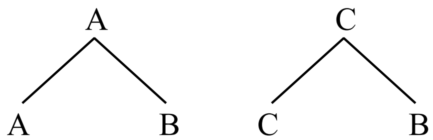
However, in all theories of merger that adopt the Extension Condition or something like it, intermediate stages of the derivation may consist of more than one (internally complex) tree. For example, in order to derive a sentence like *The man bought something*, it is necessary to assemble the subtree for *the man* and that for *bought something* before the final merge operation can take place. The unfortunate consequence of the necessity of intermediate stages with more than one tree in the 'workspace' is that it voids the Extension Condition of any empirical consequences. This is because such intermediate stages can be used to create movement dependencies in which the moved category does not c-command its trace. Internal merge – by definition – applies to a subtree that is a nonroot. In line with the Extension Condition this subtree is merged with the root of another tree. It is normally assumed that this second tree contains the first, but if we allow the 'workspace' to contain multiple trees, there is no reason why this should be so. As a consequence, the theory of internal merge incorrectly allows derivations like the one in (18), where B moves to a non-c-commanding position.

(18) a.



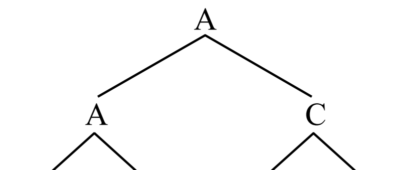
- A and B are selected from the numeration and merged.
- A projects.

b.



- C is selected from the numeration and merged with B.
- C projects.

c.

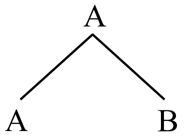


- The two trees rooted in A and C are merged.
- A projects.

This problem does not just exist in Chomsky's implementation of internal merge. As shown in

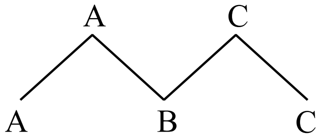
(19), there is an analogous derivation in the movement theory based on multiple domination: like the tree in (18c), the graph in (19c) encodes sideward movement of B.

(19) a.



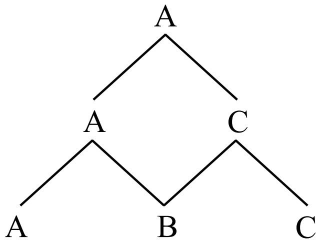
- A and B are selected from the numeration and merged.
- A projects.

b.



- C is selected from the numeration and merged with B.
- C projects.

c.



- The two trees rooted in A and C are merged.
- A projects.

That the type of derivation illustrated here is available on minimalist assumptions is corroborated by several papers that employ it to solve problems with certain types of movement. Bobaljik and Brown (1997), for example, tackle the problem that head movement does not meet the Extension Condition by adopting a sequence of operations parallel to that in (18). The analysis of V-to-I that they advocate is as follows. Once the VP has been built, I is selected from the numeration and merged with a copy of the verb. Subsequently, the V/I-complex is merged with the VP. (For an alternative view of head movement that meets the c-command condition, see Koeneman 2000, Bury 2003, and references given there.)

Similarly, Citko (2005) addresses the problem that across-the-board movement leaves multiple traces associated with a single antecedent by arguing for what she calls 'parallel merge'. This is an operation that creates a representation of the type in (19b), which is later expanded into a rooted cyclic graph like (19c). Movement of B out of this structure creates the appearance of movement from multiple positions, even though only one constituent actually undergoes internal merge. (We have addressed the issue of forking chains extensively in Neeleman and Van de Koot 2002.)

The upshot of this discussion is that the theory of internal merge must be supplemented with an additional constraint guaranteeing that the initial site of merger of a constituent X is c-commanded by any subsequent site in which X is merged. Even if the Extension Condition is adopted, the copy theory (or its re-merge variant) does not explain why movement targets a c-commanding position.

There are various ways in which a constraint guaranteeing c-command can be added to the theory. One option within minimalism would be to exploit the fact that agree requires domination. Agree is defined as a relation between a probe and a goal, where the probe is the projected label of a functional head and the goal a phrase that can value the features of the probe. Movement is licensed if a category has an EPP or edge feature requiring merger of some other category in its projection. If it is stated that the EPP feature of a probe is satisfied by the same phrase that values its agreement features, then movement must target a c-commanding position (of course, this link between agreement and movement is problematic for other reasons).

Unfortunately, an approach along these lines must be based on an underived distinction between internal and external merge. The latter cannot be conditioned by agree because prior to merger the structural description of the agree operation (domination) is not met. Therefore, it must either be assumed that internal merge requires satisfaction of an EPP feature but external merge does not, or that the EPP feature licensing internal merge is linked to agreement features, but the one responsible for external merge is not. In either case, the c-command condition on internal merge must remain a stipulated property of the theory.

Of course, there is a way of explaining the c-command restriction on movement in terms of more general restrictions on phrase structure. We have argued in section 2 that Inclusiveness and Accessibility force an encoding of grammatical dependencies that implies that the antecedent must c-command the dependent. Since movement is a grammatical dependency, it inherits the c-command property. Note, however, that our proposal is incompatible with the copy theory of movement, as explained in section 3. On this explanation of the fact that movement targets a c-commanding position, one must therefore reject the theory of internal merge. In the following section we will present a further argument supporting the conclusion that traces are terminals.

5. Against the copy theory of movement: Barss's Generalization

One argument often given in support of the copy theory of movement is that it allows a straightforward explanation of reconstruction phenomena (see Chomsky 1993, 1995, Hornstein 1995, Lebeaux 1998, Fox 1999, and many others). Consider the example of WH-movement in (20a), where the constituent in Spec-CP has a copy in the verb's object position. At PF, this lower copy is not spelled out (see (20b)). In order to obtain a well-formed LF representation, duplication of material in the movement chain must be eliminated. The operator part of the WH-phrase is deleted in the foot of the chain, while the restriction may be deleted either in the head or the foot. The former option, shown in (20c), explains why binding of *himself* is possible, even though – on the surface – there is no c-command relation between antecedent and anaphor.

(20) a. [Which picture of himself] does John like [which picture of himself] best.
b. [Which picture of himself] does John like [~~which picture of himself~~] best. (PF)
c. [Which ~~picture of himself~~] does John like [~~which~~ picture of himself] best. (LF)

As (20) illustrates, the assumption that traces are copies allows an account of reconstruction phenomena. But this assumption predicts the existence of patterns of reconstruction that do not in fact exist. To see this, we must consider cases of remnant movement in which a constituent containing an A-trace undergoes $\bar{\text{A}}$-movement. In the crucial case, the category undergoing A-movement is a quantifier (Q_1), while the category undergoing $\bar{\text{A}}$-movement contains a quantifier (Q_2) that can take scope over the A-trace but not over the surface position of the raised quantifier. This sequence of movement operations should preserve the ambiguity of the base structure, as – under the copy theory – the base structure itself is preserved by movement. Unexpectedly, however, the combination of A- and $\bar{\text{A}}$-movement just described generates a structure in which the $\bar{\text{A}}$-trace behaves as if it is opaque for reconstruction of Q_1.

(21) a. $[_{CP} \ldots [_{IP} \ldots [_{XP}\ Q_1 \ldots Q_2]]]$ $(Q_1 > Q_2;\ Q_2 > Q_1)$
b. $[_{CP} \ldots [_{IP}\ Q_1 \ldots [_{XP}\ Q_1 \ldots Q_2]]]$ $(Q_1 > Q_2;\ Q_2 > Q_1)$
c. $[_{CP}\ [_{XP}\ Q_1 \ldots Q_2] \ldots [_{IP}\ Q_1 \ldots [_{XP}\ Q_1 \ldots Q_2]]]$ $(Q_1 > Q_2;\ {*}Q_2 > Q_1)$

The observation that structures like (21c) are unambiguous goes back to Barss 1986. Sauerland and Elbourne (2002) refer to it as Barss's Generalization and formulate it as in (22), where ‘total reconstruction’ means reconstruction of all the material contained in a QP.

(22) *Barss’s Generalization*
Total reconstruction of an A-moved QP to a position X is blocked when the QP does not c-command X in the overt form.

We now consider the data that instantiate the abstract structures in (21) (see May 1979 and Lebeaux 1998). In (23a), *some young lady* may be interpreted in the scope of *every senator*. By contrast, (23b) and (23c) are unambiguous. In (23b) the binding relation with the reciprocal forces *some young lady* to take surface scope. In (23c), the universal fails to take scope over an argument of the matrix verb. In view of these data, the ambiguity in (23a) must be due to reconstruction of the existential rather than raising of the universal.

(23) a. [$_{IP}$ Some young lady$_1$ seems [$_{XP}$ t_1 to be likely [t_1 to dance with every senator]]]
(i) some > every; (ii) every > some
b. [$_{IP}$ Some young lady$_1$ seems to herself$_1$ [$_{XP}$ t_1 to be likely [t_1 to dance with every senator]]]
(i) some > every; (ii) *every > some
c. [$_{IP}$ Mary$_1$ seems to some young lady [$_{XP}$ t_1 to be likely [t_1 to dance with every senator]]]
(i) some > every; (ii) *every > some

The key observation for present purposes is that scope reconstruction of *some young lady* becomes unavailable once the constituent containing its trace undergoes WH-movement:

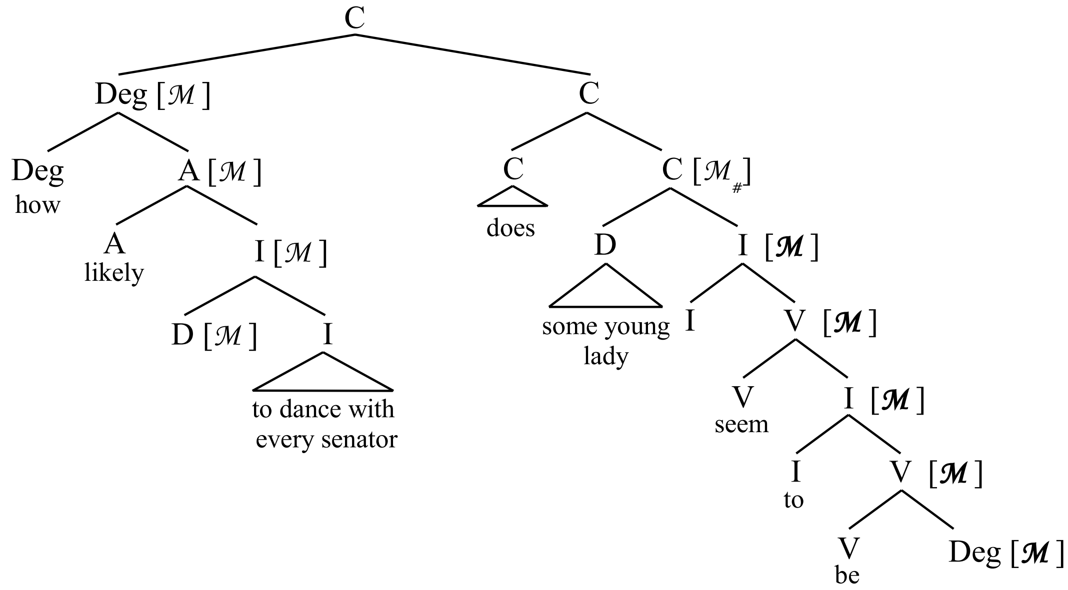
(24) [$_{CP}$ [$_{XP}$ How likely t_1 to dance with every senator]$_2$ does [$_{IP}$ [some young lady]$_1$ seem to be t_2]]
(i) some > likely/every; (ii) *likely/every > some

Sauerland and Elbourne (2002) give further examples that display the same pattern. One involves the licensing of the negative polarity item *any* through reconstruction to a position in the scope of negation. The example in (25a) shows that A-movement allows such reconstruction. However, reconstruction is no longer possible if a constituent containing the trace of A-movement is fronted, as in (25a’). The pair in (25b,b’) show that such fronting is fine if the stranded A-moved constituent is not dependent on any material in the fronted constituent.

(25) a. [$_{IP}$ [A doctor with any reputation]$_1$ was certain *(not) t_1 to be available]
a’. *... and [$_{CP}$ [$_{XP}$ certain not to be t_1 available]$_2$ [$_{IP}$ [a doctor with any reputation]$_1$ was t_2]]
b. [$_{IP}$ [A doctor from cardiology]$_1$ was certain (not) t_1 to be available]
b’. ... and [$_{CP}$ [$_{XP}$ certain not to be t_1 available]$_2$ [$_{IP}$ [a doctor from cardiology]$_1$ was t_2]]

The data described by Barss’s Generalization yield to a simple analysis if traces lack internal structure. What is needed is a scope rule along the lines suggested earlier, which allows the moved constituent to be assigned as its scope any node dominated by $\mathcal{M}_{\#}$ that contains $\mathcal{M}$, the selectional requirement encoding movement. Given that $\bar{A}$-movement in the examples in (24) and (25a’) removes part of the path of $\mathcal{M}$ from the c-command domain of the A-moved quantifier, it bleeds scope assignment to any node along that part of the path. Thus, scope reconstruction of *some young lady* can only target the nodes containing a boldface $\mathcal{M}$ in the structure below. (The two instances of Deg are related by syntactic reconstruction, a process to which we return in section 7, where a complete account of Barss's Generalization will be presented.)

(26)



An approach along these lines is unavailable under the copy theory of movement, as the trace of Ā-movement is internally complex and contains the trace of A-movement. Therefore, Ā-movement can *not* be said to remove reconstruction sites from the c-command domain of the moved quantifier. This is true no matter whether internal merge is conceptualized along the lines of Chomsky or Starke.

We are aware of two theories that attempt to reconcile the idea that traces have internal structure with Barss's Generalization. The first, proposed by Boeckx (2001), denies that the Ā-movement in (21c) plays any role in the explanation of the lost reading in remnant movement configurations. Boeckx claims instead that in the relevant examples the constituent marked XP is introduced by a degree expression (namely *how*) and that A-movement cannot reconstruct across such an operator. In other words, the trace of Ā-movement does have internal structure, but reconstruction of the A-moved element is blocked by other factors.

This theory seems incorrect. First, even if no overt degree operator is present, preposing of a constituent that contains a trace of A-movement blocks reconstruction in the A-chain. This is shown by the lack of ambiguity found with (27), where *likely to dance with every senator* has been fronted.

(27) And [likely t_1 to dance with every senator]$_2$ [some young lady]$_1$ seems to be t_2.
(i) some > likely/every; (ii) *likely/every > some

Second, as demonstrated by the example in (28a), the presence of an overt degree expression in a structure without Ā-movement does not block scope reconstruction. (*More* is not the only degree expression that fails to block reconstruction; in fact, we do not know of any degree expression that does.) For completeness, we add (28b), which is unambiguous, as expected.

(28) a. Some young lady is more likely [t_1 to dance with every senator] than some octogenarian.
(i) some > every; (ii) every > some

b. And more likely to dance with every senator than some octogenarian some young lady definitely is.
(i) some > likely/every; (ii) *likely/every > some

An alternative account of Barss's Generalization has been advanced by Sauerland and Elbourne (2002). These authors suggest that scope ambiguity with A-movement does not result from reconstruction. Rather, A-movement can take place either in the syntax or in the PF component of the grammar. Syntactic movement gives rise to a wide-scope interpretation of moved quantifiers, while PF movement is associated with narrow scope, as PF-movement does not feed the semantic interface:

(29) a. Some politician is likely to address every rally.
Syntactic movement:
PF: [some politician] is likely [~~some politician~~] to address every rally.
LF: [some politician] is likely [~~some politician~~] to address every rally.
some > likely/every
b. *PF-movement:*
PF: [some politician] is likely [~~some politician~~] to address every rally.
LF: is likely [some politician] to address every rally.
likely/every > some

This proposal captures Barss's Generalization on the further assumptions that Ā-movement cannot be delayed until PF and that lowering is ruled out in all components of the grammar. Consider why. The remnant in the crucial example undergoes Ā-movement, a syntactic operation. As a result the remnant-creating A-movement must take place in syntax as well, as in (30b). The derivation in (30c), which involves PF lowering, is blocked. Since syntactic A-movement give rise to wide scope only, the lack of ambiguity of (30a) follows.

(30) a. [How likely t_1 to address every rally]$_2$ is [some politician]$_1$ t_2?
b. *Syntactic movement:*
[some politician] is [how likely [~~some politician~~] to address every rally]
Syntactic movement:
[how likely [~~some politician~~] to address every rally] is
[some politician] ~~is~~ [~~how likely~~ [~~some politician~~] ~~to address every rally~~]
c. *Syntactic movement:*
[how likely [some politician] to address every rally] is
~~is~~ [~~how likely~~ [~~some politician~~] ~~to address every rally~~]
PF-movement (lowering of some politician*):*
*[how likely [~~some politician~~] to address every rally] is
[some politician] ~~is~~ [~~how likely~~ [~~*some politician*~~] ~~to address every rally~~]

The main problem with Sauerland and Elbourne's proposal is that the case for PF movement is weakened by the fact that it has all the properties of syntactic movement. As already noted, it must target a c-commanding position. In addition, it is subject to the cycle (so that an alternative derivation in which *some politician* undergoes raising out of the lower copy rather than lowering from the higher one is ruled out). This is suspicious, as the newly introduced operation duplicates properties of syntactic movement (note that other proposals involving PF movement, for example Bobaljik's 1995 account of affix hopping, argue that it has different properties).

Moreover, in order for the theory to be empirically adequate, PF-movement must obey conditions that mention the LF notion of scope. First, in order to keep the theory from overgenerating, Sauerland and Elbourne are forced to stipulate that PF movement of a constituent X is licensed only if (i) there is a scope-taking element Y such that X takes scope over Y if moved in the syntax, but below Y if moved at PF, and (ii) the two scopal construals are semantically distinct.

Second, reconstruction in A-chains is blocked by certain intervening quantifiers, such as negation. This means that PF-movement must be blocked by these quantifiers. Of course, there is no reason inherent to the PF component why this should be so. The problem is brought into focus by the observation that the same operators block reconstruction in $\bar{A}$-chains (see Szabolcsi and Den Dikken 1999 for discussion and references), a phenomenon that Sauerland and Elbourne locate at LF, along with most other researchers. It seems unlikely to us that a movement that shares all relevant properties with syntactic movement and is sensitive to scope could take place in the PF branch of the grammar.

Our overall conclusion is that Barss's Generalization is captured much more straightforwardly on an analysis of traces as terminals. This is especially remarkable in view of the general permissiveness of the scope rule we have proposed.

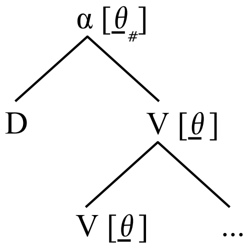
6. A-movement

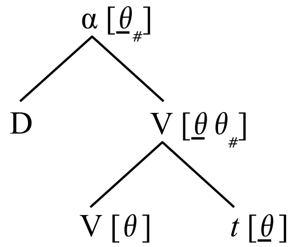
In the previous sections we have argued for the view that traces are terminals that introduce a selectional requirement linking them to their antecedents. This view is not just supported by empirical evidence but in fact forced by Inclusiveness. In what follows, we will develop this conception of movement, arguing that different types of movement can be distinguished in terms of the selectional requirements that encode them. We begin by considering A-movement, arguably the simplest type of displacement. This dependency will be compared with $\bar{A}$-movement in section 7, which is concerned with how syntactic reconstruction can be analyzed in the present framework. In the final two sections of the paper, we show that the resulting theory captures a number of facts about the interaction between A- and $\bar{A}$-movement and can be extended straightforwardly to capture the restrictions on movement discussed in Abels 2007 (see also Williams 2005).

The key question about A-movement in the present context is what selectional requirement is introduced by NP-trace. Our starting point is that one should be able to generalize over subjects of different classes of verb. How to achieve this is not entirely trivial because subjects of transitive and unergative verbs receive external θ-roles, while subjects of passive and unaccusative verbs do not (their subjects are moved from a lower thematic position). There are two ways in which one might develop a unified view of subjects.

The first relies on a positional definition of subjects. For example, one could assume that subjects of unaccusative and passive verbs move to the position in which subjects of transitive and unergative verbs are base-generated (the standard view in early GB theory). Alternatively, all subjects move from a thematic position to a designated position externally to VP (see Kuroda 1988, Koopman and Sportiche 1991). In either case, a DP qualifies as a subject if and only if it occupies a particular structural position.

The alternative defines subjects relationally: the subject of VP is the category that satisfies VP's external θ-role. Normally, this θ-role is introduced by the verb, but in passive and raising constructions it is introduced by NP-trace (a proposal in this spirit can be found in Williams 1986, 1994). If the relevant θ-role is satisfied VP-externally, subjects of passive and unaccusative verbs are indeed relationally equivalent to subjects of transitive and unergative verbs, as illustrated in (31). In (31b) the trace receives the verb's internal θ-role and simultaneously introduces a θ-role that is copied into the verbal projection. It is satisfied by D, just like the external θ-role in (31a). If the trace is a variable, equated with D through assignment of its external θ-role, then by transitivity D will be interpreted as an argument of the verb.

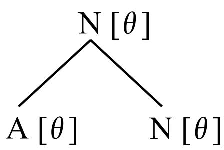
(31) a. 

b. 

It will be clear, given the general outlook of this paper, that we opt for an analysis of NP-trace as introducing a θ-role. In general, our proposal emphasizes the importance of syntactic dependencies and it would therefore be awkward to make additional assumptions that allow categories to acquire properties in virtue of their *position*.

In fact, there are several arguments supporting the analysis of NP-trace in (31a). What these arguments have in common is that they show that the distribution of passive VPs is identical to that of predicates. Consider first structures involving prenominal modification, which present something of a θ-theoretic puzzle. *Green* in *the green door* is a predicate, but it is unclear how it can discharge its θ-role. The possibility that it θ-marks the dominating DP is excluded, because 'upward' θ-marking is disallowed in general. The possibility that *green* θ-marks a PRO subject, as in Van Gestel 1986, solves the θ-theoretic problem, but introduces a parallel puzzle for the theory of control, as the PRO subject would have to be controlled by a dominating category.

A solution to this quandary can be found in Higginbotham 1985, where it is suggested that prenominal modifiers are interpreted through a process of θ-role identification with the noun's R-role. In our terms, the single θ-role in the root node in (32) functions as a copy of the θ-roles in both its daughters (obviously this implies that copying cannot be a derivational step, but must be a rule that allows two syntactic properties to be read as identical). As a result of this, *the green door* refers to an object that is both green and a door.

(32) 

This analysis implies that if the prenominal modifier lacks an external θ-role, the resulting structure will be uninterpretable. There is some supporting evidence for this: passive participles derived from unergatives cannot be used prenominally. As passive morphology absorbs the verb's single θ-role, no θ-role remains that can be identified with that of the noun. Indeed, although Dutch freely allows impersonal passives, impersonal passive participles are barred from occurring prenominally (see Perlmutter 1978, Hoekstra 1984, and Ackema 1999):

(33) a. Er wordt (door Jan) overal geslapen.
There is by John everywhere slept
'John sleeps anywhere.'

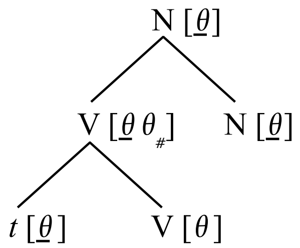
b. *de [$_{VP}$ (door Jan) geslapen] hond
the by John slept dog

Crucially, passive participles of transitive verbs *can* occur prenominally:

(34) de [$_{VP}$ (door Jan) *t* geslagen] hond
the by John beaten dog

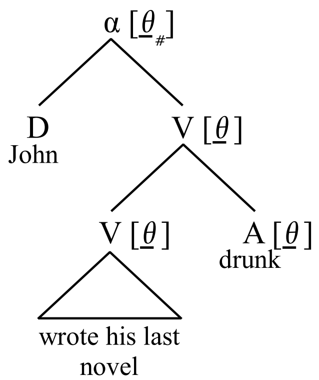
If Higginbotham's analysis is correct, the grammaticality of this structure implies that the passive VP has an unsatisfied external θ-role. The only conceivable source for this θ-role is the NP-trace in object position, as indicated below.

(35)



Secondary predication is a further phenomenon that confirms that NP-trace is the source of a θ-role. In line with our general outlook, we analyze secondary predication as an instance of θ-role assignment. Thus, in *John wrote his last novel drunk*, *John* is θ-marked by *drunk*. The traditional objection to this theory is that it appears to require a complication of the Θ-Criterion. After all, *John* is also the recipient of the verb's external θ-role and the Θ-Criterion is usually taken to exclude multiple θ-marking. Indeed, earlier proponents of a thematic theory of secondary predication relativize the Θ-Criterion to 'argument complexes' (see Williams 1983) or to chains (see Chomsky 1986a). However, this objection does not apply to theories incorporating θ-identification. If the external θ-roles of the secondary predicate and the verb are identified, then the external argument satisfies only a single θ-role in the node that directly dominates it. We illustrate this in (36). (Of course, this proposal should be worked out in more detail; a specific implementation can be found in Neeleman and Van de Koot 2002.)

(36)



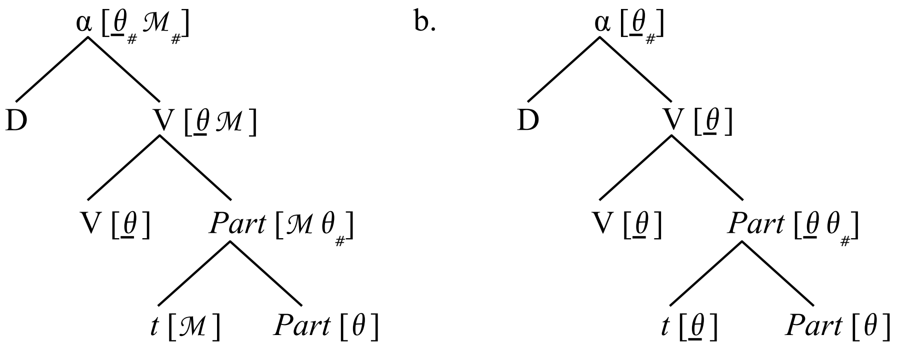
If secondary predication indeed involves θ-role identification, it supports the hypothesis that NP-trace introduces a θ-role.

First, passive and unaccusative VPs can be used as secondary predicates, as shown by the following example.

(37) John walked through town dressed up as a piggy by his friends.

If NP-trace did not introduce a θ-role, (37) should be ungrammatical. This is apparent from the representations in (38a) and (38b). In the former, NP-trace introduces the selectional requirement $\mathcal{M}$, giving rise to a structure expressing movement to a θ-position rather than secondary predication. The representation in (38b), however, parallels that in (36).

(38) a. *
b.

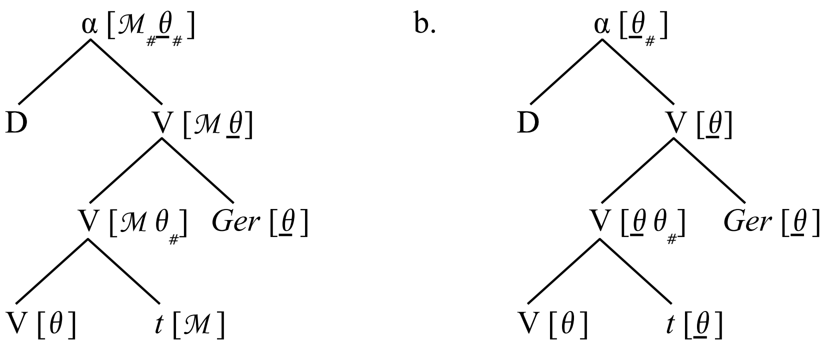


Second, subjects of passive and unaccusative verbs can be associated with a secondary predicate. Although depictives in general allow both subject- and object-oriented readings, the gerund depictive in (39a) can only be associated with the verb's external argument, presumably because it is attached too high to be c-commanded by the object. Crucially, the very same gerund may be related to derived subjects, as shown by (39b).

(39) a. John_1 killed Bill_2 [thinking about Mary]$_{1/*2}$
b. Bill_1 was killed/died *t* [thinking about Mary]$_1$

If NP-trace did not introduce a θ-role, (39b) should be ungrammatical. In (40a), the primary predicate's single θ-role is assigned too low in the structure to be available for θ-role identification, giving rise to a structure expressing movement to a θ-position. In (40b), however, the θ-role introduced by the trace is copied high enough to be identified with that of the gerund, yielding a structure parallel to (36).

(40) a. *
b.



The argument from secondary predication can be strengthened if we consider structures in which a predicate is coordinated with a VP containing the trace of A-movement (as first discussed by Burton and Grimshaw 1992). Dutch, for instance, allows coordination of an AP predicate and a passive VP:

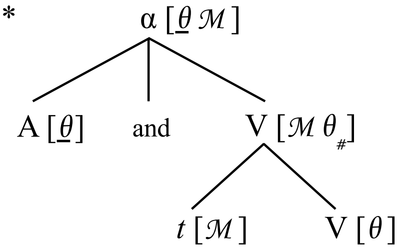
(41) Jan schreef die brief [[$_{AP}$ dronken] en [$_{VP}$ door iedereen *t* verraden]]
John wrote that letter drunk and by everybody betrayed

Although coordinates do not have to be of the same syntactic category, they must introduce the same set of θ-roles and the same set of selectional requirements encoding movement (see Sag et al. 1985 for discussion). For example, coordination of an adverbial with a depictive leads to ungrammaticality, because only the depictive introduces a θ-role:

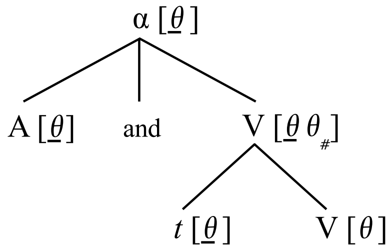
(42) *Jan schreef die brief [[$_{AP}$ dronken] en [$_{AdvP}$ slordig]]
John wrote that letter drunk and untidily

In view of these properties of coordination, the passive VP in (41) must be a predicate. If NP-trace introduced a different selectional requirement, as in (43a), a double mismatch between the conjuncts would result, giving rise to ungrammaticality. No such problem arises if NP-trace introduces a θ-role, as in (43b).

(43) a. *



b.



This analysis correctly predicts that a passive VP will resist coordination with an adverbial:

(44) *Jan schreef die brief [[$_{AdvP}$ slordig] en [$_{VP}$ door iedereen verraden]]
John wrote that letter untidily and by everybody betrayed

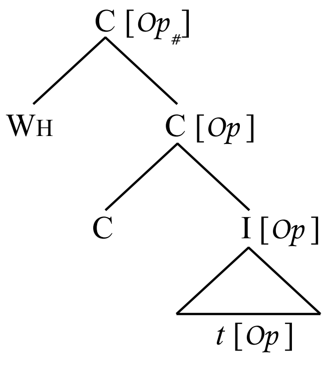
All in all, there is a surprising amount of data supporting the view that the selectional requirement that links an NP-trace to its antecedent is a θ-role.

7. Ā-movement

In the previous section we have argued that an NP-trace is a terminal node that introduces a specific selectional requirement, namely a θ-role. We will take this proposal as a model for the analysis of other types of movement. Different movement relations are encoded through different selectional requirements, but the syntax of the encoding is invariant: the selectional requirement is introduced by a terminal node and satisfied in accordance with Inclusiveness and Accessibility.

We will refer to the selectional requirement that encodes Ā-movement as *Op*. Thus, a WH-movement structure is analyzed as follows (there is an obvious parallel with the slash-feature employed in GPSG and HPSG):

(45)

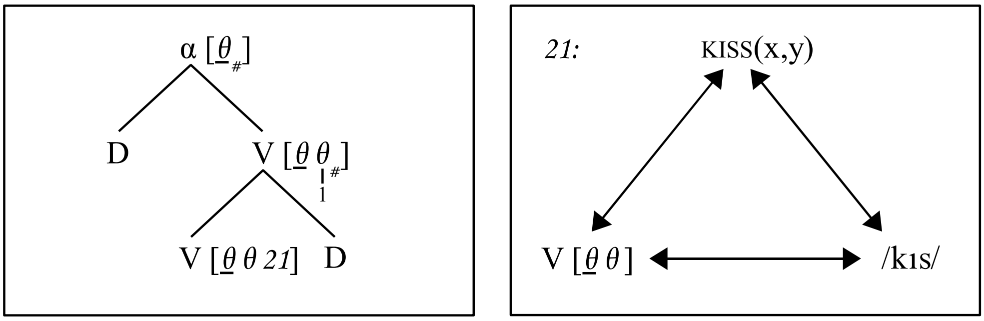


Differences between A- and Ā-dependencies must be attributable to differences in the properties of θ and *Op*. What we will concentrate on here is the reconstructive behaviour associated with selectional requirements and the consequences that this has for the interaction between movement types. Obviously, there are other issues to be addressed, such as differences in locality; for some discussion of these we refer the reader to Neeleman and Van de Koot 2002. Where appropriate, we will continue to use $\mathcal{M}$ as a cover term for the various selectional requirements that encode movement.

In order to address the issue of syntactic reconstruction within the framework developed here, we need to consider the way in which terminal nodes acquire their properties. Obviously, the requirement that syntactic structure must be inherited from dominated structure cannot be extended to terminals. The standard assumption is that terminals acquire their properties through lexical insertion. However, lexical insertion in the naive sense sense cannot exist: it does not make sense to say that a syntactic terminal contains a lexical entry. Similarly, a lexical item cannot be ‘taken’ from the lexicon when inserted, since that would lead to the absurd conclusion that insertion depletes the lexicon. At best, a syntactic terminal is a copy of a lexical item or, more precisely, it contains information matched against information in a lexical entry.

Ackema and Neeleman (2004) explore the idea that lexical insertion is a relation between two independent representations, a terminal and a lexical entry, mediated by a pointer. For example, ‘insertion’ of the verb *kiss* into a syntactic representation consists of the matching of information in that terminal with syntactic information in the verb’s lexical entry. In (46), the pointer that licenses this matching is the index 21 contained in the terminal node.

(46)

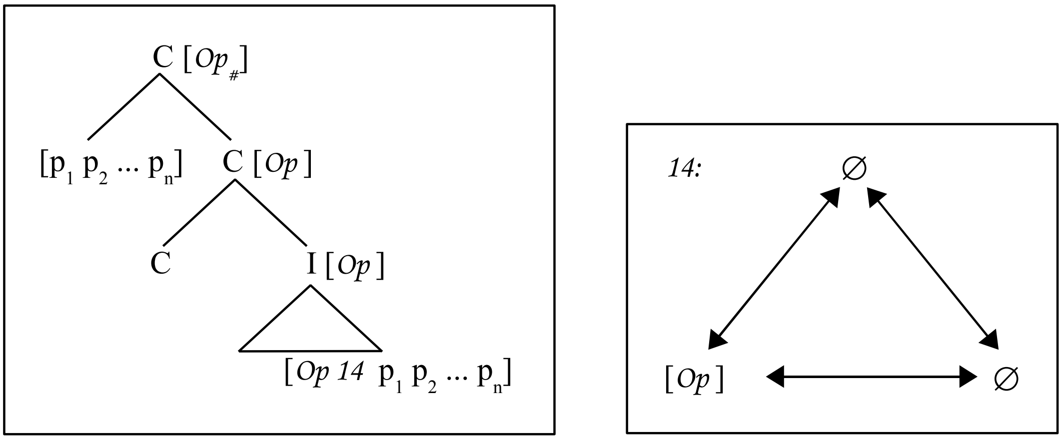


Syntax **Lexicon**

By its very nature, there can be no structural condition on the matching of information in different representations. This being so, nothing stands in the way of a terminal containing a pointer that relates it to another node in the same representation. Adapting the terminology in Chomsky 2005, we may call matching within a representation ‘internal matching’, reserving the term ‘external matching’ for lexical insertion. We will argue that internal matching is responsible for syntactic reconstruction effects.

Consider the representation in (47), a more detailed version of the tree in (45).

(47)



Syntax **Lexicon**

One of the attributes of the trace, the selectional requirement *Op*, is licensed by an external matching relation with lexical entry 14, the one for Ā-trace. *Op* is copied and satisfied in the usual way. Its function, we submit, is to identify the source for internal matching of the remaining properties of the terminal: it is a syntactic pointer. It is in this way that the properties p_1, p_2, ..., p_n in the trace satisfy Inclusiveness. Thus, our account of syntactic reconstruction combines mechanisms required to establish syntactic dependencies with the matching operation required for lexical insertion.[2]

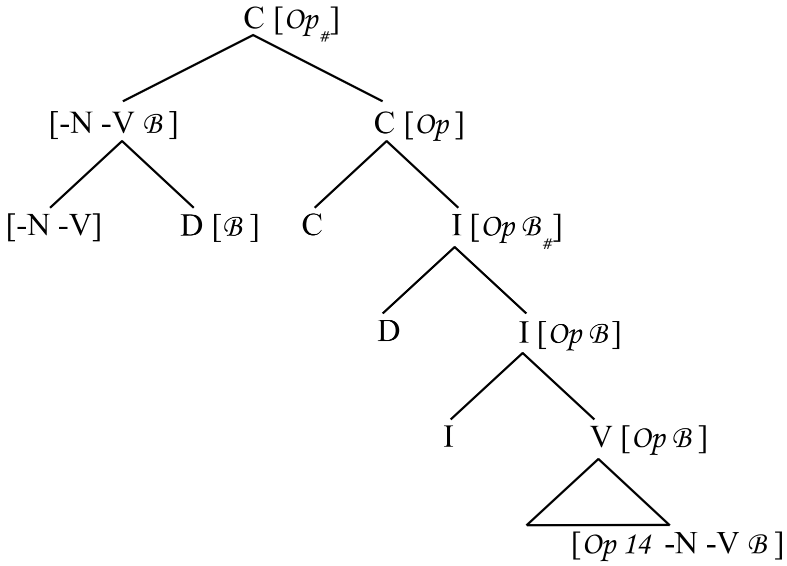
To illustrate the theory, let us consider an example of anaphoric binding licensed under reconstruction, such as the Dutch verb-second structure in (48).

(48) [$_{PP}$ Aan zichzelf] had Jan nooit t_{PP} gedacht.
on himself had John never thought
'Of himself John had never thought.'

The structure corresponding to (48) is given below. The reflexive contained in the fronted PP introduces the selectional requirement *ℬ* responsible for anaphoric binding. The mother of the reflexive is formed by copying *ℬ*, as well as the categorial features of the preposition. The resulting node satisfies the selectional requirement *Op*, introduced by the VP-internal trace. This syntactic dependency licenses matching of the trace's remaining attributes against those of the fronted category. This implies that the trace will be a prepositional category carrying *ℬ*. This lower instance of *ℬ* undergoes copying in the usual way until it is satisfied by the subject in Spec-IP. The net result is that the anaphor is interpreted as bound by *Jan*.

[2] Note that we cannot allow internal matching between a terminal and any arbitrary syntactic node, because this would undermine the effects of Inclusiveness. This problem does not arise if syntactic pointers are selectional requirements whose distribution is itself subject to Inclusiveness, as proposed here.

(49)



We can contrast the behaviour of *Op* with that of θ. In those structures in which θ is used to associate a predicate with its argument, there is no possibility of syntactic reconstruction (for example, one would not want to reconstruct the category of the argument into the verb). The simplest assumption is therefore that θ never licenses internal matching. This implies that syntactic reconstruction should be unavailable in A-chains.

This lack of syntactic reconstruction predicts that an A-moved anaphor must be bound in the head of its chain. The Dutch data in (50) show that this is indeed the case. As before, we make use of the fact that A-movement in Dutch is optional, giving rise to what is sometimes referred to as nominative-dative inversion (see Den Besten 1989, Broekhuis 1992, and references mentioned there). The anaphor in the structures at hand is the direct object of a passivized double-object verb. In (50a) it fails to undergo raising and can therefore only be bound by the indirect object *Marie* 'Mary' (due to the locality of anaphoric binding). In (50b), the anaphor raises to the subject position of the embedded clause, where it can only be interpreted as bound by the matrix subject *Jan* 'John'.

(50) a. Jan$_1$ ziet [__ Marie$_2$ zichzelf$_{2/*1}$ getoond worden]
John sees Mary self shown be
'John sees Mary being shown to herself.'
b. Jan$_1$ ziet [zichzelf$_{1/*2}$ Marie$_2$ t_{DP} getoond worden]
John sees self Mary shown be
'John sees himself being shown to Mary.'

The fact that (50b) is unambiguous could potentially be attributed to a Principle C violation rather than a failure of the anaphor's selectional requirement to undergo reconstruction to the foot of the A-chain. However, as shown in (51b), Principle C cannot fully account for the data. Embedding of the anaphor in a larger constituent circumvents the Principle C violation, but (51b) is still unambiguous.

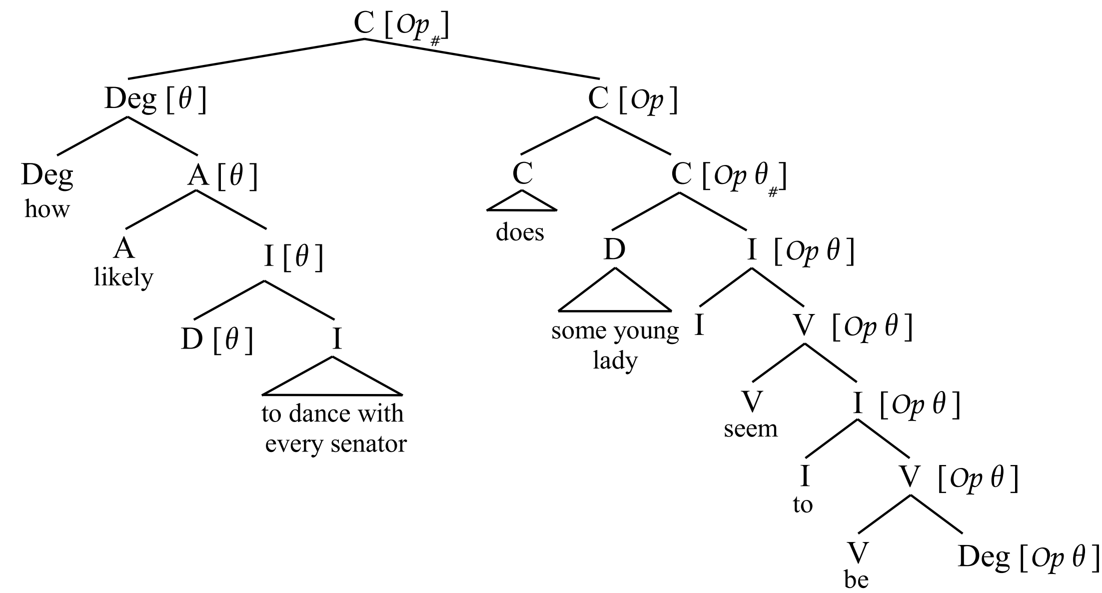
(51) a. Jan$_1$ ziet [__ Marie$_2$ een foto van zichzelf$_{1/2}$ getoond worden]
John sees Mary a photo of self shown be
'John sees Mary being shown a photo of himself/herself.'
b. Jan$_1$ ziet [[$_{DP}$ een foto van zichzelf$_{1/*2}$] Marie$_2$ t_{DP} getoond worden]
John sees a photo of self Mary shown be
'John sees a photo of himself being shown to Mary.'

We are aware of the fact that anaphors in DPs headed by a picture noun may display logophoric behaviour. Presumably, this is because they can be bound by a silent possessor, which itself is interpreted through non-obligatory control. It is this factor that explains the contrast between (50a), which requires anaphoric binding, and (51a), which allows either anaphoric binding or control. This does not affect our argumentation: the unambiguity of (51b) can only be understood if A-movement fails to reconstruct for both control and anaphoric binding.

We are now in a position to make good on our promise from section 5 to give a fuller account of Barss's generalization. We have shown that examples like *How likely to dance with every senator does some young lady seem to be?* are problematic for the copy theory of movement, because for the purposes of scope reconstruction the trace of Ā-movement behaves as if it has no internal structure. This cannot be the whole story, however, as Ā-movement must reconstruct for at least some syntactic properties introduced by subconstituents of the moved category. We have illustrated this above for anaphoric binding; similarly *some young lady* in the example at hand must be associated with the position in which it receives its thematic role, which is contained in the fronted degree phrase.

This paradox dissolves once we consider three properties of the theory developed here: (i) syntactic dependencies are locally encoded through the copying of selectional requirements, (ii) traces (of Ā-movement) are copies of the root node of the moved category but lack internal structure, and (iii) scope reconstruction is licensed by a rule that refers to the selectional requirements that encode movement; it does not involve syntactic lowering. Consider the tree in (52).

(52)



In this structure, the selectional requirement that links *some young lady* to its thematic position is represented in the root node of the moved category and reconstructs into the trace as a result of the application of Op. Hence, the syntactic reconstruction effects obtains even though the trace does not have internal structure. This is of course what we have already seen for anaphoric binding in (49), where copying of $\mathcal{B}$ to the root node of the antecedent was sufficient to guarantee its presence in the trace.

Our rule for scope reconstruction states that a moved constituent may be assigned as its scope any node dominated by $\mathcal{M}_{\#}$ that contains $\mathcal{M}$, the selectional requirement encoding movement. Since we are dealing with A-movement in (52), the relevant instance of $\mathcal{M}$ is θ. As explained before, the Ā-movement in this example removes part of the path of θ from the structure dominated by $\theta_{\#}$, with the consequence that that part of the path is no longer accessible to the scope assignment rule. Our proposal therefore captures Barss's generalization.

The reconstructive properties of A and Ā-movement have consequences beyond binding and scope. Most of these involve interactions between the two types of movement, a matter to be taken up in section 8. Here we will illustrate the point using movement of adjuncts. As the following example shows, an adverb like *yesterday* can undergo Ā-movement, but cannot be promoted to subject of a passive predicate:

(53) a. When$_1$ did Mary claim [that Bill bought this book t_1].
b. *Yesterday$_1$ was believed t_1 [that Jack is a man of substance].

The idea that adverbs semantically select for properties of their host is widespread in the literature. We propose that this semantic relationship is syntactically encoded through a selectional requirement introduced by the adverb and satisfied by the category it attaches to. In movement configurations, this selectional requirement must be reconstructed to the foot of the chain for the adverb to take scope there. Since $\mathcal{O}p$ licenses syntactic reconstruction, this is possible in Ā-chain, explaining the grammaticality of (53a). The A-chain in (53b), however, does not permit reconstruction and therefore the adverb's selectional requirement must be satisfied in the head of the chain. We remain agnostic at to whether this is possible. The structure in (53b) is ruled out in any case, because there is no syntactic or interpretive function for the trace, in violation of Full Interpretation.

We must tie up one loose end before turning to the predicted interaction between movement types. We assume that properties that undergo reconstruction are no longer 'active' in the antecedent. For example, if an anaphor undergoes Ā-movement, it is bound in one position of the chain; it cannot be bound in multiple positions. There are various ways in which this can be expressed. Here we will opt for a simple ban on upward copying into a node containing $\mathcal{M}_{\#}$ of attributes whose reconstruction is licensed by $\mathcal{M}$. For example, we have seen that $\mathcal{O}p$ licenses reconstruction of $\mathcal{B}$. Consequently, copying of $\mathcal{B}$ from a constituent that has undergone Ā-movement is impossible. This has the consequence that $\mathcal{B}$ be is rendered inactive in the moved category.[3] (Notice that the effects of this condition for features are different than for selectional requirements. Although a feature cannot be copied out of a moved category, it can of course be interpreted in that category. Therefore the operator feature in moved WH-phrases may be interpreted in the head of the chain.)

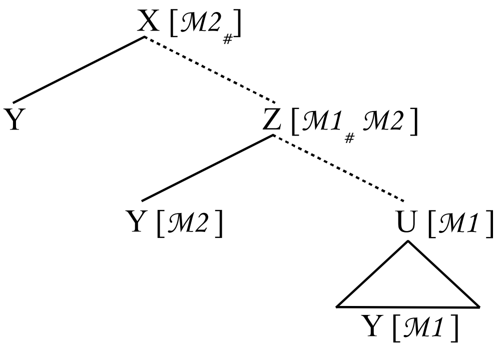
[3] Recall that anaphors in picture nouns can be bound by a silent possessor, which is itself interpreted through non-obligatory control. Hence, if such a DP moves, an anaphor contained in it can be 'bound' in the head of the chain, giving rise to examples like *John wonders which picture of himself Mary likes best*.

8. Interactions

There is an important asymmetry between the selectional requirements encoding A- and Ā-movement. As we have seen, *Op* licenses reconstruction of θ, but θ does not allow reconstruction of *any* attribute, and hence not of *Op* either. This has several consequences for interactions between A- and Ā-movement: (i) A-movement chains can be extended through Ā-movement, but Ā-chains cannot be extended through A-movement; (ii) Ā-movement out of an A-moved category is possible, but A-movement out of an Ā-moved category is not; (iii) a remnant created by A-movement can undergo Ā-movement, but a remnant created by Ā-movement cannot undergo A-movement. We will discuss each of these consequences in turn.

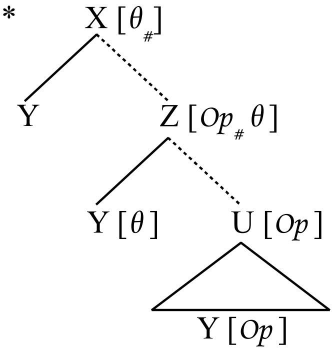
The general representation associated with examples involving stepwise movement of the same category is given in (54).

(54)

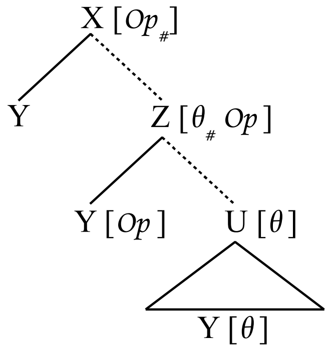


In this tree, $\mathcal{M}2$ must be copied from the trace that introduces it to Z and then onwards to X, where it is satisfied. As we have just argued, this will only be possible if $\mathcal{M}1$ is selectional requirement that does not trigger syntactic reconstruction of $\mathcal{M}2$. If it did, Z would be a barrier for copying of $\mathcal{M}2$. Therefore, an instantiation of (54) as (55a) is ruled out, as satisfaction of *Op* triggers reconstruction of θ. In contrast, an instantiation of (54) as (55b) is grammatical, because θ does not give rise to syntactic reconstruction of *Op*. Therefore, A-chains can be extended with Ā-movement, but not vice versa.

(55) a. *



b.



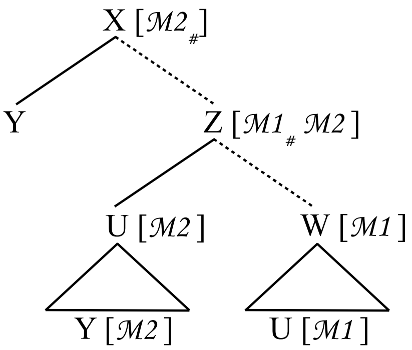
That this asymmetry in composite movement chains exists is generally accepted. We will not demonstrate the grammaticality of structures like (55b). (55a) is a configuration of improper movement; its deviance is apparent from examples like those in (56). Given that CP is a barrier for A-movement, these examples can only by generated by a derivation in which Ā-movement to spec-CP feeds A-movement.

(56) a. *[This book]$_1$ appears [$_{CP}$ t_1 that John has read t_1]
b. *[Which book]$_1$ was asked [$_{CP}$ t_1 John had read t_1]

Although the ban on improper movement is based on long-standing observations, there is no consensus regarding its explanation. What is novel about the account proposed here is that the data follow from independently motivated properties of A- and Ā-movement; in particular, from the obligatory nature of syntactic reconstruction in Ā-chains and the absence of reconstruction in A-chains. Notice that this explanation crucially relies on movement being locally encoded through a selectional requirement introduced by a trace, as the extendability of a chain depends on whether this selectional requirement is reconstructed or not.

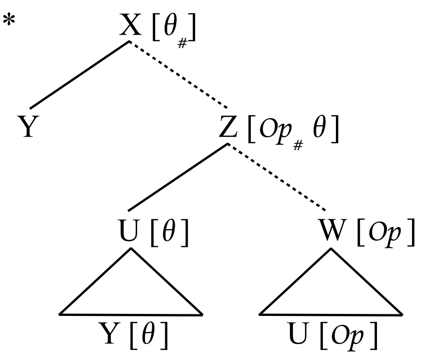
We now turn to movement out of a moved category. An abstract representation of a derivation of this type is given in (57).

(57)

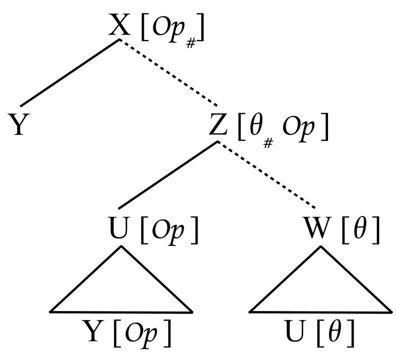


As before, this tree will be grammatical only if $\mathcal{M}1$ does not reconstruct for $\mathcal{M}2$. This is because reconstruction of $\mathcal{M}2$ is incompatible with copying of this selectional requirement to Z (and X). Therefore, an instantiation of (57) as (58a) is ruled out, while the instantiation in (58b) is grammatical.

(58) a. *



b.



In fact, the source of this asymmetry is identical to the one underlying the contrast between improper movement and A-chains extended by Ā-movement: the trees in (55) and (58) are identical, except for the fact that U has internal structure in the latter. Again, it is the local encoding of movement that allows this generalization to be captured. In the standard theory, it is not obvious how one could generalize over these cases, as extension of a chain and movement out of a moved category do not share obvious structural properties.

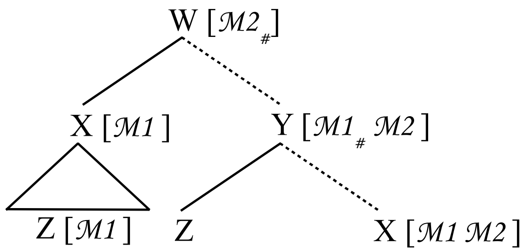
Indeed Ā-moved constituents are islands for A-movement. In (59a), for example, a prepositional phrase has been moved to Spec-CP, after which the complement of the preposition has undergone pseudo-passivization. Although both movements exist in English, combining them in this way is impossible. In (59b) topicalization feeds pseudo-passivization, again with poor results. (The latter structure might be independently ruled out as a case of improper movement, if raising can be forced to pass through Spec-CP.)

(59) a. *[Young children]$_2$ are believed [[to t_2]$_1$ that you should never give matches t_1]
b. *[Young children]$_2$ are believed [(t_2) that [[to t_2]$_1$ that you should never give matches t_1]]

As opposed to $\bar{\text{A}}$-movement, A-movement does not give rise to freezing effects. WH-extraction from exceptionally case-marked subjects is (somewhat) degraded for some speakers (see, for example, Kayne 1984), but fully acceptable for others (see, for example, Chomsky 1986b). It does not seem to make any difference whether the exceptionally case-marked subject has undergone raising internally to the infinitival complement, as in (60a), suggesting that extraction from a raised DP is possible. For those readers who find the contested status of the English example insufficiently convincing, we offer the fully grammatical Dutch examples in (60b) and (60c).

(60) a. %Who$_2$ do you believe [[pictures of t_2]$_1$ to have been sold t_1 on the internet]?
b. Waar$_2$ zag je [[een oude foto van t_2]$_1$ Marie t_1 getoond worden]?
where saw you a old photo of Marie shown be
'What did you see an old photo of being shown to Mary?'
c. Wat$_2$ zag je [[t_2 voor foto]$_1$ Marie t_1 getoond worden]?
what saw you for photo Marie shown be
'What kind of photo did you see being shown to Mary?'

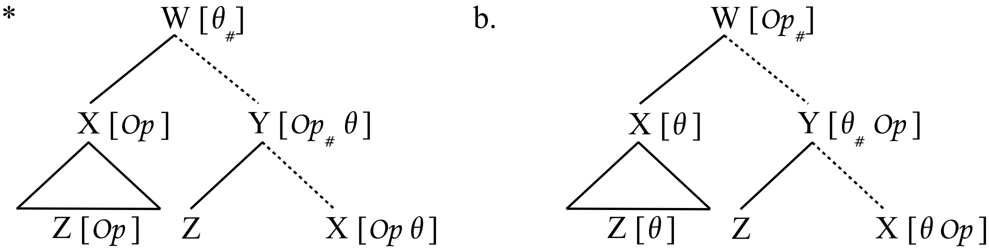
The final interaction to consider involves remnant movement. In the abstract representation in (61), movement of Z creates a remnant category X, which is subsequently moved across Z's surface position.

(61)


Recall that chain extension and movement out of a moved category are only possible if the initial step of movement does not reconstruct the selectional requirement necessary for the second step of movement. The grammaticality of remnant movement, however, relies on reconstruction. The selectional requirement encoding the remnant-creating movement must be reconstructed to the trace of the remnant, if Z is to be linked to *its* trace. In other words, in (61) $\mathcal{M}2$ must license reconstruction of $\mathcal{M}1$.

Therefore, A-movement can create a remnant that undergoes $\bar{\text{A}}$-movement, but $\bar{\text{A}}$-movement cannot create a remnant that undergoes A-movement. The structure in (62a) is ungrammatical, because it requires reconstruction of *Op*, something not licensed by satisfaction of θ. In contrast, (62b) is grammatical because *Op* reconstructs for θ.

(62) a. * b.



That A-movement can indeed create a remnant that undergoes Ā-movement has already been illustrated extensively in the discussion of Barss's generalization. The reverse pattern, Ā-movement followed by A-movement of the remnant, yields ungrammatical structures. We can demonstrate this using Dutch examples. Recall that in this language NP-raising is optional. Thus, the structure in (63a) coexists with the one in (63b), where the direct object has been raised to a VP-external position, crossing the indirect object. Dutch also has an operation of Ā-scrambling (see Neeleman and Van de Koot 2008, and references mentioned there). This operation derives (63c) from (63a). If Ā-movement could feed remnant A-movement, we would expect (63d) to be grammatical, contrary to fact. As expected, Ā-scrambling of *alleen daar* 'only that' cannot be followed by raising of the remnant *een foto van* 'a photo of'.

(63) a. dat de meisjes een foto van Piet meestal bevalt.
that the girls a photo of Pete usually pleases
b. dat [een foto van Piet]$_1$ de meisjes t_1 meestal bevalt.
that a photo of Pete the girls usually pleases
c. dat de meisjes [alleen DAAR]$_1$ een foto van t_1 echt bevalt.
that the girls only there a photo of really pleases
d. *dat [een foto van t_1]$_2$ de meisjes [alleen DAAR]$_1$ t_2 echt bevalt.
that a photo of the girls only there really pleases

We can summarize the results so far as follows. Let $\mathcal{M}1$ and $\mathcal{M}2$ be selectional requirements that encode movement. If $\mathcal{M}2$ reconstructs for $\mathcal{M}1$ but not vice versa, we expect the following pattern of interaction: (i) a chain created by $\mathcal{M}1$ may be extended using $\mathcal{M}2$, but a chain created by $\mathcal{M}2$ cannot be extended using $\mathcal{M}1$; (ii) a constituent that satisfies $\mathcal{M}1$ allows subextraction using $\mathcal{M}2$, but a constituent that satisfies $\mathcal{M}2$ does not allow subextraction using $\mathcal{M}1$; (iii) $\mathcal{M}1$ may create a remnant that is moved using $\mathcal{M}2$, but $\mathcal{M}2$ cannot create a remnant that is moved using $\mathcal{M}1$.

We have illustrated the effects of the system with the specification of $\mathcal{M}1$ and $\mathcal{M}2$ as θ and *Op*. However, it is conceivable that there are more movement types, and hence that the patterns identified have more than one instantiation. Important work by Abels (2007) suggests that developing our theory in this direction may be viable. Abels argues that there is a hierarchy of movement operations, which he dubs the Universal Constraint on Operational Ordering in Language (UCOOL). The effects of UCOOL come about through a principle called GenPIM, which refers to the hierarchy of movement types (we discuss GenPIM below). Abels illustrates the effects of his theory for four types of movement found in German, namely A-movement, scrambling to a position preceding the subject, WH-movement and topicalization into the *Vorfeld* (we refer to Abels' paper for a detailed description of these movements). These are ordered as in (64).[4]

[4] We should perhaps point out that scrambling to the pre-subject position in German has properties that differ substantially from focus scrambling in Dutch. The latter seems to be more like WH-movement/topicalization.

(64) UCOOL
... << A-movement << Scrambling << Wh-movement << Topicalization << ...

The prediction made by the conjunction of UCOOL and GenPIM is that the pattern we have derived for interactions between A- and Ā-movement should hold between any two movements in (64), as long as the first is subordinate to the second. For example, scrambling may extend an A-movement chain, take place out of A-moved constituents, and affect remnants created by A-movement. However, A-movement may not extend a chain created by scrambling, take place out of a scrambled constituent, or affect remnants created by scrambling.

A large part of Abels' paper is devoted to establishing that the conjunction of UCOOL and GenPIM makes the correct predictions for German. All of the feeding relations ruled out by Abels' theory are indeed unattested, and the vast majority of feeding relations predicted to exist indeed occur. Where this is not the case, there seem to be extraneous factors at play. The data are summarized in the following table (adapted from Abels' (36)), where the feeding operations are given in the first column and the subsequent movements in the first row.

(65)		A-movement	Scrambling	Wh-movement	Topicalization
A-movement	extension		✓	✓	✓
	subextraction		✓	✓	✓
	remnant mvt		?	✓	✓
Scrambling	extension	*		✓	✓
	subextraction	*		%	%
	remnant mvt	*		✓	✓
Wh-movement	extension	*	*		*
	subextraction	*	*		??
	remnant mvt	*	*		??
Topicalization	extension	*	*	*	
	subextraction	*	*	*	
	remnant mvt	*	*	*	

Within the framework developed here, the data can be understood if UCOOL is really a hierarchy of selectional requirements. We will dub this variant of UCOOL the Universal Constraint on Operational Ordering in Language Reinterpreted (UCOOLR):

(66) UCOOLR
... << θ << *Scr* << *Op* << *Top* << ...

In (66), *Scr* encodes German scrambling and *Top* topicalization to the *Vorfeld*. The effects of UCOOLR come about through its interaction with a principle stating that a superordinate selectional requirement triggers reconstruction of all subordinate selectional requirements, while a subordinate selectional requirement does not reconstruct for any superordinate selectional requirements:

(67) *Principle of Syntactic Reconstruction* (PSR)
Satisfaction of a selectional requirement *SR1* gives rise to syntactic reconstruction of *SR2* if and only if *SR2* << *SR1* under UCOOLR.

It should be obvious that the combination of UCOOLR and PSR predicts that the pattern of interaction found with A- and Ā-movement extends to any other pair of distinct movement types encoded by the selectional requirements mentioned in (66).

As far as we can tell, Abels' proposal and ours are empirically indistinguishable. There is, however, an important conceptual difference: where we rely on PSR to reap the benefits of the hierarchy of movement operations, Abels relies on a principle called GenPIM, which we give in (68).

(68) *Generalized Prohibition on Improper Movement* (GenPIM)
No constituent may undergo movement of type τ if it has been affected by movement of type σ, where $\tau << \sigma$ under UCOOL.

GenPIM itself is formulated in terms of a notion of 'affectedness', defined as in (69).

(69) *Affectedness*
A constituent α is affected by a movement operation if and only if
i. α is reflexively contained in the constituent created by movement, and
ii. α is in a (reflexive) domination relation with the moved constituent.

What this definition expresses is that movement affects (i) the moved constituent, (ii) any node contained in the moved constituent, and (iii) any node on the path from the moved constituent to its trace. We will not demonstrate this here, but these three cases cover extension of chains, extraction from moved categories and remnant movement, as required.

While the notion of affectedness fits the empirical bill, it must – by its very nature – remain arbitrary. There is no reason inherent in the theory of movement why the nodes affected by movement should be those covered by the definition in (69) rather than, for example, only the moved category or all nodes dominated by the mother of the moved category. We believe that our proposal has advantages over Abels' in this respect.

Specifically, it is inherent in the way reconstruction works that the nodes affected by movement are precisely those identified by Abels. Consider the three cases identified above. A moved constituent is a category that satisfies a selectional requirement that encodes movement. It will be affected by this in that the satisfied selectional requirement will reconstruct selectional requirements lower on the hierarchy in (66). This implies that certain chain extensions will be excluded (see the discussion surrounding (54)). It also implies that any node contained in the antecedent is affected. If such a node is to move, a selectional requirement must pass through the root of the moved category, where it may or may not be subject to reconstruction (see the discussion surrounding (57)). Any node on the path from the moved category to its trace is affected because movement of those nodes will take away the source for the selectional requirement that licenses the moved category to begin with. Therefore, movement of a node in the path is only possible if it is of a type that reconstructs for the relevant selectional requirement (see the discussion surrounding (61)).

Notice that this explanation of Abels' notion of affectedness crucially involves the local encoding of movement dependencies: all affected nodes are either the source of a selectional requirement or nodes to which a selectional requirement is copied.

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