A Minimalist Condition on Semantic Reconstruction

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This article explains three known constraints on scope reconstruction—reconstruction is blocked into *wh*-islands, after remnant movement, and after countercyclic merger—by postulating an underlying condition on semantic reconstruction, which follows naturally from Minimalist assumptions on chain interpretation in combination with the principle of compositionality. The result is a unifying alternative analysis of the data discussed in Cresti 1995, Fox 1999, and Sauerland and Elbourne 2002, among others.

Keywords: semantic reconstruction, copy theory, *wh*-islands, remnant movement, late merger, scope reconstruction

1 Introduction

This article aims to provide an explanation for three well-known constraints on scope reconstruction, by postulating a more general underlying condition on the interpretation of movement chains that is based on the copy theory of movement and on a semantic approach to scope reconstruction.

In *scope reconstruction* (also *scope diminishment* or *full reconstruction*), a moved element takes scope at the position it occupied before the movement, that is, at or close to the position of its trace. Consider the classical case of scope reconstruction, the context of May's (1977) Quantifier Lowering (QL).

(1) a. Someone$_i$ is likely [$_{IP}$ t$_i$ to arrive].
    b. there is some person x such that it is likely that x arrives
    c. it is likely that there is some person x such that x arrives

In addition to the surface scope reading (1b), sentence (1a) allows the reconstructed reading (1c), where *someone* seems to be interpreted in the position it occupied prior to raising to subject.

A major question discussed in the literature on scope reconstruction is whether it should be dealt with by syntactic or semantic means. May's (1977) solution for (1c) was syntactic: at LF, *someone* optionally undergoes a movement operation (QL) that lowers it into the scope of *likely*, as shown in (2).

I am grateful to Eefje Boef, Tania Ionin, Ora Matushansky, Bill Philip, Yoad Winter, audiences at Sinn und Bedeutung 15, University College London, and the Utrecht Syntax Circle, and three anonymous *LI* reviewers for extremely useful comments and discussion. Naturally, all errors are my own. A preliminary account of some of the research reported here appeared in the proceedings of Sinn und Bedeutung 15.

Linguistic Inquiry, Volume 46, Number 3, Summer 2015
453–488

doi: 10.1162/ling_a_00189

(2) is likely [$_{\text{IP}}$ someone$_i$ [$_{\text{IP}}$ t_i to arrive]]

Although some evidence in favor of this operation exists (Fox (1995) argues that it shows sensitivity to economy constraints), lowering movement is problematic since it is not otherwise attested and is generally assumed to be impossible. Chomsky's (1993) copy theory of movement made a less problematic syntactic treatment available. On this theory, A-movement creates the structure in (3a). Only one copy of *someone* is to be retained at each of the interface levels, PF and LF. Deleting or ignoring the higher copy at LF, as in (3b), will yield the narrow scope, reconstructed reading.

(3) a. someone is likely [$_{\text{IP}}$ someone to arrive]
b. ~~someone~~ is likely [$_{\text{IP}}$ someone to arrive]
c. someone is likely [$_{\text{IP}}$ ~~someone~~ to arrive]

The semantic treatment of scope reconstruction was brought to prominence by Cresti (1995), Rullmann (1995), and others, building on von Stechow 1991. It starts from the assumption that the LF representation of *Someone is likely to arrive* invariably has *someone* in its surface position (or higher). The reconstructed reading can be derived by postulating that the trace can function not only as an e-type variable (which yields the surface scope reading, as shown in (4b)) but also as a variable of the type of a generalized quantifier (GQ). In this case, function-argument relations are reversed, and the result is the interpretation (4c) in which *likely* in effect takes scope over *someone.*

(4) a. Someone$_i$ is likely [$_{\text{IP}}$ t_i to arrive].
b. someone (λx_i[likely($^\wedge$ arrive(x_i))]) — t_i is x of type e
c. ($^\wedge$someone) λX_i[likely($^\wedge$ $^\vee X_i$(arrive))] — t_i is X of type $\langle s,\langle\langle e,t\rangle,t\rangle\rangle$
$\equiv$ likely($^\wedge$someone(arrive))

The comparison of syntactic and semantic approaches to scope reconstruction in the literature has focused on which approach is better able to account for the interaction between scope reconstruction and reconstruction for binding theory, a topic I will turn to in section 5. In this article, I want to provide support for the semantic approach with evidence of a different type. The discussion on scope reconstruction is reminiscent of the discussion on the proper treatment of upward scope shift (Quantifier Raising (QR)) that started in the 1970s. In examples like (5a), *everyone* can take narrow scope (in its surface position) or wide scope relative to *someone.* As with scope reconstruction, both a syntactic theory (May's (1977) QR) and several semantic ones (e.g., Cooper's (1983) storage, Hendriks's (1993) type shifting) were available. The most fruitful strategy used in attempts to decide the issue, it seems to me, was to study the constraints on upward scope shift and to determine whether they were best characterized in syntactic or semantic terms. For instance, the fact that *everyone* in (5b) cannot take scope over *someone* follows naturally from Ross's (1967) Complex NP Constraint, which also blocks overt *wh*-movement in this construction; hence, this observation was taken to favor the syntactic approach. See Ruys and Winter 2011 for an overview.

(5) a. Someone loves everyone. $\exists > \forall, \forall > \exists$
b. Someone knows a man who loves everyone. $\exists > \forall, {}^*\forall > \exists$

My purpose here is to apply the same strategy to scope reconstruction. I will argue that several previously observed constraints on scope reconstruction are best explained by one natural condition on semantic reconstruction. If this account is successful, it constitutes an argument in favor of the semantic approach.

The empirical material comes from three previously observed constraints on scope reconstruction. The first one is exemplified in (6) and (7).

(6) a. How many people$_i$ do you think t_i I should talk to $\mathbf{t_i}$?
b. for what n: there are n-many people x such that you think I should talk to x
c. for what n: you think there should be n-many people that I talk to

(7) a. How many people$_i$ do you wonder whether I should talk to $\mathbf{t_i}$?
b. for what n: there are n-many people x such that you wonder whether I should talk to x
c. *for what n: you wonder whether there should be n-many people that I talk to

(6a) allows both a wide scope reading for *n-many people*, paraphrased in (6b), and a narrow scope reading, paraphrased in (6c), which is apparently the result of scope reconstruction undoing the effect of *wh*-movement. For (7a), in which *wh*-movement of *how many people* has crossed a *wh*-island, the reconstructed reading (7c) is blocked, as first observed by Longobardi (1987). See section 3 for further discussion.

The second constraint I will discuss is exemplified in (8) and (9).

(8) a. Some politician$_i$ is likely [$_{IP}$ $\mathbf{t_i}$ to address every rally].
b. for some politician x: it is likely that x addresses every rally
c. it is likely that for some politician x: x addresses every rally
d. it is likely that for every rally y: for some politician x: x addresses y

(9) a. [$_{AP}$ How likely [$_{IP}$ $\mathbf{t_i}$ to address every rally]] is some politician$_i$ t_{AP}?
b. for which d, for some politician x: it is d-likely that x will address every rally
c. *for which d, it is d-likely that for some politician x: x will address every rally
d. *for which d, it is d-likely that for every rally y: some politician x: x will address y

For (8a), the raised subject can take in-situ wide scope, as in (8b), or scope reconstruction can cause either of the two narrow scope readings paraphrased in (8c) and (8d). In (9a), the AP vacated by the raised subject has itself undergone *wh*-movement, a case of remnant movement. This blocks the scope-reconstructed readings, as observed by Barss (1986). See section 4 for further discussion.

A third constraint on scope reconstruction is exemplified in (10).

(10) a. [How many ideas [$_{CP}$ related to John's$_j$ theory]]$_i$ will he$_j$ invent $\mathbf{t_i}$?
b. #for what n, for n-many ideas related to John's$_j$ theory x: he$_j$ will invent x
c. *for what n, he$_j$ will invent n-many ideas related to John's$_j$ theory

In cases such as (10a), the relative clause must be attached to the *wh*-phrase after it has fronted, so as to avoid a Condition C violation. In this case, the narrow scope reading (10c) is blocked, leaving only the (pragmatically odd) (10b). See section 5 for further discussion.

In sum, it appears that scope reconstruction of XP into a trace position t is possible only if XP is not separated from t by an island boundary (7), XP c-commands t (9), and XP has not undergone late merger (10). Various explanations have been offered for each of these constraints, but no unified account has been attempted. In this article, I propose that all three constraints are explained by a single condition on reconstruction, based on a generalization that can roughly be stated as (11).

(11) Scope reconstruction of an XP into a trace position is possible only if it can be determined locally (i.e., phase-internally) that the XP and the trace are identical.

In (10a), reconstruction is blocked because the trace and its antecedent are not identical, as a result of late merger. In (7a), the *wh*-phrase and its trace, though identical, are separated by a phase boundary. The derivation of (9a) is more involved, but it does follow from the condition I will be proposing, as section 4 will show.

The question is, why should a generalization such as this hold? In section 2, I will propose a condition from which it follows, and which makes perfect sense given the semantic approach to reconstruction. If successful, my account therefore constitutes an argument in favor of semantic reconstruction and against syntactic scope reconstruction, absent an equally plausible syntactic rationale for a generalization like (11) (which also manages to capture (9)).[1] Here is a sketch of my proposal. When a constituent is a trace copy, the semantic type of the variable that it contributes is determined by the type of the regular (nontrace) interpretation of that constituent. So if a given DP can denote in the ⟨et,t⟩ domain when it is not a trace, this can also be its type when it is a trace/variable (which then results in the scope-reconstructed reading illustrated in (4c)). However, this general procedure is subject to the condition that the trace and its antecedent are identical, and that their identity can be established locally (i.e., within the phase). If this condition, stated in (17) below, is not met, then the variable defaults to type e and scope reconstruction does not obtain, as shown in (4b). I will argue that this condition follows naturally from Minimalist assumptions on chain interpretation in combination with the principle of compositionality.

The remainder of this article is organized as follows. Section 2 states the condition on semantic reconstruction that I propose and explains how it relates to the interpretation of chains.

[1] Existing theories based on syntactic reconstruction only provide separate and unrelated explanations for each of the data sets in (6)–(10). Of course, one could simply stipulate (11) as a constraint on syntactic reconstruction. The main problem would lie in understanding why this constraint should hold. Perhaps one could argue that the identity requirement reflects a recoverability condition on deletion of an upstairs copy. But it is unclear why this condition should hold only at the LF interface, and why it should not apply to deletion (or conversion) of the downstairs copy. In addition, it is not obvious that a syntactic constraint (11) would extend to (9) (see section 4). I cannot exclude in principle, of course, that a syntactic explanation of (11) could be found; see sections 3–5 for discussion of the syntactic explanations that have been offered for the data in (6)–(10).

Sections 3 and 4 discuss the freezing effects induced by *wh*-islands and remnant movement, respectively. Section 5 addresses the interaction between reconstruction for scope and reconstruction for Condition C.

2 On the Interpretation of Chains

This section states the condition on scope reconstruction that I propose and shows how the copy theory of movement and the semantic approach to reconstruction can provide a rationale for it.

I assume the copy theory of movement, which is the standard in current syntactic theory. Consider how this theory affects the interpretation of movement chains. In pre-Minimalist syntax, a movement trace was a designated lexical item (for NPs: either t or x), coindexed with the moved element (see Chomsky 1973, 1981, Fiengo 1974). For instance, a simple case of A-movement could derive the structure (12).

(12) $[_{IP}$ [some man]$_i$ $[_{I'}$ I(nfl) $[_{VP}$ arrived $[_{NP}$ t]$_i$]]]

This makes chain interpretation fairly simple, at least for the foot of the chain, as one assumes that the trace $[_{NP}$ t]$_i$ is a variable (or translates as a variable). On standard assumptions, this variable is bound by a λ-operator at the landing site, and the resulting λ-expression composes with *some man.* As to the type of the variable, the syntactic approach to reconstruction (along the lines of May 1977) can postulate that a DP-trace always is of type e, and the semantic approach can postulate that syntax provides different traces that function as variables of different types (Rullmann 1995) or can make the type of the trace a function of its index (Cresti 1995).

Under the copy theory of movement, interpreting the links in a movement chain becomes less straightforward. Instead of (12), one obtains (13).

(13) $[_{IP}$ some man $[_{I'}$ I(nfl) $[_{VP}$ arrived some man]]]

The conceptual motivation for the copy theory is laid down in Chomsky's (1995:225) Inclusiveness Condition, which states that syntactic derivations cannot introduce items, such as traces or indices, that were not present in the lexical array from which the derivation proceeds.[2] The absence of designated trace elements certainly produces a more elegant syntax, but it becomes less obvious how to proceed semantically. In particular, when we want to retain the upstairs copy of a moved element at LF and ''strike out'' the downstairs copy, how do we then obtain a variable at the struck-out foot of the chain?

A prominent proposal for the interpretation of struck-out bottom copies is Fox's (2002:67) Trace Conversion rule (see also Rullmann and Beck 1998, Sauerland 1998, Fox 1999, Bhatt and Pancheva 2004). Assuming for expository purposes that it applies in A-chains, Trace Conversion

[2] See Neeleman and Van de Koot 2010 for a treatment of traces as normal lexical items that do not violate a version of Inclusiveness in a Head-Driven Phrase Structure Grammar–like framework, and for other references on the topic.

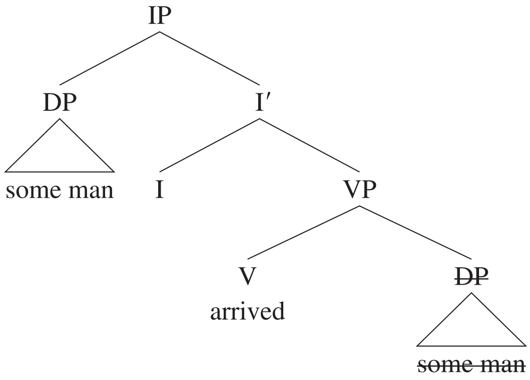
converts (13) into (14) (where the constituent [man $\lambda y(y = x)$] refers to the set of men identical to x (by set intersection)).

(14) $[_{IP}$ some man λx $[_{I'}$ I(nfl) $[_{VP}$ arrived the [man $\lambda y(y = x)$]]]]

Several kinds of evidence have been put forward in favor of such a rule (I will discuss Fox's (1999) evidence in section 5). At the same time, however, it violates the Inclusiveness Condition that motivated the copy theory, since an element with the lexical properties of the definite article needs to be inserted, as shown in (14).

I will assume that struck-out bottom copies are not subject to any kind of trace conversion. A struck-out copy simply *is* a variable (or simply translates as one).[3] Furthermore, since I adopt the semantic approach to reconstruction, it is always the downstairs copy of a movement chain that is struck out, so the downstairs copy is always a variable. Reconstruction is achieved by manipulating the type of this variable; but we will see that the possible types it can choose are determined by the semantics of the content of the trace. Consider again our simple example of A-movement, as schematized in (15).

(15)



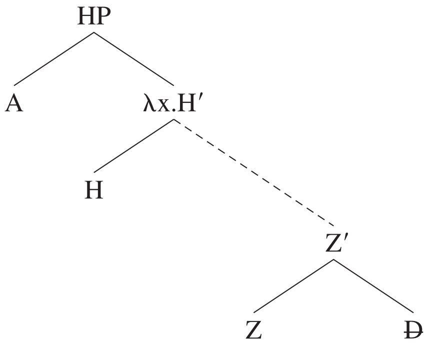
Let semantic composition proceed in a bottom-up manner, starting from the lower instance of *man.* When the DP node dominating *some man* is reached (yielding, say, $\lambda X \exists x[\text{man}'(x) \wedge X(x)]$ as a translation), it is discovered that this DP is a movement trace. (Exactly how it is determined that an item is a trace—that is, the bottom element of a chain—is a technical question inherent in the copy theory that is not particular to my proposal; assume for concreteness that the presence of unchecked uninterpretable features (Case in (15)) indicates that the element is (part of) a trace.) Therefore, what composes with arrived′ is not the regular translation ($\lambda X \exists x[\text{man}'(x) \wedge X(x)]$) computed so far; this is discarded in favor of a simple variable. The variable so obtained is subsequently λ-bound at the landing site I′, and the resulting λ-expression composes with the

[3] See the appendix for details of implementation.

translation of the upstairs copy of *some man.*[4] This process of first calculating and then discarding the regular semantics of a trace copy may appear superfluous, but it is difficult to avoid under the copy theory. A trace copy can contain subconstituents that are themselves not traces, and this at an unlimited depth of embedding; nothing can prevent these from being associated with their regular denotations. Furthermore, I will argue that the regular denotation of a trace copy, even though it is discarded, does contribute to the interpretation process in that, in the general case, it is from the denotational type arrived at for the regular interpretation of a trace copy that we can tell what the type of the variable that replaces it should be. The variable contributed by ~~*some man*~~ in (15) can be of type ⟨et,t⟩, rather than some random other type, because ⟨et,t⟩ is the type of *some man*; I will explain shortly why this must be so. As a result, the interpretation procedure crucially depends on the copy theory.

Now consider an abstract example.

(16)



In (16), D has moved, targeting H′. ~~D~~ is the struck-out bottom copy of the chain, so ~~D~~ is translated as a variable x of some type τ, which is abstracted over at the landing site H′, as indicated (see footnote 4).[5] This λ-expression then composes with A, which in most cases is just the moved element D (but not always, as we will see later—namely, when subsequent operations have caused A to take the place of D as sister of H′). How are we to fix the type τ of the variable x contributed by ~~D~~ (other than by stipulation, as is common in the literature)?

[4] There is a technical question that all approaches discussed here (whether Minimalist or pre-Minimalist, whether relying on syntactic or on semantic reconstruction) need to address: what triggers the λ-abstraction at the landing site of movement, and how is the correct variable to abstract over selected? Since my proposal does not depend on any particular solution to these questions, I will leave the matter open at this point. For concreteness, the reader may assume, for instance, the popular technique adopted in Cresti 1995 and elsewhere (based on Heim 1993, among others) that splits off the index from the moved element and adjoins it separately to the movement target. This index triggers the semantic abstraction rule; the moved element acquires a fresh index when moving further.

(i) $[_{IP}$ [some man] $[_{I'2}$ i $[_{I'1}$ $[_{VP}$ arrived $[_{NP}$ t$]_i]]]]$

See the appendix for an alternative solution that manages without the index and the extra adjunction structure.

[5] For ease of exposition, I am phrasing my explanation here in terms of a translation procedure. However, there are grounds for being especially careful here that the translation step remains omissible. For a demonstration that it does, and for discussion, see the appendix.

One option, of course, is to pick any random type. But in most cases, this would cause the composition to fail, if not at Z′, then at the point where H′ composes with A. This would force the derivational process to backtrack, until a fitting type happened to be chosen for the translation of Đ. I want to abide by the Minimalist tenet (which first became relevant in the context of Chomsky's (1995) rejection of global economy constraints, in favor of local ones, leading for example to the development of crash-proof grammar; see Putnam 2010 and references cited there) that backtracking is undesirable: choices in the derivational process (such as whether to merge or move) are preferably made once and on the basis of local information. We want to make the right choice immediately.

What I want to propose, therefore, is this. Any type may be chosen for the variable contributed by Đ, provided that we can be certain that this choice will not lead to a type clash at the point where the variable is λ-bound, that is, where H′ composes with A. If we cannot be certain that the type we pick will allow composition to proceed at HP, then we must default to the lowest possible type, type e.

The next question is, when can we be certain that the type we pick for Đ will fit at HP? There is one condition under which we can: namely, if A = D. This is because, if A = D, we can pick for the variable contributed by Đ the type of D itself (i.e., the type of the regular, nonvariable interpretation of D—or rather, in case D happens to be type-ambiguous, the type of any possible regular interpretation of D). For if we pick a possible type of D for the variable Đ, then A, being identical to D, will be able to be of this type as well.[6] And if Type(Đ) = Type(A), the composition at HP will always fit.

Conversely, there are two cases in which we cannot be certain, at the point in the derivation where we are deciding the type of Đ, which types will fit. One case is when A≠D. In this case, in order to determine whether the type we pick for Đ will fit at HP, we would need to calculate the type of A separately. But this would violate the principle of compositionality. At the point where we are deciding on the interpretation of Đ, we do have access to the type of D (which we just interpreted, before deciding to discard it and replace it with a variable). But the principle of compositionality does not allow us to make the interpretation of Đ dependent on the interpretation of some distinct A somewhere higher in the structure. Hence, in this case, choosing the type of D for Đ does not guarantee a typefit at HP, so Đ defaults instead to the lowest type, e. The other case in which we cannot safely pick the type of D for Đ is when A is outside the local domain of Đ. Assuming that interpretation proceeds phase by phase (Chomsky 2000, 2001), we cannot ''see A'' at the point where we are interpreting Đ if A is not in the same phase as Đ, but in some higher phase. In this case, we do not know whether the expression resulting from λ-binding Đ will eventually compose with an A identical to D; hence, we must again default to the lowest type.

[6] There is one exception: if A = D, but A is itself a trace forced down to type e by (17) below. For cases I am aware of, regular type shifting will always make backtracking unnecessary. See footnote 22 for a case where (17) may not prevent backtracking or failure of the derivation because of a type mismatch.

In sum, we can pick the type of D for the variable ~~D~~ (resulting in semantic scope reconstruction) just in case A = D and we can determine locally that A = D. This condition is stated as the *Condition on Trace Typing (CTT)* in (17).

(17) *Condition on Trace Typing (CTT)*
If D is a trace, then D is translated as a variable of some type τ. If D is attracted to a phase-accessible target B, and D is identical to the sister of B, then τ can be the type of any nontrace interpretation of D. Alternatively, τ can default to type e.

I have argued that this condition follows naturally from the interaction of standard Minimalist assumptions and the principle of compositionality. A formal implementation of the CTT of course requires a formal implementation of semantic reconstruction; one possible implementation is provided in the appendix. In sections 3–5, I will show how the CTT derives the generalization stated in (11), and how it explains the restrictions on scope reconstruction exemplified in (6)–(10).[7]

To close this section, let us run through a sample derivation that derives narrow scope, intermediate scope, and wide scope for *some man* in (18a). For ease of presentation, I abstract away from intensionality.[8] I also gloss over the mechanism responsible for λ-abstraction over a trace/variable (see footnote 4); where this occurs (followed by Function Application), it is indicated by ''λ + FA.'' The syntactic representation obtained is (18b).

(18) a. Some man seems to be likely to win.
b. [$_{IP1}$ some man [$_{I'1}$ seems [$_{IP2}$ ~~some man~~ [$_{I'2}$ to be likely [$_{IP3}$ ~~some man~~ to win]]]]]

some	$\rightsquigarrow$	$some'_{et,ett}$		
man	$\rightsquigarrow$	man'_{et}		
some man	$\rightsquigarrow$	$some'(man')_{ett}$		
~~some man~~	$\rightsquigarrow$	A	x_e	by the CTT, default
		B	X_{ett}	by the CTT
IP3	$\rightsquigarrow$	A	$win'(x_e)$	
		B	$X_{ett}(win')$	
I′2	$\rightsquigarrow$	A	$likely'(win'(x_e))$	
		B	$likely'(X_{ett}(win'))$	
~~some man~~	$\rightsquigarrow$	C	x_e	by the CTT, default
		D	X_{ett}	by the CTT

[7] I agree with an anonymous reviewer who observes that the reasoning behind the CTT should also allow d (the type of degrees) as a default type next to e, because it is also a ''lowest possible type.'' I will make use of this extension in the brief discussion of degree operators in section 3.2 (see footnote 14).

Other, less obvious modifications of the CTT in (17) may also be considered. If one prefers an alternative, perhaps syntactic account of the data in (25) below, this could be achieved by allowing as the default type for a trace the lowest type compatible with its syntactic category. In addition, for a trace with a local, identical antecedent, one might consider allowing, next to its regular type, a type that is some function thereof. For instance, if a trace is of regular type $\langle\langle\alpha,t\rangle,t\rangle$, one could allow it to translate as a variable of type α. Since these options are not needed for the cases discussed in the present article, I will leave them for future consideration.

[8] Assume, for concreteness, that a GQ-type variable is always intensionalized (type $\langle s,\langle\langle e,t\rangle,t\rangle\rangle$) and that composition can always add $^\wedge$ and $^\vee$ when necessary (see Cresti 1995:fn.16). This seems a technical issue that does not raise any problems, so I will attempt to abstract away from it in my presentation whenever possible.

IP2	⤳ AC	$\lambda x_e.\text{likely}'(\text{win}'(x_e))\ (x_e)$ $\equiv \text{likely}'(\text{win}'(x_e))$	λ + FA
	AD	$X_{ett}\ (\lambda x_e.\text{likely}'(\text{win}'(x_e)))$	λ + FA
	BC	$\lambda X_{ett}.\text{likely}'(X_{ett}(\text{win}'))\ (\lambda PP(x_e))$ $\equiv \text{likely}'(\text{win}'(x_e))$	by type lifting, and λ + FA
	BD	$\lambda X_{ett}.\text{likely}'(X_{ett}(\text{win}'))\ (X_{ett})$ $\equiv \text{likely}'(X_{ett}(\text{win}'))$	λ + FA
I′1	⤳ AC, BC	$\text{seem}'(\text{likely}'(\text{win}'(x_e)))$	
	AD	$\text{seem}'(X_{ett}\ (\lambda x_e.\text{likely}'(\text{win}'(x_e))))$	
	BD	$\text{seem}'(\text{likely}'(X_{ett}(\text{win}')))$	
IP1	⤳ AC, BC	$\text{some}'(\text{man}')(\lambda x_e.\text{seem}'(\text{likely}'(\text{win}'(x_e))))$	λ + FA
	AD	$\lambda X_{ett}.\text{seem}'(X_{ett}(\lambda x_e.\text{likely}'(\text{win}'(x_e))))\ (\text{some}'(\text{man}'))$ $\equiv \text{seem}'(\text{some}'(\text{man}')(\lambda x_e.\text{likely}'(\text{win}'(x_e))))$	λ + FA
	BD	$\lambda X_{ett}.\text{seem}'(\text{likely}'(X_{ett}(\text{win}')))\ (\text{some}'(\text{man}'))$ $\equiv \text{seem}'(\text{likely}'(\text{some}'(\text{man}')(\text{win}')))$	λ + FA

In (18b), (combinations of) uppercase letters identify different (combinations of) choices available in the interpretation procedure. At the first choice point, the trace ~~*some man*~~ can translate as a variable of type e (the default; choice A) or type ⟨et,t⟩ (as this is the type of (nontrace) *some man*, and ~~*some man*~~ is attracted to the phase-accessible target I′2 that composes with ~~*some man*~~; choice B). Choice A will cause *some man* to take scope over *likely*; choice B may result in narrow scope. At the next choice point, ~~*some man*~~ may also take either type, by the same reasoning. If it takes type e (choice C), there is no reconstruction to this point or lower, so *some man* will take the widest scope. For combination BC (the lower trace is of type ⟨et,t⟩), the intermediate trace first undergoes type lifting (see Partee 1986). If ~~*some man*~~ takes type ⟨et,t⟩ (choice D), we achieve either reconstruction to the base position (if the lower trace is also of type ⟨et,t⟩; BD) or intermediate scope between *seem* and *likely* (if the lower trace is of type e; AD). An important point to observe is that no expression contains both x_e and X_{ett} free, so the fact that both translate ~~*some man*~~ does not cause a problem.

This sample derivation simply traces the standard semantic reconstruction analysis of (18a). The next three sections demonstrate the empirical effects of the CTT.

3 Why *Wh*-Islands Block Scope Reconstruction

This section discusses the scope-freezing effect found in island constructions. I repeat (6) and (7).

(6) a. How many people$_i$ do you think t_i I should talk to $\mathbf{t_i}$?
 b. for what n: there are n-many people x such that you think I should talk to x
 c. for what n: you think there should be n-many people that I talk to

(7) a. How many people$_i$ do you wonder whether I should talk to $\mathbf{t_i}$?
 b. for what n: there are n-many people x such that you wonder whether I should talk to x
 c. *for what n: you wonder whether there should be n-many people that I talk to

The observation, due to Longobardi (1987), is that movement across a *wh*-island does not reconstruct for scope.[9] The discussion here can be brief because, for these data, the treatment I propose is a straightforward implementation of the generalization stated by Frampton (1999:54, (28)).

(19) A trace of long movement must be interpreted as an individual variable.

On a semantic reconstruction approach, this generalization blocks the reconstructed reading (7c), as the trace left by the movement step across the *wh*-island (i.e., the boldfaced trace, or the highest intermediate trace inside the *whether*-clause) must be of type e. The question is how (19) can be explained. As Cresti (1995:103) points out, her reformulation in (20) makes it clear that this is a filter that ‘‘needs to be defined on a non-local configuration.’’

(20) $*[\ \ldots\ \lambda P\ \ldots\ [_{\text{CP}}\ wh\ [_{\text{IP}}\ \ldots\ P\ \ldots\ ]]]$ (*P* of the GQ type)

A restatement is needed that can be locally checked. Frampton proposed a reduction of (19) to the Empty Category Principle. Cresti (1995) proposes that (7a) is derived via intermediate adjunction to the CP whose specifier is filled by *whether.* She then states a filter to the effect that traces so adjoined must be treated as type e. This entails that semantic reconstruction cannot be to a point lower than the filled specifier. This achieves the desired local configuration, but, as Cresti admits, her account does not explain *why* CP-adjoined traces must be of type e.

I assume that *wh*-movement derives the syntactic representations for (6) and (7) in (21) and (22), respectively.

(21) [$_{\text{CP}}$ How many people do you [$_{\text{vP}}$ ~~how many people~~ [$_{\text{vP}}$ think [$_{\text{CP}}$ ~~how many people~~ [$_{\text{IP}}$ I should [$_{\text{vP}}$ ~~how many people~~ [$_{\text{vP}}$ talk to ~~how many people~~]]]]]]]?

(22) [$_{\text{CP}}$ How many people do you [$_{\text{vP}}$ ~~how many people~~ [$_{\text{vP}}$ wonder [$_{\text{CP}}$ whether [$_{\text{IP}}$ I should [$_{\text{vP}}$ ~~how many people~~ [$_{\text{vP}}$ talk to ~~how many people~~]]]]]]]?

In (21), *how many people* moves through the edge of every phase (CP, vP), presumably attracted by a P-feature inserted for this purpose (see Chomsky 2001). As a result, each trace has a local antecedent, hence can be of type ⟨et,t⟩ by the CTT. In (22), the embedded Spec,CP is filled, so that the underlined trace cannot assess the type of the constituent that composes with its binder. It therefore defaults to type e, which explains why reconstruction is blocked.[10]

[9] It does reconstruct for Condition C of binding theory, as shown in (i) (Cinque 1990; but see Romero 1998 for a different view).

(i) *It is to Mary$_i$ that I don't know whether she$_i$ wrote.

[10] A technical question arises—namely, how can (22) be derived at all? The literature on *wh*-islands offers no standard solution for this problem, and fully resolving it would well exceed the scope of this article. The problem is most acute if one adopts Chomsky's (2000) Phase Impenetrability Condition (PIC), which appears to be violated when *how many people* is extracted from the *wh*-island without landing in Spec,CP. This leaves two options: weaken the PIC, or circumvent it. It is argued by Fox and Pesetsky (2005), Rackowski and Richards (2005), Boeckx and Grohmann (2007), Bošković (2007), Fortuny (2008), and Rezac (2011), among others, that the PIC should be weakened or abandoned, and its effects derived from other principles (see also Chomsky 2008). We may assume, for example, that complement CPs

Sections 3.1 and 3.2 offer a sample derivation and discuss some points of comparison with competing accounts.

3.1 Sample Derivation of a How Many*–Question*

For a complete sample derivation, we need to decide some technical issues involved in *how many*–questions. We will see that for the most part, the present framework allows Cresti's (1995) analysis to remain intact without additional assumptions being required. In particular, we can adopt the simpler of the two syntactic treatments of *how* entertained by Cresti. In (23a), at LF, *how* is extracted from the top copy of *how many people*, and adjoined to CP. This results in (23b) (let (23a) be a subclause, to avoid I-to-C movement). For the translations, I use the same conventions as for (18), but I now include the necessary intensionality operators (see footnote 8); *Card(x,y)* stands for 'x has cardinality y'.

(23) a. . . . how many people should leave

b. $[_{CP}$ how $[_{C'2}$ $[_{DP3}$ $[_{QP}$ ~~how~~ many] people] $[_{C'1}$ C_{+WH} $[_{IP}$ ~~$[_{DP2}$ how many people]~~ $[_{I'}$ should $[_{VP}$ ~~$[_{DP1}$ how many people]~~ leave]]]]]]

~~how~~ $\rightsquigarrow$ x_e — by the CTT, default

many $\rightsquigarrow$ $\lambda v_e\, \lambda Q_{\langle et\rangle}\, \lambda P_{\langle et\rangle}\, \exists z[Card(z,v) \wedge Q(z) \wedge P(z)]$

people $\rightsquigarrow$ $people'$

~~how~~ many $\rightsquigarrow$ $\lambda Q_{\langle et\rangle}\, \lambda P_{\langle et\rangle}\, \exists z[Card(z,x_e) \wedge Q(z) \wedge P(z)]$

~~how~~ many people $\rightsquigarrow$ $\lambda P_{\langle et\rangle}\, \exists z[Card(z,x_e) \wedge people'(z) \wedge P(z)]$

DP1 $\rightsquigarrow$ A y_e — by the CTT, default
B $Y_{\langle s,ett\rangle}$ — by the CTT

VP $\rightsquigarrow$ A $leave'(y_e)$
B ${}^{\vee}Y_{\langle s,ett\rangle}(leave')$

I′ $\rightsquigarrow$ A $should'({}^{\wedge}\, leave'(y_e))$
B $should'({}^{\wedge}\, {}^{\vee}Y_{\langle s,ett\rangle}(leave'))$

DP2 $\rightsquigarrow$ $Y_{\langle s,ett\rangle}$ — by the CTT

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are not PIC islands and that the *wh*-island effect is an intervention effect (see Rackowski and Richards 2005). The intervention effect might then be overcome for arguments, but not for adjuncts, because of their different feature makeup (Laenzlinger et al. 2012).

It is not impossible, however, to derive (22) while maintaining the PIC. One solution is suggested by Sabel (2002): the embedded C attracts *how many people* to a (second) specifier, but this does generate a violation (English +wh C does not tolerate a specifier containing a trace). Hence, the trace in Spec,CP is *-marked. The trace is subsequently deleted (as in Chomsky 1991, Chomsky and Lasnik 1993), resulting in only a weak (Subjacency-level) violation. Trace deletion precedes assessment by the CTT, because trace deletion is a syntactic operation whereas the CTT, as an interface condition, applies to the output of syntax.

An anonymous reviewer correctly points out that my proposal would be incompatible with a theory that would allow an intermediate trace in Spec,CP in (22). The standard assumption, however, following Chomsky (1973), is that English does not allow multiple Spec,CPs. Abandoning this assumption would make an explanation of the *wh*-island effect more difficult. I am aware of two authors who allow multiple Spec,CPs for English: Bošković (2007) and Stroik (2009). However, Bošković makes an explicit exception for English +wh CPs, as in (22). Stroik allows multiple *wh*-elements to move to a +wh CP, but does not allow them to move on, so the only way his theory would allow extraction from *wh*-islands is if the intermediate landing could be skipped, again leading to the structure (22) that I postulate.

IP $\rightsquigarrow$ A $^{\vee}Y_{\langle s,ett\rangle}(\lambda y_e.\text{should}'(^{\wedge}\text{leave}'(y_e)))$ $\lambda + \text{FA}$

B $\lambda Y_{\langle s,ett\rangle}.\text{should}'(^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\text{leave}'))\ (Y_{\langle s,ett\rangle})$ $\lambda + \text{FA}$

$\equiv \text{should}'(^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\text{leave}'))$

C_{+WH} $\rightsquigarrow$ $\lambda q_{\langle st\rangle}\ \lambda p_{\langle st\rangle}\ [p = q]$

C′1 $\rightsquigarrow$ A $\lambda q_{\langle st\rangle}\ \lambda p_{\langle st\rangle}\ [p = q]\ (^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\lambda y_e.\text{should}'(^{\wedge}\text{leave}'(y_e))))$

$\equiv \lambda p_{\langle st\rangle}\ [p = {}^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\lambda y_e.\text{should}'(^{\wedge}\text{leave}'(y_e)))]$

B $\lambda q_{\langle st\rangle}\ \lambda p_{\langle st\rangle}\ [p = q]\ (^{\wedge}\text{should}'(^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\text{leave}')))$

$\equiv \lambda p_{\langle st\rangle}\ [p = {}^{\wedge}\text{should}'(^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\text{leave}'))]$

DP3 $\rightsquigarrow$ $\lambda P_{\langle et\rangle}\ \exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge P(z)]$

C′2 $\rightsquigarrow$ A $\lambda Y_{\langle s,ett\rangle}\ \lambda p[p = {}^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\lambda y_e.\text{should}'(^{\wedge}\text{leave}'(y_e)))]$
$(^{\wedge}\lambda P_{\langle et\rangle}\ \exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge P(z)])$ $\lambda + \text{FA}$

$\equiv \lambda p[p = {}^{\wedge}\,\exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge \text{should}'(^{\wedge}\text{leave}'(z))]]$

B $\lambda Y_{\langle s,ett\rangle}\ \lambda p[p = {}^{\wedge}\text{should}'(^{\wedge\,\vee}Y_{\langle s,ett\rangle}(\text{leave}'))]\ (^{\wedge}\lambda P_{\langle et\rangle}$
$\exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge P(z)])$ $\lambda + \text{FA}$

$\equiv \lambda p[p = {}^{\wedge}\text{should}'(^{\wedge}\,\exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge \text{leave}'(z)])]$

how $\rightsquigarrow$ $\lambda R_{\langle e,\langle\langle st\rangle,t\rangle\rangle}\ \lambda p_{\langle st\rangle}\ \exists n[\text{num}(n) \wedge R(n)(p)]$

CP $\rightsquigarrow$ A $\lambda R_{\langle e,\langle\langle st\rangle,t\rangle\rangle}\ \lambda p_{\langle st\rangle}\ \exists n[\text{num}(n) \wedge R(n)(p)]\ (\lambda x_e\ \lambda p[p =$
${}^{\wedge}\,\exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge \text{should}'(^{\wedge}\text{leave}'(z))]])$ $\lambda + \text{FA}$

$\equiv \lambda p_{\langle st\rangle}\ \exists n[\text{num}(n) \wedge [p = {}^{\wedge}\,\exists z[\text{Card}(z,n) \wedge \text{people}'(z) \wedge$
$\text{should}'(^{\wedge}\text{leave}'(z))]]]$

B $\lambda R_{\langle e,\langle\langle st\rangle,t\rangle\rangle}\ \lambda p_{\langle st\rangle}\ \exists n[\text{num}(n) \wedge R(n)(p)]\ (\lambda x_e\ \lambda p[p =$
${}^{\wedge}\text{should}'(^{\wedge}\,\exists z[\text{Card}(z,x_e) \wedge \text{people}'(z) \wedge \text{leave}'(z)])])$ $\lambda + \text{FA}$

$\equiv \lambda p_{\langle st\rangle}\ \exists n[\text{num}(n) \wedge [p = {}^{\wedge}\text{should}'(^{\wedge}\,\exists z[\text{Card}(z,n) \wedge$
$\text{people}'(z) \wedge \text{leave}'(z)])]]$

The translations for *how* and C_{+WH} are also from Cresti 1995 (after Karttunen 1977 and Higginbotham 1993, within a Hamblin 1973–style semantics of questions). When *how* is extracted from *how many people* at LF, it leaves a trace that translates as a type e variable x ranging over numbers; x then composes with *many* and *people* to yield the GQ $\lambda P \exists z[\text{Card}(z,x) \wedge \text{people}'(z) \wedge P(z)]$ (‘x-many people’), which semantically reconstructs to take scope at Spec,IP or at Spec,VP. *How* itself existentially binds x. The present proposal permits this analysis, because the CTT allows the type of the variable *~~how~~* to be either $\langle\langle e,\langle\langle s,t\rangle,t\rangle\rangle,\langle\langle s,t\rangle,t\rangle\rangle$ (the type of *how*) or the default. Since the higher type would not fit with *many*, *~~how~~* defaults to type e.

How do we obtain the correct translations for the traces of the moved DP *how many people*? The exact answer partly depends on the syntactic derivation of pied-piping structures and their semantic interpretation, issues that go well beyond the scope of this article (see Heck 2008 for an overview of syntactic treatments, and Sternefeld 2001a for a semantic proposal). For present purposes, the following treatment is sufficient. Consider first DP1 in (23b), the lowest trace. *Many* and *people* start with their regular interpretations. The regular (nontrace) interpretation of *how* would not combine with *many*. However, given that *how* is the element that actually causes the movement, pied-piping the DP, the copy of *how* inside the DP-trace should itself be treated as a trace/variable; it is not fit to be interpreted in this position. This already follows from our assumptions so far: this occurrence of *how* bears the uninterpretable feature that causes movement (or makes it eligible for Attract), so we discard its regular denotation and treat it as a variable. For this variable, the higher type would be available if *how* were locally attracted to a node combining with *how*. There is no need to discuss whether this is the case, because the higher type would not fit with *many*. So, we are left with the default type, type e.[11] This variable then composes with *many* and *people* in the same way as discussed above for DP3 *~~how~~ many people*. As a result, DP1 can achieve the same GQ-type interpretation as DP3, which we then discard because DP1 is a trace. Again, it depends on the theory of pied-piping how the DP-trace is recognized as being a trace—perhaps by the fact that it dominates an uninterpretable feature that cannot percolate to the lexical projection dominating it (Grimshaw 2000). In any case, we face the type choice for variable DP1 as well. Both options are allowed. Since we have derived ⟨et,t⟩ as a possible type for the nontrace interpretation of DP1, which is attracted to the target I′, which composes with an identical DP, the CTT allows both type ⟨et,t⟩ (which will result in narrow scope relative to *should*: option B) and the default e (which gives wide scope: option A). (It is the first option that is blocked for the underlined trace in (22), so that we derive only wide scope for that example.) The same reasoning results in the same options for the variable DP2, but here type e is blocked for independent reasons (DP3 is not interpretable in Spec,CP in Cresti's (1995) setup).

Returning once more to the *wh*-island case (22), where scope reconstruction is disallowed: its derivation follows the same pattern as (23), up to the second instance of *~~how many people~~* (underlined in (22)). The regular interpretation of this DP yields type ⟨et,t⟩ as explained above. However, in (22) this DP is attracted to a target (matrix vP) that is not phase-accessible (because of the intervening CP phase). As a result, the identity of this DP and the constituent composing with the target cannot be locally ascertained at the point where the DP receives its interpretation, so the DP is not allowed to keep the ⟨et,t⟩ type of its regular translation: the CTT directs it to default to a variable of type e. This correctly blocks the scope-reconstructed reading and yields only the wide scope reading (along the lines of the type e reading of DP1 in derivation (23A)).

3.2 Comparison with Other Approaches

In this section, I want to outline briefly which subset of weak island phenomena is covered by my proposal, and how my approach compares with other, mainly semantic approaches to weak islands.

The CTT entails the generalization that also underlies Cresti's (1995) and Frampton's (1999) work discussed above: extraction from a *wh*-island leaves a type e trace. We might call this the *type-theoretical approach* to weak islands.

Conceptually, I feel that my derivation of this generalization is a small improvement over the earlier implementations of the type-theoretical approach, for two reasons. First, it provides a

[11] We might avoid some of these complexities by adopting the semantics in Rullmann 1995, where *how many* is simply translated as a type e variable ranging over numbers, which is bound because of the interpretation rule for *wh*-CPs. Also, although nothing hinges on this here, we could have simplified matters by simply ignoring the CTT in determining the type of *~~how~~* inside trace copies of *~~how many people~~*. These lower instances of *~~how~~* are not movement traces and do not end up λ-bound, so (the logic behind) the CTT arguably does not restrict their types. We may suppose instead, for instance, that they are translated as variables of any type that will fit locally, or of any type compatible with their syntactic category; the decision must depend on a full semantic theory of pied-piping. Note, finally, that a treatment of *how* as binding a degree variable will not require any significant changes (see footnote 7).

local restatement of Frampton's (19), with a rationale that makes it less stipulative than Cresti's filter. More importantly, though, it extends to the scope-freezing effects found in the remnant movement structure (9) and in the countercyclic adjunction structure (10), which I discuss in sections 4 and 5. No such extension seems possible for existing accounts of (7).

Empirically, my proposal shares the success of Frampton's (19) and Cresti's filter in accounting also for the absence of other types of ''higher-order'' readings for elements extracted from *wh*-islands. For example, (24a) does not allow the functional reading for *which book* paraphrased in (24b), where the trace is arguably a function variable, type ⟨e,e⟩.

(24) a. Which book do you wonder whether every man dislikes t?
b. *for which function f mapping men to a book, do you wonder whether every man x dislikes f(x) [possible answers: his oldest, his most expensive, . . .]

See Cresti 1995 for discussion.[12]

Another advantage of the type-theoretical approach relates to the impossibility of extracting adjuncts and predicates from weak islands. Consider (25).

(25) a. *[How tall]$_i$ do you wonder whether John is [~~how tall~~]$_i$?
b. *How$_i$ do you wonder whether John behaved ~~how~~$_i$?

Frampton's and Cresti's constraints require all traces in the offending configuration, not just DP-traces, to be of type e. Likewise, the CTT on its current formulation states that e is the default type for all categories. This predicts, correctly, that adjuncts and predicates cannot be extracted from *wh*-islands at all, because such expressions cannot bind type e variables.[13] Some, like the manner adverb *how* in (25b), must bind a variable of some complex type. Others, like the AP *how tall* in (25a), lack a quantificational meaning; they cannot bind a variable and are therefore interpretable only after reconstruction. But reconstruction could happen only if the trace was of a higher type (the same type as the AP).[14]

[12] For cases that do allow such a reading, Cresti (1995) (following Chierchia 1993) assumes that the *wh*-element leaves a complex trace, consisting of a function variable and an individual variable (to be bound by *every man*). On my account, it would be more natural to have a single trace interpreted as a single variable of the function type. Given the CTT, this requires that the *wh*-DP has a regular, nontrace interpretation of type ⟨e,e⟩. This is not unreasonable, since other DPs can also be shifted to this type: this is the case for both matrix DPs in (27a) below (see references cited there for discussion), for the DPs with *a certain* discussed in Hintikka 1986, and arguably for other DPs (e.g., dependent definites) as well. How this type is arrived at for *wh*-DPs depends of course on their internal structure and the precise treatment of pied-piping; I must leave this issue, as well as the source of the implicit individual variable that serves as the argument of the function variable, for further research.

[13] However, the generalization does not hold uniformly for all adjuncts and all weak islands (see, e.g., Rullmann 1995). Also, I am not convinced that a syntactic explanation might not be better suited for this observation (see footnote 10). If this is the case, we could rephrase the CTT to state that the default type for a trace of category C is the lowest type compatible with C. These options are neutral with regard to the reconstruction facts under discussion in this article.

[14] To illustrate such cases in a bit more detail: when *how tall* undergoes a licit movement, the derivation mirrors that of movement of *how many people* on its scope-reconstructed reading (23B), as shown in (i) (irrelevant details suppressed).

(i) a. [$_{CP}$ how [$_{C'2}$ [$_{AP2}$ ~~how~~ tall] [$_{C'1}$ [$_{C_{+WH}}$ is] [$_{IP}$ John ~~t~~$_{AP1}$ ~~how tall~~]]]]]
b. [$_{CP}$ $\lambda R \lambda p \exists d\, R(d)(p)$ (λd_{how} [$_{C'2}$ ($^\wedge tall'(d_{how})$) λX_{AP1} [$_{C'1}$ $\lambda q \lambda p[p=q]$ ($^\wedge$[$_{IP}$ (John$'$)$^\vee X_{AP1}$])]]])]
$\equiv \lambda p \exists d[p = {}^\wedge tall'(d)(John')]$

On the downside, existing implementations of the type-theoretical approach cover only filled Spec,CP islands and do not extend automatically to other weak islands, such as negative islands. (26) is from Rullmann 1995:198.

(26) a. How many books was John able to read?
 b. How many books was John not able to read?

(26a) allows reconstruction, but (26b) only allows the wide scope reading for *n-many books.* Whether my account can be extended to (26) depends on whether NegP can be argued to delimit a local context in syntax (see Rizzi 1990 and Manzini 1992 for work along these lines; see also Sabel 2002 for some discussion and references).

Rullmann (1995) proposes a semantic account of (26b) in terms of maximality: the narrow scope reading would ask for the—nonexistent—maximum number n such that John was unable to read n books.[15] The proposal also explains the impossibility of extracting modifiers and predicates that involve quantification over degrees (e.g., *how tall*) from negative islands. On the other hand, Rullmann's maximality only applies to negative islands; it does not cover extraction from *wh*-islands (including the lack of reconstruction in (7a)).

Work by Fox and Hackl (2007) and Abrusán (2011), among others, has extended the empirical coverage of the maximality approach. Fox and Hackl demonstrate that the weak island effect with negative islands can be obviated by judiciously placed modal operators. It is unclear how an extension of the type-theoretical approach to negative islands could be made to accommodate these data. Furthermore, Abrusán manages to extend the maximality approach to *wh*-islands, explaining the impossibility of *how many*–reconstruction in (7) and of degree quantification into *wh*-islands as in (25a) (the empirical evidence for modal obviation in these cases is difficult to judge).

I adopt the standard assumption (see Kennedy 1999 for discussion and references) that *tall* is of type $\langle d,\langle e,t\rangle\rangle$: it applies to a degree and returns the set of individuals tall to at least that degree. *How* is of the same type as in *how many people* (see (23)), except that I treat it here as a quantifier over degrees (type d) instead of numbers, translated as $\lambda R \lambda p \exists d\, R(d)(p)$ (setting maximality aside). I also extend the CTT to treat d as a default type, next to e (as explained in footnote 7). Each instance of ~~*how*~~ translates as a variable *d* of type d (its regular, higher type will not fit). So AP2 is translated as $tall'(d)$ of type $\langle e,t\rangle$. The same translation can be calculated for AP1, which therefore ends up as a variable X of the same type; the CTT allows this, because AP1 is attracted to a local target C′1 that composes with AP2, and AP1 = AP2. X is abstracted over at C′1, so AP2 undergoes semantic reconstruction and ends up predicating over *John*, as desired. In the ill-formed case (25a), the lower instance of ~~*how tall*~~ initially undergoes the same interpretation procedure as AP1 in (i), up to the point where the fact that ~~*how tall*~~ is a trace causes the translation $tall'(d)$ of type $\langle e,t\rangle$ to be discarded in favor of a variable. By the CTT, this variable is not allowed to retain the $\langle e,t\rangle$ type of the regular translation, so it defaults to x of type e (or d). This leads to a failed derivation, because x may not compose with *John*, and more importantly because the moved AP does not have a quantificational meaning and cannot bind a variable of type e (λ-binding of x yields a λ-expression of some type $\langle e,\tau\rangle$ that cannot compose with $tall'(d)$ of type $\langle e,t\rangle$).

[15] See Rullmann 1995 for a critical assessment of the scope-based approach to weak islands proposed by Szabolcsi and Zwarts (1993) (which does not extend to *whether*-islands; see Honcoop 1998). See Szabolcsi 2005 for an overview. The data in (29) and (30) below also seem to me to be problematic for Szabolcsi and Zwarts's (1993) proposal, because on both scope readings the variable in the scope of the negative-island-inducing element ranges over (plural) individuals, not amounts.

In spite of these advances, the maximality approach remains limited in scope: it applies only to quantification involving degrees or numbers. Weak island effects that do not involve degrees (extraction of nondegree manner or reason adverbs, as in (25b), and absence of functional readings as in (24)) remain outside its scope.

I want to present some additional evidence that the type-theoretical approach adopted here may be more promising than competing approaches. The argument is based on blocked reconstruction in relative clauses. Relative clauses in general (other than free relatives) do not appear to contain a maximality operator, but reconstruction of relative clause operators is nonetheless blocked by weak islands. Thus, the functional reading present in (27a) (see Jacobson 1994, Sharvit 1999, and references cited there for discussion) is absent in (27b).

(27) a. The woman that I think every Englishman would choose is his mother.
b. ?The woman that I'm wondering whether every Englishman would choose is his mother.

It is not easy to construct reliable instances of scope reconstruction in restrictive relative clauses. With appositive relatives, however, which allow more massive pied-piping, we can construct examples like (28)–(30), which as far as I know have not been discussed before.

(28) You will receive three towelettes, one of which you should use to dry your hands, and two of which you should store in a cool, dry place.

(28) allows scope reconstruction. And while this is perhaps not the most prominent reading, there is a clear contrast between (29a) and (29b).

(29) a. Chomsky's papers, (a different) one of which I plan to assign to every student in my class
b. Chomsky's papers, (a different) one of which I wonder how to assign to every student in my class

The weak island in (29b) blocks the reconstructed, narrow scope reading, and *different* is allowed (on its non-discourse-anaphoric reading) only if we allow *every student in my class* to take scope in the matrix clause (over *wonder*). Absent a maximality operator, the maximality approach cannot explain this.

Consider also (30).

(30) a. three towelettes, one of which I think you should use to dry your hands
b. three towelettes, one of which I don't think you should use to dry your hands

In the absence of a maximality operator, the lack of narrow scope in (30b) shows that some other explanation for the lack of scope reconstruction in negative islands is needed, so that (26) no longer favors the maximality approach.

I tentatively conclude that, while no existing account comes close to explaining all weak island phenomena, the type-theoretical approach is more promising, especially with regard to constraints on reconstruction. The next two sections discuss how the underlying Condition on Trace Typing (17) explains blocked reconstruction in other contexts as well.

4 Why Remnant Movement Blocks Reconstruction

4.1 Barss's Generalization and the CTT

I turn now to Barss's (1986) generalization, exemplified in (8) and (9) (repeated here): A-movement out of a structure that is subsequently fronted does not reconstruct into the fronted constituent.

(8) a. Some politician$_i$ is likely [$_{IP}$ $\mathbf{t_i}$ to address every rally].
b. for some politician x: it is likely that x addresses every rally
c. it is likely that for some politician x: x addresses every rally
d. it is likely that for every rally y: for some politician x: x addresses y

(9) a. [$_{AP}$ How likely [$_{IP}$ $\mathbf{t_i}$ to address every rally]] is some politician$_i$ t$_{AP}$?
b. for which d, for some politician x: it is d-likely that x will address every rally
c. *for which d, it is d-likely that for some politician x: x will address every rally
d. *for which d, it is d-likely that for every rally y: some politician x: x will address y

Whereas (8a) allows both wide scope and narrow scope relative to *likely* for *some politician* (and, optionally, relative to *every rally* as well, following local QR of the latter), (9a) allows only the wide scope reading roughly paraphrased in (9b), as Barss observed. Barss's explanation, based on a QL theory of scope reconstruction, was that QL can only move straight down (into a c-commanded position), not sideward and down.

An explanation more in line with current understanding of movement phenomena has been proposed in Sauerland 1999 and in Sauerland and Elbourne 2002 (q.v. for discussion of Barss's work).[16] A-movement does not reconstruct, but it may optionally take place in the PF component (provided that this creates an additional scope option). The reconstructed reading for (8a) in (8c) is derived as shown in (31).

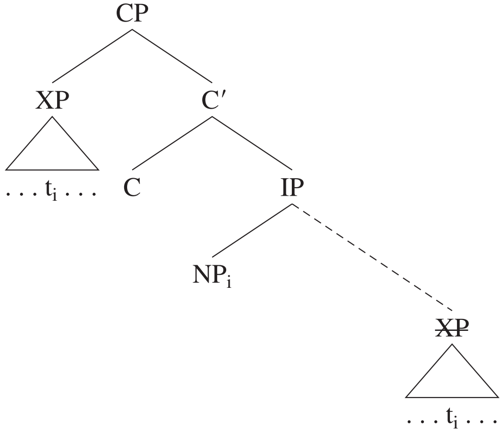
(31) Spell-Out is likely [$_{IP}$ some politician to address every rally]
PF some politician is likely [$_{IP}$ to address every rally]
LF is likely [$_{IP}$ some politician to address every rally]

Some politician does not move in syntax; this yields the first structure at the point of Spell-Out. In the PF component, *some politician* moves, yielding the second structure as the phonological form of the sentence. When LF is reached, *some politician* is still in its base position in the scope of *likely*. Given some further assumptions, this approach to A-movement reconstruction predicts

[16] Another explanation builds on Lasnik and Saito's (1992) assumption that *likely* can be a control predicate. If *how likely* (also *3% likely*; see Lasnik 1999) always selects a control structure, reconstruction will be blocked. The problem lies in blocking a raising variant of *how likely* (in particular, without blocking all remnant movement structures). Also, the explanation does not have an obvious extension to (41) below. For discussion of various options, also addressing Boeckx 2001, see von Fintel and Iatridou 2003 and Neeleman and Van de Koot 2010.

the freezing effect in (9), where A-movement is followed by Ā-movement. To see why, consider (32), an abstract structure showing NP-movement out of an XP that undergoes subsequent remnant movement (XP corresponds to the AP headed by *likely* in (9a)).

(32)



In order to obtain the narrow scope, reconstructed reading of NP, its movement would have to be delayed until the PF component. But the movement of XP must take place before Spell-Out, because it is Ā-movement. Assuming further that no movement may take place out of a trace (downstairs copy), NP would have to move out of the top copy of XP at PF.[17] This would involve illicit sideward movement. Hence, the only possible derivation first moves NP out of XP in its lower position and then remnant-moves XP. But in this case, since XP moves in syntax, NP does as well, so it will be in the moved position at LF.

There are several problems with this analysis. To begin with, since the account of reconstruction applies only to reconstruction from A-movement, it does not explain that Ā-movement also fails to reconstruct after remnant movement, as Sauerland (1999) observes; see (44) below.

More seriously, since the analysis presupposes that any instance of A-movement can take place in the PF component (under the condition that the resulting LF structure is distinguishable (by a scope effect) from the one obtained by syntactic A-movement), any A-moved element should be able to behave (under those conditions) for all syntactic purposes as though it had not moved. This seems to me unlikely to prove correct.

Consider, for instance, (33). Since the derived subject should be able to behave as an object, the *that*-trace effect is unexpected (unless, as may well be the case, the *that*-trace effect is itself a PF phenomenon).[18] Likewise, while the ''pure superiority'' violation in (34b) caused by fronting

[17] As an anonymous reviewer points out, the assumption made here is necessary on any account, since moving the (unpronounced) instance of *some politician* out of the (unpronounced) bottom copy of AP to Spec,IP would not yield the phonological form we observe in (9a).

[18] Note that the theory must allow the combination of A-movement at PF and syntactic Ā-movement of the same element, to explain the narrow scope, reconstructed reading for *How many people are likely to address this meeting?*

a dative object rather than the direct object is not too severe, the violation in (35b), caused by fronting a dative object instead of the subject, is clearly worse. Again, this would be difficult to explain if the subject in (35b) were able to behave as an object.

(33) *How many books did you think that t were sought t?

(34) a. How many gifts did you promise t to how many children?
b. ?How many children did you promise how many gifts to t?

(35) a. How many gifts were t promised t to how many children?
b. ??How many children$_i$ were how many gifts$_j$ promised t_j to t_i?

Sauerland and Elbourne (2002:304, (57)) present the data in (36) as independent evidence for their theory.

(36) a. *?[Which constraint]$_i$ are [good examples of t_i]$_j$ always provided t_j?
b. [Which constraint]$_i$ are [good examples of t_i]$_j$ always sought t_j?

(37) Good examples of this constraint are always provided. $\exists > \forall, \forall > \exists$

They argue that (36b) fails to violate the Subject Condition because the object can delay raising to subject until PF, as this will allow it to remain in the scope of the intensional verb. The PF movement option is supposedly blocked in (36a) because it does not yield a scope effect, as the verb is not intensional. However, since the narrow scope, reconstructed reading of the subject relative to *always* in (37) must be due to PF movement, the presence of the quantificational adverb in (36a) should also be enough to license PF movement of the subject. While I do not have an account of the contrast in (36), it does not appear to support Sauerland and Elbourne's theory of A-movement reconstruction, which is contradicted by (36a).[19] Finally, details of the analysis aside, Sauerland and Elbourne's explanation of (9) does not of course extend to the impossibility of scope reconstruction into *wh*-islands and after late merger discussed in sections 3 and 5.

My account of the data in section 3 does carry over to (8) and (9). The boldfaced trace in (8a), which allows reconstruction, is variable-bound when λ-abstraction applies to the matrix I′, which is in the same phase as the trace, and which composes with the antecedent *some politician*, which is identical to the trace. Hence, it can be locally determined, by inspecting only the interpretation of the trace itself, that the trace can be a GQ-type variable without mismatch. The narrow scope reading is then derived in the manner illustrated in (4c). For the remnant movement case, (9a), which does not allow reconstruction, consider again the abstract structure in (32). On a semantic approach to reconstruction, we must interpret the top copy of XP. The bottom copy only contributes a variable. Whether NP reconstructs or not therefore hinges on the type assigned

[19] An anonymous reviewer wonders whether the problem for Sauerland and Elbourne could be fixed by postulating successive-cyclic A-movement with an obligatory landing in between *always* and the verb. In (36a), the first step could not be delayed until PF (in the absence of a scope effect); one could then postulate that the subsequent steps would therefore also have to take place before Spell-Out, and this would explain the contrast in (36). However, such a theory would be falsified by the *de dicto* reading of such examples as *Someone seems to have been killed*, and indeed by the ambiguity of (37).

to its trace inside the top XP. The correct type follows from the considerations in section 2. The λ-binder of the NP-trace in the top XP (if there is a λ-binder at all) obviously will not compose with an identical copy of NP, since the head of the NP chain does not even c-command the top XP. This trace therefore defaults to type e, and reconstruction is blocked as desired.

Unfortunately, we cannot make this analysis of (9a) more concrete without first dealing with a complication that is somewhat outside the scope of this article. The NP-trace in the fronted copy of XP is unbound. On a syntactic reconstruction approach, we can solve this problem by invoking mandatory reconstruction: we move XP back down at LF, or we delete the upstairs copy of XP and retain the downstairs copy, and the NP-trace becomes properly bound. But on the semantic reconstruction approach, we must interpret the top copy of XP, so we cannot avoid ending up with an unbound NP-trace—that is, an unbound variable. This does not yield a correct interpretation. The phenomenon of remnant movement as such therefore creates a serious problem, not so much for my proposal in particular, as for the entire project of developing a semantic approach to reconstruction.

For a concrete illustration of the problem, consider the simpler case of VP-fronting under the VP-Internal Subject Hypothesis (see especially Huang 1993).

(38) [$_{VP}$ t_i admire Stalin], no one$_i$ did t_{VP}

How is the VP-internal subject trace bound? Examples like (38) show that it must be able to function as a bound variable. The obvious solution is to invoke reconstruction of VP. As noted, obligatory syntactic reconstruction solves the problem. On standard assumptions, however, semantic reconstruction is not able to produce the bound reading. A free variable cannot be made bound by λ-converting it into the scope of a binder: we obtain for (38) the (defective) interpretation in (39a), which is not equivalent to the desired (39b).

(39) a. (admire(x,Stalin)) λp_t[no one (λx.p)]
b. no one (λx.admire(x,Stalin))

I repeat that this problem exists independently of the constraint on scope reconstruction that is the topic of this article. The apparent impossibility of deriving a meaning for (38) without syntactic reconstruction might be taken as evidence against any (exclusively) semantic approach to reconstruction. Sternefeld (2001b; q.v. for further references) proposes a solution in which traces are interpreted as variables over functions from assignment functions to normal denotations. It appears that this system might support a solution for scope freezing in (9a) as well, although not in the way Sternefeld develops it. I will adopt an alternative solution that fits better with the treatment of chains I am assuming.

If unbound traces lead to uninterpretability, then something must render the trace of NP in the top XP in (32) bound—or rather, the highest of its traces in this XP, as there may be more than one. This can happen without yielding the wrong semantics only if something causes λ-abstraction over this trace. To reconcile semantic reconstruction with remnant movement, then, I assume that the highest unbound NP-trace in XP undergoes λ-abstraction. Regardless of how this is achieved, assuming that this is the general shape of the solution is enough to derive Barss's

(1986) generalization (i.e., the lack of reconstruction in (9)), as explained above. The λ-binder of the highest trace, wherever it is located, will not be sister to an NP identical to the trace. Hence, the trace defaults to type e and reconstruction is blocked by the considerations that went into motivating the CTT in section 2. Exactly how the CTT applies can only be demonstrated given some concrete implementation of remnant movement. For the sake of completeness, I will present two possible implementations in the next section.

4.2 Toward an Implementation of Remnant Movement

Because my explanation for the fact that remnant movement blocks reconstruction does not crucially depend on any particular mechanism for achieving the λ-abstraction that is required to implement remnant movement, proposing such a mechanism lies somewhat outside the scope of this article. Nonetheless, I will briefly discuss two possible mechanisms, as this will facilitate a sample derivation of a Barss case, exemplifying how the CTT applies.

The first possibility is to start from these assumptions: that any fronted predicate functions as a phase (see Chomsky 2004, 2008, and especially Legate 1998 on VP-fronting as a diagnostic for phases, demonstrating phonological independence), and that an XP extracted from such a phase may first move into its edge (in terms of the distinction proposed in Chomsky 2001, 2004, this comes down to the proposal that fronting a phase makes it a strong phase, with the escape hatch property). We can now propose the derivation (40a) for (38).

(40) a. [$_{vP}$ ~~*no one*~~ admire Stalin] [$_{C'}$ **no one** [$_{I'}$ did [$_{vP}$ ~~no one~~ [$_{vP}$ ~~no one admire Stalin~~]]]]
b. λx_e[x admire Stalin] $\lambda X_{\langle e,t\rangle}$[$_{C'}$ no one λx[$_{I'}$ [$_{vP}$ $\underline{\underline{x}}$ X]]]
c. (λx_e[admire(x,Stalin)]) $\lambda X_{\langle e,t\rangle}$[$_{C'}$ no one (λx[$_{vP}$ X($\underline{\underline{x}}$)])]

No one first attaches to the vP phase and then moves to Spec,IP. Subsequently, the lower segment of vP moves to Spec,CP, leaving a copy that contains the underlined trace of *no one*, while stranding the doubly underlined trace of *no one.* The vP that is fronted no longer contains a free variable. Because it is a movement target, it undergoes λ-abstraction over the trace ~~*no one*~~ and becomes a predicate.[20] This predicate can undergo semantic reconstruction and then apply to the variable that is the doubly underlined trace of *no one.* (40b) schematically indicates how different traces function; (40c) clarifies the function-argument relations. The result is equivalent to (39b) by λ-conversion.

With this method for interpreting remnant movement structures in place, we can finally see how the CTT blocks reconstruction after remnant movement, as in (9a). Consider the simpler case (41) from Huang 1993:125.

(41) [$_{vP}$ t_i see everyone], (I am sure) someone$_i$ did $\exists > \forall$, $*\forall > \exists$

[20] As before, it does not matter how λ-abstraction after movement is implemented. One option (see footnote 4) is that the index of the moved element adjoins below it to vP; the vP dominating the index is fronted, and the index triggers the abstraction. The index-free alternative in the appendix yields the same result.

Everyone in (41) cannot take scope over *someone*, showing that remnant movement of vP blocks reconstruction of *someone*.[21] The full structure is given in (42a).

(42) a. [$_{vP}$ ~~*someone*~~ see everyone] [$_{C'}$ **someone** did [$_{vP}$ ~~someone~~ [$_{vP}$ ~~someone see everyone~~]]]
b. [$_{CP}$ λx_e[$_{vP}$ x_e see everyone] $\lambda X_{\langle e,t\rangle}$[$_{C'}$ someone λx_e[$_{I'}$ did [$_{vP}$ $\underline{\underline{x}}$ X]]]]

The boldfaced *someone* in (42a) cannot reconstruct. The λ-binder of the italicized trace (at the top of the fronted vP) does not compose with the ''antecedent'' of the italicized trace (the doubly underlined trace); rather, it composes with the C′. Hence, the CTT causes the italicized trace to default to type e; the result is (42b). The rationale is that one would need to inspect the semantics of the C′ to determine that, indirectly, the types would match for any possible type of *someone*. The considerations of compositionality built into the CTT prevent this.[22]

It may be useful to consider an alternative to the method I have described for salvaging remnant movement structures. While this method does not require any new semantic assumptions, the syntactic assumptions are not unproblematic. First of all, it is unclear why the subject must move to Spec,vP (and how it can), given that it is already in the edge of the vP phase. One possible answer is that this movement step is needed precisely because the vP will otherwise contain a free variable after it is fronted. Another option is that what is fronted in VP-fronting is a constituent slightly bigger than vP (see Huang 1993); this constituent functions as a phase when it fronts, so that the subject can move through its edge. In the latter case, the movement might also be explained by the PIC (but see footnote 10). Another potential problem is that the analysis requires fronting of a segment of vP. Again, we may speculate that segment movement is allowed here, perhaps exceptionally, because fronting the complete category will front a free variable.[23]

As an alternative, we can attempt to sidestep these problems and implement essentially the same solution by manipulating the semantics. Assume that the conceptual-intentional (C-I) interface seeks to avoid fronted categories containing unbound variables. Therefore, any fronted constituent containing traces in its edge will undergo ''λ-closure'': all free traces in the edge are abstracted over in some fixed order (say, by order of merger). The terminal trace of the fronted constituent is raised in type accordingly and then fed the same variables as arguments. Consider again (38) as an example.

[21] If the subject were to reconstruct, nothing would seem to prevent the object from taking scope over it by adjoining to VP; in fact, it is now widely assumed, starting from Hornstein 1995 and Kitahara 1996, that object/subject scope inversion always results from the object adjoining to VP by QR, in conjunction with reconstruction of the subject.

[22] The underlined trace in (42a) may start out as type e, but also as type ⟨et,t⟩, because it has a local antecedent (the doubly underlined trace). This means that the vP-trace starts out as ambiguous between type ⟨e,t⟩ and type ⟨⟨et,t⟩,t⟩ (those are the types of its ''nontrace interpretations,'' so the CTT allows both of those types for the vP-trace as a variable). But the upstairs copy of the vP can only be of type ⟨e,t⟩ (because the italicized trace cannot be of type ⟨et,t⟩). This leaves only ⟨e,t⟩ as an option for the vP-trace, as the higher type will lead to a mismatch.

[23] An anonymous reviewer points out that these considerations imply a weakening of the autonomy of syntax. This is correct, but it holds equally for the syntactic reconstruction approach, if this approach is to deal with remnant movement. Syntactic reconstruction, generally optional, must be made obligatory in order to render remnant movement structures interpretable.

(43) a. $[_{vP}$ ~~no one~~ admire Stalin$]$ $[_{C'}$ no one $[_{I'}$ did ~~$[_{vP}$ no one admire Stalin$]$~~$]]$
b. $\lambda x[_{vP}$ x admire Stalin$]$ $\lambda X_{\langle e,t\rangle}[_{C'}$ no one λx $[_{I'}$ X(x)$]]$

The complete vP is fronted, including any traces in its edge, and undergoes λ-closure. Since the subject starts in the edge of vP, it does not need to adjoin again for its trace to be λ-bound. The trace of vP functions as a variable of the type of vP after λ-closure. Unless it is an intermediate trace, this variable is then applied to the variables in the edge of the vP.[24] One advantage of such a semantic solution would be that, unlike the syntactic solution, it would work correctly for the movement of remnants from which more than one element has been extracted. This is not just a hypothetical case; consider (44), a variation on Sauerland's (1999) example (25).

(44) a. David gave t_i to each of the students [a paper that I had written]$_i$. $\exists > \forall$, $\forall > \exists$
b. . . . and [t_k give t_i to each of the students]$_j$ David$_k$ did t_j [a paper that I had written]$_i$. $\exists > \forall$, $*\forall > \exists$

My account of the lack of reconstruction in remnant movement structures differs empirically from Sauerland's in that it predicts that Ā-movement followed by remnant movement also does not reconstruct. (44) shows that this is correct. But the fronted vP contains two traces, so the syntactic solution to the problem of the semantic reconstruction of remnants only works if λ-abstraction does not apply after each adjunction to XP, but instead applies in one position below all adjunction positions in XP; otherwise, at most one trace in the fronted remnant will be λ-bound. I expect, however, that this problem can be solved by later movement tucking in (in the sense of Mulders 1997, Richards 1997) between a prior moved element and its target. As an anonymous reviewer points out, Beck and Sauerland (2000) and Nissenbaum (2000a) provide arguments that movement can indeed create n-ary predicates in this manner. Since the problem raised by the semantic reconstruction of remnants is not the topic of this article, I will leave an exploration of these options for future research.

5 Why Late Merger Blocks Scope Reconstruction

The interaction between scope reconstruction and reconstruction for binding theory and the relative merits of syntactic and semantic reconstruction vis-à-vis this interaction constitute a major area of research, which largely falls outside the scope of this article (see, e.g., Munn 1994, Heycock 1995, Romero 1998, and references below). There is, however, a direct interaction between Condition C and the constraint on semantic reconstruction proposed above (the CTT), which I address in this section. I start by discussing the facts as they are presented in Fox 1999. Fox argues that the data support an argument for the syntactic approach to reconstruction, and against the semantic approach. I will outline the argument and show that the CTT makes the data compatible with semantic reconstruction, without a major change in Fox's analysis.

[24] If we assume, as above, that a topicalized XP functions as a phase, the CTT in (17) can remain unchanged. Otherwise, introducing λ-closure as an additional trigger for λ-abstraction will require a corresponding restatement of the CTT for it to express the same underlying rationale: the trace defaults to type e, because its λ-binder (whatever its trigger) is not sister to the antecedent of the trace.

Consider first (45a–b) (from Fox 1999:167, (20a); 168, (20c)).

(45) a. #[How many houses in John's$_i$ city]$_j$ does he$_i$ think you should build t$_j$?
b. [How many houses in John's$_i$ city]$_j$ does he$_i$ think you should demolish t$_j$?

When an R-expression is contained in an adjunct to a fronted *wh*-phrase, reconstruction for Condition C is not obligatory. Rather, it correlates with scope reconstruction: the wide scope reading bleeds Condition C, the narrow scope reading feeds it (see especially Heycock 1995). (45b) does not violate Condition C, since it can have a wide scope reading; in (45a), the embedded verb forces a narrow scope reading, which renders the structure unacceptable.

If we consider only these data, the correlation between reconstruction for binding and reconstruction for scope appears to support a simple argument against semantic reconstruction. Scope reconstruction feeds Condition C; Condition C is a syntactic condition; therefore, scope reconstruction must be syntactic as well (Fox 1999:163). The correlation does not seem to follow on a semantic approach to reconstruction: if the *wh*-phrase in (45a) is located only in Spec,CP, and obtains ''narrow scope'' only because of the type of the variable it binds, whether it takes narrow scope should not be visible to a syntactic Condition C. This version of the argument has been countered by Sternefeld (2001b), who solves the problem by moving Condition C into semantics. Following Reinhart (1983), he assumes that Condition C is violated if the R-expression can be replaced, *salva veritate*, with a bound variable pronoun. Given that pronouns can be bound under semantic reconstruction, this correctly predicts that semantic reconstruction in (45a) feeds Condition C.

I will not adopt Sternefeld's solution here, as it explains only half the pattern.[25] It predicts the correlation between reconstruction for scope and Condition C found with adjuncts; it does not explain why (46a), where the R-expression is in an argument inside the fronted NP, violates Condition C even on a wide scope reading.

(46) a. *[How many fans of Madonna$_i$]$_j$ did she$_i$ want to kick t$_j$ out of the theater?
b. [how many fans of Madonna$_i$] did she$_i$ want to kick [how many fans of Madonna$_i$] out of the theater
c. for what n: she$_i$ wanted to kick [n-many fans of Madonna$_i$ x] out of the theater
d. for what n: for n-many fans of Madonna$_i$ x, she$_i$ wanted to kick [the fans of Madonna$_i$ y that are identical to x] out of the theater

In (46), we see no correlation between scope reconstruction and binding theory reconstruction. Even though we know that *n-many fans of Madonna* can take wide scope relative to *want*, this option apparently does not bleed Condition C.[26] In fact (as mentioned in footnote 9), reconstruction for

[25] The same holds of the related proposal in Neeleman and Van de Koot 2010.

[26] Actually, the treatment of *how many*–phrases from Cresti 1995 employed so far might explain (46a), more or less by accident, since it entails that a *how many*–NP is not interpretable in Spec,CP. Now suppose that adjunction to IP is blocked; then the fronted phrase must reconstruct to a position c-commanded by the pronoun. But this explanation would fail for (45). I will assume that *how many*–phrases are interpretable in Spec,CP; see Rullmann 1995 for a possible implementation.

Condition C happens even in case scope reconstruction is blocked—for example, by a *wh*-island. On Sternefeld's theory, these data are unexpected. On the wide scope reading, the R-expression cannot be replaced *salva veritate* with a bound variable pronoun, so Condition C should not be violated.

Fox's (1999) analysis runs as follows. Under the copy theory, (46a) has the structure (46b), where *she* c-commands the lower copy of *Madonna.* The narrow scope reading is obtained by deleting the upstairs copy of the *wh*-NP, with the exception of *how*, and replacing the downstairs copy of *how* with a variable; the mechanics of these operations are not spelled out exactly. The resulting structure, (46c), violates Condition C. But the wide scope reading is not obtained by simply replacing the downstairs copy of the NP with a variable. Instead, the downstairs copy undergoes Trace Conversion (see section 2), yielding (46d), where *she* still c-commands *Madonna.* For the same reason, QR and LF *wh*-raising do not bleed Condition C. This analysis of (46a) supports the copy theory of movement and provides the motivation for Fox's Trace Conversion rule.

As for the adjunct case, (45), Fox's analysis follows Chomsky 1993, based on Lebeaux 1988. The adjunct PP can be adjoined countercyclically, after *wh*-movement. If this late merger happens, the downstairs copy of the moved NP does not contain the offending R-expression, so Condition C is not violated. If the adjunct is merged early, the downstairs copy of the NP does contain the R-expression, so Condition C *is* violated. In fact, then, there is no direct connection between binding theory reconstruction and scope reconstruction. There is only a direct connection between binding theory reconstruction and point of merger: early merger feeds Condition C and late merger bleeds it, regardless of scope.

So what causes the correlation between scope and binding observed in (45)? Consider (47) and (48).

(47) a. [how many houses in John's$_i$ city] [does he$_i$ think you should demolish [how many houses in John's$_i$ city]]

b. *for what n: ~~n-many houses in John's city~~ does he$_i$ think you should demolish [n-many houses in John's$_i$ city]

c. *for what n: for n-many houses in John's$_i$ city x, does he$_i$ think you should demolish [the houses in John's$_i$ city y that are identical to x]

(48) a. [how many houses in John's$_i$ city] does he$_i$ think you should demolish [how many houses]

b. *for what n: ~~n-many houses~~ in John's$_i$ city, does he$_i$ think you should demolish [n-many houses]

c. for what n: for n-many houses in John's$_i$ city x, does he$_i$ think you should demolish [the houses y that are identical to x]

Either the adjunct PP is merged early, as in (47), or it is merged late, as in (48). The former creates the possibility of scope reconstruction (see (47b)), but causes a Condition C violation either way; the latter avoids violating Condition C, but blocks the narrow scope reading.[27] The reconstructed structure (48b) is not possible because of one additional factor: late merger blocks scope reconstruction.

Why does late merger block scope reconstruction? This brings us to the real argument favoring syntactic over semantic scope reconstruction (Fox 1999:188–189). On the syntactic approach to scope reconstruction (at least, the one based on the copy theory), the reason is obvious. Late merger of the PP, followed by deletion of the upstairs copy of the NP, leaves the PP modifier dangling, as (48b) shows. On a semantic theory of scope reconstruction, it is far from obvious why late merger should block scope reconstruction. Suppose, for the sake of simplicity, that in (49a), the adjunct PP undergoes late merger following A-movement of *some man*.

(49) a. [Some man [$_{PP}$ with a hat]]$_i$ is likely t_i to arrive.
b. [some man [$_{PP}$ with a hat]] λX_i [$_{I'}$ is likely X_i to arrive]

In a standard semantic reconstruction theory, the trace t_i can be interpreted as a GQ-type variable. Abstraction takes place over this variable, as shown in (49b); the type of I′ comes out as ⟨ett,t⟩. Now, no matter whether the PP has merged into the NP late or early, the NP as a whole is interpretable as an ⟨et,t⟩ GQ, to which the I′ λ-term can apply. The seemingly unavoidable result is the narrow scope reading, so semantic reconstruction fails to explain the observed pattern.

However, once we add the independently motivated CTT to the semantic reconstruction theory, we do explain why late merger blocks scope reconstruction. Consider the structure of (49a) under the copy theory, given in (50). The trace/variable ~~some man~~ defaults to type e because

[27] The pattern we have been concerned with is challenged by data like (ia–b), cited by von Fintel and Heim (2011) and Lechner (2013) from work by Sharvit (1998). ((i) from Sharvit 1998 is cited in von Fintel and Heim 2011:114–115, (217); Lechner (2013:175) cites a similar example of Sharvit's.)

(i) a. How many students who like John$_i$ does he$_i$ think every professor talked to?
b. For which n does John think that every professor talked to n people in the set of students who actually like John?

In this case, the descriptive content of the *how many*–DP is supposedly interpreted *de re*, and only *de re*, but the quantificational force of the DP can take narrow scope (relative to *every professor*). If true, this constitutes a problem for both my proposal and Fox's (1999). For a Condition C violation to be avoided, the relative clause must be merged late, blocking reconstruction of any part of the DP. Von Fintel and Heim entertain the possibility that the bottom copy of the *how many*–DP is interpreted, but its NP part undergoes QR; this yields the *de re* reading and avoids a Condition C violation. However, this option should also serve to obviate the Condition C violation in cases like (46a), contrary to fact. Lechner proposes a hybrid system with both semantic and syntactic reconstruction (which is incompatible with my proposal, since the CTT will block undesirable instances of semantic reconstruction but has no effect on syntactic reconstruction). While *de dicto* readings (as in (1c)) result from syntactic reconstruction, Lechner's extensional semantic reconstruction reconstructs the quantificational force but has no effect on the world of evaluation or on Condition C. This derives (ib). However, this proposal runs afoul of the correlation between scope and Condition C observed by Fox (1999) and Heycock (1995). Next to (45), where a *de re* reading is forced, Fox (1999:169) also reports that cases like (ii) (his (28a)) do not violate Condition C, but also do not allow reconstruction of the quantificational force of the *how many*–DP.

(ii) [How many slides of Jonathan's$_i$ trip to Kamchatka] did he$_i$ decide to show t at the party?

I suspect that reports like those of von Fintel and Heim, Lechner, and Fox regarding examples like (ia) and (ii) reflect a disagreement on intuitions, which I must leave for future research to decide. Thanks to an anonymous reviewer for bringing these issues to my attention.

its λ-binder does not compose with a constituent identical to the trace; reconstruction is blocked for essentially the same reason it is blocked in remnant movement cases such as (42a).[28]

(50) [some man [$_{PP}$ with a hat]] is likely ~~some man~~ to arrive

The CTT therefore removes Fox's (1999) argument against semantic reconstruction. This is on the assumption, of course, that the other elements of his account of the binding-theoretic data in (45) and (46) can also be made compatible with the semantic approach to reconstruction. In particular, we need to explain why early merger (optional for adjuncts, obligatory for arguments) always causes a Condition C violation, regardless of scope. Fortunately, this generalization is known to be amenable to various implementations, and there is no reason to suppose that it poses a special challenge to the semantic reconstruction approach. It is true that the particular option chosen by Fox (early merger creates a chain with a bottom copy containing the offending R-expression, which is semantically interpreted after Trace Conversion, hence visible to Condition C) is not open to the semantic reconstruction approach: on this approach, the bottom copy contributes only a variable. But there are various other options. Given the copy theory, any purely syntactic Condition C explains the pattern automatically, since in our LF structures the downstairs copy remains in place. Alternatively, we can postulate that a pronoun must not c-command a coindexed R-expression at any stage of the derivation (see Lebeaux 1988); see Sportiche 2006 for an excellent overview of the issues involved. An additional option, which I feel is promising, is to adapt the pragmatic theory of Condition C proposed in Schlenker 2005 along the following lines. Assume that, during computation, a store is kept of referents of R-expressions. Condition C prevents a pronoun (or another expression) from composing with an expression whose store already contains the referent of the pronoun. Assume finally that the store of every expression E is passed up to dominating nodes, regardless of whether E contributes its regular semantic value or functions as a variable. This will derive the data in this section. I will leave an exploration of these options for further research.

Returning to semantic reconstruction, there are several other instances in the literature where countercyclic merger has been shown to block scope reconstruction of the XP merged into, as the CTT predicts (e.g., Fox and Nissenbaum 1999, Bhatt and Pancheva 2004, Takahashi and Hulsey 2009). Consider just one example (from Fox and Nissenbaum 1999:141):

(51) I looked for [$_{A}$ a picture] very intensely [$_{B}$ a picture] [$_{PP}$ by this artist].
$\exists >$ look for, *look for $> \exists$

[28] It is true that the NP after late merger is of the same type as the NP before late merger; if the default type e is chosen to avoid a possible type mismatch, the grammar is being overcautious. The point is, however, that this type identity can only be ascertained by calculating the interpretation of the NP after the late merger operation, which I have assumed cannot take place at the point where the NP's trace is interpreted. Even if late merger never changed the type of the target, this would remain a fact that is known to the linguist, not necessarily to the interpretation rule that fixes the type of the trace; in any event, the cases of late merger discussed by Bhatt and Pancheva (2004) and Takahashi and Hulsey (2009) do change the type of the target.

Fox and Nissenbaum derive PP-extraposition in (51) via pre-Spell-Out QR of *a picture*, creating the chain (B, A), followed by late merger of the PP into B. A is realized at PF, but only B can be interpreted at LF: the countercyclic merger operation blocks the reconstructed reading. A syntactic theory of scope reconstruction along the lines of (3b) easily explains why: deleting B would leave the PP modifier dangling. On a semantic theory of scope reconstruction, the effect is initially unexpected, but it is explained by the CTT: the λ-binder of the variable A composes with a nonidentical DP, so the variable defaults to type e.

I conclude that we have found independent support for the CTT as a component of the semantic theory of scope reconstruction. It correctly predicts that late merger blocks scope reconstruction, a constraint that plays a crucial role in explaining the binding facts discussed by Fox (1999) and others, and other data as well.

6 Conclusions

I have argued that three constraints on scope reconstruction (reconstruction is blocked into *wh*-islands, after remnant movement, and after countercyclic merger), which thus far had not received a satisfactory or unified explanation, follow naturally from one underlying condition on reconstruction: the Condition on Trace Typing. Since the CTT relies crucially on the semantic approach to scope reconstruction (Cresti 1995, Rullmann 1995), the account, if judged successful, constitutes an argument in favor of this approach, as opposed to a syntactic approach such as QL or deletion of the upstairs copy in a movement chain. Like current syntactic approaches, however, the CTT relies on the copy theory of movement.

Further evidence for the CTT may come from other cases of blocked scope reconstruction. For instance, there is no reconstruction for scope in *tough*-constructions (see Lasnik and Fiengo 1974 for relevant observations) or into parasitic gaps.

(52) a. How many bananas were a pleasure to eat?
     b. How many compliments were you hoping for without really expecting to get?

In both cases, movement of an (empty) operator arguably creates a λ-term that does not compose with the moved operator; hence, the CTT blocks reconstruction.

As noted, most works comparing semantic and syntactic theories of scope reconstruction focus on the interaction between scope reconstruction and reconstruction for binding theory. Although this was not my primary concern here, the outcome of that debate will of course bear on the tenability of my proposal. I have commented on possible treatments of Condition C in section 5, but the larger project of constructing a full theory of semantic reconstruction will also need to address the interaction of scope reconstruction and Condition A, where the evidence is difficult to evaluate (see Fox and Nissenbaum 2004 and references cited there). Also, I have not touched on binding theory reconstruction in A-chains; I expect that the proposal in Takahashi and Hulsey 2009 may be adapted to fit my assumptions.

Reconstruction apart, my assumptions on chain interpretation, while fairly conservative, have ramifications that go beyond what I have discussed here. To mention one example: Kennedy's puzzle (Kennedy 1994) poses a major challenge for these assumptions. On the one hand, the multitude of λ-terms created in a movement chain is incompatible with Heim's (1997) solution. On the other hand, the assumption that traces are semantically no more than variables is incompatible with Sauerland's (1998) treatment. I suspect that Sauerland's results might be duplicated by assuming only that the relative clause operator itself contains an (interpreted) copy of the head NP; further research must show whether a solution along these lines is feasible.

Appendix: Toward a Minimalist Formalization

I want to offer some thoughts on how an implementation of semantic reconstruction, in which my proposal can be embedded, might be reconciled with Minimalist considerations. In doing so, I will address certain technical questions that I have set aside so far because they can be resolved in various ways without affecting the core of the proposal. In particular, I have left open how the variable at the foot of a chain is λ-bound at the head (see footnote 4). To arrive at a formal implementation, explicit assumptions must be stated on how this is achieved, even if the choice of assumptions is not essential. I will start with an informal outline.

Rather than adopting the techniques of footnote 4, I will assume in line with the Inclusiveness Condition that traces bear no index. The problem of choosing identical variables at different positions in the chain should be solved by the solution proposed by Chomsky (1995, 2000, 2001) for determining which elements belong to the same chain: items belong to the same chain by virtue of the fact that they are occurrences of the same item (see Neeleman and Van de Koot 2010 for critical discussion). λ-abstraction therefore cannot be triggered by adjoining the index of the moved element to the target; I propose to move the necessary complications into the composition rule for movement-derived structures, as in (53) (see Nissenbaum 2000a for empirical evidence in favor of this approach). Note that I have stated (53) not as a translation rule but as a composition rule that applies directly to LF representations, so as to make sure that representationalism can be avoided. Struck-out copies therefore are not translated as variables; they *are* variables. Technically, this means that assignment functions are not functions from designated variables to objects; rather, they are functions from syntactic constituents to objects in the relevant domain. (53) states informally (glossing over the types) that the semantics of λ-abstraction applies to movement targets.

(53) Given a structure $[_{HP}$ A B], where B has been the target of internal merger owing to a relation of Attract between the label of B and a constituent D, $[\![HP]\!]^{g}$ is obtained by composing $[\![A]\!]^{g}$ with that function h such that for every d, h(d) = $[\![B]\!]^{g[D/d]}$.

This tells us to interpret, say, the IP in (15) with respect to assignment g by composing $[\![\text{some man}]\!]^{g}$ with the function h such that for every d, h(d) = $[\![[_{I'}$ arrived ~~some man~~$]]\!]^{g[[\text{some man}]/d]}$.

I repeat that these assumptions are not crucial for my explanation of constraints on scope reconstruction. Readers who so prefer may assume instead, for instance, that a struck-out copy is affixed with a hidden morpheme that functions to replace it with an indexed variable, which is then bound in the manner of footnote 4. This would provide a less elegant fit with my other assumptions, but it would not be incompatible with the CTT.[29]

Implementing a theory of semantic reconstruction in the context of the Minimalist Program is not entirely routine, because we need to derive multiple readings for sentences that are ambiguous owing to the option of semantic reconstruction, but in the absence of a lexical or structural ambiguity. As noted, Cresti (1995) solves the problem by creating a syntactic ambiguity: movements can leave different traces with different indices, which can be translated as variables of different types. Rullmann (1995) also uses indexed traces, syntactically distinguished as t and T for different types. In a copy theory, the same effect could be achieved by enriching a trace copy with a diacritic that marks its type; this would also, technically, remove the remaining tension between the compositionality principle and the CTT.[30] But these are clearly coding tricks; there is no independent evidence that a moved DP can leave traces with different properties and indices.

Hence, I propose that the necessary complication is properly located in the interpretation rule for traces. Rullmann (1995:177) takes the same view, when he suggests that the syntactic type distinction can be omitted and the optionality built into the translation rule for traces instead. The problem is that if the translation step is to remain omissible, this presupposes a semantic treatment of traces as untyped variables. One possible implementation is that an assignment function applies to a pair of a variable and a type, and the semantic value of a DP-trace x can be g(e,x) or g(⟨et,t⟩,x). Alternatively, we can allow the type of the variable to vary with the assignment function; this is the method I would opt for. This choice facilitates a solution for a problem discussed in Rullmann 1995:178n9 and left unresolved there (and glossed over in (53) above): how to ensure that λ-abstraction not only targets the correct variable, but also knows what type it has. Since Rullmann allows NP_i to leave either t_i or T_i when it moves, we cannot tell, at the point where we λ-bind the variable, whether to abstract over t_i or over T_i; the index on NP_i does not encode for this (as it does in Cresti's (1995) setup).[31] The solution I want to suggest is to allow the abstraction rule to pick a type, and to let the λ-term be defined only for assignment functions that treat the variable as being of that type. Undesired type choices are filtered out because they render the interpretation of the variable undefined; ambiguity arises when a variable yields a defined result for more than one type.

To summarize, the semantics has to deal with the following issues. A single syntactic representation must be associated with a set of possible meanings. Next, every constituent must be

[29] One immediate advantage of (53) is that it allows a more elegant implementation of the proposals in Nissenbaum 2000b.

[30] But this can be achieved by a simpler technical device: letting a feature on a trace copy indicate whether it meets the requirements of the CTT. I would not opt for this, because compositionality is not relaxed more by the CTT than for instance by type-shifting rules (cf. Groenendijk and Stokhof's (1989) implementation referenced below), as the CTT lets the meaning of a constituent depend on its local syntactic context, but not on meanings other than those of its immediate constituents.

[31] Rullmann (1995) entertains two possible solutions. One returns to a syntactic encoding of the type distinction and marks it diacritically on the moved NP. The other leaves the type unspecified in syntax, but does assume that the variable in the translation is typed, so that the translation step is no longer omissible.

allowed to receive its ‘‘regular’’ semantic value, or function as a variable. Also, a trace must be allowed to function as a variable of various types, conditioned by the CTT. Finally, a movement target must function as an abstract over the correct (types of) variable, as in (53).

The sketch of an implementation provided below deals with these shifts in meaning in much the same way that Groenendijk and Stokhof (1989) propose to deal with type-shifting rules. Every constituent is associated with a set of basic meanings. For a lexical item, this will generally be a singleton set. When two constituents are combined, the resulting meanings are all the fitting compositions of all the possible meanings of the two constituents, which are derived from their basic meanings by applying any combination of allowable type-shifting rules.

Stating such a model of interpretation is facilitated by an adjustment in the role of assignment functions. An expression does not receive a denotation relative to an assignment function; expressions denote functions from assignment functions into the usual denotations (as in Sternefeld 2001b, adapting a technique from Bennett 1979). Given the model's interpretation function I, a constant c of type τ denotes a (constant) function I(c) from assignment functions into Domain_τ. A variable v denotes a function that sends each assignment function g to g(v). And Function Application of A to B yields $\lambda g.A(g)(B(g))$ (where g ranges over assignment functions).

If traces are untyped variables, this means that gl(v) may be in a different domain than g2(v), so the same goes for the function denoted by v as it applies to g1 and g2. The effective types of variables can be constrained by partializing the functions they denote, so that expressions are defined only for those assignment functions that treat the variables they contain as being of the desired types. Assignment functions, then, are functions from tree structures into $\bigcup_{\tau \in \text{Type}} \text{Domain}_\tau$, and expressions of type τ denote (often partial) functions from assignment functions into Domain_τ.

Putting these assumptions together would lead to something like the following. We define for each expression E the set BM(E) of basic meanings of E, the set PRV(E) of its possible regular values (when it is not a trace), the set PTV(E) of its possible values when it is a trace, and finally the set PM(E) of its possible meanings, which are used for further composition. (As before, I abstract away from intensionality.)

If E is a lexical item, then BM(E) = {I(E)}.

If E = [A B], then BM(E) = $\{h \mid \exists\alpha\in PM(A), \exists\beta\in PM(B)$ such that either Typefit(α,β) and $h = FA(\alpha,\beta)$, or Typefit(β,α) and $h = FA(\beta,\alpha)\}$.

$FA(\alpha,\beta)$ is that function h such that for every g, if $\alpha(g)$ and $\beta(g)$ are defined, then $h(g) = \alpha(g)(\beta(g))$; otherwise, h(g) is undefined.

If E is a trace, then PM(E) = PTV(E).

If E is not a trace, then PM(E) = PRV(E).

If E is the target of the movement of D, then PRV(E) = $\{h \mid \exists\alpha\in BM(E), \exists\tau\in \text{Type}$ such that

- $\exists g$ such that $g(D)\in\text{Domain}_\tau$ and $\alpha(g)$ is defined; and
- for every g, if $\exists d\in\text{Domain}_\tau$ such that $\alpha(g\,[D/d])$ is defined, then h(g) is that function f such that for every $d\in\text{Domain}_\tau$, $f(d) = \alpha(g\,[D/d])$; otherwise, h(g) is undefined$\}$.

If E is not a movement target, then PRV(E) = BM(E).

PTV(E) = {h | ∃τ∈Type such that

- τ is e, or E is attracted to a local target T that composes with a category identical to E and ∃α∈PRV(E) such that α is a function from assignment functions into $Domain_τ$; and
- for every g, if g(E)∈$Domain_τ$, then h(g) = g(E); otherwise, h(g) is undefined}.

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