Attention and locality: On clause-boundedness and its exceptions in multiple sluicing*

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We provide an account of clause boundedness in multiple sluicing that also captures its exceptions. Clause-boundedness arises whenever an embedded clause's subject is not co-referential with a topical discourse referent in the embedding clause. Our account ties clause-boundedness to discourse factors. We discuss implementations that import sensitivity to information structure into the syntax, and compare our approach with recent work, in particular Grano and Lasnik (2018) and Abels and Dayal (2016), and demonstrate that their accounts both under and over generate. The empirical coverage of our

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account argues against purely syntacticized agreement-based approaches to clause boundedness.

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1 Introduction

Grano and Lasnik (2018) propose an analysis of *clause-boundedness* effects, cases where some dependency holds or process can take place within a minimal clausal domain, but not across a finite clause boundary. Clause-boundedness effects have been observed in a variety of construction types, including inverse scope phenomena, gapping, pseudogapping, comparative deletion, antecedent contained deletion, multiple questions, family of questions interpretations, reciprocal and anaphor binding, tough movement, and multiple sluicing.

To give an example, consider the phenomenon of inverse scope illustrated in (1). A wide-scope construal of the universally quantified argument is unavailable when a clause boundary separates it from a c-commanding existentially quantified argument. If we follow May (1977) in assuming that the universally quantified argument achieves wide scope via quantifier raising in (1a), the judgment in (1b) suggests that this operation cannot take place across a clause boundary. (See also Farkas 1981, and Farkas and Giannakidou 1996 for earlier treatments of clause-boundedness in quantifier raising.)

(1) **QR is Clause-bounded**

a. At least one professor reads every journal. ($\forall > \exists$)

b. * At least one professor claims that Bill reads every journal. ($\forall > \exists$)
(From Grano and Lasnik (2018), examples (1e) and (2d))

Grano and Lasnik (2018) discuss an exception to clause-boundedness which they dub the *bound pronoun effect*. When the subject of the embedded clause is a pronoun bound by an argument in the higher clause, the embedded quantifier is apparently able to scope out of the embedded clause. (The judgment reported here is from Grano and Lasnik (2018).)

(2) **Embedded Bound Pronominal Subjects Suspend Clause-boundedness**
?[At least one professor]$_i$ claims that he$_i$ reads every journal. ($\forall > \exists$)
(From Grano and Lasnik 2018, example (4d))

The bound pronoun exception has been noted sporadically in the literature, usually in the context of discussing the existence of a clause-boundedness effect for some particular construction or other. (For instance, Sloan 1991 for family of questions, Nishigauchi 1998 for multiple sluicing in Japanese, and Merchant 2001 for multiple sluicing in English and gapping.) To our knowledge, Grano and Lasnik (2018) are the first to collect these various observations under the umbrella of a single generalization and attack it head on. Under Grano and Lasnik's account, clause-boundedness is phase-boundedness. In examples like (1b), the embedded clause is a phase, blocking QR of the universal to a position above the embedded CP phase. However, under their account, in sentences like (2), the bound pronominal subject in embedded clauses renders its minimal CP a non-phase (for reasons concerning the feature content of bound pronouns that we discuss below), allowing the universally quantified argument to cross a (non-phasal) clause boundary.

In this paper, we focus on one of the domains of clause boundedness explored by Grano and Lasnik, namely multiple sluicing. Sluicing (Ross, 1969) is a construction that involves ellipsis in an interrogative clausal complement that leaves only the wh-phrase overt. Example (3) introduces some terminology we will use throughout. Following the convention in the literature on ellipsis, ~~strikethrough~~ represents unpronounced/elided material.

(3) **A Simple Sluice**
$\underbrace{\text{Jack met } \overbrace{\text{someone}}^{correlate}}_{antecedent}$ but I don't know $\underbrace{\overbrace{\text{who}_i}^{remnant} \text{ ~~he met } t_i\text{~~}}_{sluice}$

Sluicing usually requires a declarative clause, which we call the *antecedent*, that is parallel in some way to the interrogative clause in which ellipsis takes place, which we refer to as the *sluice*. The antecedent typically contains a DP, called the *correlate*, that is the correspondent of the non-elided wh-phrase, called the *remnant*.[1]

[1]For concreteness, we follow Merchant (2001), and many others, in assuming that sluicing, as

Multiple sluicing is sluicing with more than one remnant. In (4), we see an example, where *which student* and *with which professor* count as remnants. For concreteness, we follow Abels and Dayal (2016) among others in assuming that multiple sluicing involves multiple Wh-fronting, exceptionally licensed under ellipsis in English.[2,3]

(4) A student met with some professor, but I don't know which student$_i$ with which professor$_j$ ~~t$_i$ met t$_j$~~.

Multiple sluicing is subject to clause-boundedness effects, where multiple remnants are only possible when their correlates are clause-mates as in (4) but not (5), (i.e., they must not be separated by a finite clause boundary).

(5) **Correlates Must Be Clause-mates**
*[$_{CP_1}$ Some student said [$_{CP_2}$ that Sally met with some professor]], but I don't know which student with which professor.

Since *some professor* is contained within CP_2, but *some student* is not, multiple sluicing is impossible.

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a form of ellipsis, involves deletion/non-pronunciation of syntactic structure (i.e., a "silent structure" analysis), under some form of identity with a linguistic antecedent (Hankamer and Sag, 1976). However, the observations we make and the lines of explanation we explore are applicable to other approaches to sluicing.

[2]Nothing crucial rests on this assumption in what follows. Lasnik (2014), for instance, defends an alternative analysis, which has the second wh-phrase undergoing exceptionally high rightward movement. Our generalization in (7) holds regardless of the directionality of movement.

[3]A good deal of the relevant literature claims that multiple sluicing is unacceptable or only marginally acceptable in English (Takahashi 1994; Nishigauchi 1998; Hoyt and Teodorescu 2012; Merchant 2001; Takahashi and Lin 2012; Lasnik 2014.) However, in our own informal investigations, we have identified a subset of English speakers who find it unimpeachable (alongside a subset of speakers who find it unacceptable to marginal). Lasnik (2014) (in his Appendix B) reports results of a survey, supporting his claim that multiple sluicing is a "real phenomenon" in English, despite being only "marginally acceptable." Note however that Lasnik pools his data, which we take to be the source of the claim that multiple sluicing is only "marginally acceptable" in English. In our own informal surveys, we find that multiple sluicing is fully acceptable, but only for a subset of English speakers. The data and judgments we report on here pertain to those English speaking consultants we determined to productively accept multiple sluicing.

We leave open many of the questions about the phenomenon of multiple sluicing in English here that should be addressed, we think, independently. What kinds of English speakers accept multiple sluices? Are there independent factors that correlate with multiple sluicing acceptance? In other words, a micro-comparative study focused on multiple sluicing is needed, though beyond the scope of what we can offer at this stage. Though we did not closely control for demographic or geographic/regional factors, it is our sense that acceptability of multiple sluicing does not correlate with these in any simple way.

Like the other constructions discussed in Grano and Lasnik (2018) in which clause-boundedness is observed, multiple sluicing is also subject to the bound pronoun effect.

(6) **Clause Boundedness Inactive with Embedded Bound Pronoun Subjects**
[$_{CP_1}$ Some student$_i$ said [$_{CP_2}$ that he$_i$ met with some professor$_j$]], but I don't know which student with which professor.

Below, we raise empirical challenges to Grano and Lasnik's account, introducing new data that demonstrate that bound pronouns are neither necessary nor sufficient for avoiding clause-boundedness in multiple sluicing. That is, we show clear exceptions to clause-boundedness where there are no bound pronouns involved, and cases where clause-boundedness is active when there is a bound pronominal subject in the embedded clause. To make sense of the pattern, we defend the generalization in (7).

(7) **Shifty Subjects:** clause-boundedness holds in a clause C when C's subject shifts attention away from the most salient discourse referent (in the sense of Karttunen 1976, henceforth *d-ref*) evoked in the clause that embeds C.

This generalization encompasses the bound-pronoun effect. In examples like (1b), the embedded subject is not co-construed with any argument introduced in the matrix clause. Example (1b), hence, runs afoul of (7), and is correctly ruled out. Embedded bound pronominal subjects, on the other hand, will not usually shift attention away from the most salient argument in the higher clause, which serves as its binder. Our generalization in (7), then, captures the bound pronoun effect. Crucially, this generalization, which we defend below, is couched in terms of discourse/information structure, and we propose to derive it from principles governing the flow of attention in discourse. This is perhaps surprising, since clause-boundedness appears, on its face, to be a syntactic phenomenon. If the generalization in (7) is valid, it provides an argument that syntax must be sensitive to such discourse notions.

In §2, we briefly review Grano and Lasnik's account, illustrating how it derives clause-boundedness in multiple sluicing, and accounts for the bound pro-

noun effect. We also discuss the recent proposal in Abels and Dayal (2016) which aims to account for the same facts in multiple sluicing. In §3, we introduce a new data set that demonstrates that bound pronouns are not necessary for suspending clause-boundedness, challenging the approaches in both Grano and Lasnik (2018) and Abels and Dayal (2016). In §4, we sharpen our discourse-based characterization of the empirical pattern adopting notions from Centering Theory (Grosz et al., 1995), which has been proposed to model pronoun reference resolution and patterns of coherence between utterances in discourse. An important part of our proposal is that it requires syntactic constraints on movement and deletion to be sensitive to discourse coherence, and in §5, we entertain plausible theoretical accounts of our generalization in (7), each making syntax sensitive to the relevant discourse relations between clauses. In §6, we conclude.[4]

2 The Bound Pronoun Effect and Multiple Sluicing

Grano and Lasnik (2018) advocate a view in which clause-boundedness is nothing other than phase-boundedness *tout court*. In their account, bound pronouns optionally come with unvalued ϕ-features, which are valued when their binders are merged via a feature-transmission mechanism (Kratzer 1998, 2009). They further assume that the presence of unvalued features in a candidate Spell-Out domain "voids" or "suspends" phasehood (following proposals in Felser 2004).[5] Consequently, in sentences with a pronoun in an embedded finite clause that is bound by an argument in a higher clause, the embedded clause's phasehood may thereby be suspended because of as yet unvalued ϕ-features.

Applying this idea to the domain of multiple sluicing, Grano and Lasnik (2018, §4.3) assume, following Lasnik (2014), that the movement of the second wh-phrase undergoes one-fell-swoop movement from its base position to its

[4]By coherence, we are referring to the organization of information within clauses, with respect to its prominence in an evolving discourse. This use is standard in work on Centering Theory, and differs from that of Kehler (2001) who uses coherence relations to refer to the (often implicit) meaning relations that hold between clauses, such as cause-effect or temporal-contiguity.

[5]Other authors propose a similar "dynamic" view of phases, adopting terminology in Citko (2014) (cf. Bošković 2014; den Dikken 2006)

final landing site. In (6′), CP_2's phasehood is suspended because of the unvalued features on the pronoun, thereby allowing the second remnant (henceforth "Wh2") to escape CP_2.

(6′) **Clause Boundedness Inactive with Embedded Bound Pronoun Subjects**
Some student$_i$ said that he$_i$ met with some professor$_j$, but I don't know [$_{CP_1}$ which student$_i$ with which professor$_j$ ~~t_i said [$_{CP_2}$ that he$_i$ met t_j]~~].

Were CP_2 to constitute a phase, say if the embedded subject were not a bound pronoun as in (5), a phase boundary would emerge, blocking movement of Wh2 out of CP_2.[6]

Grano and Lasnik note that the bound pronoun effect appears to obtain only with bound *subject* pronouns, and that even a bound object pronoun does not trigger the bound pronoun effect. This is illustrated in the examples in (8).

(8) **Only Bound Subject Pronouns Trigger the Bound Pronoun Effect**

a. Some student claimed that he introduced Mary to some professor, but I don't know which student to which professor.

b. * Some student claimed that Mary introduced him to some professor, but I don't know which student to which professor.

To account for this asymmetry, Grano and Lasnik follow a suggestion of Hisa Kitahara that phase suspension only takes place when there are unvalued features *on the head of the complement to a phase head*. This proposal is outlined in (9).

(9) **Grano and Lasnik 2018 Account of the Bound Pronoun Effect**

a. Unvalued features on the head of the complement to the phase head keep the phase open.

b. The locality domain for the phenomena that give rise to the bound pronoun effect is the phase.

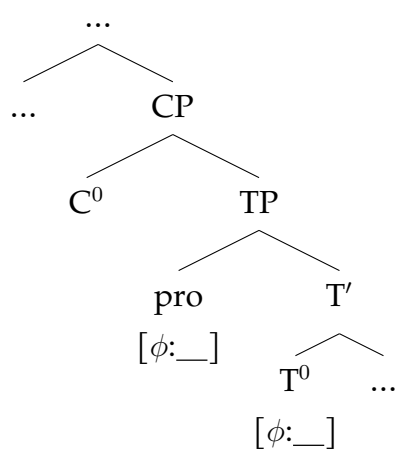
c. Bound pronouns optionally come with unvalued phi-features.

Bound pronominal subjects with unvalued ϕ-features fail to value T^0's ϕ-features. Since T^0 is C^0's complement, C^0 fails to count as a phase head. When the sub-

[6] This line of argument requires the assumption that Spec,CP_2 is unavailable as an escape hatch for Wh2 in this case.

ject is non-pronominal, as in (8b), its ϕ-features will always value the corresponding features on T^0, giving rise to a phase boundary. A result of this is that only in a configuration like that in (10) (where [ϕ:__] represents unvalued ϕ-features) does C^0 fail to count as a phase.

(10)



Note that the discourse-based characterization of the bound pronoun effect in (7) explicitly (and apparently correctly) stipulates its subject orientation. We return later to how this subject specificity might be derived from discourse factors.

Abels and Dayal (2016) propose an alternative account of the bound pronoun effect in multiple sluicing. Specifically, they advocate a "short source" solution, where apparent cases of non-local multiple sluicing are, despite appearances, mono-clausal. The basic idea is that an intuitively synonymous mono-clausal "*pre-sluice*," as in (11), is available when the embedded pronoun is bound by the matrix subject correlate in the antecedent.

(11) **Short Source Solution to the Bound Pronoun Effect**
Some student$_i$ claimed that he$_i$ met with some professor$_j$, but I can't recall which student$_i$ with which professor$_j$ ~~[$_{TP}$ t_i must have met t_j]~~.

In the absence of an embedded bound pronominal subject, no synonymous short source will be available, as the external arguments of the upper and lower predicates are non-identical.

(12) **No Short Source for Embedded Clauses without Bound Pronouns**

*Some student$_i$ claimed that Mary met with some professor$_j$, but I can't recall which student$_i$ with which professor$_j$ [$_{TP}$ t_i ~~must have met~~ t_j]~~]~~.

In a similar way, this line of analysis also provides an account of why the bound pronoun must be the subject. It is only when the embedded subject is coreferential with the main clause's subject that a short source is available. Though this analysis requires a limited degree of non-identity between the sluice and antecedent, sufficient at least to introduce modality in the sluice. Whatever the degree of flexibility allowed, we expect that it will not be sufficient to permit the creation of a short source in the absence of a bound subject pronoun.

3 Bound Pronouns are Unnecessary

We introduce a new pattern of data that demonstrates that bound pronouns are unnecessary for suspending clause-boundedness in multiple sluicing. We further show that a short source account is also unavailable in such cases. Insofar as exceptions to clause-boundedness should have a unified analysis, such data challenge the motivations for both the Grasno and Lasnik and Abels and Dayal accounts. In contrast, we will see that our generalization in (7) extends to these cases.

To begin, consider the following cases of bi-clausal multiple sluicing, this time with a different type of embedded subject, an expletive or a quantifier.[7]

(13) **No Clause-Boundedness with Expletive Subjects**
Some student claimed that there was a problem with some professor, but I can't recall which student$_i$ with which professor$_j$ ~~t_i claimed that there was a problem t_j~~.[8]

[7]Huang (to appear) argues on the basis of results from a judgment task that violations of clause-boundedness involving expletive *there* subjects are more acceptable than violations involving expletive weather *it* (though his materials do not test clause-boundedness in multiple sluicing specifically). As has been noted repeatedly in the literature, weather *it* (along with its correspondent in other languages) behaves differently from other expletives in a variety of respects, leading a number of authors to conclude that it is not in fact semantically vacuous, but is instead an argument of sorts (see e.g., Chomsky 1981; Rizzi 1990; Cardinaletti 1990; Bennis 2005). We might then take Huang's results as further evidence against weather *it*'s expletive status, and indeed in favor of its ability to evoke a discourse referent.

[8]Thanks to Larry Horn (p.c.) for this example.

(14) **No Clause Boundedness with Quantificational Subjects that Fail to Evoke a Discourse Referent**

Some student lamented that no professor talked about a certain topic, but I can't recall which student$_i$ about which topic$_j$ ~~t_i lamented that no professor talked t_j~~.

In spite of the absence of bound pronominal subjects, both examples are substantially improved as compared to cases with referential DP subjects like (5). The approach in Grano and Lasnik (2018) has nothing to say about such cases since it is based on the presence of ϕ-features on the embedded T^0 that are unvalued within the embedded CP. In both of these cases, however, T^0 will be valued in the embedded CP, either through agreement with the post-copular DP or the quantifier.[9]

[9]It is not the case that all determiners that are typically taken to be quantificational in nature give rise to this effect. For instance, indefinite articles, numerals, and proportional quantifiers, seem to behave differently than affective/negative quantifiers like "no."

(i) * Some student lamented that {some/many (of the)/three/each} professor(s) talked about a certain topic, but I can't recall which student about which topic.

Crucially, for our account, what matters is whether the NP in question makes a discourse referent salient. Following Karttunen 1976, not all quantificational NPs evoke d-refs in this way. *No NP*, in particular, fails to, as evidenced by the inability to refer to the putative d-ref with a pronoun downstream in the discourse:

(ii) Jack has no car. #It is blue.

On the other hand, it is well known that certain quantificational NPs do license pronominal reference downstream in the discourse, which we take as evidence that such quantificational NPs do evoke d-refs (e.g. Safir 2004).

(iii) a. Many senators$_i$ admire Kennedy, but they$_i$ are very junior.
b. * No senators$_i$ admire Kennedy, but they$_i$ are very junior.
(Safir 2004, examples (iii) and (iv), pg. 240)

With respect to quantifier interveners, we might expect this kind of pattern to extend more generally to contrasts between e.g., "a few" and "few." We believe this to be correct, though the judgments are delicate; perhaps this is due to the possibility of coercion or accommodation.

(iv) Some student lamented that {few/?a few} professors talked about a certain topic, but I can't recall which student about which topic.

In further support of this point, an anonymous reviewer notes that *somebody* in (v) below should not introduce a d-ref if it scopes under "might," and suggests the following example as a test case. Under our approach, this example should be acceptable, which we believe to be the case.

(v) Some linguist said that somebody might have written a paper about a Balkan language, but I can't recall which linguist about which Balkan language.

The proposal in Abels and Dayal (2016) likewise fails to account for such data, as no short source is available for the sluices in (13) and (14). To construct a mono-clausal short source, both wh-phrases must be arguments or modifiers of a single predicate, and the result should be synonymous with the sluice. This works in cases where the embedded subject is bound by the matrix subject, as in (11), but there is no way to achieve this in examples like (13) and (14) (we leave it to the reader to try). The best we can do yields non-synonymous (and pragmatically infelicitous/incongruent) sluices. For instance, for (13), a plausible argument position (possibly the only one) which *which student* may occupy is that occupied by the expletive *there*: *#which student was a problem with which professor*, or for (14), the position occupied by the quantified embedded subject: *#which student talked about which topic.*[10]

We turn to another set of examples, where clause-boundedness is again suspended in the absence of a bound subject pronoun. Like the original bound pronoun cases, but unlike the examples just discussed, the embedded subject in these cases is coreferential with a DP outside of the embedded clause. Cru-

The judgment in (v) should be compared to the judgment in (vi), which we believe to be degraded. Under our approach, the embedded subject "a certain student" favors a wide-scope reading, which should introduce a shifty d-ref, inducing clause boundedness.

(vi) # Some linguist said that a certain student might have written a paper about a Balkan language, but I can't recall which linguist about which Balkan language.

Of course, judgments involving scope are notoriously subtle and complex. A more thorough investigation of the facts surrounding antecedents with quantified embedded subjects is needed, a project we leave aside here for scope reasons for future work.

[10] An anonymous reviewer suggests short sources behind the acceptability of (13) and (14) indicated by the elided material in the following:

(i) ? Some student claimed that there was a problem with some professor, but I can't recall which student ~~said that~~ about which professor.

(ii) Some student lamented that no professor talked about a certain topic, but I can't recall which student ~~said that~~ about which topic.

We note here that such short sources are unlikely for various reasons. First, (i) contains a different preposition in the remnant as compared to the antecedent. Chung et al. 1995; Chung 2006 observe that the argument structure of the predicate in the antecedent must match that of the sluiced clause. This is presumably, in part, behind the unacceptability of (i) above. Additionally, following Chung 2006, such short sources (in both (i) and (ii)) violate "No New Words," a constraint requiring all elided lexical content to have some matching antecedent in the antecedent clause. In both these examples, the verb *said* lacks an antecedent lexical item in the antecedent clause.

cially, though, the co-referential element does not c-command the embedded subject. Since binding is no longer at issue, we can use a broader range of possible anaphoric DPs, including pronouns, epithets and R-expressions. Nonetheless, clause-boundedness is suspended exactly when co-reference obtains.

(15) **No Clause Boundedness with Referentially Dependent R-expressions**

a. **No Clause Boundedness with Co-referential Pronouns or Epithets**
[$_{DP}$ One of the headhunters who interviewed Jack$_i$] said that {he$_i$ / the idiot$_i$ / *Sally} would be a good fit for a certain company, but I can't recall which headhunter$_k$ for which company$_h$ ~~t_k said that he$_i$ would be a good fit t_h~~.

b. **No Clause Boundedness with Co-referential Proper Nouns**
[$_{CP}$One of the headhunters who interviewed him$_i$] said that {Jack$_i$/*Sally} would be a good fit for a certain company, but I can't recall which headhunter$_j$ for which company$_k$ ~~t$_j$ said that Jack$_i$ would be a good fit t$_k$~~.

Because of the absence of c-command between the co-referential elements, the ϕ-features of the embedded subject cannot be valued by the co-referential DP, under the standard assumption that such valuation takes place under an Agree relation that demands c-command. Consequently, the Grano and Lasnik analysis does not extend to these cases. Similarly, no synonymous mono-clausal short sources are available, rendering the Abels and Dayal analysis unable to account for these cases..

We take the above data to show that it is not necessary for the embedded subject to be a pronoun bound by the matrix subject in order for clause-boundedness effects to be neutralized. Instead, as already anticipated above, we claim that normally porous embedded clauses become locality domains for multiple sluicing when the embedded subject is "shifty," that is, when it shifts attention away from the most salient d-ref evoked in the matrix clause. All of the cases we have discussed in this section involve embedded subjects that do not induce such a shift in attention, either because they do not have reference (as in the expletive or quantifier) or because they are anaphorically dependent (even if not pronominal). In short, we emphasize here that bound pronouns are not

necessary for suspension of clause-boundedness, which casts serious doubt on any accounts of clause-boundedness (or its exceptions) that rest on specific featural properties of bound pronouns. Below, we sharpen our definition of Shifty Subjects in (7), and demonstrate how bound pronouns are also insufficient to suspend clause-boundedness.

4 Sharpening Shiftiness

Thus far, we have been somewhat loose in our formulation of our generalization in (7), repeated below.

(7) **Shifty Subjects:** clause-boundedness holds in a clause C when C's subject shifts attention away from the most salient discourse referent (in the sense of Karttunen 1976, henceforth d-ref) evoked in the clause that embeds C.

Specifically, we have not provided an explanation of what we take to be the most salient discourse referent in a clause, or of what it means to shift attention away from such a discourse referent. In this section, we make our generalization more precise, adapting several notions from Centering Theory (Grosz et al. 1995), a theory of the flow of attention in discourse across utterances and how the attention status of a discourse entity affects its syntactic realization.

4.1 Applying Centering Theory to Clause-Boundedness

Centering theory, henceforth CT, is a theory of discourse coherence and salience, and the relationship between these notions. To illustrate the sort of phenomena CT is concerned with, consider the discourse in (16):

(16) a. Terry$_i$ really goofs sometimes.

b. Yesterday was a beautiful day and he$_i$ was excited about trying out his$_i$ new sailboat.

c. He$_i$ wanted Tony$_j$ to join him$_i$ on a sailing expedition.

d. He$_i$ called him$_j$ at 6 AM.

e. He$_j$ was sick and furious at being woken up so early.
(Grosz et al., 1995, p.207)

Clearly the intended reference of *he* in (16e) is *Tony*, but this renders the discourse intuitively incoherent and somewhat misleading. Sentence (16e) has a garden-path feel; it is only when we get to the information in the predicate that we can conclude that the subject refers to Tony, and not Terry. In other words, there is a strong preference for interpreting the subject in (16e) as co-referential with the subject in (16d). A more natural alternative to (16e), for instance, would be as in (17), where the subject pronoun persists in referring to Terry, as it does in (16b–16d).

(17) He$_i$ gave him$_j$ three rings to answer, and then hung up in disappointment.

CT explains patterns like this is by making reference to the *realization* of d-refs as linguistic expressions, both with respect to the form of these expressions (whether they are pronouns or definite descriptions, proper nouns, etc.), and their grammatical role in syntax, given that such roles are often associated with *information packaging* (borrowing a term from Chafe 1976). CT builds on the observation that there are clear patterns for how salient/topical entities in discourses tend to be realized in utterances. The discourse in (16) runs afoul of pressures having to do with a preference governing the realization of salient entities across utterances: salient entities tend to be realized in consistent ways. Discourses that maintain such consistency, i.e., which preserve the property of a narrative being about some specific topical entity, are easier to process, and are preferable to discourses which do not (the discourse in (16) being a case in point).

We assume that discourses are broken up into *discourse segments*. In early work in CT, discourse segments were identified with utterances. We will assume a generalization suggested by Kameyama (1998), Miltsakaki (2003) and Poesio et al. (2004) whereby individual finite clauses constitute discourse segments. Given that discourses unfold over time, we take the ordering among these segments to be determined by their linear order, so that those associated

with matrix clauses precede those associated with embedded clauses.[11,12]

A fundamental tenet of CT is that each discourse segment is associated with a single d-ref that constitutes its focus of attention. This focus of attention corresponds to what the segment is intuitively "about", i.e., its topic. The notion of aboutness used in CT is grounded in terms of what came before the current segment, U, and correspondingly the focus of attention in segment U is called its *backward looking center*, notated $C_b(U)$. Additionally, we associate each discourse segment U with its *forward looking centers* $C_f(U)$, a (partially) ordered list of d-refs that are realized by some DP in U. This list contains the d-refs that are realized in U, and the ordering among the elements in C_f corresponds to the d-refs' relative salience in U. Salience is determined by a number of factors. Most prominently, this is grammatical role. For the most part, subjects are ranked above objects, which are, in turn, ranked above obliques, though as we will see, there are principled exceptions to this. The backward looking center of a discourse segment U_n is defined to be the d-ref realized in U_n which is ranked highest among the forward looking centers from the previous utterance, i.e., $C_f(U_{n-1})$. The highest ranked d-ref in $C_f(U)$ is therefore the d-ref that is most likely to be the backward looking center in a subsequent discourse segment, and indeed it must be so if it is realized in the next segment. This d-ref is therefore given a distinctive name, namely the discourse segment's *preferred*

[11]This ordering is particularly natural in top-down views of grammatical derivation (Phillips, 2003; Bianchi and Chesi, 2014; den Dikken, 2018), but it can also be expressed under a bottom-up derivational regimen.

[12]An anonymous reviewer points out that the correlation between hierarchical relations and linear order is language-specific, and that we may end up making different predictions in other languages besides English. This is a fair assessment. We might expect, for instance, in languages where embedded clauses precede the main clause, that the ordering of discourse segments would be the reverse of that in English.

One related potential domain in which this could be checked in English is by examining the effect of linearly intervening adverbial clauses on shiftiness. For instance, in the following example, we might expect *Trump* to intervene as the subject of the adverbial clause, rendering the bound pronoun *they*$_i$ in the embedded clause shifty. To our ear, this example does sound somewhat degraded, though perhaps such examples are clunky on independent grounds.

(i) Some politician$_i$ said that, because Trump lost, she$_i$ would meet with some reporters, but I can't recall which politician with which reporters.

For space reasons, we do not endeavor to cache out what our predictions would be in languages with significantly different mappings from English when it comes to hierarchical relations and linear order here. Though we acknowledge this may be a rich domain for further research.

center, $\text{Cp}(\text{U})$.

We can now use these notions to distinguish between two types of transitions among discourse segments:

(18) **Transition Types Between U_n and U_{n+1}**

a. ATTENTIONAL MAINTENANCE: $\text{Cp}(\text{U}_{n+1}) = \text{Cp}(\text{U}_n)$

b. ATTENTIONAL SHIFT: $\text{Cp}(\text{U}_{n+1}) \neq \text{Cp}(\text{U}_n)$

In cases of attentional maintenance, the same d-ref remains at the top of adjacent discourse segments' C_f lists. For attentional shift, the d-refs encoded by the two are distinct.[13] The intuition here is that coherent discourse keeps a single element, the focus of attention, in a grammatically prominent position across discourse segments. When this is not the case, the discourse is taken to be marked.

This attentional shift vs. maintenance distinction allows us to account for intuitions concerning short discourses like (19).

(19) U_1: Jack_i called Bill_j.
U_2: He_j was irritated because the ringtone interrupted his presentation.

What goes wrong here is a violation of a preference for interpreting the subject pronoun in U_2 as co-referring with *Jack*, not *Bill*. The transition between these utterances involves a case of attentional shift: the Cp of U_1 is Jack, as it is the highest ranked element of $\text{C}_f(\text{U}_1)$ (as the d-ref realized by the subject), while the Cp of U_2 is Bill (as the d-ref realized by that clause's subject). Looking back at the discourse in (16), repeated below, we can also see why the final transition between discourse segments gives rise to anomaly, while the other transitions are coherent.

[13] This dichotomy is similar in certain respects to the split in transitions made by Grosz et al. (1995) between center continuation on one hand and center retention and center shift on the other, and even more so to the formulation given by Strube and Hahn (1999), who also make use of identity of Cps in adjacent discourse segments to distinguish center continuations and smooth shifts from other transitions. We suspect that the other linguistically relevant types of transition, for instance center retention, can be captured by making reference to whether $\text{C}_b(\text{U}_{n+1})$ is identical to $\text{Cp}(\text{U}_n)$, though we leave this broader claim open for future work. For now, we note one advantage of this approach: by eliminating reference to the C_b of the earlier discourse segment, we do not have the problem of a transition from the first segment of the discourse to the second being undefined because of a non-existent C_b for initial discourse segment.

(16) a. Terry$_i$ really goofs sometimes.

b. Yesterday was a beautiful day and he$_i$ was excited about trying out his$_i$ new sailboat.

c. He$_i$ wanted Tony$_j$ to join him$_i$ on a sailing expedition.

d. He$_i$ called him$_j$ at 6 AM.

e. He$_j$ was sick and furious at being woken up so early.

For all but the final sentences, the highest ranked d-ref in the forward looking center list is Terry. As a result, all the transitions constitute instances of attentional maintenance. However, in the last sentence, (16e), the only d-ref that is realized is Tony, As a result, Cp for this discourse segment is Tony, which is distinct from the Cp of the preceding one, giving rise to attentional shift.

With this much in place, we can make our proposal precise: deviation from optimal discourse coherence in the form of attentional shift induces clause-boundedness.

(20) **Our Claim in CT Terms**
Attentional shift induces clause-boundedness.

We can now apply this condition to derive the core cases of clause-boundedness suspension, cases with and without bound pronouns. First, consider again example (6), repeated here with discourse segments annotated.

(6′) **Clause Boundedness Inactive with Embedded Pronoun Subjects**
U_1: Some student said
U_2: that he met with some professor
U_3: but I don't know
U_4: which student$_i$ with which professor$_j$ ~~t_i said~~
U_5: ~~he$_i$ met t_j~~

By the definitions in (18) above, the discourse in the segments hosting sluicing in (6′), namely U_4 and U_5, counts as attentional maintenance: the d-ref associated with the bound pronoun *he* is the preferred center of the embedded discourse segment, $Cp(U_5)$, and is identical to the d-ref realized by the subject of U_4, *which student*, the preferred center of the interrogative discourse segment,

U_4. Since clause-boundedness is only triggered in cases of attentional shift, we correctly predict clause-boundedness effects to be absent in examples like (6).

On the other hand, if the embedded subject in U_5 were not a bound pronoun, but instead a name or other R-expression, the d-ref it realizes, which is the preferred center of that discourse segment, is now distinct from $Cp(U_4)$. As a result, this transition constitutes an instance of attentional shift, triggering clause-boundedness effects, as in (5), repeated below with discourse segments indicated.

(5′) **Correlates must be clause-mates**
U_1: Some student said
U_2: that Sally met with some professor
U_3: but I don't know
U_4: which student$_i$ with which professor$_j$ ~~t_i said~~
U_5: ~~Sally$_k$ met t_j~~

We now proceed to illustrate how our proposal extends to the other cases of clause-boundedness exemptions introduced in §3 above.

4.1.1 Expletives and Quantificational Subjects At first pass, it is not clear why existential clauses should be porous if attentional shift induces clause-boundedness. The relevant example, (13), is repeated below.

(13) **No Clause Boundedness with Embedded Expletive Subjects**
Some student claimed that there was a problem with some professor, but I can't recall which student$_i$ with which professor$_j$ ~~t_i claimed that there was a problem t_j~~ .

Assuming the expletive subject, *there*, does not realize a d-ref, there are two d-refs realized in the existential clause, neither of which are backward looking centers: the d-ref realized by the post-copular nominal (henceforth the *pivot*), the DP headed by *problem*, and the d-ref realized by the DP complement to the preposition, i.e., *which professor*. It is not entirely clear what metric one should use to determine their relative rank, since it is not clear what the relevant grammatical roles are in this case. We might instead appeal to structural notions

other than grammatical role, such as hierarchical prominence: though plausibly neither c-commands the other, we might appeal to the containment relation and posit that it is the *problem*-headed DP that outranks *which professor*. Either way, the d-ref realized by the higher ranked one will be the Cp of the existential clause, and will not be identical with the Cp of the matrix clause, which is the d-ref associated with *which student*. Consequently, it would seem that we have an instance of attentional shift.

It has been claimed in the literature on existential sentences that they are topic-less, purely *thetic*/comment structures, or are entirely rhematic (see Mikkelsen 2011 for a survey and discussion). Their function in discourse is typically described as one of simply introducing a new d-ref. If attentional shift requires the introduction of a new distinct topic (i.e., Cp) from the one immediately before, such sentences cannot trigger attentional shift.

To capture this property of existential sentences, we capitalize on the observation that although the existential pivot is not in the canonical subject position. The expletive locative pronoun *there* is. We assume then that this expletive has a place in the forward looking center list, and as a result the existential pivot is not the highest ranked element of a forward looking center list (and consequently cannot serve as a preferred center). Since expletives are, by definition, not associated with referential content, there would seem to be no way to include them among the C_f list which consists of d-refs. We modify the definition of $C_f(U)$, then, and assume that its members are not d-refs, but rather $\langle \sigma, \delta \rangle$ pairs, where each σ is a syntactic constituent in U (typically of category DP) that realizes the d-ref δ. When a DP σ does not realize a d-ref, we take this to give rise to a pair $\langle \sigma, \emptyset \rangle$ in C_f.

As before, we contend that the grammatical subject of U_n is typically ranked highest in $C_f(U_n)$, so that even an expletive subject may occupy the highest position in C_f. The $C_f(U_{n+1})$ for the embedded existential clause in (13), then, has the pair $\langle$*there*, $\emptyset\rangle$ as its top ranked element. Recall that the preferred center is defined to be the highest ranked d-ref in a C_f list. Since such a Cp, as a candidate C_b, is a d-ref, it will be undefined in existential sentences: there is no d-ref present in the highest pair in C_f. In such a case, then, the transition

between a discourse segment U_n and the one following it, U_{n+1}, cannot be categorized as Attentional Shift: there is no d-ref corresponding to $Cp(U_{n+1})$ that is distinct from $Cp(U_n)$.

This refined characterization of Attentional Shift is supported by data concerning discourse coherence. In (21), which seems like a coherent discourse, the presence of the discourse segment U_2 does not induce Attentional Shift because of the existential structure.

(21) U_1: Jack$_i$ walked into the room.
U_2: There was a chair$_j$ in the middle of the floor.
U_3: He$_i$ sat down.

There is no problem with interpreting the pronoun in U_3 as the d-ref *Jack* in spite of the intervening clause.

One might object however that the felicity of this discourse comes from the fact that the intervening existential clause does not introduce any new animate d-refs consistent with masculine-gender pronouns, which are necessary to induce ambiguity in the interpretation of the pronoun. Indeed in examples like (22) we find that when such d-refs are introduced in the intervening clause by a DP in subject position, the ambiguity does give rise to a mild incoherence, if the pronoun in U_3 is to be interpreted as identical to *Jack*.

(22) U_1: Jack$_i$ walked into the room.
U_2: Another man$_j$ greeted him$_i$.
U_3: He$_{\#i/j}$ sat down.

This pattern is as we would expect. The subject DP *another man* realizes a novel d-ref in U_2. Therefore it is $Cp(U_2)$, which is distinct from $Cp(U_1)$, namely *Jack*. As a result, this constitutes an instance of Attentional Shift. We then have Attentional Shift again in the transition from U_2 to U_3. Note, however, that introducing such a discourse reference in U_2 with an existential does not have the same effect:

(23) U_1: Jack$_i$ walked into the room.
U_2: There was another man$_j$ waiting for him$_i$ in the middle of the floor.
U_3: He$_{i/\#j}$ sat down.

Though the DP *another man* introduces a male d-ref in U_2, it is our judgment that the most natural interpretation of the pronoun in U_3 is *Jack*, and that the other interpretation is associated with mild incoherence. This is consistent with what we've claimed above — if there is no Attentional Shift between the first and second (existential) discourse segments, then there is no Attentional Shift between the second and third. The existential sentence just adds additional non-topical information to the context, or comment against which *Jack* remains the topic.

The same reasoning we have outlined for existential sentences applies to cases where the embedded subject is a quantificational expression that fail to realize a discourse referent. Example (14) is repeated below, where *no professor* fails to evoke a d-ref, and clause-boundedness is relaxed.

(14) **No Clause Boundedness with Quantificational Subjects that Fail to Evoke a Discourse Referent**
Some student lamented that no professor talked about a certain topic, but I can't recall which student$_i$ about which topic$_j$ ~~t_i lamented that no professor talked t_j~~.

The highest ranked element in the forward looking center list of the embedded clause in (14) is the pair $\langle$*no professor*, $\emptyset\rangle$. Consequently there is no preferred center for the embedded clause. As we saw with embedded existential sentences, this fact entails that the discourse transition between the matrix and embedded clause is not defined. Since Attentional Shift does not obtain, clause-boundedness is correctly predicted to not be active.

As predicted, just as existential sentences do not induce Shift (see (23)), sentences with quantificational subjects/expressions that fail to evoke a discourse referent also fail to do so. The following discourse seems coherent and felicitous with the indicated co-reference relations.

(24) U_1: Jack$_i$ walked in.
U_2: No one greeted him$_i$.
U_3: He$_i$ sat down.

4.1.2 Referentially-Dependent R-expressions Earlier, we saw cases in which R-expressions may be the subject of an embedded clause that does not induce clause-boundedness, but that such cases are distinguished by the fact that the R-expression must realize a d-ref that is mentioned earlier (e.g., they are epithets). As we saw, this kind of case also extends to referentially dependent pronouns that are not syntactically bound. The relevant examples, in (15), are repeated here.

(15) **No clause-boundedness with referentially dependent R-expressions**

a. **No Clause Boundedness with Unbound Pronouns or Epithets**
[$_{DP}$ One of the headhunters who interviewed Jack$_i$] said that {he$_i$ / the idiot$_i$ / *Sally} would be a good fit for a certain company, but I can't recall which headhunter$_k$ for which company$_h$ ~~t_k said that he$_i$ would be a good fit t_h~~.

b. **No Clause Boundedness with Referentially Independent Proper Nouns**
[$_{CP}$One of the headhunters who interviewed him$_i$] said that {Jack$_i$/*Sally} would be a good fit for a certain company, but I can't recall which headhunter$_j$ for which company$_k$ ~~t$_j$ said that Jack$_i$ would be a good fit t$_k$~~.

Following Miltsakaki (2003), we assume that adjoined phrases, such as relative clauses, form a single attentional domain/discourse unit with the clause to which they are adjoined.[14] If the d-ref realized by the embedded subject (whether pronoun, proper noun, or epithet) is identical to the preferred center of the matrix domain, none of these examples involves Attentional Shift, and clause-boundedness would be predicted to be relaxed. This holds however, only if we relax the assumption that grammatical role is the determining factor for ranking in $C_f(U_n)$. Take (15a), for instance; here, *Jack* is contained inside the matrix subject *one of the headhunters who interviewed Jack*, and is a direct object, whereas the matrix subject d-ref itself is also realized as the relative clause

[14]Note that this means there is a distinction between complement clauses, which we have been treating as distinct attentional domains from their embedding contexts, following Poesio et al. (2004), and adjoined clauses, which form a single attentional domain with the clause within which they are adjoined.

subject.

If grammatical role alone determined ranking, we would expect the matrix subject to outrank *Jack*, and Attentional Shift would be predicted (incorrectly predicting clause-boundedness to be active). It is however not a central claim of CT that grammatical role is the only factor determining ranking in C_f lists. Instead, it is possible that relevance broadly construed, lexical choices, world knowledge, and speaker intentions play a form-independent role. The topic at the time of utterance of (15a) may well most plausibly be *Jack* and his job prospects, favoring him as Cp.

We thank an anonymous reviewer for providing us with the following challenging example of a connected discourse where our predictions don't seem to go through at first glance, though we believe examples like this actually demonstrate how factors other than grammatical role can hinder or help discourse coherence.

(25) a. Terry$_i$ just told me this unbelievable story!

b. The other day, $[_{DP}$ one of the headhunters who interviewed him$_i]_j$ emailed about another exciting job opportunity.

c. # And then he$_i$ called him$_j$ at 6 AM the next morning to talk about it!
(Compare to "And then he$_j$ called him$_i$ at 6 AM the next morning to talk about it!")

In (25), there is a preference to construe the subject of (25c) as co-referential with the headhunter who interviewed Terry, realized as the subject in (25b) (bracketed), and not Terry himself. In other words, a strong tendency to analyze the transition between (25b) and (25c) as Attentional Shift (accounting for the infelicity). Note that the subject in (25b) is the same as our subjects in the acceptable cases in (15), so that the incoherence in (25) is somewhat surprising if we are on the right track.

However, note that the judgment shifts with some manipulation of the lexical choices in (25c), where instead of *and then,* we have *So,* introducing the discourse segment. To our ears, this favors co-construal of the subject pronoun

with Terry while coherence is maintained.[15]

(26) So he$_i$ called him$_j$ at 6 AM the next morning to talk about it!

The switch from *and then* to *So* is pretty minimal, and we do not have much more to say about why this switch results in the effect demonstrated above.[16] However, further manipulation of the lexical content of (25c) can more clearly favor one or the other construal. Given world knowledge about how headhunter/job-seeker interactions typically proceed, the most coherent reading of the following version of (25c) even more strongly favors construal of the subject pronoun with Terry, since headhunters typically do not call job-seekers to learn more about positions to which they themselves alerted the job-seeker.

(27) So he$_i$ called him$_j$ back at 6 AM the next morning to learn more about the position.

Turning to our cases in (15), similar results can be achieved via manipulation of lexical items as informed by world knowledge. Let us call the reviewer's (25b) "U_1," and (25c) "U_2." The analogous segments in our sluicing antecedents in (15) are the main clause (corresponding to U_1), and the embedded clause (U_2) (following Poesio et al. 2004; Miltsakaki 2003). In the examples in (15), the embedded clause in the antecedent favors co-construal of the subject pronoun with the job-seeker, since headhunters do not typically report on their own job prospects in typical headhunter/job-seeker interactions.

We can also change the lexical content of U_2 in our sluicing antecedents to favor, instead, co-construal of the embedded subject pronoun with the headhunter. Here, once again, world knowledge about typical headhunter/job-seeker interactions weigh against construing the embedded subject pronoun as co-referring with the subject of the main clause.

(28) $[_{DP}$ One of the headhunters who interviewed Jack$_i$$]_j$ said he$_j$ would follow up with some promising leads the next morning.

[15] In fact, (26) seems equally coherent with the reviewer's indexation as well, suggesting that there is some optionality introduced with *So* in the resolution of pronoun reference.

[16] Perhaps the use of coordination in the connective *and then* favors a reading of the subsequent discourse segment as being about sequential actions the subject of the preceding clause engaged in, favoring construal of the subject pronoun with the headhunter, a possibility we do not explore any further here.

Note that we correctly predict multiple sluicing (along with clause-boundedness suspension) to be possible whether the embedded subject pronoun is co-construed with the headhunter, or with Jack (as in (15)). In (28), when the embedded subject pronoun is co-construed with the main clause subject, we have a run-of-the-mill bound pronoun case.

(29) $[_{DP}$ One of the headhunters who interviewed Jack$_i]_j$ said he$_j$ would follow up with some promising leads the next morning, but I can't recall which headhunter, with which leads.

Note that this appears to introduce some optionality as to whether the d-ref realized by the main clause subject, or the d-ref realized by *Jack* gets to be the preferred center in U_1. One fact that supports the status of *Jack* (the job-seeker) as the preferred center in the matrix discourse segment in (15a) is that the embedded subject, which is co-referential with *Jack*, is pronominal. As the only pronoun in the embedded segment, it must serve as the embedded discourse segment's backward looking center.[17] In CT, when the C_b of some utterance, U_{n+1}, is the preferred center of U_{n+1}, there is a pressure towards Attentional Maintenance. The fact that (15) is coherent supports the hypothesis that the transition type between the matrix and embedded clause is one of Attentional Maintenance, which follows if *Jack* is the Cp of the matrix segment. The fact that (28) is coherent as well suggests, via the same reasoning, that the headhunter (the d-ref realized by the main clause subject), may instead, optionally, be the Cp of the matrix segment.

The upshot is that, beyond grammatical role, lexical choice and world knowledge can be equally important factors in the determination of discourse coherence and the nature of transitions between discourse segments. We do not endeavor to develop a full account of these facts here, as that would take us too far afield.

[17] Rule 1 of Centering theory (Grosz et al. 1995) states that if anything is pronominalized in a discourse segment, the backward looking center must be also.

4.2 Some Puzzling Cases and a Shifty Solution

Thus far, we have explored the analysis of examples that demonstrate that bound subject pronouns are not necessary for the suspension of clause-boundedness. We now examine a set of cases that demonstrate that bound subject pronouns are not even sufficient to defuse clause-boundedness. We will show that the behavior of such cases is as expected under the system we've developed above, once we incorporate an additional factor that influences the rankings in C_f lists.

4.2.1 Subject vs. Object Binders In (30), we see that clause-boundedness is suspended only when the embedded subject pronoun is bound by the matrix subject. In (31), we see the opposite pattern, with binding by the object being necessary to diffuse clause-boundedness. Importantly, in both (30b), and (31a), the embedded subject is bound by an argument in the higher clause, yet clause-boundedness remains in effect.[18]

(30) **Obligatory Subject Binder**

a. Some professor$_i$ told Sally$_j$ [that he$_i$ would talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~t$_k$ said he$_k$ would talk more t$_h$~~.

b. * Some professor$_i$ told Sally$_j$ [that she$_j$ should talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~t$_k$ told Sally$_j$ that she$_j$ should talk more t$_h$~~

(31) **Obligatory Non-subject Binder**

a. * Sally$_i$ told some professor$_j$ [that she$_i$ would talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~Sally$_i$ told t$_k$ that she$_i$ would talk more t$_h$~~.

[18] An anonymous reviewer points out that our data in this section disagrees with data in Grano and Lasnik 2018 (footnote 7), where the antecedent of the bound subject must be, itself, a subject. Importantly, these examples involve gapping. While we focus on multiple sluicing here, there is an important question whether our generalizations extend to other construction types discussed in Grano and Lasnik 2018. Whether our approach can be generalized to constructions like gapping remains to be seen, though see §5.3 below for discussion on how such investigation may proceed.

b. Sally$_i$ told some professor$_j$ [that he$_j$ should talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~Sally$_i$ told t$_k$ that he$_k$ should talk more t$_h$~~.

We suggest that the relevant generalization across all of these cases relates to the nature of the binder. When the pronoun is bound by the indefinite, the effects of clause-boundedness are obviated. But why should indefiniteness matter?

We take alternative evoking expressions like indefinites to be sufficiently salient to factor into the ranking of arguments in C_f in the matrix discourse segment. That is, in the matrix clauses in (30–31), the indefinite is ranked highest regardless of its grammatical role or hierarchical prominence in the clause. Thus, when the embedded pronoun is bound by a DP other than the indefinite, Attentional Shift obtains, since the Cp of the matrix and embedded clauses are not identical, leading to clause-boundedness.[19]

4.2.2 A Challenge for Grano and Lasnik 2018 The examples in (30)-(31) show that bound pronominal subjects on their own are insufficient to diffuse clause-boundedness. Such data, it turns out, are challenging for the analysis of the bound pronoun effect given by Grano and Lasnik (2018), which in fact leads to predictions that are opposite from what is found.

Recall from §2 that Grano and Lasnik takes clause-boundedness to be phase

[19]Interestingly, a similar pattern is found with infinitival clausal complements:

(i) **Non-finite clauses requiring subject controller**
   a. ?* Some professor told Sally$_i$ [PRO$_i$ to talk about a certain topic], but I can't recall which professor about which topic.
   b. Some student$_i$ asked the professor [PRO$_i$ to get an extension on a certain project], but I can't recall which student on which project.

(ii) **Non-finite clauses requiring object controller**
   a. Sally told some professor$_i$ [PRO$_i$ to talk more about a certain topic], but I can't recall which professor about which topic.
   b. * Sally$_i$ asked some professor [PRO$_i$ to get an extension on a certain project], but I don't know which professor on which project.

Here we see the effect of clause-boundedness driven by Attentional Shift in spite of the absence of a finite clause boundary. We believe such examples tell us that complement CPs, both finite and non-finite, constitute independent discourse segments.

boundedness. Thus, by the Phase Impenetrability Condition (PIC, cf. Chomsky 2001), movement across a finite CP boundary that does not pass through the CP's edge will be ill-formed, which includes cases of movement subject to clause-boundedness under Grano and Lasnik's assumption. Grano and Lasnik further assume that bound pronouns are introduced into the derivation with unvalued ϕ-features, and that the presence of such features results in a phase containing them remaining "porous"' to derivational operations.

Return now to the data in (30)-(31). As already noted above, cases like (30a) are handled straightforwardly under these assumptions: the ϕ-features of the subject pronoun are not valued until the Merge of the matrix subject. Assuming with Grano and Lasnik that v does not count as a phase head, there will be no phase boundary between the base position of the second wh-phrase and its ultimate landing site in the higher CP, resulting in the well-formedness of the example. What is puzzling on this view is why an example like (31a) should behave differently. Here, the embedded pronominal subject is bound by the matrix subject, as before, which should lead to the voiding of the embedded phase, yet the example is unacceptable.

Next, consider the contrast in acceptability between (30b) and (31b). In both, the embedded subject is bound, which should suspend phasehood for the embedded CP because of the presence of unvalued ϕ-features. In each case, the binder is not the matrix subject, but rather a matrix (indirect) object. Assuming that v is not a relevant phase head and that the pronoun's features are valued within the VP when the object is merged, the matrix CP will be the first active phase head encountered. Therefore, Wh2 should be able to reach Spec of the matrix CP in one-fell swoop without running afoul of the PIC in either case.[20]

4.3 Summary

To summarize, in this section, we have built on results in §3, where we established that bound pronouns are not necessary to suspend clause-boundedness,

[20]If v is taken to be a phase head, then the prediction might change: the ϕ-features of the pronoun would be valued within the vP phase, since the object DP that binds the pronoun could perform valuation within this domain. Consequently, vP would constitute an impediment to movement to the higher Spec, CP. We would then expect the movement of Wh2 to be ruled out in both cases, contrary to fact.

showing that bound pronouns are additionally insufficient. We sharpened our generalization in (7) by appealing to notions from Centering Theory, where clause-boundedness is active whenever the transition between an embedded clause and the main clause counts as Attentional Shift. This characterization of the facts gets us the right empirical cut, and unifies bound pronoun cases with the other cases we introduced here.

As we have discussed at length, our account ties a syntactic effect, clause-boundedness and its exceptions, to notions of discourse coherence that are tied to the flow of attention across utterances. Yet Grano and Lasnik (2018) advance some arguments against this very notion, i.e., that the bound pronoun effect might have something to do with salience. The general idea they target is that somehow, when the reference or construal of the embedded subject pronoun is easier to establish, perhaps because its referent is more salient at the time of utterance, the embedded clause boundary is somehow more permeable and less offensive for establishing long distance dependencies across it. They report on results from a judgment study, where embedded clauses had unbound first and second person pronoun subjects. Arguably, first and second person pronoun referents are always salient in any discourse, and such test items were rejected just the same as clause-boundedness violations with unbound pronoun subjects more generally (see (32)). One might conclude from this result that salience and the flow of attention in discourse is irrelevant in accounting for the bound pronoun effect, and a purely syntactic account is on the right track.

(32) * More teachers claimed that I gave the students pencils than ~~claimed that I gave the students~~ pens.
(From Grano and Lasnik (2018), example (15c))

However, our proposal evades this criticism through its implementation in Centering Theory. Our account makes crucial reference not just to salience and attention, but to constraints on coherent discourse sensitive to information packaging across discourse segments. In short, examples like (32) count as Attentional Shift transitions under our assumptions, just the same as examples not subject to the bound pronoun effect, and so our account correctly predicts clause-

boundedness to be active in such cases.[21] In other words, clause-boundedness (and its exceptions) is best understood as an interface phenomenon, where pragmatic constraints on the flow of attention across utterances in discourse have a syntactic consequence. In what follows, we suggest theoretical implementations of this idea.

5 Towards a Syntactic Account

The view we have endorsed thus far envisions a restriction on the syntactic locality of certain grammatical processes that is sensitive to the discourse transition between one clausal domain and another. If this view is correct, the archi-

[21] An anonymous reviewer provides us with the following discourse in (i).

(i) a. U_1: The teacher$_i$ walked in.
b. U_2: I greeted him$_i$.
c. U_3: He$_i$ sat down.

While the first person pronoun in the subject position of U_2 would seem to meet the conditions for an attentional shift, the sentence does not appear to induce incoherence in the discourse. The reviewer asks, therefore, whether there is any evidence for attentional shift in this case. We believe that the answer is yes, but the evidence is somewhat indirect. In CT, transition type is a discourse structural notion, having to do with relations between segments in a connected discourse. This structural notion is however neither necessary nor sufficient for discourse coherence. In the examples with an ambiguous pronoun, discourse coherence results when the intended interpretation induces Attentional Shift, but the unintended one does not. In examples like (i), there is no relevantly similar discourse that does not involve Shift, and the discourse is perceived as relatively coherent. Discourse (ii) is similar to (i) in involving discourse structural Attentional Shift. This time, there is a potentially ambiguous 3^{rd} person subject pronoun in the downstream segment:

(ii) a. U_1: The woman waved at Sally$_i$,
b. U_2: so she$_i$ waved back.

Here, however, the ambiguity does not induce incoherence. The relevant factor appears to be the presence of "back" in the verbal predicate U_2. Without it, the resulting discourse becomes poignantly incoherent:

(iii) a. U_1: The woman waved at Sally$_i$,
b. #U_2: so she$_i$ waved.

One can see the role of disambiguating material such as "back" in (ii) as that of inducing a repair effect that mitigates or removes incoherence that would otherwise result from Attentional Shift, a possibility we leave aside exploring any further here, other than to point out that the reference of 1^{st} person pronouns is never ambiguous, so that shift transitions involving them may perhaps always be expected to be salvaged along these lines.

tecture of grammar must incorporate some way in which the syntax can show such sensitivity to discourse notions.

Though we are not committed to any particular syntactic implementation of such an interaction, in this section we sketch two proposals that achieve this. The first of these is a modification of Grano and Lasnik's approach, which preserves many of their core architectural assumptions, but makes phasehood contingent on discourse properties. Our second approach is couched in the Harmonic Minimalism framework of Murphy (2017) and jettisons syntactic modularity, instead allowing discourse properties to interact directly with syntactic derivations. The clause-boundedness of multiple sluicing across a shifty subject turns out to be an instance of cumulativity, where multiple wh-movement in sluicing and movement across a shifty subject are allowed individually but not in combination.

5.1 Contingent Phasehood and Attentional Shift

A simple and conservative way to capture the clause-boundedness paradigm as regulated by Attentional Maintenance is to incorporate our discourse notions directly in the determination of the phasehood of candidate phase heads in Grano and Lasnik's system, abandoning reference to bound pronouns or ϕ-features. We provide such an implementation here as a sketch of how further work in this domain might proceed.

First, let us assume, with Grano and Lasnik, that clause-boundedness is phase boundedness along with a dynamic view of phases, where sometimes candidate phase heads count as phase heads, and other times they do not. Following Lasnik 2014, we also assume that Wh2 movement in Multiple Sluicing proceeds in one-fell-swoop. Finally, let us import Grano and Lasnik's assumption that unvalued features on the head of the complement of a phase head, X, render X a non-phase (allowing for exceptions to clause-boundedness). To capture subject-orientation in the suspension of clause-boundedness, adopt Grano and Lasnik's assumption that it is the valued/unvalued status of the head of a candidate phase head that determines its phasal/non-phasal status. The innovation/modification we suggest is in the nature of the features phasehood is sen-

sitive to. Instead of any unvalued features, phasehood is specifically sensitive to Attentional features.

(33) **Our Phase-Theoretic Assumptions**

a. Unvalued Attentional features on the head of the complement to the phase head keep the phase open.

b. The locality domain for the phenomena that give rise to clause-boundedness effects is the phase.

One immediate question that comes to mind concerns the locus of these attentional features. In the preceding paragraph, we suggest that it is phase heads that bear attentional features. An anonymous reviewer rightly asks, what independent evidence there might be for the existence of such attentional features. We are not aware of any work that explicitly makes reference to attentional features per se, though highlight the fact that there is much work in the syntax-pragmatics interface literature that makes reference to the notion of *topichood*, and we suggest here an intimate connection between topichood and shiftiness.

Frascarelli and Hinterhölzl (2007) identify three kinds of topic constituents in Italian and German: shifting topics, contrastive topics, and familiar topics with distinct syntactic and prosodic properties. In Italian, shifting topics are constituents that introduce a novel topic in a discourse (which is information-structurally evocative of our notion of shifty subjects), and always precede other kinds of topics when co-occurring with them in the same clause. Frascarelli and Hinterhölzl (2007) posit a left-peripheral ShiftP projection associated with shifting topics.[22]

Let us assume that this left peripheral ShiftP projection contains is a phase head, and that Shift^0 is the element with attentional features. When the lower clause includes a DP subject whose associated d-ref constitutes a new topic, i.e., when we have a case of Attentional Shift between the higher and lower clauses, this DP will value the attentional features on embedded Shift^0. As a result,

[22]Frascarelli and Hinterhölzl (2007) propose that shifting topics bear an "aboutness" feature they equate with topic-hood, along with a phonological feature determining the prosodic contour of the XP bearing such a feature. The addition of the phonological feature pragmatically signals a "new topic" (hence, a "shift" in topic—See Frascarelli and Hinterhölzl (2007) for more discussion).

ShiftP's phasehood will remain intact, giving rise to clause boundedness. In the absence of a shifty subject in the downstairs clause, the attentional features on the embedded Shift^0 head will remain unvalued until the occurrence of the DP that constitutes the aboutness topic. As a result, the embedded clause will be porous to one-fell-swoop movement, yielding the possibility of long-distance multiple sluicing.

An anonymous reviewer argues that Grano and Lasnik's approach predicts our result, assuming attentional features exist. That is, if phasehood is suspended whenever any features remain unvalued, then phasehood would be suspended were attentional features to remain unvalued just the same. We emphasize here that things cannot be that general, and that phasehood (and its suspension) must be sensitive to *attentional* features in particular. If *any* unvalued feature may suspend phasehood, then we do not expect our puzzling cases discussed in §4.3 to have the empirical pattern they do. In Grano and Lasnik's proposal, unvalued ϕ-features associated with bound pronominal subjects in embedded clauses are sufficient to suspend phasehood of the embedded CP. This would make it mysterious why (30b), repeated below, persists in being ungrammatical despite having an embedded subject bound by the matrix object.

(30b) * Some professor$_i$ told Sally$_j$ [that she$_j$ should talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~t$_k$ told Sally$_j$ that she$_j$ should talk more t$_h$~~

Under Grano and Lasnik's approach, *she*$_i$ has unvalued ϕ-features, which keep the embedded CP phase open. Under our approach, indefiniteness plays a role in determining the Cp of the main clause, and (30b) constitutes attentional shift, so that the embedded clause counts as a phase, correctly predicting ungrammaticality.

Additionally, example (31b), repeated below, arguably should be grammatical in Grano and Lasnik's approach, since the embedded subject is bound by the matrix subject (therefore lacking valued ϕ-features until the matrix subject is merged). Under our approach, the indefinite direct object of the matrix clause is the Center of Attention in the matrix clause, and this example counts

as Shift, correctly predicting its ungrammaticality.

(31b) * Sally$_i$ told some professor$_j$ [that she$_i$ would talk more about a certain topic], but I can't recall which professor$_k$ about which topic$_h$ ~~Sally$_i$ told t$_k$ that she$_i$ would talk more t$_h$~~.

In other words, it cannot be the case that *any* unvalued feature manages to suspend phasehood. Instead, phasehood and its suspension must be restricted to our attentional features.

In further support of this point, we highlight an additional empirical pattern that is unexpected under Grano and Lasnik's approach, focused on ϕ-features, but which is expected under our proposal, focused on attentional features. Grano and Lasnik discuss the relevance of the bound pronoun effect for island phenomena, showing that bound pronouns in islands yield more acceptable island violations than island violations without bound pronouns.

(34) a. What$_2$ did John$_1$ go home [after PRO$_1$ reading t$_2$]?
b. ? What$_2$ did John$_1$ go home [after he$_1$ read t$_2$]?
c. * What$_2$ did John go home [after Mary read t$_2$]?
(Grano and Lasnik 2018, examples (78a-c))

Our proposal also captures this pattern in the same way. Example (34c) constitutes a case of attentional shift. Attentional shift is avoided in (34b).

On the other hand, Grano and Lasnik's proposal predicts that we should not see the same cline in acceptability in the following examples.

(35) a. ? Which article$_2$ did Ann$_1$ cheer [because she$_1$ won the Pulitzer [after she$_1$ published t$_2$]]?
b. * Which article$_2$ did Ann$_1$ cheer [because Bill won the Pulitzer [after she$_1$ published t$_2$]]?

The most deeply embedded clausal island, the *after* clause, has a bound pronoun subject in both cases, which will not be valued until its binder is encountered in the main clause. This ensures that any higher potential islands, such as the *because* clauses in these examples, will remain "open" as well, regardless

of the their own subjects, since they also contain within them the unvalued ϕ-features of the most embedded island. Therefore, there should be no difference in acceptability between these examples, contrary to fact. In contrast, under our approach, the hierarchically intermediate "*because*" clause's subject (*Bill*) in (35b) induces attentional shift, and phasehood, predicting unacceptability relative to (35a), where the subject of the *because* clause is a bound pronoun, which does not shift attention.

Even accepting the empirical arguments for the distinctive role played by attentional features in establishing phase boundaries, we might nonetheless ask why these features play this special role. We believe that one potential response relates the original computational motivations underlying centering theory. Recall that the existence of phases has been motivated as well by the need to reduce complexity in grammatical derivation. Typically such complexity is taken to derive from the desire to reduce search during grammatical derivation. In the centering context, Joshi and Kuhn (1979) and Joshi and Weinstein (1981) suggest that the avoidance of shifts between centered entities in discourse is similarly motivated by the need to reduce the complexity, in this case of inference. Structuring utterances around a center effectively reduces the underlying logical predicates to a monadic structure. This restriction yields a logical system that allows more efficient inference as compared to unrestricted predicate logic. Though monadic logic is not sufficient to represent linguistic meaning in general, the idea that sections of discourse retain an attentional center will lead to a reduction in inferential complexity. If this is on the right track, phases under our view are indeed motivated by computational considerations, not of narrow grammatical computation but of inference.

5.2 Clause Boundedness as Cumulativity

Our second suggestion for a syntacticization of our discourse-based understanding of clause-boundedness builds on Murphy's (2017) framework of Harmonic Minimalism. In this framework, the well-formedness of syntactic representations is determined by the outcome of a Harmonic Grammar optimization. As Murphy argues at length, this framework provides a natural analysis

of cumulativity phenomena, cases in which two syntactic processes A and B are permitted individually, but they cannot occur in combination. He documents a wide range of phenomena that fall under the cumulativity rubric. One example is found in languages including Serbo-Croatian, Russian, Polish, Romanian, Bulgarian and Czech, among others, which permit the fronting of multiple wh-phrases in a wh-question. The following Serbo-Croatian example (from Rudin 1988) illustrates:

(36) Ko$_i$ koga$_j$ t_i vidi t_j?
who whom sees
'Who sees whom?'

A subset of these languages, including Serbo-Croatian, Russian, Polish and Czech, are exceptional in another way: they allow left-branch extractions, i.e., the movement of a pre-head modifier or possessor out of a DP. We illustrate with Serbo-Croatian once again (example from Bošković 2005):

(37) Čijeg$_i$ si vidio [$_{\text{NP}}$ t_i oca]
whose are seen father
'Whose father did you see?'

Interestingly, however, even in languages that allow multiple wh-fronting and left-branch extraction to occur separately, they are not permitted to occur together. That is, multiple left-branch extraction is not possible (Serbo-Croation example from Fernández-Salgueiro 2006).

(38) a. * Čiji$_i$ kakva$_j$ [$_{\text{NP}}$ t_i otac] kupuje [$_{\text{NP}}$ t_j kola] ?
whose what kind father buy car

b. * Kakva$_j$ čiji$_i$ [$_{\text{NP}}$ t_i otac] kupuje [$_{\text{NP}}$ t_j kola] ?
what kind whose father buy car
'Whose father buys what kind of car?'

As is well known, multiple wh-fronting and left-branch extraction are cross-linguistically marked; many languages do not permit either of them to occur, even by themselves. As a result, from the perspective of optimality theory, there should be a constraint that is violated by each of these processes. Murphy adopts the following:

(39) a. MultSpec: assign a violation for each wh-phrase after the first that is in specifier positions of a single C head.

b. *LBE: assign a violation for structure involving extraction from a left branch.

Murphy follows other work in OT syntax in assuming that wh-movement is motivated by a constraint that is violated in the absence of movement.

(40) WhCrit: assign a violation if any wh-phrase is not in the specifier of a licensing head, or a licensing head does not have a wh-phrase in its specifier.[23]

In a traditional OT setting, if we rank MultSpec above WhCrit, the result will be a language that prohibits the fronting of multiple wh-phrases, while the reverse order will yield multiple wh-fronting. Similarly, if we rank *LBE above WhCrit, wh-movement out of a left-branch will be blocked, with the reverse ordering allowing it. No strict ranking will however suffice to derive the cumulativity pattern, where each is allowed separately but they are not permitted together. Instead, to derive this, Murphy argues that we should assign each constraint a numerical weight. In order to evaluate the relative goodness of each candidate, the violation of each constraint is multiplied by -1 times the number of violations, and the set of weighted violations is then summed to compute the harmony, indicated by $\mathcal{H}$. The optimal candidate is the one with highest (least negative) harmony. This is illustrated in the following tableau:

(41)

$[_{CP}\ C_{[+wh]}\ [wh_i \ldots wh_j]]$	WhCrit w=3	MultSpec w=2	*LBE w=2	$\mathcal{H}$
$[_{CP}\ wh_i\ C_{[+wh]}\ [t_i \ldots wh_j]]$	-1			-3
☞ $[_{CP}\ wh_i\ wh_j\ C_{[+wh]}\ [t_i \ldots t_j]]$		-1		-2

[23] The initial analysis of this pattern from Murphy (2017) adopts a formulation of WhCrit under which multiple unmoved wh-phrases induce only a single violation. Later in the same work, he proposes a different analysis of this pattern using a different set of constraints. For simplicity of presentation, we adopt this first analysis. Note, however, that allowing multiple unmoved wh-phrase to induce additional violations of WhCrit would leave the predictions we discuss unchanged.

(42)

	WhCrit w=3	MultSpec w=2	*LBE w=2	$\mathcal{H}$
$[_{CP}\ C_{[+wh]}\ [[_{DP}\ wh_i\ NP]\ \ldots\ ]]$				
$[_{CP}\ C_{[+wh]}\ [[_{DP}\ wh_i\ NP]\ \ldots\ ]]$	-1			-3
☞ $[_{CP}\ wh_i\ C_{[+wh]}\ [[_{DP}\ t_i\ NP]\ \ldots\ ]]$			-1	-2

In each case, because the weight associated with WhCrit is larger than the ones associated with MultSpec and *LBE, violations of either of these latter constrains are preferred to violations of the former. As a result, either multiple wh-movement or left-branch extraction is preferred to lack of movement. The outcome for an input that includes multiple wh-phrases within left-branches will be different: because of the cumulative cost, lack of movement is preferred to multiple left-branch movement.[24]

(43)

	WhCrit w=3	MultSpec w=2	*LBE w=2	$\mathcal{H}$
$[_{CP}\ C_{[+wh]}\ [[_{DP}\ wh_i\ NP]\ \ldots\ [_{DP}\ wh_j\ NP]\ ]]$				
☞ $[_{CP}\ C_{[+wh]}\ [[_{DP}\ wh_i\ NP]\ \ldots\ [_{DP}\ wh_j\ NP]\ ]]$	-1			-3
$[_{CP}\ wh_i\ wh_j\ C_{[+wh]}\ [[_{DP}\ t_i\ NP]\ \ldots\ [[_{DP}\ t_j\ NP]]]$		-1	-1	-4

Returning now to the analysis of sluicing, we will adopt from past work the following constraints that restrict the deletion of material:

(44) a. MaxElide: Delete e-marked constituents

b. Faith(wh): assign a violation for each wh-phrase in the input that is not present in the output.

The first of these constraints, taken from Merchant (2008), favors the deletion of material that is marked as informationally backgrounded. The second constraint, first posited by Baković and Keer (2001), seeks to prevent the deletion of wh-elements. To these constraints, we add the following additional constraint that penalizes movement out of a domain that includes a new focus of attention, that is, which includes a shifty subject:

(45) SingleAtt: assign a violation for movement that goes beyond a CP that houses a new center of attention.

[24] Because it is not relevant to the central point of the current paper, we ignore here the possibility of candidates involving a single instance of LBE. See Murphy (2017, ch.4) for extensive discussion and analysis.

We recognize that SingleAtt constraint simply stipulates the badness of extracting across a shifty subject. While we are not averse to purely formal constraints on syntactic derivations, in this case, we believe SingleAtt is the grammatical reflection of the aforementioned considerations of inferential efficiency mentioned above that have motivated much of the work in centering theory.

With these constraints in place, we can evaluate an instance of sluicing involving a single wh-phrase that needs to move across a shifty subject to satisfy the requirements of the relevant C head.

(46)

[$C_{[+wh]}$ [$_E$ A said B talked to whom]]	Faith(wh)	MaxElide	WhCrit	MultSpec	SingleAtt
☞ [$_{CP}$ to whom $C_{[+wh]}$ [$_E$ ~~A said B talked~~]]					-1
[$_{CP}$ $C_{[+wh]}$ [$_E$ ~~A said B talked to whom~~]]	-1		-1		

Note that that the correct output, involving non-clause-bounded movement, will be chosen so long as the weight of the constraint SingleAtt is less than the sum of the weights of Faith(wh) and WhCrit.

$$w(\textsc{SingleAtt}) < w(\textsc{Faith(wh)}) + w(\textsc{WhCrit})$$

Note that if the subject of the lower clause were not shifty, the movement candidate would not violate any of the constraints we are dealing with, and would therefore also have higher harmony that a structure in which the wh-phrase does not move. To allow such shifty-subject-crossing movement to take place in the absence of sluicing, so that a question like *Who did A say B talked to* can be generated, a stronger condition is required on the weight of SingleAtt:

$$w(\textsc{SingleAtt}) < w(\textsc{WhCrit})$$

The fact that this condition is stronger than what is necessary to allow phase-boundary-crossing movement to take place under ellipsis makes the prediction that there would exist languages which permit movement of a single wh-phrase across a shifty subject in sluicing contexts, but not in non-sluicing contexts. At present we are unaware of any languages which show this pattern.

Let us now consider inputs that are both e-marked and contain multiple wh-phrases, i.e., candidates for multiple sluicing. We will start with a mono-

clausal structure, so as to avoid issues of locality.

(47)

[$C_{[+wh]}$ [$_E$ who talk to whom]]	Faith(wh)	MaxElide	WhCrit	MultSpec	SingleAtt
[$_{CP}$ $C_{[+wh]}$ [$_E$ ~~who talk to whom~~]]	-2		-1		
[$_{CP}$ who $C_{[+wh]}$ [$_E$ ~~*t* talk to whom~~]]	-1		-1		
☞ [$_{CP}$ who to whom $C_{[+wh]}$ [$_E$ ~~*t* talk to *t*~~]]				-1	

Here we consider only candidates in which the e-marked TP is deleted, and contrast candidates in which either zero, one, or two of the wh-phrases are fronted. The first candidate in which no movement takes place is harmonically bounded by the second (it suffers all of its violations and more), and hence will never be selected as optimal regardless of the constraint weights. In order to correctly choose the third multiple sluicing candidate, the following condition on the constraint must be respected:

$$w(\textsc{MultSpec}) < w(\textsc{Faith(wh)}) + w(\textsc{WhCrit})$$

In other words, under the grammar of English, the movement of multiple wh-phrases, though in violation of the MultSpec constraint, is less grammatically marked than failing to move and deleting one of the wh-phrases. Of course, if there is nothing inducing the deletion of a wh-phrase that remains in-situ, because of the absence of e-marking, the movement of a single wh-phrase will be grammatically preferred under the assumption that

$$w(\textsc{MultSpec}) > w(\textsc{WhCrit})$$

Let us turn finally to the evaluation of candidates involving multiple long-distance sluicing. Assuming that the embedded subject constitutes a new center of attention, movement out of the embedded clause will yield a violation of SingleAtt.

(48)

[$_E$ who said B talked to whom]	Faith(wh)	MaxElide	WhCrit	MultSpec	SingleAtt
[$_{CP}$ [$_E$ ~~who said B talked to whom~~]]	-2		-1		
☞ [$_{CP}$ who [$_E$ ~~*t* said B talked to whom~~]]	-1		-1		
[$_{CP}$ who to whom [$_E$ ~~*t* said B talked *t*~~]]				-1	-1

As before, multiple wh-fronting will induce a violation of MultSpec. This time, because we also have a violation of the locality constraint SingleAtt, we find an instance of the cumulativity pattern: either multiple wh-fronting or movement across a new attentional center may take place, in the right conditions, but they are not permitted together. Such cumulativity requires that constraint weights abide by the following inequality:

$$w(\textsc{MultSpec}) + w(\textsc{SingleAtt}) > w(\textsc{Faith}(\textsc{wh})) + w(\textsc{WhCrit})$$

A large number of solutions (indeed infinitely many) satisfy the inequalities over constraint weights, among which is the following:

(49) $w(\textsc{MultSpec}) = 2.5$
$w(\textsc{SingleAtt}) = 1$
$w(\textsc{Faith}(\textsc{wh})) = 1$
$w(\textsc{WhCrit}) = 2$

5.3 Clause Boundedness Beyond Multiple Sluicing

Our discussion in the paper has focused entirely on multiple sluicing, and we have developed our analyses to be able to account for the patterns found in that empirical domain. However, the existence of clause boundedness and well-defined exceptions to it holds beyond multiple sluicing, as Grano and Lasnik argue extensively for the bound pronoun effect. Specifically, they argue that the same pattern holds across *Tough*-movement, Comparative Deletion, Quantifier Raising, Antecedent Contained Deletion, Gapping, Pseudogapping, Multiple Questions, Reciprocal Binding, and Family of Questions readings. This immediately raises an important empirical question: does the discourse-related generalization that we have argued governs exceptions to clause boundedness in the multiple sluicing case also apply in these other empirical domains? If the answer to that question is positive, this has an important theoretical consequence: we should expect the analysis of the multiple sluicing case will extend to the others as well. On the other hand, if the empirical landscape does not generalize to these other cases, that would favor an analysis which treats multiple

sluicing in a distinctive manner.

Interestingly, our two analyses are distinguished by the extent to which they generalize in this way. Our first, dynamic phasehood approach extends to the full range of phenomena in exactly the way that Grano and Lasnik proposed, as it constitutes a minimal modification of their proposal. A CP containing an unvalued Shift^0 head will fail to constitute a locality domain for all phase-sensitive operations or dependencies, and thus will be porous to any such operation or dependency. The Harmonic OT analysis, in contrast, does not generalize in such a straightforward fashion. The success of this analysis depends crucially on the cumulative weighting of two constraints, SingleAtt which penalizes movement across a clausal domain in the presence of attentional shift and MultSpec which penalizes multiple specifiers, as compared to the weights of constraints that induce movement of wh-phrases. While SingleAtt would be relevant for any multi-clausal structure and therefore to all potential cases of clause boundedness, the others will not necessarily apply. Most conspicuously, MultSpec plays a role only in structures containing multiple elements that are moved to the specifier a single phrase, and it seems unlikely that this structural configuration obtains in all of the cases that Grano and Lasnik explore. Consequently, unless something specific is assumed about the linking of constraint weights, it should be possible to have a grammar that will allow attentional-shift exceptions to clause boundedness for some cases but not all.

To decide which of these approaches is correct, we must first resolve the empirical question: to what degree is attentional shift relevant to the broader landscape of clause boundedness. In other work, we have begin to explore the empirical question of the relevance of attentional shift to the entire set of phenomena discussed by Grano and Lasnik, and believe that same pattern holds by and large for other construction types examined (except for reciprocal binding, which we believe should receive an independent account). If this is correct, it would favor the dynamic phasehood approach. For now, however, we leave this issue open.

Before concluding, we want to address the arguments raised by Huang (to appear), who argues that attentional shift is not the relevant factor governing

clause boundedness in comparative deletion. Huang conducts an acceptability study involving examples like the following:

(50) a. More baristas claimed to drink tea than coffee. (infinitival baseline)

b. More baristas claimed that they drink tea than coffee. (bound pronoun)

c. More baristas claimed that there is tea than coffee in the pot. (expletive)

d. More baristas claimed that no customer drinks tea than coffee. (quantifier)

e. More customers who know the barista claimed that he drinks tea than coffee. (unbound pronoun)

f. More baristas claimed that the cafe owner drinks tea than coffee. (shifty subject)

Huang reports that judgments that examples with a bound pronoun subject like (50b) are judged as highly as the infinitival baseline in (50a). In contrast, the participants in his experiment judged the examples with expletives, quantifiers and unbound pronouns (50c-e) to be considerably worse. On the surface, this constitutes substantial evidence against the generality of the pattern we have reported here. However, we believe there is reason to be skeptical of this conclusion. First of all, it is interesting to note that the canonical shifty subject example in (50f) was judged to be better than all of our non-shifty subject examples, which we find surprising. Indeed, we had constructed examples of comparative deletion that we judge to be as good as the bound pronoun case:

(51) a. More people claimed there was a problem with the economy than with illegal immigration.

b. More survey participants claimed that no politician would address economic issues than environmental ones.

c. More headhunters who interviewed Jack$_i$ claimed that he$_i$ would be a good fit for Google than for Facebook.

What explains the difference between these cases and the results Huang found, then? We believe that issue lies in confounds present in each of Huang's ex-

amples, which we suspect have a negative impact on their acceptability coupled with the way in which Huang assesses the modulating effect of lack of attentional shift. In the case of the expletive subject (50c), the comparative is attached to a DP that is non-final in the clause (unlike all of Huang's other examples). For reasons that are not clear to us, finality has a significant impact on the acceptability of this construction:

(52) a. More baristas offered their friends tea than coffee.
b. ??? More baristas offered tea than coffee to their friends.

When the comparative is attached to the final DP in an embedded clause with an expletive sentence, the sentence improves considerably.

(53) More baristas claimed that there is tea in the pot than the thermos.

For the cases of quantifier subjects (50d), the confound relates to the impact of the presence of a negative quantifier on an acceptability judgment. Because of the semantic complexity such quantifiers add, it is our expectation that the following pair of sentences would yield an acceptability contrast in a survey of judgments:

(54) a. More baristas than cashiers claimed that no cafe owner drinks tea.
b. More baristas than cashiers claimed that the cafe owner drinks tea.

As a result, identifying the degree to which the presence of the quantifier subject modulates the clause boundedness effect would require us to first control for the impact of the presence of the quantifier, and determine whether the reduced acceptability in cases like (50d) is lower than this. The case of unbound pronouns in (50e) is similar: here the confounding factor is the presence of the subject-modifying relative clause. Such complexity in a subject yields a center-embedded structure that induces a higher processing load, something which we would expect to yield lower judgments. Again, in order to understand whether there is any modulating impact of the unbound pronoun, we need to compare such cases to examples with relative clauses, but where the pronouns are bound by the subject:

(55) a. More customers who know the barista claimed that he drinks tea than coffee.

b. More customers who know the barista claimed that they drink tea than coffee.

Our judgment is that these examples are comparable in acceptability. In any case, it is only by comparing structurally comparable examples that we can assess the impact of the pronoun binding itself on clause boundedness.

6 Conclusion and Prospects

In this paper, we have examined clause-boundedness and its exceptions in multiple sluicing. We have uncovered data that point to the inadequacy of past work on this topic (Grano and Lasnik, 2018; Abels and Dayal, 2016) which tied exceptions to clause-boundedness to the presence of a bound-pronoun in the embedded clause. Our work instead introduces a new generalization, stated in (7), according to which clause-boundedness arises from constraints on forming dependencies across discourse transitions involving what we call "shifty subjects." We provide a characterization of this pattern in (20), building on ideas from Centering Theory. and we provide two possible syntactic implementations.

We take an implication of the pattern we have uncovered to be that syntactic locality must be sensitive to discourse factors. We have implemented such sensitivity by explicitly representing discourse features in syntax. But there is a reductionist alternative, as one of our anonymous reviewers observes. Specifically, we might say that, in sluicing contexts, Attentional Shift across discourse segments results in degraded acceptability, obviating the need to invoke syntactic well-formedness. Such a discourse-based perspective on syntactic locality is in fact not novel, and has previously been advocated by Erteschik-Shir (1973), Kuno (1987), Van Valin, Jr. (1995), Goldberg (2013), and Abeillé et al. (2020) among others. Though these authors present a range of specific proposals, they share a central idea: islandhood derives from a conflict between the information status of a displaced element (i.e., it is focused) and that of the constituent out of which it is extracted (i.e., it is topical). For example, subjects, which are typically topics, constitute islands to extraction for question formation, which

involves a focused wh-phrase, under the assumption that it is infelicitous to have a focus as part of a topic. While this approach is similar in some respects to the perspective we take here, it differs in important details: we do not focus on the information status of a complement clause, but rather the information status of the complement clause's subject. Moreover, it is not obvious how the presence of a shifty as opposed to non-shifty subject would impact the information status of the entire clause containing it. All of the cases we have discussed here involve extraction from a complement clause, which is assumed by these authors to constitute a topical constituent. A shifty subject, then, would not alter the information status of the clause containing it. In contrast, a non-shifty subject, though focal, should also not impact the information status of its clause (cf. Abeillé et al. (2020, fn. 5)). Even if there were some way of extending these previous discourse-based conceptions to the current context, it is not clear why the kind of clause-bounded locality described here should arise only in very specific contexts such as multiple sluicing.[25]

Consequently, though we believe the ultimate motivation for clause boundedness does indeed derive from properties of information structure and their impact on the efficiency of inference, we think that such an impact must arise through its grammaticized structural reflection. We have argued that this grammaticization can be cached out in one of two ways. One involves the incorporation into syntactic representations of features that encode discourse properties. This has been a theme of much recent work (Frascarelli, 2007; Frascarelli and Hinterhölzl, 2007; Haegeman, 2012), and we view our findings as providing potential support for this development. An alternative approach to the syntax-discourse interaction jettisons syntactic modularity, and instead allows

[25] A reviewer suggests another reductionist alternative, which would aim to derive clause-boundedness in multiple sluicing from processing complexity (cf. Kluender and Kutas (1993)). On such a view, both multiple sluicing and attentional shift are assumed to impose processing complexity, with the combination yielding a level of complexity beyond what is possible. This excess complexity is perceived as unacceptability by speakers. Such processing-based treatments have attracted considerable attention, but it is our sense that they are ultimately not viable for reasons of the sort discussed by Sprouse et al. (2012). We believe that the approach the reviewer suggests will not succeed for some of reasons as those discussed by Sprouse and colleagues. Additionally, there is a considerable explanatory burden on such an approach to clause-boundedness, showing that all and only those constructions that exhibit clause-boundedness induce processing complexity. Nonetheless, we leave further exploration of this possibility open for future work.

discourse properties to interact directly with syntactic derivations.

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