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What the EPP and comp-trace effects have in common: Constraining silent elements at the edge

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We focus here on the "classic" EPP, the requirement that certain subject positions be filled, and argue that characterizing it in terms of a syntactic movement-triggering feature is misguided. Specifically, we argue that, contrary to standard assumptions but along the lines of some recent proposals, the factors conditioning the EPP are actually not syntactic, but phonological. Nonetheless, the operations that it seems to trigger clearly are syntactic. Under common assumptions about the architecture of the grammar, the EPP thus seems to involve a violation of modularity or strict cyclicity. A novel approach to the EPP is thus required, which must simultaneously be able to handle its unique properties but must also be made to fit in with the broader grammatical architecture. We will argue that such an approach will not only allow a more satisfactory account of the EPP itself, but can also yield a unification with the comp-trace effect and yield insight into how both of these interact with pro-drop.

1 Overview

The status of the EPP is a long-standing puzzle for syntactic theory, which is reflected in the development of its various incarnations and implementations. It has undergone an evolution from a specific condition requiring a subject in each sentence (Chomsky 1981), to a more abstract feature used to ensure that a head projects a specifier (Chomsky 2001: and subsequent), and even to being a general movement trigger, driving head movement in addition to phrasal movement. This modern version of the EPP is arguably the formal feature par excellence, used purely to trigger syntactic operations, without being tied to any interface requirements. As such, it is also a thorn in the side of the Minimalist goal to have syntactic derivation be driven by interface concerns interacting with general principles of economy and efficient computation.

In this paper, we focus on the original empirical domain of the EPP, the requirement that certain subject positions be filled, and argue that characterizing it in terms of a syntactic movement-triggering feature is misguided. Specifically, we will argue in Section 3.1 that, contrary to what is standardly assumed, the factors conditioning the EPP are actually not syntactic, but phonological, as has also been proposed in one way or another by researchers like Holmberg (2000); Landau (2007); Sigurðsson (2010) and Salzmann et al. (2013). Nonetheless, the operations that it seems to trigger clearly *are* syntactic, which is the focus of Section 3.2. This sheds light on why the EPP has been so difficult to get a handle on, but it also presents a conundrum, as it seems to suggest that aspects of the syntactic derivation depend on phonological information. Under the broadly Minimalist

framework we adopt here, this would be clearly countercyclic. In the standard Y-model and its descendants, the output of the (narrow) syntactic derivation feeds into the interpretive components of PF and LF; thus while syntactic information feeds into PF, phonological information is not available to the syntax. More recent phase-based and multiple spellout models (etc. Uriagereka 1999; Chomsky 2001) introduce a certain amount of feedback, such that syntactic cycles may be interleaved with non-syntactic ones, but it is normally *not* assumed that phonological information from previous cycles can actually interact with later syntactic cycles. Indeed, the crucial point here is not specific to the Y-model. Rather, it extends to any framework which assumes that the syntactic derivation does not have access to the phonological properties of the structures it manipulates, e.g. as a general principle of modularity (e.g. the Principle of Phonology-Free Syntax, see Zwicky & Pullum 1986), or because phonological content is explicitly inserted at a late stage of the derivation after the narrow syntax has done its work (as in realizational theories of morpho-phonology like Distributed Morphology Halle & Marantz 1993). The EPP thus seems to involve a violation of modularity or countercyclicity.

A novel approach to the EPP is thus required, which must simultaneously be able to handle its unique properties but must also be made to fit in with the broader theory of grammatical architecture. We will argue that such an approach will not only allow a more satisfactory account of the EPP itself, but can also yield a unification with the COMP-trace effect and yield insight into how both of these interact with pro-drop. This paper is intended as an initial contribution in this direction.[1]

2 Background on the EPP and its development

In this section, we consider the basic evidence for assuming some version of the EPP, along with significant developments in how it has been understood over the past 35 years. The original formulation of the EPP (Chomsky 1981, et seq.) was based on the observation that clauses require their subject position (now usually identified as Spec-TP) to be filled (see also Svenonius 2002; Landau 2007; Jouitteau 2008; Cable 2012, for useful background on the EPP and its history). This was intended to include straightforward overt subjects as well as covert ones, such as traces of A- and Ā-movement, PRO and *pro*, with the choice among these being regulated separately.

The pattern in (1) can be explained in terms the θ-criterion: the verb *mow* has two θ-roles to assign, but when the subject is absent, it only gets to assign one of them, leading to ungrammaticality:

(1)   *(Dan) mowed the lawn.

However, there are cases where there is no thematic requirement for a subject, e.g. with verbs that engage in the causative-inchoative alternation like *shatter*. When used transitively, as in (2a), *shatter* assigns two θ-roles, an AGENT role to the subject and a PATIENT role to the object. Yet such verbs can famously also be used intransitively, as in (2b), with the agent role left unexpressed. Crucially, the contrast between (2b) and (2c) shows that the remaining argument, which was the object in (2a), must surface in subject position in English: i.e. it cannot remain in its post-verbal position where it gets its θ-role:

(2)   a.   Sandra shattered the pot.
        b.   The pot shattered.
        c.   *Shattered the pot.

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[1] Due to space limitations, extended discussion of relevant prior work and of how our proposals fit into broader architectural considerations have been cut from the current version of this paper. This can be found in the expanded version of this work in McFadden & Sundaresan (2017).

Given that (2b) is grammatical, the problem with (2c) cannot be that a θ-role has gone unassigned—the AGENT role of *shatter* must somehow be optional. Instead, the issue seems to be the lack of a DP in subject position, which is addressed by moving *the pot* there in (2b). Passive sentences like *The pot was shattered* are parallel in this respect. Again, we need something beyond the θ-criterion to ensure that DPs, which would otherwise be objects, appear in subject position.

Of course, GB theory and its descendants have another key mechanism that can be invoked to account for these facts, namely Case theory. As per Burzio's Generalization, no accusative Case should be assigned to the object position in sentences like (2c), given the lack of an external θ-role. The only Case available then is nominative, which was traditionally assumed to be assigned in Spec-IP/TP. It could thus be posited that these DPs are forced to move to subject position by their Case needs. Much subsequent work has called this analytic strategy into question, however, arguing that nominative isn't actually restricted to subjects or to any particular position, and thus Case can't be used to trigger movement (see e.g. Marantz 1991; McFadden 2004, a.o.). If that line of work is on the right track, patterns like that in (2) already serve as evidence for the EPP.

The really clinching argument, however, has always been based on expletives. Under certain circumstances (related to predicate-class and subject-definiteness), the subject can surface in an unexpectedly low post-verbal position, even in English. However, as (3) illustrates, the normal pre-verbal subject position must still be filled, in this instance by the expletive *there*:

(3)   *(There) is an elephant on my sofa.

The grammatical version of (3) shows us that, whatever Case (and other) needs the expected subject DP has, they can be met in situ, without movement up to Spec-TP. Nonetheless, Spec-TP must be filled by *something*. An essentially parallel argument can be extended to *it*-type expletives with post-copular sentential subjects in English:

(4)   [That Julie has two heads] is strange. *vs.* *(It) is strange [that Julie has two heads].

(5)   [For Jay to wear that] would be sad. *vs.* *(It) would be sad [for Jay to wear that].

In all these cases, the requirement for these expletives cannot be thematic, since they essentially double an argument that appears elsewhere in the clause. More importantly, they are not easily amenable to an account in terms of the Case needs of DPs. While one can argue that *the pot* has to move to Spec-TP in order to receive nominative Case in (2b), it does not make sense to say that expletives *there* and *it* must be inserted in Spec-TP because they require Case—if they were simply left out of the derivation, their needs would be irrelevant. Rather, they must be entering the derivation for some other reason. These patterns taken together lead to the assumption of a further principle to regulate the distribution of DPs, stated in a simple traditional form in (6):

(6)   **The traditional EPP**
        Every clause must have a filled subject position.

3 Establishing the modularity problem

In this section, we will present empirical evidence to show that the EPP in languages like English is conditioned by phonological factors (section 3.1). At the same time, the operation responsible for creating a structure that satisfies the EPP shows the properties

of being syntactic, not prosodic (section 3.2), and its output can affect interpretation at both LF and PF.[2]

3.1 The EPP must hold at PF

Compelling evidence that the EPP has a phonological side comes from the fact that, in the core cases it is meant to capture, it is a requirement, not just for *any* subject, but specifically for an *overt* one:[3]

(7)   a.   I like beans.
        b.   *Like beans. (under the interpretation 'I like beans')
        c.   *pro like beans.

(8)   a.   It is strange [that Julie has two heads].
        b.   *Is strange [that Julie has two heads].
        c.   *pro is strange [that Julie has two heads].

More or less any version of the EPP will rule out structures like (7b) and (8b), as they lack any representation of a subject. The interesting question is why the same surface strings are ungrammatical with the analyses indicated in (7c) and (8c), i.e. where they are each understood to have silent *pro* subjects. Subject pro-drop languages like Spanish of course *do* allow such clauses with a silent *pro* subject under the right circumstances (see e.g. the contributions in Biberauer et al. 2010, for an overview), as in (9):

(9)   Hablo   español.
        pro speak-1SG Spanish
        'I speak Spanish.'

The standard account is that the EPP would indeed be satisfied by the syntactically present but silent subjects, but that the structures are nonetheless ruled out because English is not a (subject) pro-drop language. I.e. the special silent element *pro* is available in Spanish, but not in English.

   However, this falls short of an adequate explanation on multiple grounds. First, it may not actually be correct to rule out pro-drop in general in English, given arguments that at least some instances of Non-Obligatory Control (NOC) should be analyzed as (a restricted kind of) pro-drop, even in languages like English (Hornstein 1999; McFadden & Sundaresan under review). Thus the theory would have to account for why pro-drop is not possible in specifically this type of clause. Second, even if we managed to exclude *pro* in prototypical finite clauses, we would still need to explain why there are no *other* silent DPs that could occur in this position. Note that a considerable number of elements have been posited for English that are fully present and active in the syntax, but happen to receive no overt pronunciation: e.g. silent C elements in unembedded declaratives and in some complement clauses, silent T in present-tense clauses lacking an auxiliary, silent *v* with underived verbs, silent D with bare mass nouns and plurals, silent P in bare noun-phrase adverbials like *last week* in *I went to Berlin last week*, PRO subjects in infinitival clauses, all manner of unpronounced copies or traces of movement, and of course a variety of constituents in ellipsis configurations. Once we acknowledge that such null elements exist, we

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[2] We are by no means the first to recognize that the EPP must be at least partly phonological and to explore analytical possibilities for integrating this idea with standard architectural assumptions. Of particular note are Holmberg (2000); Landau (2007); Sigurðsson (2010) and Salzmann et al. (2013). For reasons of space, we are not able to discuss these works and how our proposals relate to theirs in detail here. See McFadden & Sundaresan (2017) for more.

[3] For the moment we are abstracting away from cases involving Ā-bar movement of the subject and the various non-finite clause types, but will examine them in detail over the course of the paper.

need a story for why *all* of the DPs that are licensed to appear in the subject positions in sentences like (7) and (8) in English happen to include at least one terminal node that is not on that list, i.e. why they all happen to have overt forms. Finally, this approach to the contrast between (7c) and (9) presupposes that there is an explanatory theory of pro-drop that can account for why it isn't available in languages like English, including the qualifications noted here. In the absence of such a theory, saying that English is not a (subject) pro-drop language is clearly just a restatement of the facts.

A second potential argument that the EPP applies at PF comes from effects with ellipsis, discussed e.g. by Merchant (2001); van Craenenbroeck & den Dikken (2006). Extraction from surface subjects in English is generally ruled out (10a), arguably because such subjects have moved, and moved elements are islands. However, extraction becomes possible if the extraction site is elided, as in (10b):

(10)   a.   *Which Marx brother$_i$ is [a biography of t$_i$]$_j$ going to appear t$_j$ this year?
        b.   A biography of one of the Marx brothers is going to appear this year, but I
              don't know which (Marx brother).

Merchant proposes that what happens in (10b) is that the subject never actually moves, thus it is not an island to extraction. I.e. the correct structure is (11):

(11)   … [$_{CP}$ [which (Marx brother)]$_i$ ~~is [$_{TP}$ going to appear [a biography of t$_i$] this year]~~].

Of course, this should lead to an EPP violation since the embedded clause doesn't have any material in Spec-TP. The fact that it is nonetheless grammatical suggests that the EPP only applies at PF, after ellipsis, thus it never sees the potentially violating structure, and (11) is allowed. Such an analysis would be impossible with a syntactic EPP. However, we will not rely heavily on this argument for a phonological EPP, as it has recently been challenged by Barros et al. (2014).[4]

A further class of evidence for the phonological status of the EPP comes from a comparison with certain other restrictions on subjects that are usually handled separately, namely the COMP-trace effect.[5] The central idea, which we will develop throughout the paper, is that the EPP can and should be unified with the COMP-trace effect, the ban on *for-to* and the anti-*that*-trace effect. If this is correct, it provides two pieces of support for a phonological account. First, there is independent evidence for the phonological status of the COMP-trace effect. Second, what the various constraints here have in common is their reference to *silent* subject positions in specific contexts. In other words, they can only be unified via reference to (non-)overtness, and thus the unifying implementation must be situated at PF.

The COMP-trace effect is exemplified in (12):

(12)   a.   Who$_i$ do you think [(that) Alex punched t$_i$]?
        b.   Who$_i$ do you think [t$_i$ is stupid]?
        c.   *Who$_i$ do you think [that t$_i$ is stupid]?

(12a) shows that when an object is *wh*-extracted from an embedded clause into the matrix, the complementizer *that* is optional. But when the subject is extracted, *that* suddenly must be dropped, as is clear from the contrast between (12b) and (12c). The first important point to note is that the COMP-trace effect descriptively amounts to a constraint against a silent subject position in a particular context, just like the EPP. The second is that

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[4] We thank Gary Thoms and an anonymous reviewer for very helpful comments on the issues here.
[5] We thank an anonymous reviewer for comments on a previous version which helped us restructure the exposition of this argument to (hopefully) improve clarity.

there is mounting evidence that COMP-trace effects are not actually syntactic, as was long thought, but rather involve something phonological or prosodic (Kandybowicz 2006; Bruening 2009; McFadden 2012; Salzmann et al. 2013). For one thing, ellipsis seems to eliminate the effect (Merchant 2001):[6]

(13)   John said that someone would write a new textbook, but I can't remember who$_i$ ~~John said that t$_i$ would write a new textbook.~~

For another, the intonational break created by Right Node Raising (indicated here by the | character), while not completely removing the effect, greatly improves grammaticality (de Chene 1995):

(14)   ?Who$_i$ does John doubt whether | and Bill suspect that | t$_i$ cheated?

Finally, the effect is substantially ameliorated by having an adverbial intervene between the complementizer and the presumed position of the trace (Bresnan 1977, and others):

(15)   Who$_i$ do you think [that, against better judgment, t$_i$ punched Alex]?

We can further underline the connections to the EPP by looking at infinitival clauses. Note first that the COMP-trace effect applies equally well to the infinitival complementizer *for*, as demonstrated by the triple in (16). It is optional in the complement of certain verbs when an object is extracted (16a), but when the subject is extracted, it must be null as shown by the contrast between (16b) and (16c) (Chomsky & Lasnik 1977; Pesetsky & Torrego 2001):

(16)   a.   Who$_i$ would you like [(for) Alex to punch t$_i$]?
       b.   Who$_i$ would you like [t$_i$ to punch Alex]?
       c.   *Who$_i$ would you like [for t$_i$ to punch Alex]?

Interestingly, overt *for* is also ruled out when the following subject is null for reasons other than Ā-movement, i.e. when it is (controlled) PRO. (17a) shows again as a baseline that *for* is optionally overt before an overt subject. The contrast between (17b) and (17c) shows that this optionality disappears when the subject is PRO, overt *for* being ruled out. This is thus completely parallel to a COMP-trace paradigm.[7]

(17)   a.   I would like [(for) you to punch Alex].
       b.   I$_i$ would like [PRO$_i$ to punch Alex].
       c.   *I$_i$ would like [for PRO$_i$ to punch Alex].

It's important to note at this juncture that the analysis of the distribution of *for* in terms of the Case needs of the following subject (see e.g. Martin 2001, for a detailed presentation of this position) is untenable (see e.g. Landau 2006; Sigurðsson 2008; McFadden 2012). Briefly, it struggles with the optionality of overt *for* in examples like (17a), requires a problematic conflation of *want*-class predicates with *believe*-class ones for purposes of Case assignment, and has nothing to offer in the face of (18):

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[6] Though again, see Barros et al. (2014) for discussion of how well this argument stands up to closer scrutiny. With COMP-trace effects in particular, their verdict remains inconclusive, as they find *some* evidence for genuine amelioration due to ellipsis and note the existence of the kind of ellipsis-independent arguments we discuss here that COMP-trace effects apply at PF.

[7] There are historical and contemporary varieties of English where the facts are different, with overt *for* being possible with a silent PRO subject. However, in these varieties *for* has a rather different syntactic status. See Henry (1992) for careful discussion of the facts in Belfast English.

(18) a. Heinz wants, with all his heart, *(for) Hans to join him in Paris.
      b. Who$_i$ does Heinz want, with all his heart, (*for) t$_i$ to join him in Paris?

(18a) shows that, when the matrix verb is separated from the embedded infinitival by an adverbial, overt *for* becomes obligatory. In the Case story, *for* is required here to assign Case to *Hans* because the adverbial prevents the matrix verb *wants* from doing so by ECM. However, if we *wh*-move the embedded subject into the matrix as in (18b), *for* is no longer needed, and in fact is ruled out. If Case regulates the distribution of *for*, (18b) should be just as bad as the version of (18a) without *for*, since there is still nothing to assign Case to the embedded subject (see Landau 2006; McFadden 2012, for more detailed argumentation against using Case to model the properties of infinitives).

Thus a different story is required for the distribution of *for*. Our approach will be to unify it with the COMP-trace effect, as both involve ruling out configurations where an overt complementizer is followed by a silent subject position, which clearly applies as intended in (18b). Note then that if this is the right characterization of the offending configuration, it cannot have anything to do directly with traces or movement per se, but with nullness being a problem in subject position under certain circumstances. Again, this means that we must be dealing with something at PF, since it is phonological silence that matters, and the connection to the EPP is reinforced, with the two conditions amounting to different circumstances under which the subject position is not allowed to be null.

The discussion in this section leads us to the preliminary conclusion, in partial agreement with Holmberg (2000); Merchant (2001); van Craenenbroeck & den Dikken (2006); Landau (2007); Sigurðsson (2010) and Salzmann et al. (2013), that the traditional EPP is not a narrow syntactic condition, requiring that a particular syntactic position be filled at some point in the derivation, but a PF condition requiring the presence of an overt element. It will be the work of sections 4 and 5 to implement such a condition and show how it can cover EPP and COMP-null effects. First, however, we must consider the syntactic side of the EPP.

3.2 The operations that satisfy the EPP are syntactic

If, as we have just argued, the EPP operates by placing restrictions at PF, an obvious conclusion would be that it triggers DP-movement to subject position and the insertion of expletives to happen at PF. However, at least in the case of movement, this is clearly incorrect. EPP-satisfying movement bears all the hallmarks of a syntactic operation, and furthermore yields LF effects in addition to the obvious PF ones. Given standard assumptions about the architecture of the grammar, we are left to conclude that displacement that satisfies the EPP is not a PF operation, but quite standard (narrow-)syntactic movement.

First of all, what actually undergoes movement is a *syntactic* constituent, not a phonologically or prosodically defined one from the prosodic hierarchy, like a syllable, prosodic word or major phrase, but a DP in its entirety:

(19) a. [$_{DP_1}$ [$_{DP_2}$ The man] [$_{PP}$ with the red hat]]$_i$ seemed [$_{TP}$ t$_i$ to be insane].
      b. *[$_{DP_2}$ The man]$_i$ seemed [$_{TP}$ [$_{DP_1}$ t$_i$ [$_{PP}$ with the red hat]] to be insane].
      c. *[$_N$ Man]$_i$ seemed [$_{TP}$ [$_{DP_1}$ [$_{DP_2}$ the t$_i$] [$_{PP}$ with the red hat]] to be insane].

Second, EPP movement is sensitive to standard syntactic restrictions like locality and minimality. In (20), *The hungry man* starts out closer to the landing site of Spec-TP than *the soup* does, so it is the former that moves there (20a), not the latter (20b):

(20)   a. $[_{DP_1}$ The hungry man$]_i$ will t_i devour $[_{DP_2}$ the soup].
        b.   *$[_{DP_2}$ The soup$]_i$ will $[_{DP_1}$ the hungry man] devour t_i.

(21) illustrates a different type of minimality effect. *Matilda* is contained within the larger DP *a relative of Matilda*. Since the larger DP is itself eligible to move to Spec-TP, as in (21a), *Matilda*, though of the right syntactic category, may not be sub-extracted to do so, yielding ungrammaticality in (21b):

(21)   a. $[_{DP_1}$ A relative of $[_{DP_2}$ Matilda $]]_i$ arrived t_i.
        b.   *$[_{DP_2}$ Matilda$]_i$ arrived $[_{DP_1}$ a relative of $t_i]$.

Both (20b) and (21b) violate relativized minimality. If we adopt the proposal that DPs are phases (e.g. Svenonius 2004), then (21b) also violates locality—specifically, the Phase Impenetrability Condition (PIC). Another locality contrast is seen in (22). Raising succeeds in (22a), which we can attribute to the raising infinitive being a TP, hence not a phase. On the other hand, raising is impossible in (22b), where the embedded clause is finite, hence a CP and a phase. A-movement out of this embedded clause from Spec-TP thus violates the PIC:[8]

(22)   a. $[_{DP}$ Matilda$]_i$ seems $[_{TP}$ t_i to be lazy].
        b.   *$[_{DP}$ Matilda$]_i$ seems $[_{CP}$ that t_i is lazy].

Such sensitivity to minimality and locality would be unexpected if EPP-satisfying movement were implemented at PF. This holds even under a framework like Distributed Morphology where a portion of the post-syntactic PF derivation can involve movement on partially hierarchical structures. Such post-syntactic movement is heavily restricted in ways quite different from syntactic movement and would thus be predicted to yield patterns rather different from what we've seen here for EPP movement. Abstracting away from the expectations of particular theories of PF movement, there is no evidence for the relevance of prosodic or phonological wellformedness conditions (e.g. linearity, adjacency, stress-placement and phonotactics) for movement to subject position.

Further evidence that EPP-satisfying movement takes place in the narrow syntax comes from the fact that it has clear *interpretive* consequences. First, it affects anaphoric binding possibilities. In (23a), *every male senator* is in an embedded clause, thus does not c-command the anaphor *himself* in the matrix. Since there is no other c-commanding potential antecedent, the sentence is ruled out:

(23)   a.   *It seems to himself$_i$ $[_{CP}$ that every male senator$_i$ is silly].
        b.   Every male senator$_i$ seems to himself$_i$ $[_{TP}$ t_i to be silly].

(23b) is largely parallel, except that *every male senator* raises out of the embedded clause, satisfying the matrix EPP, and ending up in a position where it does c-command *himself*. The sentence is grammatical under the interpretation indicated, which tells us that binding has succeeded. Since *every male senator* started out in a position from which precisely that binding was ruled out in (23a), we can conclude that it is the EPP-satisfying movement that feeds the binding. While we can debate whether the relevant stage for binding is LF itself or some earlier point in the syntactic derivation, what is clear is that it cannot be on the PF branch, since binding feeds into the determination of reference, which clearly is an issue handled on the (output of the) LF/interpretive branch. Essentially parallel arguments can be made with respect to changes in scope relations, as in (24a)–(24b):

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[8] Going via the Spec-CP escape hatch is ruled out because it would lead to improper movement.

(24) a. It seems to one cook [$_{CP}$ that every dish stinks]. ($\exists \gg \forall$; ?*$\forall \gg \exists$;)
      b. [Every dish]$_i$ seems to one cook [$_{TP}$ t$_i$ to stink]. ($\exists \gg \forall$; $\forall \gg \exists$)

While EPP-satisfying movement affects LF, it nevertheless clearly does not occur on the LF branch itself, because it has obvious PF effects E.g. *every dish* is pronounced earlier in the string in (24b), where it has undergone EPP-satisfying movement into the matrix clause, than in (24a), where it has not. Under the modular architecture of the grammar assumed here, operations on the LF branch should be invisible to PF, just as operations on the PF branch should be invisible to LF. The only appropriate portion of the derivation for an operation like EPP-satisfying movement that has both LF and PF effects is the narrow syntax, which feeds into both.

  The data up to this point show that the EPP has the rather puzzling constellation of properties in (25):

(25)   The EPP must be stated at least in part at PF, as it is sensitive to phonological properties of the configurations it regulates. Nevertheless, the movement responsible for creating structures that satisfy the EPP bears the structural hallmarks of a syntactic operation, and its output feeds both LF and PF interpretation, thus it must take place in the narrow syntax.

Given standard assumptions about the architecture of the grammar that are adopted here, the EPP thus appears to involve a violation of modularity. Our ultimate goal must thus be an analysis of this constellation of facts that somehow resolves the modularity issue.

4 Implementing the EPP as a PF-constraint

The intuition we will try to formalize is the following one. The requirement for a non-zero pronunciation is presumably the sort of thing that can be stated at PF, because it involves phonological information. However, identifying that position through direct reference to subjects or positions like Spec-TP clearly involves syntactic information, and thus does not seem to be at home at PF. We need a way then to define the relevant position targeted by the EPP in terms that should make sense at PF, and ideally there should also be a phonological or prosodic reason for why this position in particular should have to be filled by something overt.

4.1 *The subject position and Intonational Phrases*

What is special about Spec-TP, or more generally the position occupied by the subject, that could lead it to being singled out by the EPP at PF? The idea we would like to pursue is that it has to do with a confluence of two factors which are relevant for how syntactic structure interacts with the construction of prosodic domains. The first factor is the position of the subject at or near the left edge of the clause. It is commonly argued that clauses, and in particular root clauses, correspond with an important prosodic domain called the Intonational Phrase (henceforth IntP) (see An 2007; Selkirk 2011; Hamlaoui & Szendrői 2015, and much earlier work cited there). The second factor is how the position usually occupied by the subject relates to syntactic phases.[9] Under standard phase theory (Chomsky 2001, etc.), what is sent to the interfaces is a phase domain, i.e. the complement of the phase-defining head. Given that C is such a phase-defining head, TP will be the spellout domain of the CP phase, with the usual subject position in Spec-TP being at

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[9] See also Richards (2003), who similarly attempts to derive the special status of the EPP position from interactions of phase theory with spellout, but with a rather different approach based on rather different assumptions.

the left edge of this domain. While there is significant disagreement on the details, it is commonly assumed that such spellout domains play an important role in the mapping between syntactic structures and prosodic domains (Adger 2003; Kahnemuyipour 2009; Selkirk 2011; Sato & Dabashi 2016, and many others).

What we would like to propose is that these two factors taken together will ensure that the portion of the clause where subjects normally appear will be at the left edge of an IntP in the contexts where we see EPP and COMP-null effects. This will allow us to derive the overtness requirement by means of a proposal we adopt from An (2007: 61):

(26)   **Intonational Phrase Edge Generalization (IPEG)**
        The edge of an IntP cannot be empty (where the notion of edge encompasses the specifier and the head of the relevant syntactic constituent).

The reason why such a constraint should hold has to do with how prosodic structure is built up hierarchically. IntPs are constructed on top of prosodic words (which are built on top of feet, syllables, morae etc.), and An (2007) argues that this implies that the boundary of an IntP must correspond to the boundary of a prosodic word. Assuming that only elements with an overt pronunciation can constitute prosodic words, this derives the requirement that the edge of an IntP will have to contain overt material. If the subject position at or near Spec-TP finds itself at the left edge of an IntP in cases where we see EPP and related effects, we can reduce the phonological side of the EPP to the IPEG in (26).

We have a bit of work to do, however, because An (2007) is almost entirely concerned with CPs (rather than TPs) being parsed as Intonation Phrases, and thus he uses the IPEG in his paper primarily to regulate the overtness of complementizers like *that* (potentially alternating with overt material in Spec-CP like moved *wh*-phrases or relative pronouns). If IntPs generally correspond to CPs, the subject position in Spec-TP would have to be regulated by something other than IPEG. However, it is important to recognize that An does not argue or assume that CPs are *generally* parsed as IntPs. Indeed, his paper is not about CPs in general, but specifically about what he refers to as "clauses in noncanonical positions". This includes clauses that appear in subject position, are topicalized or extraposed, or are otherwise separated from the preceding context, e.g. by intervening adverbial material. This is why, in line with the IPEG, they typically require overt complementizers. CPs appearing in "canonical" position, i.e. as the immediate complement of a clause-embedding verb, are *not* obligatorily parsed as independent IntPs. In other words, a CP in a non-canonical position has to map its left edge onto the left edge of an IntP not because it is a CP, but because it appears in a position where its left edge is somehow set off from any preceding material, and thus cannot be parsed into the same IntP as that material. It thus seems reasonable to think that a syntactic constituent of any category appearing in these non-canonical positions will be parsed as being at the left edge of an independent IntP. Such constituents just happen to frequently be CPs because CPs, as complete clauses, have a certain amount of flexibility in their syntactic distribution.

The question then is how IntP boundaries are determined in contexts where they are not forced by something external like the beginning of the utterance or a prosodic break introduced by an adverbial or extraposition structure. It is here that we think phase theory is relevant. We propose that spellout domains, i.e. the complements of phase-defining heads, correspond by default to IntPs. As the chunk of structure shipped from the narrow syntax to the interfaces, it is reasonable to think that they will function as a starting point for building prosodic structure, though the ultimate outcome may be obscured by independent factors. That is, we do not expect that phasal domains will always end up being parsed as independent IntPs, because the mapping between

syntactic structure and prosodic domains is not one-to-one. But this does mean that, in the default case, Spec-TP will be at the left edge of an IntP, and thus will be subject to the IPEG. The EPP and the various COMP-null restrictions can then be construed as a sub-case of this constraint, and the contexts where an overt subject is not required will be argued to fall out from it as well. Note crucially that (26) makes no direct reference to subjects, Spec-TP or any other specific syntactic position. This is what makes it a plausible PF constraint, and it means that we should find mismatches under certain circumstances between what it and a traditional syntactic EPP would predict. For example there should be no typical EPP effects when independent factors prevent Spec-TP from being at the left edge of an IntP, or when some other overt element appears in the left edge of the IntP, satisfying the IPEG without the need for a subject. We summarize this prosodic version of the EPP as in (27):

(27)   **Overt Subject Requirement (OSR):**
        Constraints against configurations with an empty subject position, including the EPP, the COMP-trace effect and the ban on *for*-PRO-*to,* arise when the standard subject position in Spec-TP, as the left edge of the spellout domain of a CP phase, appears at the left edge of an Intonational Phrase, and thus must be overt to satisfy the IPEG.

Before we begin a detailed development of the approach described in (27), it is important that we understand a bit more about how our use of the IPEG to regulate the distribution of overt subjects interacts with An's (2007) own use of it to regulate complementizers. The central intuition we are pursuing here is that there are two different ways for a syntactic phrase to end up aligned with an IntP, one categorial and the other positional. The categorial route is essentially our innovation, according to which the complement of a phase head constitutes a spellout domain, shipped to PF as a unit, and thus will by default be aligned with the left edge of an IntP. TPs tend to end up as IntPs by this route because they appear as the complement of the phase head C.[10] The positional route, on the other hand, is the one that An (2007) was primarily concerned with. A syntactic phrase in a non-canonical position—e.g. subject, adjunct, topicalized or extraposed—will also be aligned with an IntP at its left edge, because it is not in a tight relationship with what precedes it. I.e. these are positions that typically have either a clear intonational break or nothing at all to their left.[11]

  We will generally follow An (2007) on the determination of IntPs by position and, in general, on the distribution of overt complementizers. Our contribution will be in working out the details of IntPs by category, and the really interesting effects will come out of how the the two routes interact, and how subjects interact with complementizers and other aspects of the syntactic structure. While a single syntactic phrase will occasionally be identified as being aligned with an IntP by both routes, more frequently they will disagree, putting boundaries in different locations. Again, TPs will typically be identified as IntPs by the categorial route as complements of a phase head, and CPs will frequently be identified as IntPs by the positional route due to their ability, as complete clauses, to appear in the various non-canonical positions. This means we will often have configurations where both

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[10] See An (2007: Section 5.1.2) for discussion of some evidence on overtness effects that we should also expect within the vP phase.

[11] This does *not* imply that any phrase in subject position or any of the other non-canonical positions will align with an IntP at its *right* edge, so the IntP may e.g. include the entire containing clause.

a TP and its dominating CP will be aligned with a left IntP boundary, and thus both will be forced to have something overt to satisfy the IPEG.[12]

4.2 The basics of overt and non-overt subjects

Let us begin then with how we can use the OSR as stated in (27) to cover the basic patterns associated with the EPP. Typical finite clauses are straightforward:[13]

(28)   a.   [A book]$_i$ is t$_i$ on the shelf.
       b.   There is a book on the shelf.
       c.   *Is a book on the shelf.

The basic premise laid out in the OSR is that, all other things being equal, TPs will be parsed as IntPs, thus by the IPEG they require an overt edge. Hence, the standard subject position Spec-TP must be filled by overt material, which is accomplished in (28a) by having internally merged the DP *the book* there, and in (28b) by having externally merged expletive *there*. In (28c), on the other hand, neither of these things has been done, so the edge of the IntP remains empty, and the sentence is straightforwardly ruled out by the OSR.

One crucial difference between an EPP formulated as a requirement for a filled Spec-TP and one formulated as a requirement for an overtly pronounced left edge of IntP, as in OSR, is in the treatment of non-overt subjects. An unpronounced movement copy, PRO or little *pro* in Spec-TP will satisfy the former but violate the latter precisely because it is silent. A big part of the evaluation of our prosodic EPP will thus be to carefully consider clauses with non-overt subjects to see whether it can cover them correctly. Note, first of all, that a parse of (28c) with either a PRO or *pro* subject as in (29) will be correctly ruled out by the OSR, without needing recourse to any specific theory of control or pro-drop:

(29)   *PRO/*pro* is a book on the shelf.

We have no reason to expect this kind of structure to be treated differently from the ones in (28)—it has a TP parsed as an IntP, which however has a phonologically empty left edge. As far as the OSR is concerned, it is irrelevant that there is something there in the syntactic representation; it cares only about the phonological side of things, and thus (29) is ill-formed. What we need to do now is to ensure that the OSR doesn't similarly—but incorrectly—rule out structures where silent subjects are in fact licit.

Let us then consider infinitives. Spec-TP in the embedded clauses in (30) is filled syntactically—by controlled PRO in (30a) and by the trace of the raised subject in (30b)—but of course neither is pronounced overtly, and yet the sentences are unobjectionable:

(30)   a.   Beau tried [PRO to eat the samosa].
       b.   Carrie$_i$ seemed [t$_i$ to find the solution].

A traditional account, which conceives of the EPP simply as a condition that subject positions be filled, has no problem ruling these sentences in due to the presence of PRO and

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[12] We do *not* predict that two distinct IntPs will be diagnosable in the prosodic realization in such cases, as PF repair mechanisms can be expected to simplify matters when two boundaries of the same type appear so close to one another. It must simply be the case that such repair takes place *after* the evaluation of the IPEG. In general, what we are concerned with in this paper is a layer in the determination of prosodic structure that is very close to the syntax, essentially at the syntax-prosody interface. We should not expect that actual surface realization of prosody will reflect this too transparently, as various prosody-specific factors may intervene which will obscure the mapping.

[13] Finite root clauses raise a question for the IPEG at the CP level, in that they should be IntPs by the positional route and thus require an overt complementizer, contrary to fact. There are several reasonable ways to deal with this, and the choice among them doesn't interact crucially with our concerns here. See An (2007) for discussion and proposals.

the trace, but our PF story has some work to do. For the raising example in (30b), one option is to take advantage of the standard assumption that raising infinitives are TPs lacking a CP layer, and thus do not constitute phases. This means that the embedded TP will not be a spellout domain, and hence will not be parsed as an IntP by the categorial route. Therefore, the OSR simply does not apply, because the IPEG is not relevant. This is the first case where we see a clear difference from a simple requirement for an overt Spec-TP: what matters for our approach is not the Spec-TP position or subjects per se, but that which occurs at the left edge of an IntP. For the example in (30a), things are not so simple. Unlike raising infinitives, control infinitives are normally assumed to be CPs and hence phases, thus under our approach their TP complements would constitute IntPs by the categorial route. As such, we would incorrectly predict that the silence of the subject in (30a) would lead to a violation of the OSR. One way to obviate this would be to propose that the standard analysis is wrong, and control infinitives actually do not count as phases (or perhaps they constitute "weak phases"), thus their TPs don't form IntPs, just like with raising infinitives.

However, there is good reason to reject this line of argumentation. Such an analytic strategy works with raising infinitives only because they appear as complement clauses, i.e. in a canonical position in An's (2007) sense. This means that there will always be material from the matrix clause immediately to their left, and so we can say that the relevant empty Spec-TP position is somewhere in the middle of a larger IntP containing both matrix and embedded material, not causing any problems for the IPEG and the OSR. For non-raising infinitives (like control infinitives), however, this can't work as a general solution, because they are not restricted to complement position. While some kinds of obligatory control (OC) infinitives appear as complements that are tightly connected to their selecting verb, infinitival clauses with various types of NOC can appear as adjuncts, subjects and root clauses, and even certain OC clauses can appear as adjuncts under the right circumstances. In other words, these infinitives can appear in An's (2007) non-canonical positions, where there is no possibility of them being included in an IntP with preceding material.[14] The relevance of this should be especially obvious in cases like (31) where the non-finite clause is sentence-initial:

(31)   a.   [To eat the samosa] would be a mistake.
         b.   [To eat all the samosas in one go], Beau would need a lot of spicy chutney.
         c.   [To eat a samosa and finally die happy!]

In such examples, it doesn't matter what the internal structure of the non-finite clauses is, whether they constitute phases or whether they can be included in the same IntP as the matrix clause. They will be at the left edge of an IntP, because they are at the left edge of the utterance (and the utterance must of course be aligned with an IntP edge). So if we want to analyze this kind of non-finite clause in a way that doesn't run afoul of the OSR, we can't do it by saying that they aren't at the left edge of an IntP and hence aren't subject to the IPEG.

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[14] In fact, even raising infinitives can appear in a plausibly non-canonical position, separated from the selecting verb by an adverbial, as in (i):

   (i) Carrie$_i$ seemed, when last I checked, [t$_i$ to have already found the solution].

It would certainly seem that there is an intonational break before the embedded clause here, suggesting a boundary between IntPs: thus, even for raising infinitives we cannot always rely on the idea that they are parsed into the IntP of a higher clause. We must be able to generalize the kind of account suggested for non-raising infinitives to cover these particular cases as well, or potentially an analysis in terms of IntP Extension, as we will discuss later. We know of no reason to think that this should prove problematic.

Rather, we must assume that the left edge is actually filled, i.e. that the OSR applies and is satisfied. What the left edge is filled by is not difficult to see—the leftmost overt material is the infinitival marker *to*. Of course, this *to* is not a subject and it is presumably not in Spec-TP, but recall that our version of the EPP based on the IPEG has nothing specifically to do with subjects or the Spec-TP position but with the left edge of the phrase aligned with an IntP. The edge consists of both the relevant head and its specifier, and so in order for *to* to satisfy the IPEG in these infinitival clauses, we must simply ensure that it occupies the highest head in their structure. We propose to relate this to the fairly uncontroversial idea that control infinitives, while perhaps not as reduced as raising infinitives, are still structurally smaller than typical finite clauses (see Wurmbrand 2001; McFadden 2014, among many others). For concreteness, let us make the simplest assumption that *to* is in T, and these types of non-finite clauses simply lack the CP layer, as indicated in (32a). What we must rule out is an analysis like that in (32b), where the clause contains silent structure above the head where *to* is realized:

(32) a. $[_{TP}$ $(^{IntP}$ PRO To$_T$ [eat the samosas]] would be a mistake.
      b. $[_{CP}$ $(^{IntP}$ C $[_{TP}$ PRO To$_T$ [eat the samosas]]] would be a mistake.

We use $(^{IntP}$ to represent the left boundary of an IntP in our structures, which helps to clarify the contrast here (but will not generally represent right boundaries of IntPs, as they are less relevant for our concerns and not always easy to diagnose). Crucially, (32a) obeys the OSR even though Spec-TP is silent, because *to* is overt and realizes the highest head in the structure, i.e. the TP and hence the IntP has an overt left edge. In contrast, a structure like (32b) would be ruled out because the left edge is the head C and its specifier, neither of which contains overt material.

The precise identity of the head realized by *to* is not crucial as long as it is the highest in these control infinitives. But it is commonly assumed that finite auxiliaries in English occupy T as well, and so we need to ensure that our analysis doesn't predict that they could also satisfy the OSR. This would undermine our account of the EPP by incorrectly allowing null subjects in finite clauses with auxiliaries, along the lines indicated in (33):[15]

(33) *Celine said that $[_{TP}$ *ec* will$_T$ [play hockey]].

So we need a way to ensure that the *to* in control infinitives is treated differently from finite auxiliaries in a way that matters for OSR.

One avenue would be to propose that while *to* really is in T, auxiliaries occupy some head below T, call it F, as in (34):

(34) *Celine said that $[_{TP}$ $(^{IntP}$ *ec* T $[_{FP}$ will$_F$ [play hockey]]].

The left boundary of the IntP is still aligned with TP here, but the edge of TP is empty, as *will* is further down in FP, and thus the OSR is violated. We will pursue an alternative here, which allows us to maintain the standard intuition that *to* and the finite auxiliaries occupy the same position. What distinguishes them, instead, for the purposes of their ability to satisfy the OSR, is the structure of clauses in which they appear. Finite clauses include an additional phrase above the one headed by the auxiliaries which is missing in control infinitives—for concreteness we can call it FinP—as indicated in (35a). It is this phrase which is the complement of C and which hosts overt subjects in its specifier, as in (35b).

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[15] Here and in what follows, we indicate such null subjects as *ec*, as it is irrelevant to our concerns whether they are analyzed as PRO, *pro* or something else.

(35)   a.   *Celine said that [$_{FinP}$ (^{IntP} ec_i Fin [$_{TP}$ t_i will$_T$ [t_i play hockey]]].
        b.   Celine said that [$_{FinP}$ (^{IntP} she$_i$ Fin [$_{TP}$ t_i will$_T$ [t_i play hockey]]].

The left edge of IntP in these structures would be the Fin head and its specifier. The OSR thus rules out (35a) where they are both silent, the overt auxiliary in T simply being too low. An overt subject in Spec-FinP is required, as in (35b). The relevant contrast with control infinitives is that they simply don't project FinP, so that T is the highest head and is overtly realized by *to*, as in (32a), thus satisfying the OSR without the need for an overt subject.[16] While the difference we posit between finite and control infinitives to get the right behavior of *to* and finite auxiliaries remains somewhat stipulative at this point, it is again building on a long tradition of positing that non-finite clauses are structurally reduced relative to finite ones (again see Wurmbrand 2001; McFadden 2014, and references there). Furthermore, as we will see in section (5.5) this analysis receives some independent support in that it also allows us to handle connections between embedded subjects and the complementizer *for*.

   A version of what we say here about non-raising infinitives must apply analogously to gerundival clauses, which can also happily appear in non-canonical positions with no overt subject (e.g. *Eating the samosas would be a mistake*). With these it would be the head realized as the *-ing* suffix (perhaps with the verb moved up to it) that fills the left edge. They presumably have an even more reduced structure than infinitives, so the relevant head is even lower than T, but what is crucial is that they do not project any structure higher than the *-ing* head, so that it will count as the edge for purposes if the IPEG.[17]

5 Interactions with the CP layer

Where things get complicated, and where we think our account of the EPP in terms of the OSR really shows its merits, is when we consider how restrictions on the overtness of subjects interact with Ā-movement and the appearance of complementizers.

5.1 Subject wh-movement and comp-trace effects

We've gotten a first view of how to deal with null subjects in non-finite clauses. Now we can turn to the other main context in which English clauses have non-overt subjects, namely when the subject has undergone *wh*-movement, as in (36a):

(36)   a.   Who punched Alex?
        b.   [$_{CP}$ Who$_i$ [$_{TP}$ t_i punched Alex]]?

Under the standard analysis, *who* has moved from Spec-TP to Spec-CP, as indicated by the bracketing in (36b). At PF, then, Spec-TP is empty, yielding an IntP without an overt left edge, and we would expect a violation of the OSR, contrary to fact. Again, the traditional syntactic version of the EPP has no problem here, since it can be satisfied by the unpronounced copy of *who* in Spec-TP. Derivational accounts of a prosodic EPP (e.g. Holmberg 2000; Landau 2007) can handle such configurations as well, since an element with overt phonology does occupy Spec-TP at some point in the derivation. This avenue is not available to us however, as we will need to rely on *surface* overtness to cover the various

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[16] In what follows, we will stick to a simplified CP/TP system with subjects in Spec-TP for simplicity in cases where the distinction doesn't matter, but this should be understood as shorthand for the kind of analysis presented here.

[17] Something similar could be entertained for imperatives, which, as an anonymous reviewer points out, pose obvious questions for our analysis, being root clauses that do not require an overt subject. We will not attempt here to analyze ECM infinitives with *believe*-class verbs, bare infinitives with causative and perception verbs or the various types of small clauses, though we think that our approach sets up plausible avenues to consider for each of them in future research.

COMP-null configurations going forward. A reasonable response would be to adopt the minority analysis of subject *wh*-questions in English, according to which they don't actually involve overt *wh*-movement (see e.g. Brillman & Hirsch to appear). Since root subject questions lack any overt realization of C, the default subject position in Spec-TP is directly adjacent to the normal landing site for *wh*-movement in Spec-CP, thus the structure for (36a) under the movement analysis in (36b) is string-identical to the non-movement one in (37):

(37) $[_{CP} [_{TP} (^{IntP}$ Who punched Alex]]?

Since *who* remains in Spec-TP under this analysis, the left edge of the presumed IntP aligned with TP is filled, and no problem arises with the OSR.

   Now, when the *wh*-element is the subject of an *embedded* clause, and the question has matrix scope, it is clear from the surface order that it must have moved out of Spec-TP. We thus predict that the EPP in the form of the OSR should crop up here. Interestingly, precisely here is where we find the COMP-trace effect, demonstrated again in (38):

(38)   a.   Who$_i$ did you say (^{IntP} Alex punched t$_i$?
         b.   Who$_i$ did you say that (^{IntP} Alex punched t$_i$?
         c.   *Who$_i$ did you say that (^{IntP} t$_i$ punched Alex?
         d.   Who$_i$ did you say t$_i$ punched Alex?

The grammaticality of (38a) and (38b) is straightforward. In both, it is the embedded object that has moved, so the embedded subject surfaces in Spec-TP, at the left edge of the expected IntP, and there is no danger of violating the OSR. The ungrammaticality of (38c) is also expected based on the OSR. The embedded subject has *wh*-moved from embedded Spec-TP into the matrix clause; thus, the IntP corresponding to the embedded TP has no overt left edge, violating the OSR and leading to ungrammaticality. This is the kernel of how we will unify the various COMP-null effects with the EPP, and it makes it clear why we cannot adopt a derivational view of the EPP, but really must depart from Holmberg (2000) and Landau (2007) and have the OSR apply to the output of the syntax.

   The question that will be crucial to making all of this work is how we keep the OSR from ruling out (38d), without accidentally letting (38c) in through the back door. Here we also have *wh*-movement of the embedded subject, hence an empty embedded Spec-TP. We expect there to be an IntP with no overt material in its left edge, and yet the sentence is grammatical. Given our approach, the outlines of the strategy we must pursue should be clear. It must be that the presence of the overt *that* in examples like (38c) requires the embedded TP to be aligned with the left edge of an IntP, while the absence of an overt *that* in examples like (38d) makes it possible that there is no such IntP edge, as indicated. As with the control infinitives, we can imagine different options for achieving this. However, most of them can be ruled out with a bit of careful consideration. To pave the way for this, we want to first lay out some additional data. This will allow us to quickly reject several classes of analyses that depend on specific properties of the *that*-trace configuration that don't generalize to the others.

   First, recall that the COMP-trace effect is significantly ameliorated when something is done to break things up prosodically in the right place near the offending configuration, e.g. by an intervening adverbial as in (39):

(39)   Who do you think [that, against better judgment, punched Alex]?

Second, there is not just a *that*-trace effect, but a general COMP-trace one, extending also to configurations with *for*. We repeat the crucial example here as (40):

(40)   *Who$_i$ would you like [for t$_i$ to punch Alex]?

This means that whatever is wrong with (38c), it has nothing to do with finiteness. Third, problems again arise not just with overt complementizers before traces, but before any kind of silent subject, including PRO in infinitives, as shown in (41a) repeated from above:

(41)   a.   I$_i$ would like [(*for) PRO$_i$ to punch Alex].
        b.   [(*For) PRO$_{arb}$ to punch Alex] would be rude.

Assuming that we're correct in bringing these patterns together, this tells us that the problem with structures like (38c) involving the classic *that*-trace effect has nothing to with traces or movement (see also Bruening 2009; Sato & Dabashi 2016, for this point). The example in (41b) broadens the picture by showing that the pattern is not restricted to complement clauses, but is found in subject clauses as well. So we have a fairly general ban on overt complementizers preceding silent subject positions of any kind, independent of the position of the clause.

   Before we seize too strongly on that formulation however, there is one last pattern that needs to be added to the discussion. This is the so-called "anti-*that*-trace effect", which has periodically received attention in the literature on the *that*-trace effect, and has recently been treated in detail by Douglas (2017). The pattern is found in restrictive relative clauses, as in (42):

(42)   a.   The bassist [(who/that) Matt visited *ec*] was tall.
        b.   The bassist [*(who/that) *ec* visited Matt] was tall.

(42a) shows us that restrictive relatives with an object gap are flexible—they can optionally be introduced by an overt relative pronoun or complementizer. But when the relative has a subject gap, an overt pronoun or complementizer becomes obligatory, as shown in (42b). Thus, in direct contrast to the COMP-trace effect, in (42b) we have an empty subject position, preceded by an overt element in C or Spec-CP, and yet the sentence is perfectly grammatical. Indeed, it is the only way to realize the configuration, as the version leaving off the overt complementizer is ruled out. However we rule out COMP-trace and for-PRO configurations, we will have to ensure that it does not overapply to rule out anti-*that*-trace configurations like (42b).

5.2 Subject relatives, the anti-that-trace effect and IntP Extension

A closer look at the subject-gap relatives shows us that they have something important to tell us about the interactions between complementizers and subjects with respect to conditions of overtness at the left edge, which can help us find a way forward here. As a background, An (2007) shows, on the basis of data from several languages, that restrictive relative clauses do not have to be parsed as separate IntPs, i.e. the restrictive relative context does not count as a non-canonical position. The English facts are that, as discussed, restrictive relatives are in principle possible without an overt element in Spec-CP:

(43)   a.   I saw the child [$_{CP}$ who/that [$_{TP}$ Mary was waiting for *ec*]].
        b.   I saw the child [$_{CP}$ ∅ [$_{TP}$ Mary was waiting for *ec*]].

If the embedded CP were an independent IntP, then by the IPEG, something would have to be overt in its edge, either in Spec-CP or in the C head itself. I.e. one of the variants in (43a) would be required. We thus take the grammaticality of (43b) to mean that it must be possible to parse the restrictive relative as part of the IntP including the head noun to its left. Furthermore, much like complement clauses, restrictive relatives *do* show

signs of being parsed as their own IntPs by the positional route, when adverbial material appears between the clause and the structural material it depends on, in this case the head noun:

(44)   a.   I saw the child yesterday [$_{CP}$ (^{IntP} who/that [$_{TP}$ Mary was waiting for *ec*]].
        b.   ?*I saw the child yesterday [$_{CP}$ (^{IntP} ∅ [$_{TP}$ Mary was waiting for *ec*]].

This in turn must mean that the relative clause is subject to the IPEG. Thus (44a) is grammatical, where the left edge of CP is filled by an overt relative pronoun or complementizer, but (44b), where this edge is empty, is significantly degraded. All of this tells us that restrictive relatives are not IntPs by the categorial route and, when they are adjacent to their head nouns, they are not IntPs by the positional route either. Only when separated from the head noun (as in 44a) do they become IntPs by the positional route.

   Note now that all of the examples An (2007) discussed were relatives with an object (or at least non-subject) gap. If we bring back the subject relatives, we find something both interesting and surprising from the standpoint of An's system. Unlike with the object relatives, adding an adverbial between the head noun and the relative clause has no effect, as shown by the *lack* of contrast between (45) and (46). When the relative has a subject gap, an overt element in the CP edge is simply obligatory.

(45)   a.   I saw the child [$_{CP}$ (^{IntP} who/that [$_{TP}$ *ec* was waiting for Mary]].
        b.   *I saw the child [$_{CP}$ (^{IntP} ∅ [$_{TP}$ *ec* was waiting for Mary]].

(46)   a.   I saw the child yesterday [$_{CP}$ (^{IntP} who/that [$_{TP}$ *ec* was waiting for Mary]].
        b.   *I saw the child yesterday [$_{CP}$ (^{IntP} ∅ [$_{TP}$ *ec* was waiting for Mary]].

Under An's (2007) system, this means that subject relatives behave like they are obligatorily parsed as IntPs, thus subject to the IPEG. But as far as their external syntax is concerned, they are no different from the object gap relatives. This means that they actually shouldn't be IntPs by the positional route when they appear immediately adjacent to the head noun as in (45). The fact that they are ungrammatical when there is nothing overt at the CP edge, as in (45b), tells us that they are aligned with an IntP nonetheless. The alternative conclusion we are led to is that subject relatives must be IntPs by the categorial route instead.

   How is that possible? We have said that a syntactic constituent will be parsed as being aligned with an IntP when it constitutes a spellout domain, i.e. the complement of a phase-defining head. But here we are looking at CPs, which should actually correspond to the entire phase, rather than just to its spellout domain. What we expect here, as in general for CPs, is that the spellout domain should be the TP, which is hence aligned with the IntP. As such, the IPEG in the form of the OSR should require something overt in the edge of TP, not the edge of CP. And yet, here we have a structure where the edge of TP seems to be empty, while the edge of CP seems to be obligatorily filled. We would like to propose that the solution to the puzzle lies precisely in this confluence of unexpected facts. That is, the unexpected possibility of silence in the edge of TP is related to the unexpected requirement for overtness in the edge of CP.

   The kernel of the solution lies in the observation that these two positions are related by *wh*-movement. At least in the variant of (45a) with the relative pronoun *who*, what appears overtly in Spec-CP is precisely the element that *would* have been overt in Spec-TP

had the movement not occurred.[18] We would like to pursue the idea that the IntP that is normally aligned with TP is, in subject relatives, aligned with the position where *who* and *that* appear, whereas in an object relative, it is aligned with the position where the subject appears below them. This is why object-gap relatives require an overt subject, with the material identifying it as a relative clause being optionally overt, whereas subject-gap relatives can have a null subject, with one of the relativizers being overt.

   We see two plausible ways of implementing this idea. One is to say that the whole configuration as usually described, involving an overt element in the edge of CP and a silent subject position in Spec-TP, is just an illusion. Instead, the *who* or *that* actually occupies Spec-TP and never undergoes *wh*-movement to Spec-CP. This would of course be analogous to an analysis of local subject *wh*-questions as also not involving movement to Spec-CP as discussed surrounding (37) above. The general idea would be that local *wh*-movement of subjects from Spec-TP to Spec-CP is either unnecessary (because Spec-TP is already sufficiently local to C for the relevant feature-checking relationships to be established) thus ruled out by economy, or it is in fact directly ruled out, e.g. by anti-locality (see e.g. Brillman & Hirsch to appear; Erlewine 2016; Douglas 2017, for some relevant discussion). This would make things straightforward from the point of view of the OSR and the IPEG, as indicated in (47):

(47)   I saw the child [$_{CP}$ [$_{TP}$ (^{IntP} who/that was waiting for Mary]].

TP aligns with the left edge of an IntP as usual, and its edge is filled overtly by either *who* or *that*, satisfying the OSR. The reason why these elements are obligatorily overt in subject relatives unlike object relatives is precisely that they are in this lower position, occupying the edge of an IntP (by the categorial route). The edge of CP is not filled by anything overt, but this is not a problem, since CP is not aligned with an IntP in this case, thus the IPEG doesn't apply to it.

   The tricky part about making this implementation work is what happens in examples like (46a), where an adverb intervenes between the head noun and the subject relative. Given the behavior of object relatives in this context, as shown by the contrast in (44), we expect the relative clause itself in this context to be an independent IntP by the positional route, meaning that the left edge of CP should require something overt. We would then predict something like (48a) to appear instead of (46a), where we have *who* or *that* in Spec-TP satisfying the IPEG/OSR on the lower IntP, and an overt element like *that* in Spec-CP, satisfying the IPEG on the higher IntP. This doubling is, however, clearly ruled out. The alternative would be to adopt an analysis where subject relatives—in contrast to object relatives—lack not only *wh*-movement, but the entire CP layer, as in (48b):

(48)   a.   *I saw the child yesterday [$_{CP}$ (^{IntP} that [$_{TP}$ (^{IntP} who/that was waiting for Mary]].
         b.   I saw the child yesterday [$_{TP}$ (^{IntP} who/that was waiting for Mary].

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[18] In the variant of (45a) with *that,* we could either follow e.g. Arsenijević (2009) in claiming that this really is another form of the relative pronoun rather than a complementizer as indicated in (i), or we can assume that a null operator moves from Spec-TP to Spec-CP as in (ii), so that the two edges are still connected by *wh*-movement, if not *wh*-movement of an overt element.

(i)   [$_{CP}$ that$_i$ C [$_{TP}$ t$_i$ was waiting for Mary]].

(ii) [$_{CP}$ Op$_i$ that [$_{TP}$ t$_i$ was waiting for Mary]].

There would thus be only one IntP that needed to have a filled edge. While technically workable, such an analysis faces serious challenges due to the lack of a CP, so we will not pursue it here.

Instead, we will pursue an alternative implementation of the idea that *who* and *that* in subject relatives appear in the edge of the IntP normally aligned with TP.[19] The idea is that, in this configuration, the IntP boundary is actually passed up from TP to CP as a result of the *wh*-movement. Specifically, *wh*-movement from what would have been an IntP by the categorial route *extends* the IntP up to include the landing site of that movement. Consider that there are a number of recent proposals, which differ in their details and terminology, but all pursue the intuition that the size of a phase can be affected by movement and other dependencies that cross would-be domain boundaries, e.g. Phase Extension (den Dikken 2007), Phase Sliding (Gallego 2010), Domain Suspension (Bobaljik & Wurmbrand 2013). Adopting this basic intuition, we propose the following:

(49) **IntP Extension**
      Given a syntactic constituent XP that would normally be aligned with an IntP boundary by the categorial route, if an element moves from the edge of XP into a constituent YP which contains XP, the IntP will be aligned with YP instead.

IntP Extension will straightforwardly solve the problem of subject relatives and the anti-*that*-trace effect, and (50) gives an indication of how things will proceed. As matters stand in (50a), the TP would be mapped onto an IntP by the categorial route, because it is a spellout domain in the complement of a phase-defining C head. However, the *wh*-movement step in (50b) extends the domain that will be mapped on an IntP up to include the whole CP:

(50) a. $[_{CP}$ C $[_{TP}$ $(^{IntP}$ who was waiting for Mary]]
      b. $[_{CP}$ $(^{IntP}$ who$_i$ C $[_{TP}$ t$_i$ was waiting for Mary]]

In the structure that actually gets interpreted by PF in (50b), TP is not aligned with an IntP boundary, and thus there is no requirement for an overt subject from the OSR. Instead, the IntP is aligned with the CP, and so it is the edge of CP that has to have an overt element—either the moved *who*, or *that*, potentially as a realization of C itself. It should also be clear that IntP Extension will not overgenerate in an obvious way and undermine the general EPP effects of the OSR. It only provides a way for the TP edge to be empty when something from within the TP edge moves up into CP, i.e. we essentially need Ā-movement of the subject. Ā-movement of an object or adverbial won't come from the edge of TP and thus won't trigger extension. Note also that movement of an auxiliary to C as in subject-auxiliary inversion won't be able to do it, because the starting point of that auxiliary must actually be below the edge of Spec-TP. As discussed surrounding example (33) in section 4.2, English auxiliaries must be lower than T, or they would be expected to be able to satisfy the OSR in the absence of an overt subject, contrary to fact.[20] Another way to think about this is that IntP extension only happens when an element that would have satisfied the IPEG in its starting position moves up, bringing the edge of the IntP with it.

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[19] We thank two anonymous reviewers for a series of comments on the rather different approach to *wh*-moved subjects in an earlier draft, which indirectly inspired the alternative we propose here.

[20] Of course, if auxiliaries start out lower than T, then they must undergo successive-cyclic head movement via T (and any other intervening heads) on the way to C so as to obey the head movement constraint.

5.3 Extending IntP Extension

Now note that, whatever detailed implementation of the IntP Extension idea we adopt to handle the behavior of subject relatives, it will straightforwardly carry over to local subject *wh*-questions. As discussed above, these could involve overt *wh*-movement of the subject from Spec-TP to Spec-CP, as in (51a), which would be parallel to the kind of analysis that is required for non-subject questions. Alternatively, they could lack such movement, with the *wh*-subject remaining in Spec-TP, as in (51b):

(51)   a. $[_{CP}$ $(^{IntP}$ Who$_i$ $[_{TP}$ t$_i$ punched Alex]]?
       b. $[_{CP}$ $[_{TP}$ $(^{IntP}$ Who punched Alex]]?

We saw that the non-movement analysis gave us a way to maintain a simple view of the EPP in terms of the OSR, where Spec-TP is generally at the edge of an IntP and thus must have something overt in it. The movement analysis, on the other hand, raised the question of how its empty TP edge could be made to square with the OSR. Given the possibility of IntP Extension, however, we now have a way to analyze (51a) that is consistent with OSR. Here, as in the case of the subject relatives, we expect TP to correspond to an IntP, but the element that would normally be overt in that edge *wh*-moves up to the edge of Spec-CP. In line with (49), this would extend the IntP up to CP, simultaneously allowing the edge of TP to be empty, and requiring the edge of CP to be overt. In principle then, either a movement or non-movement analysis of local subject *wh*-questions is compatible with our prosodic version of the EPP, and we can ultimately decide between them based on their independent merits.[21]

This finally brings us back to long-distance subject *wh*-movement, as in (38c) and (38d) above, repeated here as (52a) and (52b).

(52)   a.   *Who$_i$ did you say that $(^{IntP}$ t$_i$ punched Alex?
       b.   Who$_i$ did you say t$_i$ punched Alex?

Again, in such examples there can be no question that overt *wh*-movement has applied. And again we are left with the puzzle of figuring out why such structures are possible just when there is no overt complementizer in the embedded clause. We have to set things up so that the overt complementizer in (52a) forces the embedded TP to be parsed as an IntP, as indicated, leading to problems with the OSR because of its non-overt edge, whereas something allows TP to not be parsed as an IntP when there is no overt complementizer as in (52b).

One could again imagine that when there is no overt complementizer, even finite clauses can avoid counting as phases (along the lines of Doherty 2000). The embedded clause would then be a TP, thus not a phase, and there would be no IntP by the categorial route. There are problems with this approach, however. One is that we would need an account of when complement clauses can be TPs rather than CPs, which would have to ensure that we couldn't leave off the CP layer e.g. when an adverbial intervenes between the selecting predicate and the embedded clause, or when the clause gets itself into a derived non-canonical position. Otherwise we would not be able to explain why an overt

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[21] ATB subject *wh*-questions like *Who invited and kissed Mary*, brought to our attention by an anonymous reviewer, might be of relevance here, in particular as regards the treatment of the second conjunct. If their correct analysis requires literal, overt, ATB movement, then we would need to go with the IntP Extension account. Also relevant will be the treatment of T-to-C movement, which does not appear to occur with subject *wh*-questions, and thus has always played a crucial role in the debate between the movement and non-movement analyses. As we do not presently see clear implications for the workings and triggering of T-to-C movement (e.g. whether it and other types of head movement actually occur at PF) from our proposals, we will say no more about it here.

realization of C is required in those contexts. Even if we could develop such an account, there is evidence from the effects of Ā-movement on binding that these embedded clauses are not (particularly) reduced and actually do constitute phases (see Douglas 2017, for convincing arguments to this effect from opacity effects involving A-bar reconstruction in cross-clausal binding).

Thus it seems that we cannot explain the lack of an IntP aligned with the embedded TP in long-distance subject questions by claiming that CP is missing.

Instead, we will pursue the idea that IntP Extension is at work again here. This is entirely reasonable, since again we need a TP to fail to behave as an IntP when something is *wh*-moved out of its edge. The difference when compared to the subject relatives is that in this case the extension would have to go beyond the embedded CP, as the moving element continues moving, i.e. we will have to assume multiple steps of extension. The edge of the IntP initially associated, by the categorial route, with the edge of embedded TP, can thus be extended as far as the *wh*-subject moves—in the cases at hand up to the matrix CP, as illustrated (in abbreviated form) by the steps in (53).[22]

(53) a. $[_{TP}$ $(^{IntP}$ Who punched Alex]
      b. $[_{CP}$ $(^{IntP}$ Who$_i$ $[_{TP}$ t$_i$ punched Alex]]
      c. $[_{CP}$ $(^{IntP}$ Who$_i$ did you say $[_{CP}$ t$_i$ $[_{TP}$ t$_i$ punched Alex]]]?

Again, this kind of successive-cyclic IntP extension should not overgenerate in an obvious way, since it is restricted to cases of successive-cyclic *wh*-movement of an embedded subject, and can only serve to extend the IntP associated with the TP where the subject starts out. IntPs constructed elsewhere in the structure will not be affected and thus will still have to have something overt to satisfy the IPEG. Furthermore, this story for why long-distance subject *wh*-movement does not run afoul of the OSR, avoids the problems associated with the assumption of a lack of intervening CPs. The embedded clause is still a CP and acts as an intermediate landing site for the *wh*-movement of the embedded subject, indeed crucially so, and so the binding facts discussed in Douglas (2017), referenced above, can be accommodated.

5.4 Integrating the comp-trace effect

What we need to make this approach complete is an explanation for the actual COMP-trace effect, i.e. why an overt complementizer gets in the way of the kind of derivation laid out in (53).[23] What we propose is that IntP Extension is blocked by the intervention of an overt element at the crucial position. Given that we are concerned with the determination of prosodic domains, this is a reasonable assumption. One way to think about it is that the first step of the extension relies on treating the subject as though it were simultaneously in Spec-TP and Spec-CP, but this only works as long as the copies of the subject in the two positions are indistinguishable from each other in terms of linearization. If something overt intervenes between the two positions, like an overt *that*, then the copy of *who* in Spec-TP will follow *that*, while the copy in Spec-CP will precede it (see also Erlewine 2016, for the idea that an intervening overt complementizer causes problems in COMP-trace configurations due to contradictory linearization statements, based on Fox

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[22] This does not mean that there can be no other IntP boundaries parsed along the way, just that this particular left boundary is extended up to the matrix.

[23] Sato & Dabashi (2016) also propose an account for the *that*-trace effect that is based on how prosodic units are built up in concert with phase-based spellout. For them, the offending configuration is where *that* ends up on its own inside a prosodic phrase. It is not clear at this point how Sato and Dobashi's system could be extended to cover the basics of the EPP and the cross-linguistic data that we discuss here, but their work is based on careful consideration of purely prosodic data, and it will bear investigating in future research to what extent our approaches could be integrated.

& Pesetsky's 2005 approach to cyclic linearization). In other words, we can imagine that IntP Extension applies unproblematically in a structure like (54a), but not in one like (54b):

(54) a. … [$_{CP}$ who$_i$ [$_{TP}$ who$_i$ punched Alex]]
       b. *… [$_{CP}$ who$_i$ that [$_{TP}$ who$_i$ punched Alex]]

One can even imagine that (54a) is derived via deletion of *that* in (54b) in order to facilitate IntP Extension, somewhat analogous to the cases discussed by Merchant (2001) where ellipsis eliminates structures that would be ill-formed at PF. In any case, it should be clear that, if IntP Extension fails in such cases of long-distance subject Ā-movement, ungrammaticality will necessarily ensue: the embedded TP will be aligned with an IntP by the categorial route, but it will have an empty left edge due to the movement of the subject, leading to a violation of the OSR.[24]

To bring it all together, we can summarize as follows. The OSR requires that the edge of TP (as a spellout domain) be filled by overt material. If something moves from the edge of TP to a higher position, thereby extending the IntP to CP (IntP Extension), this requirement can be loosened—yielding clauses with local subject *wh*-movement, including subject relatives. Additional steps of *wh*-movement of this element can extend the IntP even further, yielding an embedded clause with completely empty left edges, both in TP and CP, which will then be parsed into the IntP built around the matrix clause: e.g. long-distance subject *wh*-movement structures. However, if the complementizer in the embedded clause is overt, it disrupts the IntP Extension operation already in that clause. This means that the TP must remain an IntP, and since its edge is empty (the subject having moved to Spec-CP), it violates the IPEG via the OSR. Further *wh*-movement of the subject can do nothing to repair this, and thus there is no route from this intermediate structure to a grammatical instance of long-distance *wh*-movement.

Hence the COMP-trace effect comes down to two mutually incompatible requirements. The overt complementizer ensures that its TP complement will be parsed as an IntP, but the subject trace ensures that this TP will have an empty edge. This runs afoul of the OSR, causing a crash. With long-distance extraction of something other than the subject, these problems don't arise because the embedded subject surfaces overtly in Spec-TP satisfying the OSR.

To round off the discussion of the COMP-trace effect, we need to address how *that*-trace amelioration effects like those in (55) are derived:

(55) a. Who do you think [that | against better judgment | punched Alex]?
       b. ?Who does John doubt whether | and Bill suspect that | cheated?

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[24] Of interest here is the following pair of examples discussed by Bošković & Lasnik (2003: 536), helpfully pointed out to us by an anonymous reviewer:

(i) ?Who$_i$ do you believe sincerely [$_{CP}$ t$_i$ C [$_{IP}$ t$_i$ likes Natasha]]?

(ii) *What$_i$ do you believe sincerely Natasha likes t$_i$?

Both examples involve an adverb intervening between the matrix verb *believe* and the embedded CP, which normally leads to the CP requiring an overt complementizer, hence the ungrammaticality of (ii). For us, following An (2007), this is because the adverb makes the CP count as an IntP by position, triggering the IPEG, while for Bošković and Lasnik it is because the null variant of *that* is a PF affix that needs to affix hop onto the verb to be licensed, but is blocked from doing so by the intervening adverb. To explain why (i) is marginally possible in spite of this, Bošković & Lasnik (2003) are forced to posit an additional silent C that is only selected to trigger movement and is crucially *not* an affix, and to make a series of additional very specific assumptions about intermediate landing sites. We, on the other hand, simply have to assume that IntP Extension can apply, at least marginally, to structures that are IntPs by position as well as those by category.

Note that both the intervening adverbial and right-node-raising structure above typically lead to marked changes in sentence-prosody, introducing an intonational break between the overt complementizer and the following material (notated by the placement of |). We can expect this to create an additional IntP boundary by position, with the material following the complementizer counting as being in a non-canonical position in An's (2007) terms. This prosodic restructuring, which takes place right at the linear position where the COMP-trace configuration would arise, would then prevent that configuration from blocking IntP Extension.

We note two important points about how this comes about. First, it cannot be a matter of adverbial elements like *against better judgment* serving to fill the edge of an IntP, thereby satisfying the OSR even with a silent subject. This would undergenerate on the one hand, failing to explain the right-node-raising cases like (55b), and it would overgenerate on the other, leading us to expect that all sorts of COMP-trace, and even general EPP, violations could be rescued by inserting an overt clause-intial adverb, contrary to fact. Second, and relatedly, if the COMP-trace effect is about blocking IntP Extension, then the amelioration effect has to come down to *un*blocking the Extension. This will correctly limit the effects to cases involving *wh*-movement of the subject, covering the right-node-raising cases but not general EPP violations. And it will also explain why the amelioration effect does not work for *for*-PRO configurations:

(56)   a. *I_i would really like [for PRO_i to see the end of the movie].
        b. *I_i would really like [for, just in this one case, PRO_i to see the end of the movie].

In this case, the silence of the embedded subject is not due to *wh*-movement, thus there is nothing to trigger IntP Extension, and so the insertion of the adverbial makes no difference.

5.5 The distribution of for

The remaining patterns we need to cover have to do with the particular distribution of *for* in infinitives. The *for*-trace facts fall under the account of the COMP-trace effect just described, but we still need to deal with the facts when no subject movement is involved. Let us begin with the data in (57), repeated from section 3.1, where the infinitive is the complement of a verb. The optionality of overt *for* in (57a) tells us that, as expected for verbal complements, the embedded clause is not an obligatory IntP by position. We argued in section 4.2 that examples like (57b) with a null PRO subject involve a reduced structure, which means that the head realized by the infinitival marker *to*—which we are calling T for concreteness—ends up as the highest in the clause. Additional evidence that this analysis is on the right track is furnished by a comparison with (57c):

(57)   a. I would like [$_{CP}$ (for) you to punch Alex].
        b. I_i would like [$_{TP}$ PRO_i to$_T$ [punch Alex]].
        c. *I_i would like [$_{CP}$ for PRO_i to punch Alex].

(57c) looks parallel to COMP-trace examples on the surface, as it involves an overt complementizer followed by a silent subject, but the details are different as there is no subject movement involved. It is ungrammatical, in contrast to (57b), because the complementizer rules out the reduced structure. I.e. it must be a CP and a phase, meaning that the phrase below will be parsed as an IntP by the categorial route, causing the null subject, in turn, to violate the OSR.

We must say a bit more, however, to ensure that we get the intended contrast between sentences like (57b) and (57c). Consider then the sentences in (58). The infinitives here are

utterance-initial subject clauses, thus clearly aligned with a left edge of IntP by position, and so by the IPEG they must have overt left edges. Again, for (58a) with its null complementizer and null subject, we can propose a reduced TP structure, where *to* is in T, and thus at the left edge, satisfying the IPEG. The overt *for* in (58b) indicates that we cannot have a reduced structure here, but must rather have a complete CP. The CP is at the left edge of the utterance, thus also at the left edge of an IntP by position, and *for* itself can satisfy the IPEG here. However, since this is a phase, its complement will also be an IntP by the categorial route, and thus also be subject to the IPEG via the OSR. This is where the problem arises—given the nullness of PRO, it cannot satisfy the OSR here, yielding ungrammaticality:

(58) a. $[_{TP}$ $(^{IntP}$ PRO To$_T$ [cuss with your grandma here]] is rude.
      b.   *$[_{CP}$ $(^{IntP}$ For $[_{FinP}$ $(^{IntP}$ PRO $[_{TP}$ to$_T$ cuss with your grandma here]]] is rude.

To further ensure that the overt *to* cannot satisfy the OSR here as it could in (58a), we propose that what matters is not finiteness but the difference between CPs and reduced clauses—non-finite CPs contain the additional phrase above TP which we have been calling FinP as well. We thus update the structures in (57) above as follows:[25]

(59) a.   I would like $[_{CP}$ (for) $[_{FinP}$ $(^{IntP}$ you $[_{TP}$ to$_T$ punch Alex]]].
      b.   I$_i$ would like $[_{TP}$ $(^{IntP}$ PRO$_i$ to$_T$ [punch Alex]].
      c.   *I$_i$ would like $[_{CP}$ for $[_{FinP}$ $(^{IntP}$ PRO$_i$ $[_{TP}$ to$_T$ punch Alex]]].

Since it is the complement of the phase head C, this FinP is what aligns with the edge of an IntP by the categorial route, and thus it is where something overt is required. This is indeed where overt subjects apppear, satisfying the OSR, but infinitival *to* is still down in T, and so it cannot satisfy the OSR in these non-reduced infinitives. This is entirely parallel to our analysis of why finite auxiliaries, also in T, cannot satisfy the OSR.

  While the details are different from the COMP-trace effect, there is thus a basic pattern of mutually incompatible requirements that is common to the configurations with an overt complementizer followed by a silent subject. I.e. the presence of the overt complementizer ensures in various ways that the following structure will be parsed as an IntP, but the silent subject entails that this IntP will not have an overt left edge and thus will violate the IPEG.[26] Note, incidentally, that the account presented here can be seen as a further argument against traditional Case-based theories of the distribution of overt *for* (see e.g. McFadden 2012), as it achieves far better empirical coverage, and also captures the fact that the distribution of overt *for* is, for the most part, entirely parallel to that of overt *that* (as also nicely described by Pesetsky & Torrego 2001).

6 The OSR isn't really about subjects

Our implementation of the EPP in the OSR, in terms of a PF constraint requiring overt material at the left edge of an IntP, has the consequence that it can't really be about subjects. In this section, we will explore the consequences of this shift in perspective, which will offer a way to understand certain types of cross-linguistic variation as well as a series of minor constructions in English where the EPP can be satisfied by something other than the subject.

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[25] The left IntP boundary indicated at the edge of TP in (59b) is at best optional in this sentence, appearing only by position, but we indicate it here to show that nothing will go wrong if, e.g. we insert an adverbial here, since *to* is overt in T.

[26] Note that the anti-*that*-trace effect avoids this problem because the overt element in CP is actually a realization of local IntP Extension via Ā-movement of the subject.

6.1 The EPP, pro-drop and cross-linguistic variation

We predict that if a language has an English-style EPP, then it shouldn't allow generalized subject pro-drop.[27] Our re-implementation of the EPP as the OSR is not a requirement that Spec-TP be filled in the narrow syntax, but that there be overt material in a certain position at PF. Hence *pro*, as a silent pronoun, cannot satisfy the requirement, and we would expect every run-of-the-mill pro-drop root clause like Spanish (60) to violate it:

(60)   *pro* hablo español.

That such sentences are perfectly fine tells us that the OSR simply can't apply in the same way in these languages, or at least that they have some way of satisfying it that doesn't involve an overt subject. We will say more about this second possibility directly. For now, note that if we're on the right track, these languages also shouldn't display the other properties of English discussed above which, while not traditionally subsumed under the EPP, we have argued to be derivable from the OSR.

   This seems to be essentially correct. It is not just that subject pro-drop languages allow the subject to be null—even when it is overt, it has commonly been observed that languages like Italian and Spanish also allow the subject to appear post-verbally, i.e. not in Spec-TP, and apparently not at the left edge of anything (Rizzi 1982):

(61)   Sono   cadute alcune pietre.
        are.3PL fallen some   stones
        'Some stones fell down.'

Strikingly, as has been known for some time, these languages also seem to be oblivious to the COMP-trace effect (Rizzi 1982):

(62)   Chi$_i$ credi   che t$_i$ abbia   telefonato?
        who$_i$ think-2SG   that t$_i$ has.SBJV   telephoned
        'Who do you think called?'

Relatedly, they seem to have no problem with overt complementizers in non-finite clauses without overt subjects (Rizzi 1982):

(63)   Tenterò   di lavorare di più.
        try.FUT.1SG   C work.INF of more
        'I will try to work more.'

These connections provide strong support for our unification of COMP-null effects with the EPP. While these connections have been observed before (see e.g. Pesetsky to appear, for an overview), the proposals made to account for them have typically posited an indirect relationship between these patterns and have relied on outdated or questionable theoretical assumptions (like the ECP or a crucial role for Case in regulating the presence and position of certain complementizers; see McFadden 2012, for some relevant discussion). Our proposal instead ties them together in a direct and straightforward way without any assumptions beyond what we propose for the EPP itself. For us, these are all just expressions of the OSR, so they should also pattern together cross-linguistically, as summarized in (64):

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[27] There are several different types of pro-drop, which differ according to the constraints under which pronouns can be left silent (see e.g. the papers in Biberauer et al. 2010 and Kučerová 2014 for discussion and references). It is reasonable to think that they involve distinct underlying mechanisms, potentially with different implications for what we predict regarding the EPP. What is most relevant here is the possibility of dropping the subject, hence our repeated reference specifically to **subject** pro-drop.

(64)   The EPP, the ban on pro-drop, the comp-trace effect and the ban on *for*-PRO
         all reduce to the requirement in OSR for something overt in the left edge of a
         clause. If a language has a way to avoid running afoul of the OSR, then *all* of
         these requirements should be lifted, all other things being equal.

This leads us to the question then of how a language could actually avoid the OSR and
lack all of these restrictions. The simplest possibility is that the IPEG itself, which under-
lies the OSR, is parametrized somehow, so that it simply does not apply in languages like
Spanish and Italian. Languages would thus simply differ in the constraints that apply to
their prosodic systems. While this is certainly possible, it calls into question the concep-
tual motivation for the IPEG offered by An (2007). It is also not particularly satisfying
because, in the absence of a theory of such prosodic variation, it simply stipulates the
difference and offers no predictions about what other properties of a language should
correlate with it. A more interesting possibility is that something like the OSR, or rather
the IPEG, is indeed quite general, but languages differ in the syntactic structures that they
produce for mapping onto prosodic units. Thus, what the OSR applies to in Spanish or
Italian looks quite different from what it applies to in English. As a result, the elements
that are forced to be overt by the OSR are parametrized across languages.

   We will mention here one concrete instantiation of this possibility, based on ideas of
Barbosa (1995); Alexiadou & Anagnostopoulou (1998), which seems to have a lot of the
right properties and is quite promising, though we won't develop it in detail here. What
these authors proposed is that pro-drop languages satisfy the EPP, not with the subject,
but with the verb, which moves to T in the languages under discussion, and carries a rep-
resentation of the ϕ-features of the subject in the form of agreement. The specifics of their
proposals for reinterpreting the EPP were syntactic, but we can adapt the basic idea. The
verb does indeed move to a higher position in the relevant pro-drop languages than in
languages like English, and if we can establish that it is indeed to the highest head in the
spellout domain below C, then the facts will follow quite nicely. To be consistent with our
discussion of control infinitives and English finite auxiliaries above, let us call this head
Fin. Since FinP will be aligned with the relevant IntP that is determined by the categorial
route below the phase head C, it is what requires an overt left edge by the IPEG/OSR.
The verb in Fin will satisfy this requirement, and thus the subject position in Spec-FinP
is free to be empty—either because the subject is a silent *pro*, because it appears in some
post-verbal position, or because it has been Ā-moved to some higher position. Note that
this doesn't work in languages like English, because no verb moves to the highest head
in the clause, as we discussed in the context of finite auxiliaries and control infinitives
in sections 4.2 and 5.5. Example (65) indicates the details of the structure of a pro-drop
sentence in Spanish under this analysis:

(65) $[_{CP}$ C $[_{FinP}$ $(^{IntP}$ *pro* hablo$_i$ $[$ t$_i$ español$]]].$

Of course, it is reasonable to think that different types of pro-drop languages can get
around the OSR in different ways, not just via verb movement. But the attractiveness of
this approach is that it connects variation in the factors tied together in (64) to indepen-
dently observable syntactic differences among languages.[28]

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[28] This kind of approach clearly will not work for languages like Dholuo, as explicitly argued by Cable (2012),
   where we do not observe typical EPP effects, but also don't generally find pro-drop. One can perhaps imag-
   ine that such languages avoid the OSR in a more fundamental way relating to how syntactic structure maps
   onto IntPs, but we will not speculate further here.

More broadly, the approach to the English-style EPP here outlines a template that could be extended to phenomena in a number of languages, which don't necessarily involve subjects, but do boil down to a requirement for *something* to be overt in some edge position (essentially what Sigurðsson 2010, refers to as Filled Left Edge Effects). The details vary considerably from language to language and among specific instantiations in single languages, but they could all potentially be reduced to different applications of something like An's (2007) IPEG, requiring overt material to demarcate the edge of a prosodic constituent. The variation may be attributable to differences in which prosodic domain is relevant, what syntactic positions map onto the domains and what kinds of operations are available for moving things into and out of these positions and manipulating the size of the domains. We have argued here that the English EPP results from having the IPEG refer to IntP, with a left IntP boundary being mapped by default onto TP/FinP by the categorial route, coupled with (fairly general) syntactic movement of DPs to Spec-TP, *without* syntactic movement of any verbal elements as high as T/Fin.

But change any one of those pieces, and a different surface pattern will arise, e.g. a standard subject pro-drop pattern if we add V-to-T movement. Similarly, an IntP built at a higher level, coupled with particular patterns of verb movement, could be responsible for V2 patterns. The fact that both head and phrasal elements are relevant could also provide a way to approach the rather complex interactions between the positions of subjects and verbal elements in Celtic languages like Scottish Gaelic (see Thoms 2016, and citations there for some relevant data) which have thus far eluded successful analysis in terms of a traditional EPP. This approach may also offer a clue as to why it is specifically in *embedded* clauses that many partial pro-drop languages are more likely to allow subject pro-drop: root clauses are typically at the left edge of the utterance, hence their left edge generally aligns with an IntP. Embedded clauses, on the other hand, often have their edge internal to the utterance, which makes it possible for them to be parsed into an IntP containing material from the matrix clause, meaning that they will not necessarily be subject to the IPEG. Kučerová (2014) in particular presents intriguing data from Czech, Old French and Hebrew, among other languages, showing that pro-drop is generally possible there only when something other than the subject occupies material at the left edge of the clause.[29] We also see a clear connection here, though there are important differences in assumptions, to the approach of Hamlaoui & Szendrői (2015), where IntPs generally map onto clauses, but there is flexibility in what syntactic constituent is involved, depending on how high in the structure verbal material is realized in the language.

6.2 Non-subject EPP satisfiers

The fact that the OSR isn't really about subjects or even Spec-TP, but about the edge of IntP, is why certain subject positions are not required to be overt—they happen not to be at the edge of an IntP. We have seen this for certain kinds of non-finite clauses and for examples with *wh*-movement of the subject. An important prediction related to this is that we should also find cases where the usual subject position *is* at the edge of an IntP, but the subject need not overtly appear there, because something other than the subject is there which can satisfy the OSR. Certain expletives like *there* could be seen as instances of this pattern, and we've already argued as much for the infinitive marker *to* and now for verbs that have moved particularly high in languages like Spanish. Here we will look at some

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[29] Indeed, the differences we see in Kučerová's work and elsewhere between full and partial pro-drop languages drive home clearly that what matters is not the simple availability of a referential null subject like *pro*. Rather, languages seem to be able, to differing degrees and under different circumstances, to use things other than the subject to satisfy requirements for overt material along the lines of the IPEG or Sigurðsson's FLEE. This determines the extent to which they allow null subjects.

suggestive evidence that the pattern is fairly general, as it should be, even in languages like English.

First, this offers a way to analyze locative inversion, in which a certain class of locative PPs can appear pre-verbally, with the expected subject appearing in a post-verbal position as in (66a). Largely parallel to this are also other cases where the subject is extraposed, but the usual subject position is filled by some other element, e.g. participle preposing in (66b) (Thoms & Walkden 2015), *so*-inversion in (66c) (Toda 2007) and comparatives with VP ellipsis in (66d) (Culicover & Winkler 2008):[30]

(66) a. **Across the table** marched an army of ants.
      b. **Sitting at the table** should be a bottle of wine chosen especially for you by the sommelier.
      c. Our comments should be robust, and **so** should be our response.
      d. John has bought more books **than** has Mary.

In all of these cases, there is evidence that the syntactic subject has been extraposed to a post-verbal position, yet the sentences are grammatical even without the insertion of an expletive. This strongly suggests that the various pre-verbal elements—the PP in (66a), the participial vP in (66b), *so* in (66c) and *than* in (66d)—are satisfying the EPP here, even though they do not otherwise behave like subjects. Note also that this is strongly reminiscent of the way that Holmberg (2000); Sigurðsson (2010) look at the phenomenon of Stylistic Fronting in Icelandic, as involving an adverbial or participial element moving up to an EPP position, essentially behaving like an expletive in clauses that lack an overt subject.

We can also use our approach as a way to understand some anomalous facts about what are typically regarded as sentential subjects, i.e. embedded clauses that appear in what looks like the subject position of the matrix clause, as in (67a). According to various diagnostics, these don't actually seem to behave like real subjects in Spec-TP. For example, they don't participate in subject-auxiliary inversion, and in fact can't appear in interrogative matrix clauses, as shown in (67b):

(67) a. [That Medea killed her children] upset Jason.
      b. *Did [that Medea killed her children] upset Jason?

Nonetheless, these clauses must satisfy the EPP for the matrix clause, since no expletive is required (or even allowed) to accompany them:

(68) a. *It/there [that Medea killed her children] upset Jason.
      b. *[That Medea killed her children] it/there upset Jason.

This makes sense under our analysis as long as these clauses are in the left edge of the IntP, even if they fail to count as subjects for some other reason. Finally, our approach may also be a way to understand why no expletive subject is required (or, again, allowed) in a certain kind of parenthetical with *as*:

(69) Irene was drunk, as (*it) was clear from her slurred speech.

Postal (2004) argues convincingly that *as* isn't the subject here, yet seems to satisfy the EPP. For us, the grammaticality of (69) follows quite simply, since the left edge of IntP is overtly filled by *as*, satisfying the OSR.

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[30] See Thoms & Walkden (2015) for summarizing discussion of these structures and evidence regarding the position and subject status of the various components, with references. Thanks again to Gary Thoms for pointing us to the relevance of the additional constructions that parallel locative inversion.

It goes beyond what we can tackle in this paper to propose specific analyses for the syntactic patterns presented in this subsection, and indeed there is good reason to think that they differ in their details. What they all have in common is that they involve an overt non-subject, appearing in a clause-initial position (or positions) that may not be the actual subject position in Spec-TP, but is in our terms at the left edge of the relevant IntP, and thus is relevant for the OSR. What we *can* say is that this position is distinct from the position(s) occupied by clause-initial adverbials, since as noted in section 5.4 above, the latter are *not* able to satisfy the OSR. Rather, this must be a functional position projected in the left periphery of the clause that can exceptionally be filled by something other than the subject.[31] The ways in which the specific elements described here find their way into that position may well be language- or even construction-specific, but they all have in common the fact that they provide a way to satisfy the OSR without an overt subject in the normal position.

7 Back to the modularity problem

We hope to have shown that a prosodic characterization of the configuration ruled out by the EPP gets the basic facts right and can also be fruitfully extended to explain other phenomena like the COMP-trace effect. However, this just serves to underline the issues for modularity that we laid out in Section 3 and summarized in (25). With the specific formulation we have adopted in the OSR, there can be no doubt that it must apply after spellout on the PF branch, as it makes crucial reference to overtness and to the intonational phrase, a category in the prosodic hierarchy. And yet, as discussed in section 3.2, core EPP-satisfying operations like DP movement to Spec-TP must apply in the narrow syntax, *before* spellout. If these operations are to be truly *driven* by the EPP, then we run into problems with our standard architectural assumptions of modularity and cyclicity.

At this point, we see three potential ways to deal with this problem:

   I.   **Phonology in syntax:** Change our theoretical assumptions, so that the syntax *does* have access to the relevant phonological information.

   II. **Split movement across syntax & PF:** Motivate a reanalysis of EPP-satisfying movement in a way that initiates movement in the syntax but has its output depend on PF considerations.

   III. **Overgenerate & filter:** Decouple DP movement from the EPP, insisting that while it may be EPP *satisfying*, it is not EPP *driven*. Movement occurs for syntactic reasons, and PF is left to interpret the structures output by syntax, filtering out ones that do not satisfy constraints like the EPP.

Particularly relevant versions of the first two alternatives have been proposed in the literature. Richards (2016) is an exploration of Option 1, for the EPP along with other phenomena, and Bobaljik (2002) develops a version of Option 2 for other empirical phenomena that present similar modularity issues. For reasons of space, we do not discuss these approaches here here, but the reader is referred to McFadden & Sundaresan (2017) for a detailed exploration of their ramifications. There, we ultimately argue that a version of Option 3 looks the most promising based on our current understanding. At this stage, this is a tentative conclusion, and we would like to stress that the choice among these options is ultimately orthogonal to the argument that the EPP applies at PF, and even to the specific characterization we have proposed in the form of the OSR.

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[31] The behavior of adverbials in Stylistic Fronting in Scandinavian is in a sense the exception that proves the rule—they are able to satisfy some version of the OSR, not simply as adverbials, but because in these languages, unlike in English, there is a syntactic movement operation that can apply to them—and crucially also other elements like participles—to bring them into the relevant position at the left edge.

Abbreviations

1 = first person, 2 = second person, 3 = 3rd person, FUT = future, INF = infinitive, PL = plural, SBJV = subjunctive, SG = singular, IntP = Intonational Phrase, IPEG = Intonational Phrase Edge Generalization, NOC = Non-Obligatory Control, OC = Obligatory Control, OSR = Overt Subject Requirement, PIC = Phase Impenetrability Condition

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Competing Interests

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