Paths: the Ghost of Features Past

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Abstract

We discuss a set of cases where an adjunct or specifier is neither uniformly opaque nor uniformly transparent for extraction, but is rather sensitive to other properties of its local context. These cases pose a problem for classic analyses of the CED, as non-complements are usually taken uniformly to be islands for extraction. To describe these variable transparency effects, we first suggest that each exception to the CED occurs in a multiple specifier environment, like that proposed by Nissenbaum (2000) for parasitic gap constructions. In addition, we propose a theory of locality which makes fine-grained predictions about what phrases are accessible for operations external to them. The proposal features a path-based view of locality in dependency formation (Kayne 1981, Pesetsky, 1982, McFadden et al. 2019, a.o.), where projection of a feature from the goal to the probe is necessary for a dependency to be well-formed. On our view, the feature projection algorithm allows goals to project their features only when their sisters have certain properties, predicting complements and second specifiers, but not first specifiers, to be transparent for extraction.

Keywords: syntax, control, wh-movement, islands, scrambling

1. Introduction

In this paper, we discuss some exceptions to the CED, such as (1). In (1), wh-movement is permitted from an adjunct clause, despite the fact that adjuncts are typically thought to be islands for extraction.

(1) What is the flower$_i$ open [PRO$_i$ to attract ___]?

(cf. *The flower is open to attract passing pollinators.*)

Interestingly, this counterexample to the CED is sensitive to interpretation – while the obligatory control (OC) interpretation of (1) permits wh-movement out of the adjunct clause, a corresponding non-obligatory control (NOC) variant, as in (2), blocks wh-movement from the adjunct clause (Truswell 2011).

(2) *What is the door$_i$ open [PRO$_{arb}$ to listen to ____]?
(cf. *The door is open to listen to confessions.*)

Taking inspiration from Müller (2010) and Landau (2021), we suggest that (1) and other exceptions to the CED are multiple specifier constructions (treating adjuncts as a kind of specifier). Unlike these previous works, however, we offer a theory of how multiple specifier constructions obviate island effects that also takes into account the significance of interactions between different dependencies, such as movement and control, as in (2).

The analysis is built on the idea that (all) syntactic dependencies make use of an operation: Search (Chomsky 2004). Importantly for the present approach, Search is not blind, but is guided by the distribution of checked features in the clause. An algorithm for projecting said features therefore makes predictions about which parts of the structure are accessible to Search and which aren't, thus producing both transparent and opaque domains. As we will see, the particular algorithm that we propose, combined with the above assumptions about Search, make nuanced predictions about when a specifier or adjunct will be transparent for extraction or control. One of these predictions is that first specifiers of a head are opaque, while second specifiers are transparent. We argue that this theory explains both basic CED effects, as well as exceptions to the CED, more successfully and in a broader sense than alternative theories.

§1.1 introduces the rationale for this approach to the CED, and describes what data will be covered by the theory.

1.1 Moving toward Paths

This paper develops a novel theory of locality rooted in the notion of *path* (Kayne 1981; D. M. Pesetsky 1982; McFadden and Sundaresan 2019). Long distance dependencies, on this approach, must be mediated by a sequence of local dependencies.

(3) **Path**

For a probe A to enter into a dependency with a licit goal B, there must be a path of local relationships between A and B.

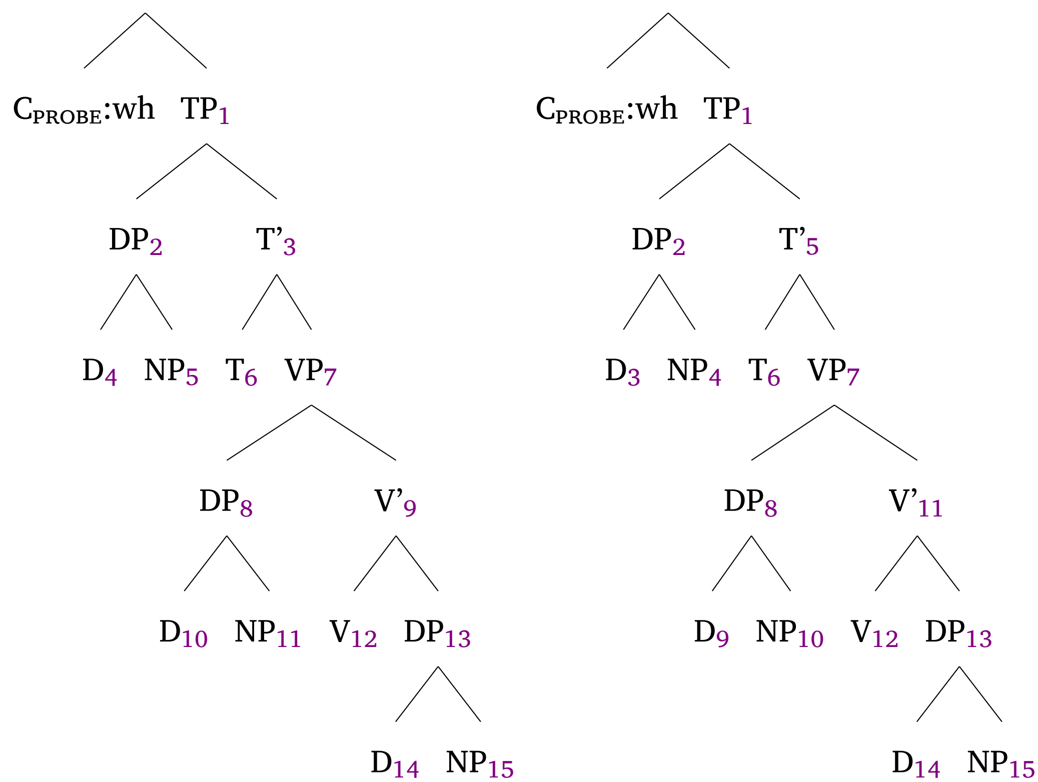
We propose that, underlying this notion of *path* is a more general notion of *economy* in dependency formation. Paths, as we define them, allow the grammar enough information to know whether or not a search procedure, on which long-distance dependencies are contingent, will succeed or fail.

Chomsky (2004, et seq.) suggests that *probing* involves an operation of "Minimal Search". Minimal, for the purposes here, means that the search procedure will halt once a match has been found, the hope being that the right specification of the search procedure will capture Relativized Minimality effects (Rizzi 1990). A number of algorithms for Minimal Search have been proposed and discussed in the literature, see Branan and Erlewine (2021) for an overview and Preminger (2019), Ke (2019), Atlamaz (2019), Krivochen (2022), and Chow (2022) for more specific proposals. The basic idea is that nodes in a syntactic tree are sequentially "examined" to see if they are a match for what the probe is specified to look for, with the sequential search algorithm only being able to move to sisters or daughters of failed matches.

Why should Search be minimal? One reason — as Chomsky suggests — might be for reasons of computational efficiency. Searching the tree involves *examining* a number of nodes to see if they are a match for the probe. We can define a cost in terms of the number of failed examinations that take place prior to success. Examining as few nodes as possible would be desirable, given that the process of examining a node to see if it is a match bears some computational cost.

With this in mind, consider a case like the following, involving an interrogative C seeking a matching [WH] element, which is not present in the tree. Every node in the tree must therefore be examined, regardless of the choice of algorithm.[1] In terms of computational cost, this is the worst case scenario: every node in the tree must be examined, but doing so does not produce any observable change to the structure.

(4) **The least-efficient scenarios** *Two simple search algorithms*



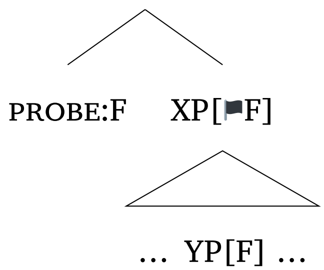
We suggest that the grammar is designed to avoid costly failed searches of the type above.[2] In the abstract, we suggest that the grammar is endowed with a set of *flags* that

1. The numbering for the trees below corresponds to a pre-order breadth-first and depth-first Search, in that order. Similar results obtain for the aforementioned search algorithms.

2. This question is ultimately orthogonal to the question of whether or not probing may fail without leading to a derivational crash (see Preminger (2014) for some discussion), and is in principle compatible with either view. Failed searches are consistently costly because they require the entire search space of a probe to be exhausted: each node must be examined to see if it matches the needs of the probe, and the examination of each node is that which bears the cost. In a world where probing may fail, knowing that a

provide (limited) information about the makeup of a constituent. For instance, in the case of a probe specified for a feature F, the daughters of a node will only be examined by the search procedure if the node itself bears [⚑F].

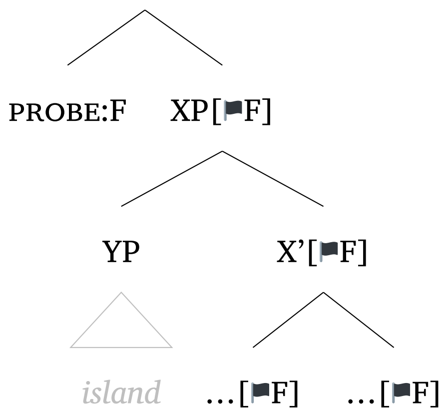
(5) **The probing configuration**



A desirable consequence of this is that it produces island effects: (some) islands, on this approach, would simply be phrases that lack a flag for the relevant sort of feature. As schematized below, the internal components of a node lacking [⚑F] will not be subject to Search. In the case below, probe-goal relationships for [F] will be impossible into YP, since it does not bear the relevant flag. Note that this entails a local relationship between a probe and its goal: every node in the sister of the probe that dominates the goal must bear a flag for a feature on that goal.

(6) **An island configuration**

particular instance of it will fail allows the derivation to proceed to the next step without incurring the cost associated with Search. In a world where failed probing leads to crash, knowing that a particular instance of it will fail allows the derivation to be thrown out without incurring the additional cost discussed above.



This raises a number of questions, the most pressing of which we hope to answer. In §2, we suggest that the *flags* in (6) are checked selectional features — presumably an independently necessary component of the grammar.[3] Checked selectional features provide a record of the derivation — the presence of a checked selectional feature on a maximal projection serves as a *flag* that either the specifier or complement of that phrase is of a particular sort. The chief innovation is an algorithm for determining whether or not checked selectional features are able to project past the maximal projection of the head they originated on. Crucially, this decision is *local*: it creates paths of local relationships between a probe and a licit goal, in the sense of (3). We show that the theory captures the basics of the classic CED: adjuncts and specifiers are, in the basic case, opaque for extraction, while complements are not. We show also that the theory avoids what we term the "escape hatch problem" for phase-based approaches to the CED, a stipulation which requires adjunct islands to both be phases and consistently lack an edge feature.

In §3, we show that the theory under development makes nuanced predictions about

3. This proposal has some surface similarity to H/GPSG (see e.g. Gazdar 1981) approaches to long-distance dependencies. On both proposals, some information about the relationship between heads and their arguments is projected up the clausal spine to a relevant probe. Our theory differs in several ways, however. First, we assume that dependencies may be formed through movement, contra H/GPSG, where dependencies are always formed through external Merge. Second, the information that is projected is a *checked* selectional feature rather than something representing an unmet selectional requirement (e.g. the *slash* in GPSG). In that sense, dependencies in our theory crucially rely on a notion of internal Merge — without a previously merged instance of some phrase, a path of the relevant checked selectional features could never be created.

whether an adjunct will behave as an island or not: the local context that an adjunct appears in determines its opacity. We note that the presence of certain dependencies into a class of control adjuncts — such as *wh*-movement and parasitic gaps — consistently forces the control adjunct to receive an Obligatory Control interpretation, despite the Non-Obligatory Control interpretation being available in other contexts. In §4, we show that specifiers, too, may be rendered transparent for extraction, based on cases of "melting" first discussed in Müller (2010). In §5, we discuss how these facts are challenging for previous literature and conclude.

2. A Theory of Locality

As discussed in §1.1, we propose that a notion of *path* mediates Search. As Search underlies the establishment of long-distance dependencies, paths become preconditions for long distance dependencies by extension. More specifically, for a probe A to establish a dependency with a goal B, we propose that A's sister must bear a feature checked by B. An algorithm for projecting features checked by B from the head that selected B to the sister of A establishes a series of local relationships that links probe and goal. Here we will discuss the predictions of the approach for dependencies involving selected elements. We return to the extraction of unselected elements, e.g. adjuncts, in §3.2.

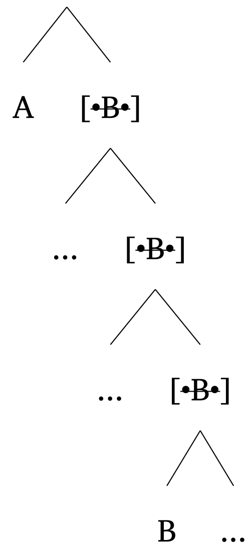
(7) **Accessibility**

A probe A searching for a goal B may only initiate Search for B if there is a path from A to B.

(8) **Path** (shorthand)

There is a Path from A to B if A's sister bears a feature checked by B.

(9) A long-distance path from A to B



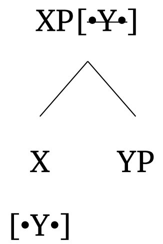
If for some reason A's sister does not bear a feature checked by B (i.e. because there is no local B), Search fails at the outset, without examining any nodes in the tree. Thus, Search never applies unnecessarily.

We begin by establishing some assumptions about clause construction, and show how a modified theory of feature projection creates long-distance dependencies according to (7) and (8). Adopting the notation of Müller (2010), we represent the features that drive Merge as in (10). A head that selects for a YP, for example, might bear a feature [•Y•], which may be checked when that head (or a projection of it) merges with a YP. In other words, a head with an unchecked [•Y•] feature that merges with a YP produces a projection bearing the checked version of that feature, [•~~Y~~•], as in (11). As will become important later, we follow Müller (2010), Nicholas Longenbaugh (2019a), and Newman (2021) in assuming that these features may drive *any* kind of Merge, representing not only external Merge, but movement (internal Merge) as well.

(10) **Merge features**

[•Y•] = an instruction to Merge with an element bearing Y

(11) **Selection for YP**



These checked features are inactive in the sense that they may no longer drive syntactic operations. However, contra Chomsky (2000), Adger (2003), and Asudeh and Potts (2004), a.o., we suggest that they do not disappear from the derivation. Instead, we propose that they remain present throughout the computation to serve as a pseudo-record of selection. On this view, XP provides more information to higher heads than just its own category feature. It also bears checked Merge features, which tell higher heads something about the elements inside XP, for instance that XP contains a YP in the case of (11).

So far, we have seen how checked features may be projected by a head to its own maximal projection, when it merges with elements it selects for. These features do not delete, and are thus visible to whatever subsequently merges with XP. According to the conditions in (7) and (8), for YP to be accessible to anything beyond XP's sister, [•~~Y~~•] must be able to project *past* XP. Only if [•~~Y~~•] projects past XP can it ever appear on the sister to a higher probe, making YP accessible to that probe.

We propose that feature projection past maximal projections is conditioned by the local context of that maximal projection. More specifically, maximal projections whose sisters are what we call *Indivisible Feature Bundles* get to project their checked selectional features to higher nodes, making their contents accessible to later operations (12). Indivisible features bundles are defined in (13) – they are essentially nodes whose features locally come from a single source. The intuition guiding this approach is the belief that language is binary: at every step of the derivation, feature projection should only project two bundles of features at a time. If one sister already locally projects two feature bundles, the other cannot project at all. If one sister locally projects one or fewer feature bundles, the other can project one as well.

(12) **Checked Feature projection**

A feature bundle {[~~•F•~~],[~~•G•~~]...} on a maximal projection may project iff its sister is an *indivisible feature bundle*.

Features of non-maximal projections may always project.

(13) **Indivisible feature bundle**:

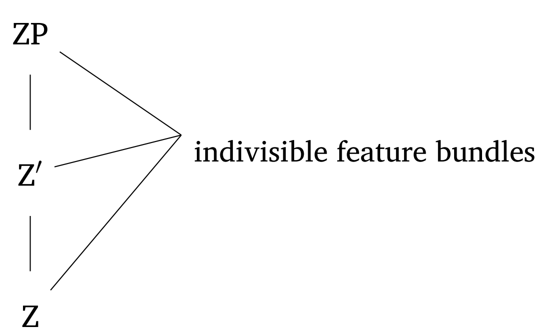
a. a feature bundle that comes straight from the lexicon

→ e.g. a terminal node (Matushansky 2006), OR

b. a feature bundle that has projected to a node from only one daughter

As an illustration, consider a hypothetical projection in (14), in which a terminal node projects straight to a maximal projection without merging with anything else. The terminal node is an indivisible feature bundle because it comes straight from the lexicon. The Z′ node dominating it is also an indivisible feature bundle because it only projects from a single daughter. The ZP node that dominates them both is likewise an indivisible feature bundle, for the same reason. In this simple case, every node is an indivisible feature bundle because there is no binary branching, which would introduce other sources of feature projection.[4]

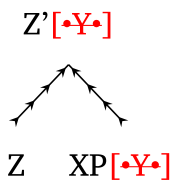
(14) Indivisible feature bundles



4. The projection in (14) should be taken as an artificial element, which illustrates our notion of indivisibility. We do not commit to the existence of non-binary branching phrase structure here.

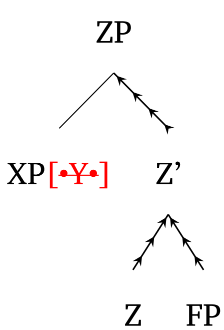
Recalling the XP maximal projection from (11), we can now calculate the predicted effects of context on whether XP gets to project its [•Y•] feature to higher nodes. If XP is the first-merged element with a head (othwerwise known as a *complement*), as in (15), the rule in (12) states that XP can project its [•Y•] feature – its sister is an indivisible feature bundle.

(15) XP projects [•Y•] to a higher node if it is a complement



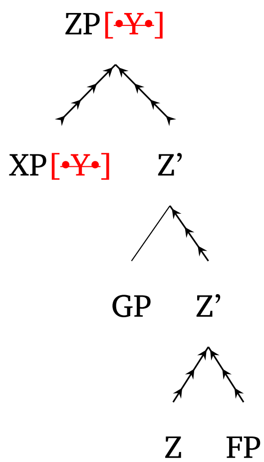
If XP is the second-merged element in ZP, i.e the first specifier of ZP (16), its sister is *not* an indivisible feature bundle. The Z′ sister to XP projects from two daughters: the terminal node (which always projects) and its sister (complements get to project, according to (15)). Since Z′ is not an indivisible feature bundle, XP does not get to project [•Y•] in this context, rendering YP inaccessible to operations external to XP. The theory thus accounts for basic CED effects: complements permit subextraction but first specifiers do not.

(16) XP does not project [•Y•] to a higher node if it is a first specifier



The theory makes a surprising prediction for third-merged elements, however. If XP merges as a second specifier (17), rather than a first specifier, its sister now only locally projects from *one* daughter. Its sister may bear features that originally came from multiple sources, but the notion of indivisibility that we pursue only examines a node's local context, namely whether it projects from its immediate daughters. On this view, the sister to XP in this case only projects from one daughter because first specifiers cannot project, according to (16). The first node that dominates a first specifier is therefore an indivisible feature bundle according to (13b), which licenses projection from a second specifier.[5]

(17) XP projects [•~~Y~~•] to a higher node if it is a *second* specifier



This approach therefore has an on-again off-again profile. If some maximal projection is allowed to project, it often creates a context in which the next merged maximal projection cannot project. If a maximal projection does not project, it often creates a context in which the next merged maximal projection can project, and so on. Thus, we expect the time of Merge to determine transparency for higher operations more than the complement-specifier distinction. We leverage this context sensitivity to explain the variable opacity of adjuncts and specifiers in different contexts.[6]

5. The present discussion assumes that Merge and feature projection proceed cyclically: each successive specifier extends the clause, and the feature projection algorithm follows the order of Merge. This may not be a necessary feature of the system, however. If multiple specifiers instead *tuck in*, as in Richards (1997), we could imagine reformulating the approach so that the feature projection algorithm and its consequences for Search inform representational constraints on movement rather than derivational ones. In a world with tucking in, properties of a phrase's sister could still inform whether that phrase projects, but projection would not proceed according to the order of Merge, but rather according to the resulting constituent structure.

6. A question arises: what happens in the case of "simple" phrases, e.g. phrases that have themselves

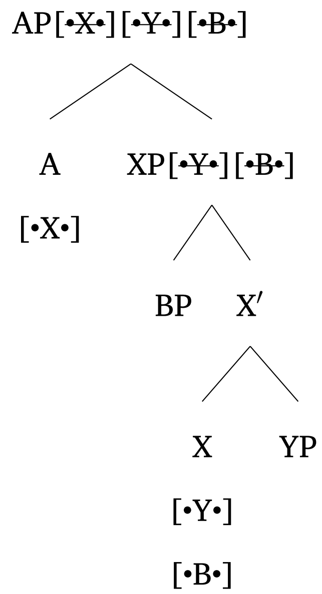
In sum, we propose that the distribution of checked features on nodes creates paths between probes and goals, where paths are a precondition for Search. A probe whose sister bears a feature checked by its goal may initiate Search for that goal, in which each successive node is examined for features checked by the goal until the goal is found. If the probe's sister has no relevant checked features, Search fails before it starts, avoiding unnecessary and costly searches. We proposed that the distribution of checked features is controlled by the rules of feature projection outlined here: maximal projections may project their checked features if their sisters are indivisible feature bundles but not otherwise. Successive projection of checked features creates paths.

Important to note is that [~~•Y•~~] is not equivalent to the YP that checked it. [~~•Y•~~] is a feature that was checked/rendered inactive by an element bearing Y. By contrast, YP is a phrase that can check some set of features on a probe, including [•Y•]. Thus, a probe whose sister bears [~~•Y•~~] has not "found" YP before searching – it must still search for the YP that checked the feature in order to satisfy the probe.

Lastly, though the presentation here only discussed a case where *one* checked feature was projected, we assume that feature projection is *wholesale* in general. What we mean by this is that multiple checked features on a phrase get projected together as a bundle – a maximal projection cannot selectively project some of its features but not others, as illustrated in (18).

failed to select anything? One approach would be to deny the existence of simple phrases of this sort: on this view, every functional item would enter into some sort of selectional dependency with something else, while lexical items would minimally consist of a root and categorizing head (see Marantz (1997) for a proposal along these lines). Another approach would be that they fail to project features, which could potentially have consequences down the line if the phrase that they are a complement of later takes a specifier: the first specifier in this case should be allowed to project in the way a complement normally would. We leave investigation of these possibilities to future research.

(18) **Projection is wholesale**



Because projection is wholesale, we expect maximal projections to be opaque or transparent to higher operations in a very general sense. To reiterate, the tree in (18) illustrates how these projection rules create long-distance dependencies: if XP is selected as the complement of A, then the newly-formed AP not only bears a [~~•X•~~] indicating the presence of an XP inside it, but also inherits any checked features borne by XP itself, allowing whatever selects for AP to search into XP for YP and BP.[7] A transparent maximal projection is transparent for potentially multiple dependencies across itself – it projected every feature it had, so everything inside it that checked a projected feature is visible to higher heads. An opaque maximal projection is similarly opaque for every imaginable dependency – if a maximal projection projects no features past itself, there can be no paths leading into

7. It is worth noting that the "wholly-tranparent"/"wholly-opaque" nature of certain domains is not inherent to the theory developed here, but only if the wholesale nature of projection is assumed. We could, of course, imagine more elaborate theories of feature projection that don't require wholesale feature projection of the sort here. The consequence of this would be that some domains would be transparent for some dependencies but not others (see Keine (2019) for some discussion of such patterns). We acknowledge this here as a point of interest for future work, but do not develop such elaborations here beyond what has here been said. For now, we will proceed with a fairly simple subtheory of feature projection, to highlight the — to our mind interesting fact that the "parity" of specifiers/adjuncts determines whether or not they may project — and acknowledge that a more intricate subtheory of feature projection might make more intricate predictions.

it. We will see that this all or nothing approach captures correlations between different dependencies that cross adjunct boundaries.

Before moving on, we will clarify certain assumptions that we make about features that drive syntactic operations, which underpin much of the discussion that follows. We assume that certain elements bear a [D] feature, which marks them as an argument of a clause. This is the same feature which allows certain elements but not others to satisfy the EPP in English, and bears similarity to the Case feature of Van Urk and Richards (2015), and the φ feature assumed in Van Urk (2015) and Nicholas Longenbaugh (2019b). We use [wh] as a feature for elements that enter into Ā-dependencies.

3. Adjunct (Non-)Islands

We now have a theory that predicts that maximal projections may be transparent for dependencies into them in certain configurations (for instance, when merged as a complement or to a phrase that already has a specifier). In this section, we discuss two cases where dependencies into adjuncts appear to be correlated, a phenomenon we term *correspondent transparency effects*.

First we discuss an observation from Truswell (2011) that wh-movement out of adjuncts tracks the obligatory/non-obligatory control distinction: control adjuncts that are transparent for wh-movement are obligatorily controlled, while control adjuncts that are opaque to wh-movement are non-obligatorily controlled. We argue that this correlation follows from our view of feature projection if both wh-movement and control are dependencies that employ Search.

Second, we observe that parasitic gaps also track the obligatory/non-obligatory control distinction. We argue that Nissenbaum (2000)'s independently proposed structures for parasitic gap constructions are configurations in which an adjunct should be transparent for multiple dependencies, such as binding of an operator and obligatory control. Thus the same explanation that accounts for correlations between wh-movement and control extend to parasitic gaps and control.

The obligatory/non-obligatory distinction is shown in (19).

(19) a. The flower$_i$ is open [PRO$_i$ to attract passing pollinators].
b. The door$_i$ is open [PRO$_{arb}$ to listen to confessions].

The non-agentive, inanimate subjects in (19) may corefer with an embedded PRO, as in (19a), or not, as in (19b). In the latter case, the embedded PRO is interpreted as referring to an arbitrary individual/group who might serve as a *listener* in this context. Insights from Chomsky (1981), Williams (1992), and Landau (2013, 2021) teach us that an inanimate interpretation for PRO is necessarily sensitive to c-command by a controller, while an animate interpretation for PRO may not be. To reflect this difference, we call (19a) a case of *Obligatory* control (henceforth OC), and (19b) a case of *Non-obligatory* control (henceforth NOC).[8]

McFadden and Sundaresan (2018) have argued that obligatory and non-obligatory control, despite appearances in (19), are in complementary distribution. On that view, a better description of (19) would be that (19a) is a case of genuine control, while (19b) is what happens when control cannot be established (i.e. an *elsewhere* construction). When the predicate of the adjunct clause is strongly biased towards an interpretation where its subject has sentience — as is the case with *hear* — the preference for the elsewhere construction emerges when there is no licit controller. This view of the obligatory/non-obligatory control distinction is further motivated by the observation that OC adjuncts are transparent for wh-movement, while NOC adjuncts are opaque.

8. Interestingly, these control adjuncts show a Weak Island effect – they permit extraction of a DP but not an adjunct.

(i) *How did the flower open [in order to attract pollinators ____]
→ A: with a particular UV pattern

While we do not offer a theory of Weak Island-hood here, see Appendix A for some possible views of Weak Islands on the present theory.

(20) a. What is the flower$_i$ open [PRO$_i$ to attract ____]?

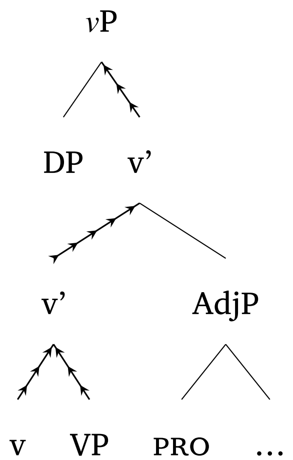
b. *What is the door$_i$ open [PRO$_{arb}$ to listen to ____]?

The examples in (20) show that infinitival adjuncts can either be fully transparent for wh-movement and control or fully opaque. We now propose that this variable transparency of control adjuncts results from a structural ambiguity in their attachment sites. When the adjunct attaches below the subject in Spec *v*P, it is a first specifier, unable to project its features, which renders it opaque. When it attaches above the subject in Spec *v*P, it is a second specifier, permitted to project its features, which makes it transparent.

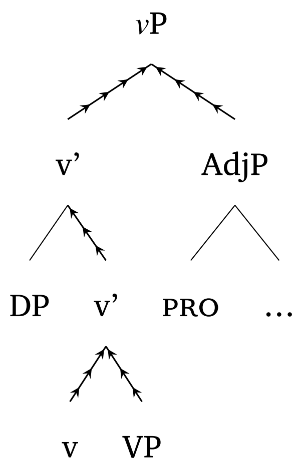
3.1 Adjunction Sites and Feature Projection

Following Landau (2021) and references there, we propose that the controlled adjuncts under discussion are attached within *v*P. In addition, we follow Landau in assuming that adjuncts which are ambiguous between an OC/NOC interpretation have an ambiguous position within *v*P. Landau suggests that the two relevant attachment positions for a controlled adjunct of this sort are either above or below the base position of the external argument (illustrated in (21)). Notice that the feature projection algorithm makes different predictions for each choice: adjuncts that merge as a first specifier (below the subject) should not project, while adjuncts that merge as a second specifier (above the subject) should project.

(21) a. Below the subject: sister projects from two daughters – adjunct can't project



b. Above the subject: sister projects from one daughter – adjunct can project



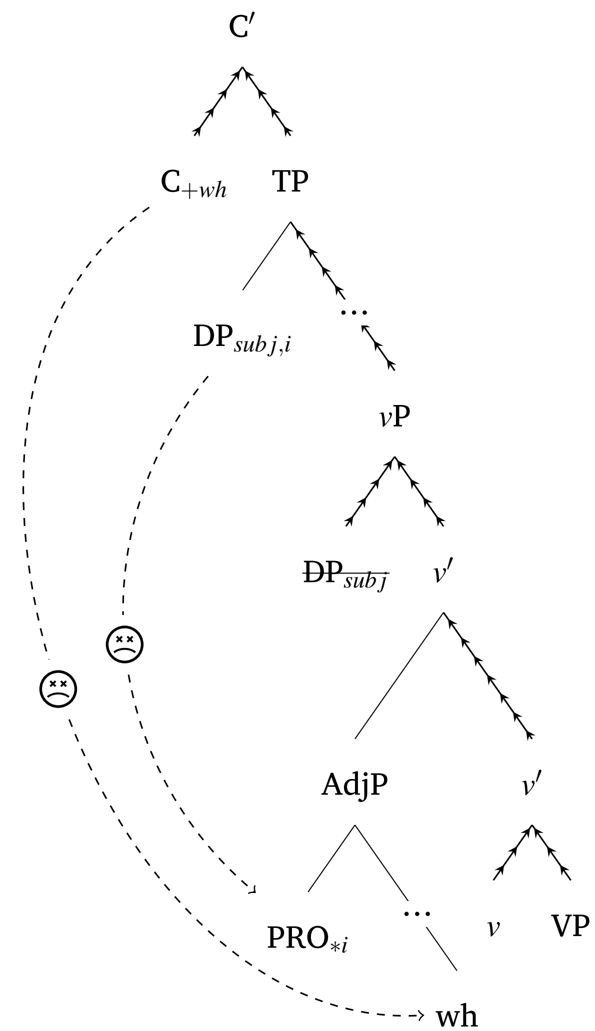
We suggest that variable projection from controlled adjuncts accounts for their variable transparency to OC and wh-movement.

First, we propose that both *wh*-movement and OC control involve the establishment of a long-distance syntactic dependency through Search. *Wh*-movement arises when interrogative C searches its complement for a phrase bearing a [wh] feature, which is used to check a [•wh•] feature on itself. OC control likewise involves a syntactic dependency formation that is also contingent on successful Search, where the complement of a potential binder for PRO is subject to Search for PRO (see Ke 2019 for a similar proposal for reflexive binding). Consequently, there must be a *path* between PRO and its controller for OC to arise, and a path between interrogative C and a *wh*-phrase for movement to occur. When an adjunct projects its features, there are paths into it for every feature that it projects, as illustrated in (22) and (23).

In (22), we see the continuation of the derivation in (21a); the matrix subject raises to Spec TP and an interrogative C is merged. According to (8), in order for the matrix subject to control adjunct PRO, its sister (T′) must bear a feature checked by PRO. Similarly, in order for interrogative C to attract a wh-element from inside the adjunct, its sister (TP) must bear a feature checked by the wh-element. In this case, the adjunct has merged as a first specifier, which prevents it from projecting its features to *v*P, let alone to T′ and TP. Thus, the lack of paths into the adjunct for any feature blocks both control into and wh-movement out of it.[9]

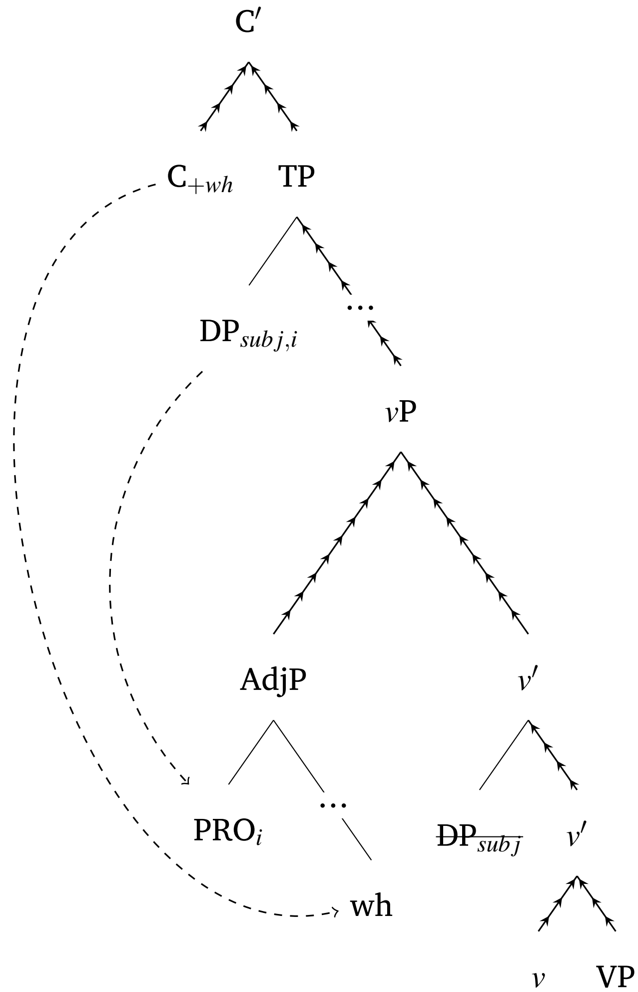
9. From here on out, we will represent adjunct clauses as leftward specifiers to make the representations more legible, but we continue to assume that they are in fact linearized to the right.

(22)



In (23), we find the continuation of the derivation in (21b), where the adjunct merged as a second specifier. In this case, the adjunct was allowed to project its features to *v*P. When *v*P is merged as the complement to the next highest functional head, *v*P projects its features to the next highest node, which include those of the adjunct. Eventually, these features project up to T′ and TP, creating paths into the adjunct for control and wh-movement.

(23)



The adjunct is thus, in principle, transparent for subsequent Search. Both PRO and the *wh*-phrase within the adjunct should be visible, provided they have checked a feature in the adjunct that some higher head has initiated Search for. In the following subsection, we discuss what those features might be for both the *wh*-phrase and PRO, and discuss some broader implications of this for our theory. Having clarified the theory under development, we then return to our second case study: parasitic gap-containing adjuncts.

Interestingly, the feature projection algorithm predicts the exact opposite of what Landau proposes: on our proposal, adjuncts that are first specifiers should be opaque, and therefore should not receive an OC interpretation, while adjuncts that are second specifiers should be transparent, and therefore should receive an OC interpretation. This is the opposite of Landau's proposal, in which OC is established for first specifier adjuncts but not second specifier adjuncts. We return to this issue in §3.4, where we discuss support from Nissenbaum for our proposed specifier order, and show that it isn't wholly incompatible with Landau's claims about the semantics. We will first flesh out our proposal, however.

3.2 Dependencies through Paths

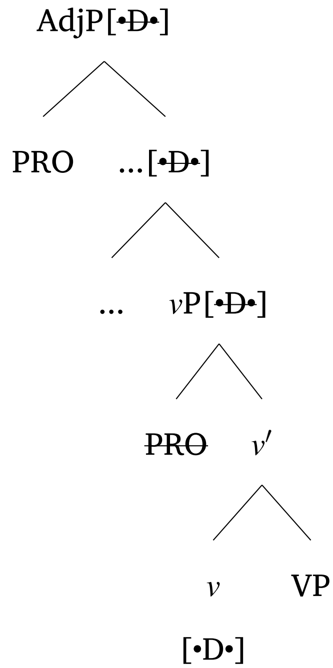
On the theory developed here, the requirement for there to be a path between two elements "linked" through Search should be seen as a way to ensure that Search will succeed. We now explain how Search interacts with movement to account for the correspondent transparency effects. Recall, as discussed beforehand, that both internal and external Merge are licensed only when they check [•F•]s. Movement — or internal merge — requires an invocation of Search on the sister for some matching feature, followed by Merge of the goal at the root of the tree.

Not only must there be a path of checked features between the two elements in question, but the target of Search must have checked the sort of feature that Search is looking for. In other words, a probe with a feature [•X•] must find a path of [~~•X•~~] features to its goal, not just any path of features checked by its goal.

At this point, one might wonder *which* features actually establish these paths between the matrix subject/PRO and C/the wh-element, and how those features get checked/projected. For PRO, the answer is straightforward: PRO is presumably selected as the external argument of the adjunct clause. We can therefore imagine that it checks a [•D•] feature on adjunct *v*, which gets projected to the highest node in the adjunct clause. We have illustrated PRO as the highest specifier of AdjP on the assumption that PRO moves to the edge of its clause (Heim and Kratzer 1998). As long as control is mediated by a search for DPs, if that [~~•D•~~] feature projects to the sister of the matrix subject, the matrix subject may find and control PRO.[10]

10. An equivalent alternative is that whichever feature attracts PRO to the edge of the adjunct clause is

(24) PRO checks [•D•] on *v*, which projects to AdjP



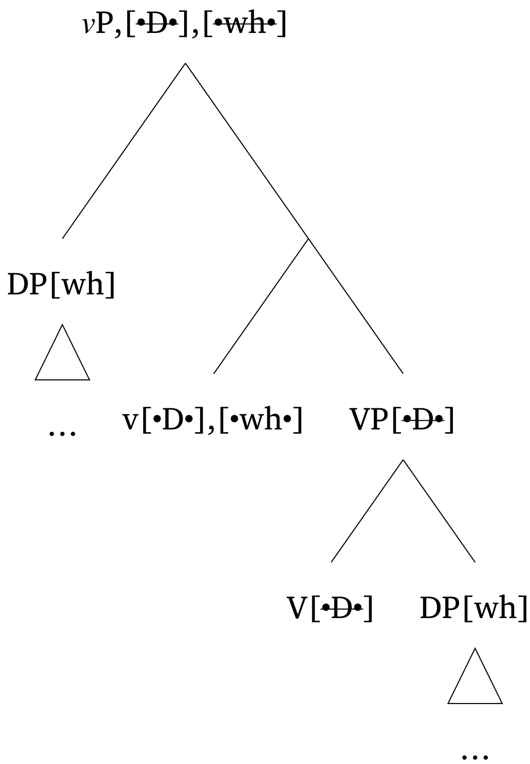
For wh-elements, the picture is slightly complicated by the fact that wh-features are not commonly viewed as being selected. When a wh-object merges, for example, we don't usually assume that it checks a [•wh•] feature as well as a [•D•] feature, in which case a [~~•wh•~~] feature should never project to the sister of any wh-probe. Assuming that wh-movement is mediated by the search for wh-features, what establishes the path between C and wh-elements, when wh-elements don't check [•wh•] features in their base positions?

One possibility would be to propose that complement *wh*-phrases generally undergo a short step of [•D•]-driven movement to an intermediate position in the clause. For concreteness, consider the case below. Here, *v* bears both a [•D•] and [•wh•] feature. Internal merge to satisfy [•wh•] is not possible: the complement of *v* does not bear a [~~•wh•~~] feature, so it may not be searched for [wh]. The complement does, however, bear a [~~•D•~~] feature, so it may be searched for an element bearing [D], in which case the object

what establishes the path between the matrix subject and PRO. If that feature is also [•D•], however, there is no meaningful difference between the two options. If some other feature is responsible for adjunct-internal movement of PRO, then some other feature could be responsible for the control path, but we won't speculate about what that feature could be here.

will be found. Subsequent merge of the object in Spec *v*P will check both the [•D•] as well as the [•wh•] on *v*. Consequently, the [~~•wh•~~] will be able to project higher in the tree from this *v*P, creating a path between the wh-phrase in Spec *v*P and higher elements in the tree.

(25)



For the sake of having a concrete analysis, we will adopt this approach here, but note that there are alternative possibilities that would work just as well. The present approach, however, has the advantage that it has precedent in the literature from Canac Marquis (1994), Van Urk and Richards (2015) and N. Longenbaugh (2017). The first two propose that Ā-movement chains involving non-subjects always involve a step of A-movement within VP. Canac Marquis (1994) suggests that English Ā-movement of objects is analogous to *tough*-movement, involving A-movement of a null operator to the inner specifier of the phrase that the element undergoing Ā-movement is introduced to as an outer specifier. This step of operator movement allows the moved element to be linked to its gap; the position which the moved object is itself initially Merged in is presumably motivated by a need to check the [wh] feature of the relevant projection.

Van Urk and Richards (2015) propose that *wh*-movement of objects in Dinka (Nilotic; Sudan) is parasitic on a prior step of A-movement to a position low in the clause, based on facts about the exceptional absence of an internal argument in an otherwise obligatorily filled preverbal slot, in contexts involving Ā-movement of an internal argument. The idea, presented using the feature ontology assumed throughout, is that movement to this preverbal position may in principle check both [wh] and [D] features. In the absence of an element which bears [wh], this is driven solely to satisfy the needs of [D] on the relevant head. When an element bears both, checking of the [•wh•] feature on the head that triggers movement may take place, with the path licensing movement involving a [•D•] feature.

N. Longenbaugh (2017), like Canac Marquis (1994), discusses a derivation like this in the context of English tough constructions, though the details of the analyses differ. On Longenbaugh's view, tough movement involves successive cyclic *composite* movement through Spec *v*P, which has both A and Ā-properties. On the present view, this "mixed" movement is represented by the multiple checking of two different features on *v*: [•D•] and [•wh•].

We could conceive of other analyses of wh-path-formation, however. We could, for instance, imagine denying that the problem arises in the first place: arguments on this view would generally be introduced as the specifiers of functional heads (see Ahn, to appear for a recent argument to this effect), which would always be potential bearers of a [•wh•]. Or we could propose that *wh*-elements are always themselves internally complex (see Cardinaletti and Starke 1994 for the proposal that pronominal elements are syntactically complex, Hagstrom 1998; Cable 2010 for consonant proposals about the syntactic complexity of *wh*-elements, and Nicolae and Scontras 2018 for an explicit proposal along these lines for Tagalog *wh*-questions). On this approach, DP-construction would involve checking of a [•wh•] feature contained within the *wh*-element itself, which would then be able to project up the tree. Given that these possibilities are not mutually exclusive, more work is ultimately needed to tease apart the predictions made by these theories, and determine which, if any, are unattested options for the grammar.

The proposal that wh-movement is mediated by DP-movement raises questions about wh-movement of non-DPs, such as PP arguments and adjuncts. Here, again, a number of ways forward present themselves.

(26) a. To whom did John first speak?
 b. On which day did John first speak?

For adjuncts, a fairly straightforward analysis would be to propose that they consistently externally merge in Spec *v*P, at least in cases where they undergo *wh*-movement. For argument PPs the way forward is less straightforward. One possibility is that wh-PP arguments, like adjuncts, often have the option of initially merging with a functional head like *v*P, ensuring that the PP argument checks a *wh* feature (see Newman 2021 for a proposal along these lines). Another possibility is that PP arguments are required to exit the VP for independent reasons (see Stowell 1981 for such a proposal). Assuming this movement is feature-driven, subsequent Merge of a PP argument with *v*P consequently checks v's [•wh•] feature in cases where the PP bears [wh].

In sum: both PRO and *wh*-elements must respectively check [•D•] and [•wh•] if they are to be visible for subsequent Search operations. In the case of PRO, this is relatively trivial: PRO checks a [•D•] when it is initially merged. In the case of *wh*-elements, this means that the *wh*-element must first undergo movement for independent reasons to an intermediate projection, with checking of [•wh•] on this intermediate position taking place as a side effect. Only after movement to such a position will there be a path of [~~•wh•~~] features to the *wh*-element, rendering it visible for subsequent Search.

3.3 Parasitic Gaps

We have discussed how wh-movement out of adjuncts correlates with obligatory control into them, and have proposed that our theory of projection accounts for this correlation: adjuncts that project their features are transparent for multiple dependencies across them, while adjuncts that do not project their features are opaque for every dependency. We now observe that this correlation between wh-movement and control is not specific to wh-movement out of adjuncts. Parasitic gaps inside adjuncts show the same effect. Observe in (27) that parasitic gaps are possible in OC adjuncts, but not in NOC adjuncts.

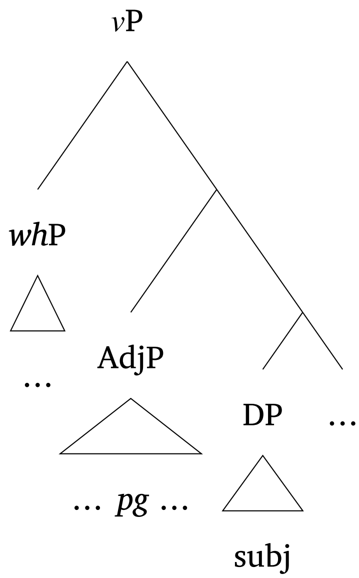
(27) a. [What direction]$_i$ was the flower$_j$ opened to ~~what direction~~ [OP$_i$ PRO$_j$ in order to attract passing pollinators from ~~OP~~]?

b. * [What sort of person]$_i$ was the door$_j$ opened to ~~what sort of person~~ [OP$_i$ PRO$_{arb}$ in order to listen to confessions from ~~OP~~]?

Before, we saw that OC adjuncts are transparent as a consequence of the position that they are merged in, namely: as second specifiers. Adjuncts that are adjoined in such a position are transparent both for control as well as *wh*-movement, while the same adjunct merged in a different position will be opaque for both control and *wh*-movement, forcing an NOC interpretation of PRO.

Nissenbaum (2000) develops a theory of parasitic gap licensing that, juxtaposed with the proposals put forth here, straightforwardly captures the correlation in (27). For independent reasons, Nissenbaum proposes that parasitic gap-containing adjuncts must merge in a particular position: immediately above the subject that controls PRO, and immediately below a position occupied by the *wh*-element which licenses the parasitic gap. In other words: parasitic gap-containing adjuncts must be second specifiers of *v*P, schematized below.

(28) **Nissenbaum's parasitic gap licensing structure**



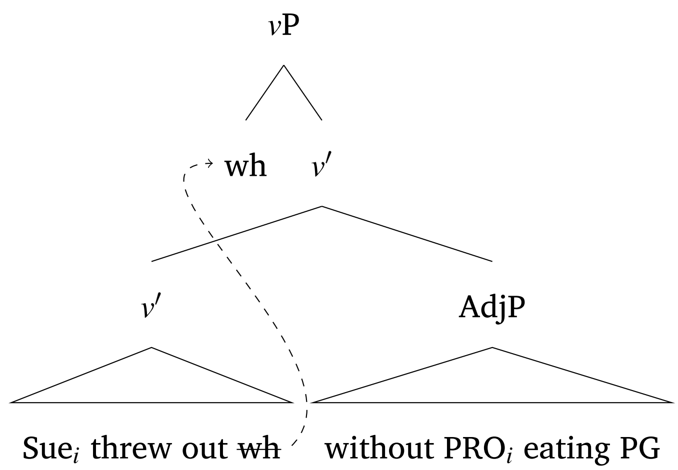
Recall that our theory of feature projection predicts second specifiers to be able to project their features to higher nodes, making them transparent to dependencies like wh-movement and control. The adjunct in (28) is therefore predicted to be transparent for control, because it is a second specifier. NOC adjuncts must not be in this position, since they block parasitic gap licensing, thus providing further motivation for the treatment of NOC as an elsewhere construction when an infinitival adjunct is opaque for a control dependency.

The fact that parasitic gap licensing is contingent on this structure also supports a view of operator binding as requiring Search, just like control and wh-movement. We follow Chomsky (1986), Larson (1988), Postal (1998), and Nissenbaum (2000) in assuming that parasitic gap constructions do not involve ATB wh-movement out of both matrix and adjunct clauses, but rather involve binding of an operator that moves adjunct-internally. By merging in second specifier position, the adjunct makes the features of PRO as well as the features of the operator accessible to higher elements. The configuration that licenses control thus should also license binding of the operator. If the adjunct merges in a different position, one which blocks feature projection, we expect both OC and operator binding to be blocked, as we find in (27b).

3.4 Precedent for the order of specifiers at *v*P

On our proposal, for dependencies like obligatory control and wh-movement to cross an adjunct clause boundary, the adjunct must merge as the second specifier of *v*P and the external argument (controller) must merge as the first specifier of *v*P. This configuration of specifiers is consistent with Nissenbaum 2000, who likewise argues that (OC) adjuncts with parasitic gaps merge higher than the external argument, creating the configuration that we want.

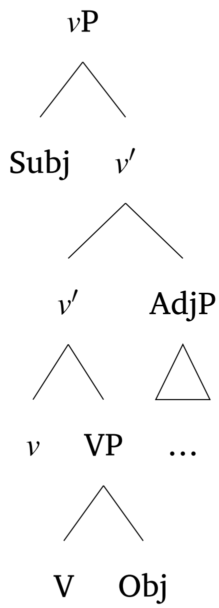
(29) Nissenbaum's configuration of specifiers with PG-containing OC adjuncts
(e.g. *What did Sue throw out without eating?*)



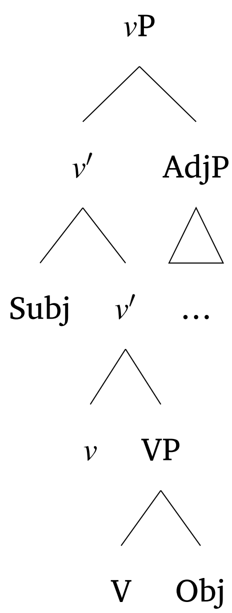
However, this configuration is the exact opposite order of specifiers proposed by Landau 2021, who suggests that OC can only be established if the adjunct merges *below* the external argument; NOC arises when the adjunct merges above it.

(30) Landau's OC vs. NOC

a. OC: subject is second specifier



b. NOC: subject is first specifier



Here we will explore each analysis in closer detail and see whether the insights from Landau can be made consistent with our proposal. Starting with Nissenbaum 2000, Nissenbaum offers two main reasons to put PG-containing adjuncts where they are: 1) constituency/binding tests showing they are at least as high as Spec *v*P, and 2) placing them above the subject allows us to treat adjunction as interpreted via predicate modification. He provides examples like (31), which show that the adjunct outscopes material internal to the verb phrase, such as the verb and internal arguments.

(31) Nissenbaum 2000, ex. 27a, 29c, p. 37-8

a. John [filed the papers and shelved the books] without reading them.

b. We gave him$_i$ a book [without talking to John$_i$'s mother].

He argues that (31) show us that the adjunct must be at least as high as Spec *v*P. He then argues that having them be a second specifier, where the external argument is a first specifier, gives us the right semantics.

Nissenbaum draws an analogy between parasitic gap containing adjuncts and constructions with operator-movement, such as relative clauses. In a relative clause, an operator moves clause-internally, creating a one-place predicate, which is saturated by merging with the relative noun. In a parasitic gap construction, he argues the same thing happens, following Chomsky 1986, Larson 1988, and Postal 1998: there is adjunct-internal operator movement, which creates a one-place predicate. When the adjunct merges in Spec *v*P, its open argument is saturated by the copy of the wh-phrase that moves successive cyclically through Spec *v*P. For this analogy to hold, the adjunct must be of type $< e,t >$, and it's closest c-commanding phrase must be the wh-element.

(32) Parasitic gaps as derived by operator movement

a. Relative clause: the book [Op (that) John threw out t]

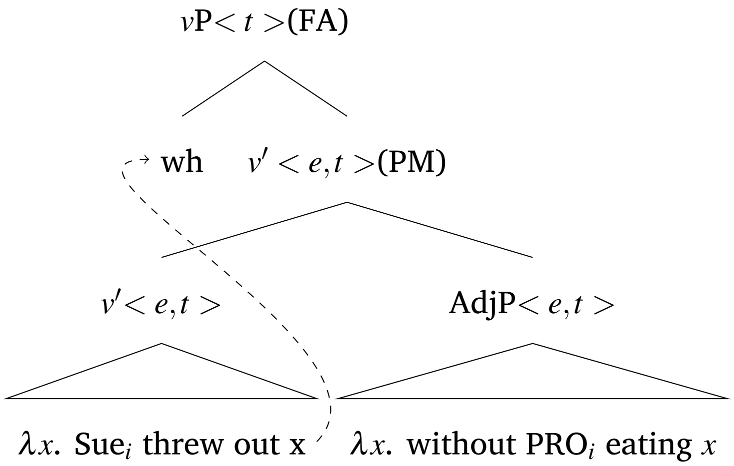
LF: ($\lambda x.$ John threw out x) (the book)

b. Parasitic gap adjunct: [Op without PRO reading t]

LF: ($\lambda x.$ without PRO reading x)

He also draws on the intuition that adjuncts are interpreted via predicate modification (PM). As a result, in order for the above configuration to be interpretable, the sister of the adjunct must have the same type, namely it must also have type $< e,t >$ (in need of saturation by the wh-element). These conditions are both easily met if the subject is internal to the sister of the adjunct clause, as in (33). Wh-movement in the main clause through Spec *v*P leads to lambda abstraction over the verb phrase. As long as the adjunct merges below the wh-element but above the external argument, predicate modification and subsequent saturation proceed straightforwardly.

(33) Adding semantics to Nissenbaum's configuration



As a result, Nissenbaum's analysis of parasitic gap licensing requires the opposite of Landau's specifier ordering. Let's now explore Landau's reasons for putting specifiers in that order to see whether any common ground can be found. To foreshadow, Landau independently needs to permit specifiers to move freely to create his configuration, in which case his results may not be contingent on having a particular base order of Merge.

3.4.1 *Why Landau's specifiers can be flexible*

Landau 2021 takes a significantly different approach to the interpretation of control adjuncts compared to Nissenbaum. While Nissenbaum proposed that they compose via predicate modification (like other modifiers), Landau proposes that the adjuncts we have been looking at compose with the matrix clause via functional application – he assigns adjunct heads a higher type, which first selects its own clause and then the matrix clause.[11]

11. It is important to note that Landau does not propose this analysis for *all* control adjuncts, just those that he describes as alternating between OC/NOC. Adjuncts that can only receive a strict OC interpretation are treated differently, but we don't discuss those here.

On his view, adjuncts are not uniform in type either; OC adjuncts and NOC adjuncts are headed by elements of different types with different selectional requirements.

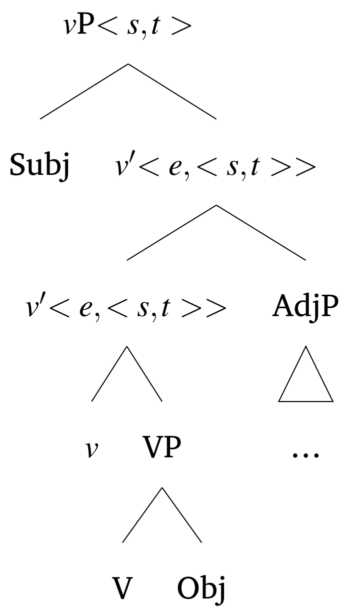
(34) Landau's semantic types for OC/NOC adjuncts

	OC	NOC
Adj head	$<<e,<s,t>>,<<e,<s,t>>,<e,<s,t>>>>$	$<<s,t>,<<s,t>,<s,t>>>$
AdjP	$<<e,<s,t>>,<e,<s,t>>>$	$<<s,t>,<s,t>>$

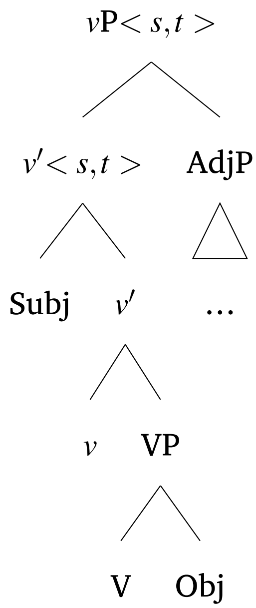
Due to the semantic types he assigns, OC adjuncts have to combine with the main clause before the matrix predicate has merged the subject. By contrast, NOC clauses have to merge after the subject.

(35) Landau's OC vs. NOC

a. OC: subject is second specifier

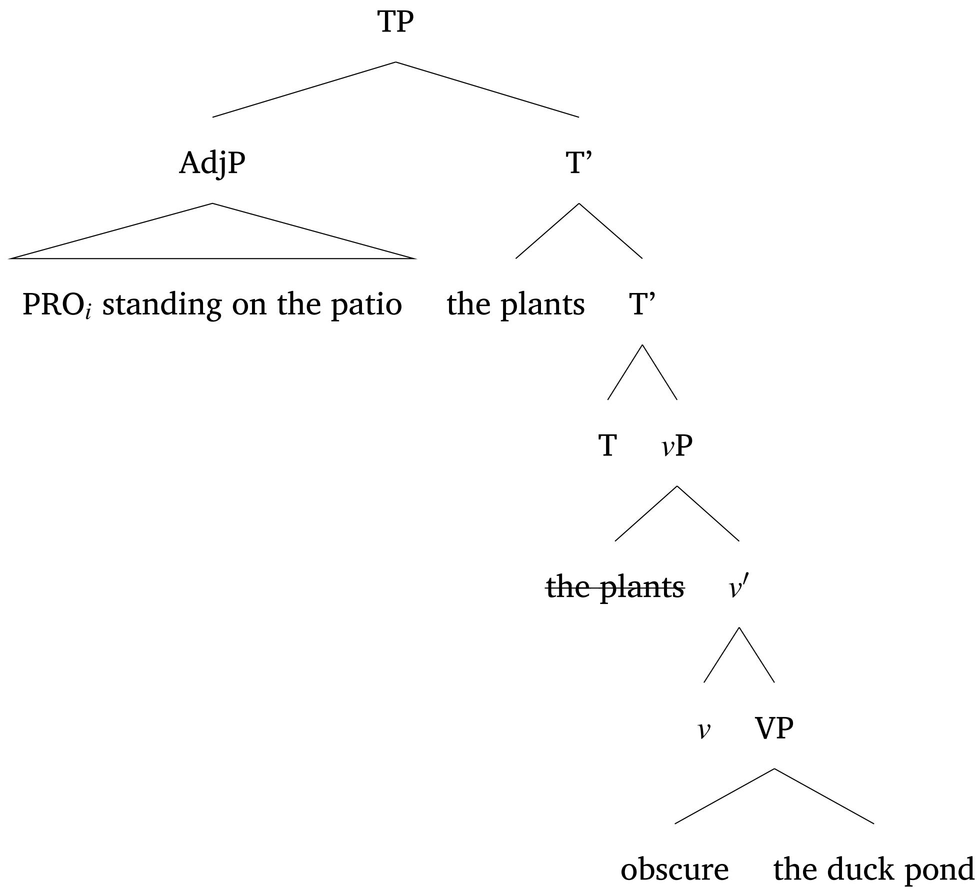


b. NOC: subject is first specifier



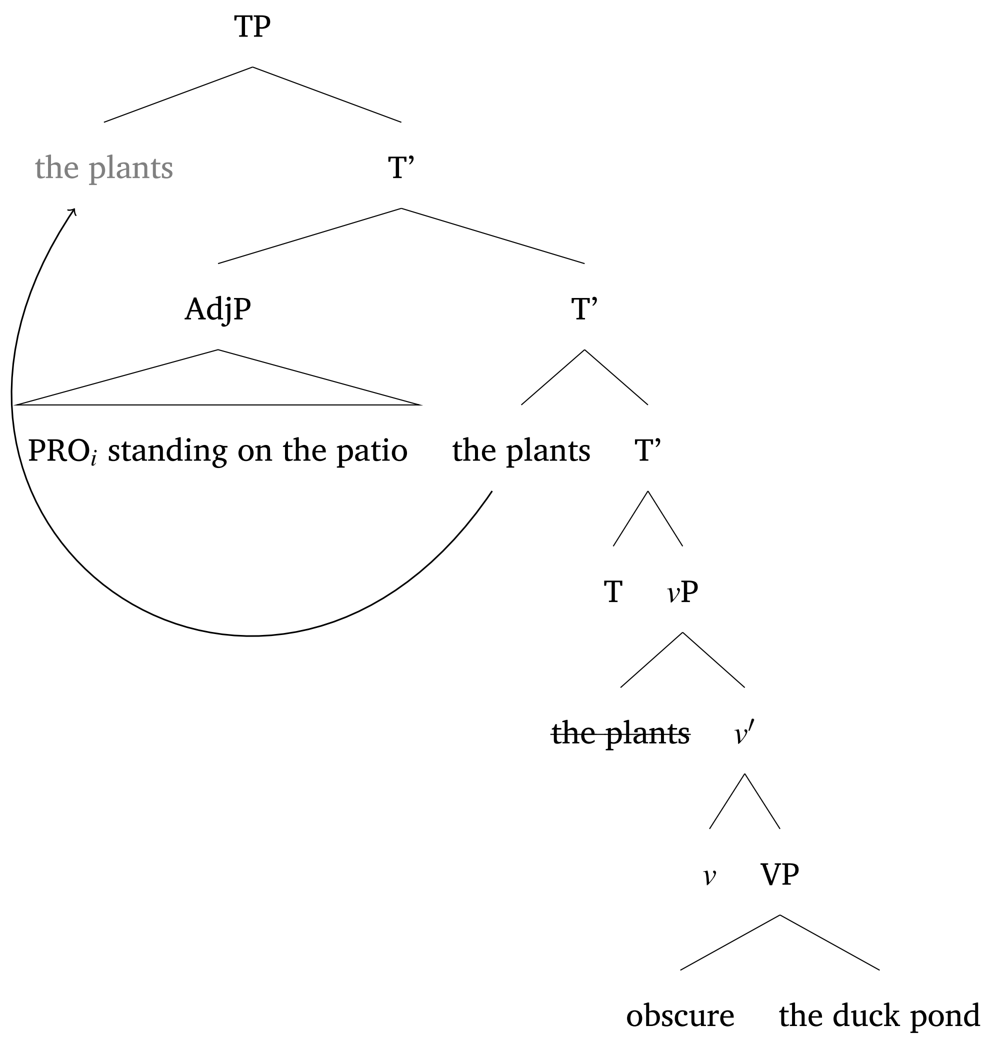
Landau faces a challenge from clause-initial OC adjuncts, however. In (36), the OC adjunct appears to c-command the surface position of the subject, despite the fact that its semantics should require it to adjoin to the matrix clause below the subject.

(36) [PRO$_i$ standing on the patio], the plants$_i$ obscure the duck pond.



To capture cases like these, Landau proposes that LF movement of the subject applies, taking the subject from its surface position to a higher position to feed the semantics. This movement is both unpronounced and insensitive to syntactic rules that might prevent a specifier from moving to a new specifier position of the same projection.

(37) [PRO$_i$ standing on the patio], the plants$_i$ obscure the duck pond.



Given this amendment, it isn't obvious that Landau's semantic approach actually restricts the order of specifiers in the narrow syntax. In other words, if our analysis is right that OC adjuncts are generated above the subject (as in Nissenbaum 2000), which is what allows dependencies into the adjunct clause, Landau's analysis could be easily made compatible with our approach by just assuming that his LF movement applies whenever necessary to get the semantics right.

At this point, it is still not obvious whether Landau's assumptions about the semantics of control can be made compatible with Nissenbaum's when it comes to parasitic gap licensing in control adjuncts. For this reason, as well as the fact that Landau's account allows flexibility in specifier ordering, we will maintain our proposal that the *syntax* enforces the specifier order in (29), whenever the adjunct receives an OC interpretation or permits wh-extraction/parasitic gaps.

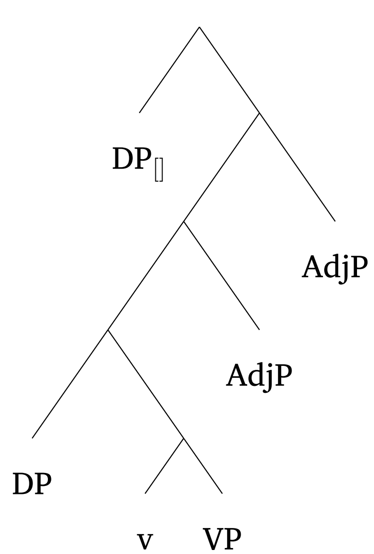
3.4.2 *Stacked adjuncts: a loose end*

Before moving on, it is worth tying up a loose end. As noted by Nissenbaum, one instance of *wh*-movement may license parasitic gaps in more than one adjunct.

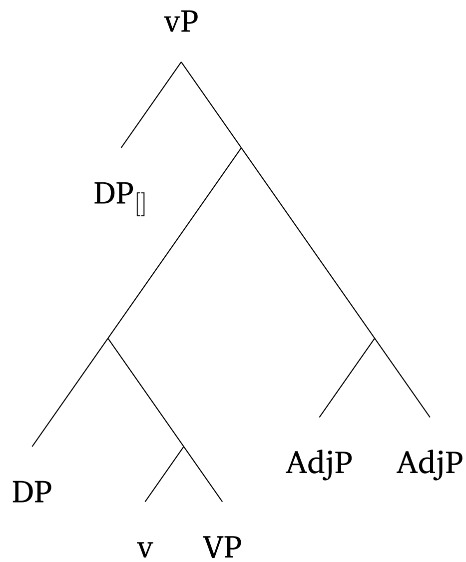
(38) Who will you hire ____ [after interviewing ____] [if they recommend strongly ____]?

As pointed out by a reviewer, an analysis of stacked adjuncts like (39) poses a potential problem for the theory developed here — only one of the two adjuncts on such an analysis would be of the right parity to project its features and license the parasitic gap within. We believe there is good reason, then, to favor an analysis like that in (40) for "stacked" adjuncts of the sort discussed here, following Chomsky 2019. In this structure, the two adjuncts Merge with each other prior to their Merge with vP. Since the "combined" adjunct is an even parity specifier of vP, it will be able to project its features from this position. Furthermore, since the adjuncts that make up the combined adjunct themselves have a specifier — the null operator which gives rise to the parasitic gap — they will be able to project their features up to the "combined" projection.

(39)



(40)



This theory also accounts for Nissenbaum's observation that parasitic gap-containing adjuncts must appear closer to the predicate they are construed with than adjuncts that do not, as shown below. If Nissenbaum is right that parasitic gap-containing adjuncts are of a distinct semantic type, then they would only be able to conjoin with adjuncts of the same type (i.e. gap-containing adjuncts can conjoin with other gap-containing adjuncts). Given this, the adjuncts in (41) must form different specifiers of *v*P. The inner adjunct may be of even parity provided the Ā-moved object lands above it in vP; the outer adjunct, conversely, may not. It would have to be above both the inner adjunct and the subject, but below the wh-phrase in order to license a parasitic gap (according to Nissenbaum). From this position, however, it couldn't project, blocking a parasitic gap. As a result, when there are two adjuncts, one with a gap and one without, the adjunct with the gap must be the inner adjunct.

(41) a. *Who will you hire ____ [after interviewing someone else] [if they recommend ____]?

b. Who will you hire ____ [after interviewing ____] [if they recommend someone else]?

What we have seen, then, is that multiple kinds of dependencies which Search plausibly underlies — control and Ā-dependencies such as *wh*-movement and binding of null operators — are allowed into adjuncts only when those adjuncts appear in a particular context. Moreover the theory captures the fact that one and the same adjunct clause may be opaque or transparent, given that such clauses may merge as second specifiers or not. In §4 we discuss further implications of the theory we've developed, and compare it to other theories with comparable empirical coverage. §4 shows how the theory predicts contextual transparency of specifiers in addition to adjuncts, based on a set of facts first discussed in Müller (2010).

4. Melting – from Adjuncts to Specifiers

Müller (2010) discusses a class of exceptions to the CED, which he calls *Melting* effects. He observes that external arguments in German and Czech are typically opaque to extraction, as expected for specifiers, according to the CED. However, he shows that scrambling an object to the left of the external argument has the effect of making the external argument transparent for extraction. In other words, object scrambling obviates the CED for transitive subjects. This is shown in (42) and (43) for German and Czech respectively. Wh-extraction out of the subject is only available when the object appears to its left.[12]

12. Müller observes that this effect is not limited to extraction of a DP, but also of PPs. See also Heycock (1991), chapter 3 for examples of pseudo-melting.

(ii) *German PP extraction* (Müller 2010, ex.37)

a. *[$_{PP1}$ Über wen] hat [$_{DP3}$ ein Buch t_1] [$_{DP2}$ den Fritz] beeindruckt?
   about whom has a book.NOM the Fritz.ACC impressed
   intended: "About whom did a book impress Fritz?"

b. [$_{PP1}$ Über wen] hat [$_{DP2}$ den Fritz] [$_{DP3}$ ein Buch t_1] t_2 beeindruckt?
   about whom has the Fritz.ACC a book.NOM impressed
   "About whom did a book impress Fritz?"

(iii) *Czech PP extraction* (ex.44)

a. *[$_{PP1}$ O starých autech] oslovila [$_{DP3}$ kniha t_1] Petra$_2$.
   about old cars fascinated book.NOM Petr.ACC
   intended: "A book about old cars fascinated Petr."

(42) *German wh-extraction* (Müller 2010, ex.36)

a.

*Was$_1$	haben	[$_{DP3}$	t_1	für	Bücher]	[$_{DP2}$	den	Fritz]	beeindruckt?
what	have			for	books.NOM		the	Fritz.ACC	impressed

intended: "What kind of books impressed Fritz?"

b.

Was$_1$	haben	[$_{DP2}$	den	Fritz]	[$_{DP3}$	t_1	für	Bücher]	t_2	beeindruckt?
what	have		the	Fritz.ACC			for	books.NOM		impressed

"What kind of books impressed Fritz?"

(43) *Czech split DP constructions* (ex.42)

a.

*Stará$_1$	neudeřila	[$_{DP3}$	žádná	t_1]	Petra$_2$.
old.NOM	hit		no.NOM		Petr.ACC

intended: "No old one hit Petr."

b.

(?)Stará$_1$	neudeřila	Petra$_2$	[$_{DP3}$	žádná	t_1]	t_2.
old.NOM	hit	Petr.ACC		no.NOM		

"No old one hit Petr."

Importantly, Müller cites evidence from Grewendorf (1989) suggesting that the subject of a psych verb like *beeindrucken* is a regular external argument in German, and not a VP-internal argument. Thus, it must be a specifier, making (42b) a true counterexample to the CED. What is surprising about (42) and (43) is that the exact same specifier (e.g. *was für Bücher*) can be opaque in (42/43a) but transparent in (42/43b), solely based on the position of the *object*. The surface position of the object presumably does not affect the specifier-hood of the subject, suggesting that island effects have more to do with local context than the complement/non-complement distinction.

b.

(?)[$_{PP1}$	O	starých	autech]	oslovila	Petra$_2$	[$_{DP3}$	kniha	t_1] t_2.
	about	old	cars	fascinated	Petr.ACC		book.NOM	

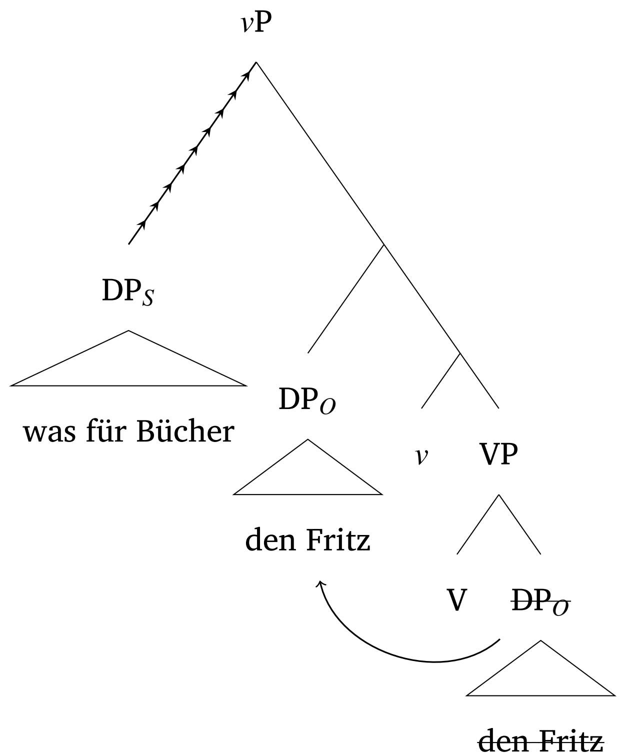
"A book about old cars fascinated Petr."

Our theory provides a natural explanation for this effect on the assumption that object movement proceeds successive cyclically through the edge of *v*P, as discussed in §3.2.[13] Assuming that a scrambled object must stop in the edge of *v*P at some point in the derivation, the (b) examples in (42) and (43) differ from the (a) examples with respect to the total number of specifiers *v*P can have. When no scrambling takes place, the external argument is the only argument to ever occupy the edge of *v*P, while in scrambling derivations, *v*P has *two* specifiers at some point in the derivation.

Our theory predicts that first specifiers of *v*P should be opaque for extraction but second specifiers should be transparent. In non-scrambling derivations, the external argument is the first (only) specifier of *v*P, and is thus correctly predicted to be opaque. In scrambling contexts, by contrast, as long as the specifier configuration in (44) is allowed, the external argument may be a second specifier, which makes it transparent for extraction. We assume that Spec *v*P is only an *intermediate* landing site for the object – it eventually moves to a higher position to derive the surface word order OS, as shown in the full derivation in (45).

(44) A moving object can make the external argument a second specifier of *v*P, licensing (45)

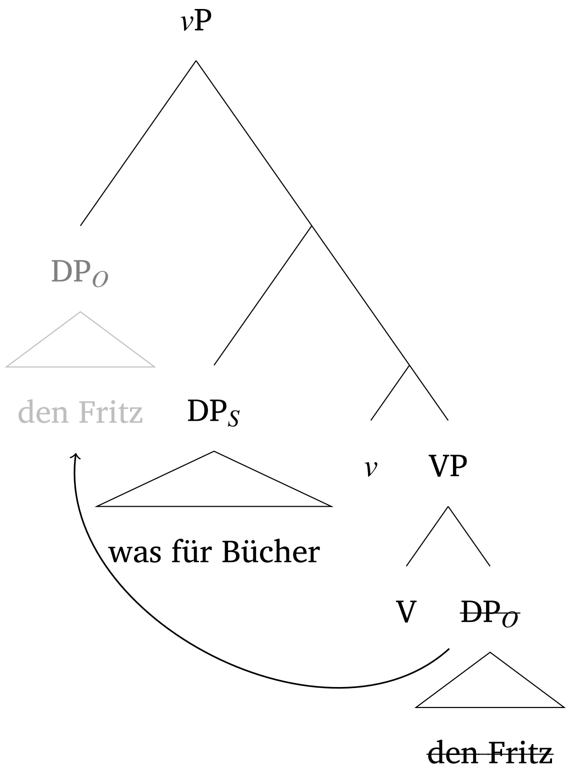
13. Following Legate (2003) and Sauerland (2003), we propose that the requirement to move successive cyclically through Spec *v*P transcends the A/Ā-distinction, thus side-stepping the question of whether scrambling has A or Ā-properties.



(45) $[_{CP}$ Was$_1$ haben $[_{DP2}$ den Fritz$]_2$ $[_{vP}$ $[_{DP3}$ t_1 für Bücher$]$ t_2 $[_{VP}$ t_2 beeindruckt $]$?

This proposed interaction between scrambling and extraction from specifiers is similar in spirit to Müller (2010)'s analysis, with some key technical differences. Müller presents a phase-based theory of the CED, in which phases can only produce escape hatches as long as they are incomplete. The last-merged element in a phase completes the phase, and blocks it from producing an escape hatch. As a result, his theory predicts that only the last-merged specifier of a phase is opaque for extraction. All earlier-merged material is transparent, including specifiers, because they merge early enough for an escape hatch to be produced. In non-scrambling contexts, the subject is the last-merged specifier of *v*P, while in scrambling contexts, Müller proposes that the object is the last-merged specifier of *v*P, making the subject transparent. In other words, his theory requires the opposite configuration of specifiers in *v*P in order to capture melting effects.

(46) Müller's *v*P in Melting contexts: only the highest specifier is opaque → highest specifier must be the scrambled object



Following Moltmann (1990), Grewendorf and Sabel (1999), McGinnis (1999), and Yoshida (2001, a.o.), with evidence from quantifier scope and the position of negation and adverbs, Spec *v*P is not the final landing site for objects scrambled to the left of subjects – a higher position, like Spec TP is. Regardless of the order of specifiers of *v*P, we therefore expect the object to be able to surface in a position that derives the surface word order OS. Both Müller's derivation and ours therefore make the same predictions here – the only difference is that our theory requires an earlier stage of SO order at Spec *v*P while Müller's requires an earlier stage of OS. Since we know of no diagnostics that consistently distinguish these two theories in German and Czech, it seems like both are equivalent analyses of melting.[14]

14. It is sometimes argued that the second movement step in German scrambling has Ā-properties, in which case we might be able to diagnose the order of specifiers in *v*P with reconstruction tests. Here, the results are inconclusive, however. A scrambled anaphoric object may be bound by a subject as in (iv,a),

However, our approach has the advantage that the same explanation for melting can also extend to the previously discussed correspondent transparency effects: wh-movement and parasitic gap-licensing track the obligatory/non-obligatory control distinction. It is not obvious that Müller's proposal could account for these other cases without some elaboration.[15] The theory developed here, then, preserves Müller's insight that the addition of a specifier to a phrase might determine whether or not other specifiers of that phrase may be extracted out of, given a minor emendation of the ordering of specifiers.

4.1 Parasitic gaps in subjects: a melting analogy

We just observed so-called "melting" examples, in which scrambling past a subject permitted exceptional subextraction from that subject. In fact, we observe analogous behavior in parasitic-gap-containing subjects in both English and German: subjects on their own generally do not permit gaps, but subjects that have been crossed by scrambling or wh-movement do.

(47) Nissenbaum 2000, ex. 3b, p. 22

a. Who do [friends of __] often end up hating __?

b. *Who do [friends of __] often end up hating you?

c. Which judge did [my talking about __] offend __?

---

motivating the order of specifiers SO, while a scrambled quantificational object may bind a pronoun in the subject in (iv,b), motivating the opposite. This may indicate that specifier ordering is generally ambiguous, just as the position of adjuncts is, where the choice of position affects extraction and binding possibilities.

(iv) a. ...dass sich$_i$ Hans$_i$ nie rasiert.
that REFL.ACC Hans.NOM never shaves
"...that Hans never shaves himself." (Yoshida 2001, ex.68)

b. (?)...weil jeden$_i$ sein$_i$ Hund gebissen hat.
because everyone.ACC his dog.NOM bitten has
"...because everyone has been bitten by his dog." (Moltmann 1990, ex.130)

15. On a version of Müller's proposal that extended to control and parasitic gap-licensing, it seems that parasitic gaps would be predicted to be licensed in any kind of adjunct — the wh-phrase becomes the outer specifier of *v*P, rendering any kind of adjunct a transparent inner specifier. However, we saw that parasitic gaps were only licensed for OC adjuncts, contrary to this prediction.

d. *Which judge did [my talking about __] offend you?

(48) Nissenbaum 2000, ex. 7, p. 23

a. ...weil der Hans **das** **Formular** [ohne __ vorher auszufüllen]
...because the.NOM Hans the.ACC form without before out.fill

__ abgeschrieben hat.
copied has.

"...because Hans copied the form without filling it out."

b. ...weil der Hans [ohne *(es) vorher auszufüllen] **das**
...because the.NOM Hans without it before out.fill the.ACC

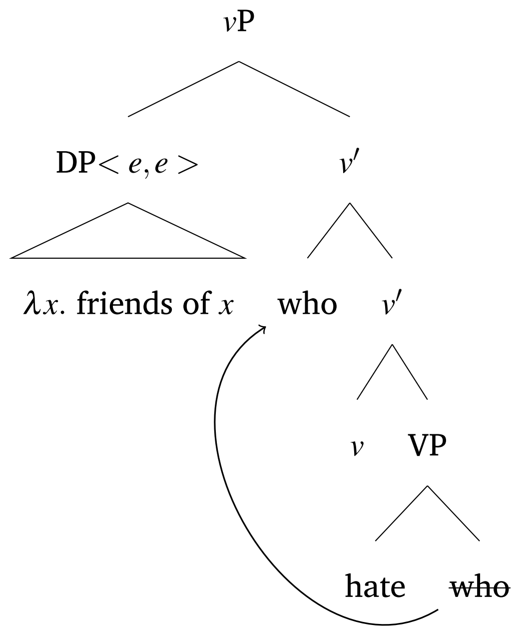
Formular abgeschrieben hat.
form copied has.

"...because Hans copied the form without filling it out."

We propose that these facts receive the same treatment as the melting facts discussed by Müller 2010: movement through the edge of *v*P allows for a configuration in which the subject is a *second* rather than *only* specifier. Second specifiers are allowed to project their features, creating paths into them, which license movement/parasitic gaps.

At first glance, one might worry that this requires an order of specifiers that is incompatible with Nissenbaum's original analysis of parasitic gap licensing. If we were to treat gap-containing subjects like their adjunct counterparts, namely as being derived by operator movement, in need of saturation by a wh-element, it becomes unclear how the order of specifiers in (49) would ever allow the wh-phrase to saturate the gap in the subject.

(49) If subject gaps are of type $< e, e >$, but they c-command the wh-phrase

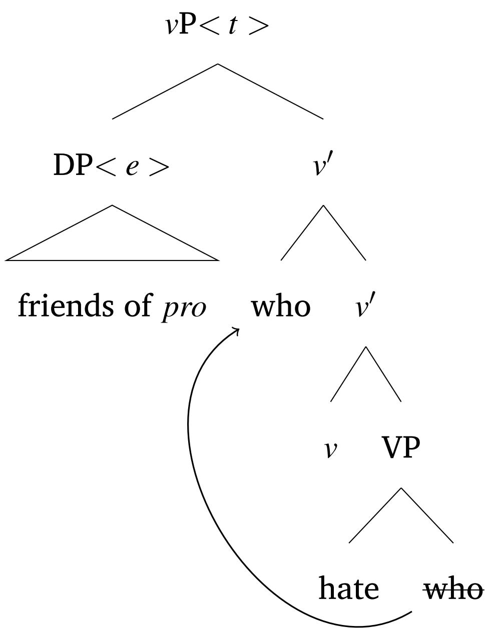


There is an important reason why we *cannot* treat parasitic-gap-containing subjects like their adjunct counterparts, however: the subject needs to be selected by the matrix predicate. It therefore cannot have type $< e, e >$ if the v selecting it requires something of type e.

(50) The subject's sister is of type $< e, t >$, where the subject must be interpreted as its argument:
LF of subject's sister: $\lambda x.\ x$ hate who

As Nissenbaum acknowledges (footnote 24, p. 48), something else needs to be said to capture the semantics of parasitic gaps in subjects. We offer the possibility that their gaps are interpreted through binding instead of functional application. On this view, subjects that contain gaps are definite descriptions containing a null pronoun. They are therefore the right type to feed argument-selection; when they project their features, their contents are accessible for binding by a higher wh-element.

(51) If subject gaps are null pronouns



This solution may not be the only possibility: Nissenbaum and Schwarz 2011 alternatively propose treating the subject as containing operator movement, where modified compositional rules allow it to compose with the matrix clause and wh-moved element.

In any case, treating the order of specifiers differently in PG-containing subjects vs. adjuncts has a second advantage: it allows us to explain why gaps are licensed in subjects under different conditions than in adjuncts. For example, heavy NP-shift (HNPS) licenses parasitic gaps in adjuncts but not in subjects, while wh-movement licenses gaps in both.

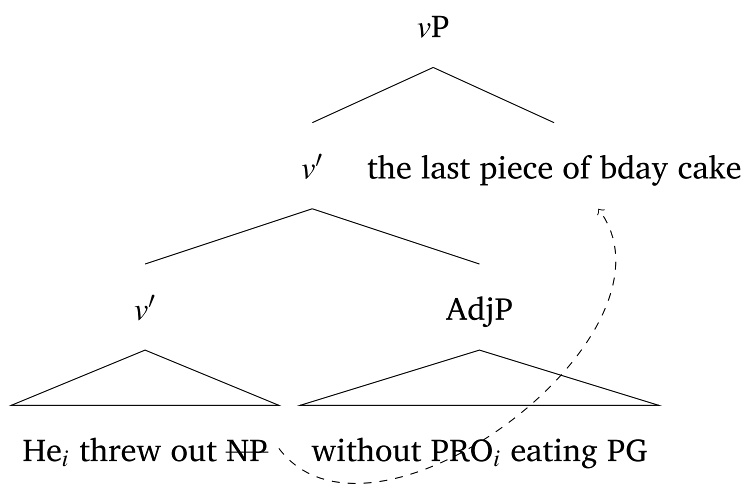
(52) a. He threw out ___$_i$ [without eating ___$_i$] [the last piece of birthday cake]$_i$.

b. ??/*[My talking about ___$_i$] offended ___$_i$ (yesterday) [the recently appointed judge]___$_i$.

Suppose that in order for the gap inside a subject or an adjunct to corefer with the moved element, the moved element must c-command it at some stage of the derivation. While wh-movement always brings the moved element to a very high position in the clause, allowing the wh-element to c-command everything in its final position, Nissenbaum 2000 argues that HNPS stops at the edge of *v*P. If that is right, the configuration of specifiers at *v*P needs to satisfy multiple conditions in order for HNPS to license a parasitic gap: 1) the heavy NP must be a higher specifier than the PG-containing subject/adjunct, so that it c-commands the subject/adjunct, and 2) the PG-containing subject/adjunct must be the second specifier, or else it will be opaque to dependencies crossing it. Both conditions can be met easily for adjuncts, but not for subjects.

As we saw earlier, a PG-containing adjunct can (in fact, must) merge above the subject and below the moved element. In this configuration, the heavy NP c-commands the adjunct, satisfying the first condition, and the adjunct is a second specifier, satisfying the second condition.

(53) Heavy NP shift licensing parasitic gaps



By contrast, a PG-containing subject must merge above the moved element if it is to be a second specifier, as in (49). This configuration does not allow the heavy NP to c-command the parasitic gap, however, thus failing to license it. Switching the order of specifiers might meet the c-command requirement, but will make the subject opaque. As a result, we correctly predict HNPS not to license parasitic gaps in subjects, though it may license parasitic gaps in adjuncts.

5. Discussion and Conclusions

What we have seen so far is a novel theory of locality in which locality domains are determined by their local context. §2 develops a theory of feature projection that captures something like the classical CED. §3 shows that the theory is able to account for a number of exceptions to the classical CED, and furthermore explains a hitherto unexplained correlation between extraction from adjuncts and the possibility of a non-obligatory control interpretation for the adjunct in question. §4 discuss an extension of the theory to other cases of contextual transparency in specifiers. Having motivated and developed this theory of locality, we now compare our approach to previous literature, and sketch ways forward for future work.

5.1 Other Approaches to the CED

Since Cattell (1976), it has been common to treat specifiers and adjuncts as islands for extraction as a matter of definition. The CED, shown in (54), states that any non-complement should be opaque for extraction.

(54) *The Condition on Extraction Domain* (CED) (Huang 1982; Chomsky 1986; Cinque 1990; Manzini 1992):
Movement may not cross a barrier XP, unless XP is a complement.

The CED raises several questions: first, many have shown that it is not exceptionless (see e.g. Stepanov (2007) for discussion). In particular, we have just discussed examples of wh-extraction out of adjuncts and specifiers, both of which are clear violations of (54). These counterexamples refute the generality of (54), and suggest that we need a more fine-grained metric for island-hood besides the complement/non-complement distinction. Second, existing attempts to derive (54) face a conceptual disadvantage compared to the present theory.

A popular approach to the CED is to treat adjuncts and specifiers as subject to different rules than complements. For example, Uriagereka (1999), Johnson (2003), Sheehan

(2013), and Privoznov (2021) suggest that non-complements must spell-out when they merge, rendering their contents inaccessible to further operations.

This approach requires some elaboration to theories of spell-out, given that complement clauses are also often proposed to spell-out at particular points in the derivation. Phases (including complement clauses) are typically assumed to be opaque to operations external to them after their time of spell-out. However, unlike adjuncts/specifiers, phasal complements are thought to have an *escape hatch*. Elements that move to that escape hatch become accessible to later operations, despite the face that the phase has "spelled out". In order to capture the contrast between adjuncts/specifiers and complements, adjuncts/specifiers must therefore lack an escape hatch.

One could imagine several ways to encode the escape-hatch property on a phrase, such that complements have them but adjuncts/specifiers do not. For example, we could stipulate that complementation triggers spell-out of the *complement* of the phase head, while adjunction/specifier-Merge triggers spell-out of the entire phrase. Complements therefore have a specifier position which has not spelled out, while adjuncts/specifiers do not. Alternatively we could propose that edges of spelled-out phrases are always accessible, but that only certain heads have the ability to attract elements to their edge — adjuncts/specifiers routinely lack these edge features, in contrast to complements.

Both of these possibilities require us to stipulate a distinction between complements and non-complements in a way that the theory outlined in this paper does not. The present theory treats complements as first-merged elements with a head, specifiers as second-merged elements, and so on, reducing the number of primitive distinctions we need between different phrases. Moreover, the present theory is able to account for *variable* island-hood of adjuncts and specifiers, without stipulating special properties of those adjuncts and specifiers. Instead we propose that every phrase (complements and non-complements alike) is subject to the projection algorithm, which yields different results depending how many feature bundles are present on each node.

5.2 Conclusion

In sum, this paper examined a number of exceptions to the CED and offered a novel theory of locality designed to account for these exceptions. On the proposed approach to locality, a specifier or adjunct is rendered transparent or opaque based on the properties of its sister rather than any inherent properties of the specifier or adjunct phrase in question. This allowed us to explain why the same adjunct or specifier might be transparent in some context but opaque in another — context rather than specifier/adjunct-hood determines opacity.

The proposed theory made use of a modified projection rule, which conditionally allows features to percolate higher than the maximal projection of a head. When the conditions for projection past the maximal level are met, the contents of that phrase become visible to higher probes, allowing dependencies to target them. Crucially, we proposed that probes could not search for a goal in the absence of such a *path* of features (created by feature projection). Phrases whose features get suppressed by the projection rule are therefore predicted to be opaque to dependencies crossing them.

Importantly, the projection rule does not reference the complement/non-complement distinction — it instead references the local feature context of a phrase's sister. As a result, specifiers/adjuncts are not uniformly predicted to be opaque: only adjuncts/specifiers whose local context suppresses feature projection are opaque, accounting for observed exceptions to the CED.

This approach to locality of course raises many questions, which we have not had space to discuss here. For example, we have looked at the transparency/opacity of phrases in their base positions, but have not yet considered what the approach should look like for phrases derived by movement. To be more specific, consider the melting cases discussed by Müller: Müller shows that object scrambling licenses extraction out of in situ subjects, but not those that have raised to a higher position, as diagnosed by the presence of intervening adverbs.

(55) Müller 2010, ex. 48c, 49b, p. 68-9

a. Was haben [den Fritz] **denn** [____ für Bücher] beeindruckt?
what have the F. PRT for books impressed
"What sort of books have impressed Fritz?"

b. *Was haben [den Fritz] [____ für Bücher] **denn** beeindruckt?
what have the F. for books PRT impressed

This kind of a freezing effect raises several questions about our proposal, such as: How do copies of phrases interact with the projection rule? And in cases where movement alters the parity of a specifier, can a path of features created by projection from one position find those elements in their new positions? We hope to explore these and other related questions in future research.[16]

While there are certainly further details to develop, the theory as developed so far already makes interesting and nuanced predictions in a traditionally tricky empirical domain, and has the advantage of unifying CED effects with other kinds of locality effects analyzed by a Search procedure (e.g. intervention effects). As such, we believe it holds promise for a more unified approach to locality, grounded in the nature of the combinatorial system itself rather than the typology of adjunct/specifier phrases.

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16. A theory of freezing would help us explain, among other things, why adding NOC adjuncts to sentences in English doesn't license melting — English subjects always raise to Spec TP, and are thus subject to freezing.

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A. Weak Islands

The theory discussed so far is able to account for, among other things, the fact that *wh*-movement from certain adjuncts is in principle possible. Interestingly, however, not all types of *wh*-movement are possible: movement of an adjunct is considerably degraded when compared with movement of an argument. The answers in (56) are provided to force parses where both gaps originate within the control adjunct.

(56) **A weak island effect**

a. What did the flower open [in order to attract ____]

$\rightarrow$ A: passing pollinators

b. *How did the flower open [in order to attract pollinators ____]

$\rightarrow$ A: with a particular UV pattern

(56) is puzzling. The answer to this puzzle, in part, depends on whether or not we want our theory to be a general theory of weak islands. As the facts below suggest, weak islandhood is not straighforwardly connected to being a non-specifier: (57a) shows that complement clauses may be weak islands, while (57b) shows that the complement of a Neg head is comparably a weak island.

(57) **Complement weak islands**

a. *How do you regret that [John fixed the car ____]?

b. *How didn't [Mary arrive at the party ____]?

For the theory at hand, we can state the weak island property as something like the following, stated below. This description is vague enough to allow for either a syntactic (see D. Pesetsky 1987; Cinque 1990; Rizzi 1990) or a semantic (see Szabolcsi and Zwarts 1993; Szabolcsi 1997; Abrusán 2014, a.o) approach to weak island-hood.

(58) **Weak islandhood**

Operations making reference to a path defined by [~~•wh•~~] are barred from certain domains.

For us, given the generalization about weak islands above, the puzzle is why (56a) is acceptable. We sketch here a theory that will allow (56a), making use of certain assumptions about *wh*-movement first developed in §3.2, and having much in common with antecedent proposals about escape from weak islands originating in Rizzi (1990).

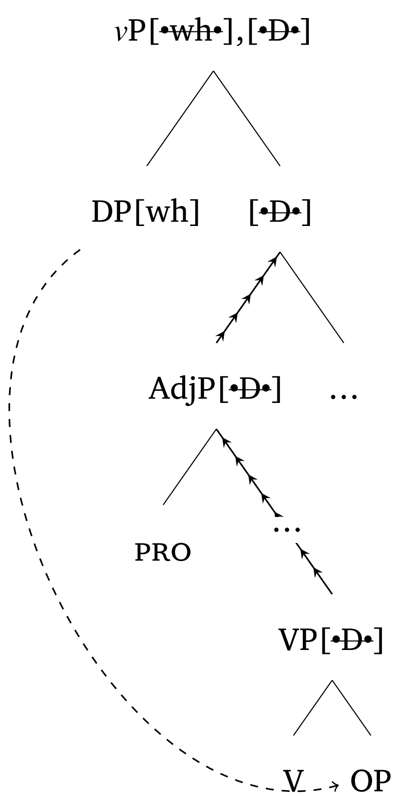
The core idea is that *wh*-movement out of weak islands is contingent on a feature [~~•D•~~] instead of a feature [~~•wh•~~]. Recalling our discussion of [wh] feature projection from §3.2, we saw that projection of a [~~•wh•~~] checked by the object was contingent on movement to an intermediate position motivated by checking of [•D•].

Wh-movement of objects, then, must involve two well-formed paths: one between the *wh*-phrase and its base position, defined by the feature [~~•D•~~], and another between the *wh*-phrase and the final landing site, defined by the feature [~~•wh•~~]. This, notably, contrasts with *wh*-movement of adjuncts, which do not occupy a position where they check [•D•].

Much work on *wh*-movement, at least in English, suggests that movement of *wh*-arguments may involve either a "true" movement dependency, or binding between the moved *wh*-element and something like a null pronominal (see D. Pesetsky (1987), Rizzi (1990), Postal (1994), and Stanton (2016) for discussion along these lines). Notably, the same is not true for movement of *wh*-adjuncts, where the binding strategy is not generally available. We suggest that the binding strategy — which only arguments may make use of — involves Search through a domain bearing [~~•D•~~], rather than [~~•wh•~~], and that it is this distinction which allows *wh*-movement of arguments to avoid being blocked by (58).

Consider the structure below, where AdjP is taken to be a weak island as in (56), and thus subject to (58). Following Rizzi (1990) and Postal (1994), a null element — represented here by OP — may in principle be merged in a position where it checks [•D•], provided it is subsequently bound by a *wh*-phrase of some sort. Binding requires a path of [•D•] features between the binder and bindee, similar to the binding of PRO and null operators discussed earlier in this paper. As we see below, the *wh*-phrase may in principle be generated in Spec *v*P of the matrix clause, so long as the adjunct containing OP appears in a position from which it may project its features. The *wh*-phrase may bind OP from this position, via the path of [•D•] features between the two. The *wh*-phrase is also Merged in a position where it checks a [•wh•] feature in the matrix clause, creating a path of [~~•wh•~~] to matrix Spec CP that does not traverse a weak island.

(59)



In contrast, such a derivation is not available for adjunct *wh*-phrases such as *how*, as in the case of (56b). Such an adjunct could be merged in Spec *v*P of the matrix clause, but it would be unable to bind a comparable OP in the adjunct clause. Such an adjunct could also be merged in Spec *v*P of the adjunct clause, but subsequent movement of the adjunct would run afoul of (58).