

# On parasitic gaps in relative clauses and extraction from NP<sup>0</sup>

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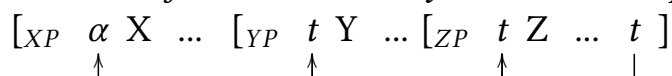
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## 1 Introduction

- In this project, I extend a line of research using parasitic gaps (PGs; Engdahl 1983) to investigate the properties of A'-movement (Nissenbaum 2000; Legate 2003; Overfelt 2015b; Erlewine and Kotek 2018; Bondarenko and Davis 2019; Davis 2020b, a.o.).

- ▷ A property of movement paths identified by a great deal of research is that they are, in many cases, comprised of several **successive-cyclic** steps:

(1) *A schema for a successive-cyclic movement path*

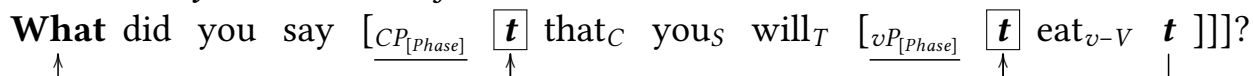


- ▷ See, for instance, Chomsky 1973, 1977, 1986; Du Plessis 1977; Henry 1995; Cole and Hermon 2000; McCloskey 2000, 2001, 2002; Nissenbaum 2000; Legate 2003; Sauerland 2003; Bruening 2001, 2006; Barbiers 2002; Torrence 2012; Abels 2003, 2012; Wiland 2010; Henry 2012; van Urk 2015; van Urk and Richards 2015; Korsah and Murphy 2019; Davis 2019, 2020a,b, and many others.

- Many recent works in this vein argue that movement must be successive-cyclic when exiting a *phase* (Chomsky 2000, 2001, a.o.), pausing in its edge before continuing on.

- ▷ The set of phases is generally taken to be vP, CP, and sometimes DP.

(2) *Successive-cyclic movement from vP and CP*

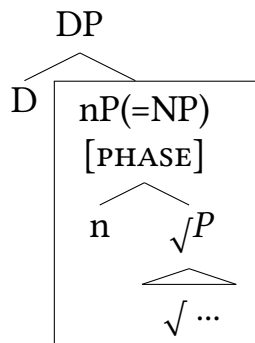


- ▷ By hypothesis, phases force successive-cyclic movement due to the way that they trigger Spell-Out/Transfer to the interfaces (for reasons I am not concerned with here).

! **Importantly** for this presentation, there is also a body of work arguing that the NP (or a similarly positioned constituent) is a phase.<sup>1</sup> For instance:

- Several works on morpho-phonology argue that lexical projections like NP, VP, and AP consist of a category-neutral root and a **phasal categorizing head** (Marvin 2003; Newell 2008; Embick and Marantz 2008; Embick 2010; Newell and Piggott 2014, a.o.).
  - ▷ These categorizers are respectively  $n^0$ ,  $v^0$ , and  $a^0$ , the first of which heads the phrase more generally referred to as NP under such analyses:

(3) *NP as phasal nP*



- Syed (2015); Simpson and Syed (2016); Syed and Simpson (2017) argue for the presence of a DP-internal phase in Bangla.
- Bayırlı (2017) argues that the phasehood of NP (in certain languages) constrains the distribution of concord.
- **General prediction:** If a sub-DP constituent like NP is indeed a phase, then we expect movement from it to pass successive-cyclically through its edge:

(4) *Successive-cyclic movement via edge of NP*

Who did you take [<sub>DP</sub> a [<sub>NP</sub>  $t$  [<sub>N'</sub> picture of  $t$  ]]]?

✓ **I argue that** the possibility of such movement is revealed by PGs in relative clauses licensed by extraction from NP—a phenomenon that has received little attention:<sup>2</sup>

(5) *PG in relative clause licensed by extraction from NP*

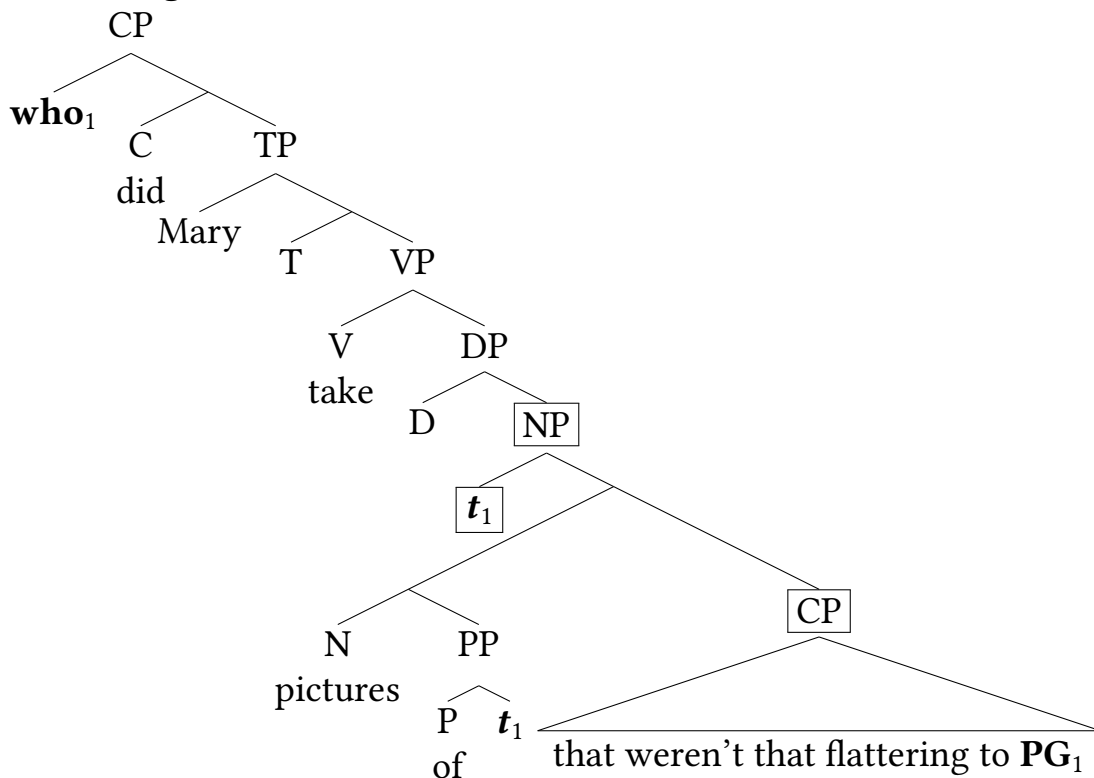
- Who**<sub>1</sub> did Mary take [pictures of  $t_1$  [that weren't that flattering to **PG**<sub>1</sub>]]? (Citko 2014, ex. 105)
- That's the manager **which**<sub>2</sub> I know [an employee of  $t_2$  [who's got a very intense grudge against **PG**<sub>2</sub>]].
- Let me tell you **who**<sub>3</sub> I've noticed [an aspect of  $t_3$  [that really makes me want to avoid **PG**<sub>3</sub>]].
- [**This person**]<sub>4</sub>, I painted [a portrait of  $t_4$  [that unfortunately was unable to satisfy **PG**<sub>4</sub>]].

- **Preview of the core proposal:**

- ▷ If (restrictive) relative clauses are adjoined to NP, below determiners/quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975; Heim and Kratzer 1998, a.o.)...
- ▷ ...and if the interpretation of a PG is dependent on movement through the edge of the phrase to which the PG-container adjoins (Nissenbaum 2000; Legate 2003)...

★ ...then the possibility of PGs in relative clauses reveals the availability of a landing site in the NP edge:

(6) *PG-bearing relative clause adjoined to NP (based on (5a) above)*



- In principle movement via the DP edge as well is not precluded, as I discuss later.
- **Disclaimer:** The facts I analyze here do not reveal the necessity of movement via the NP edge, which we expect if NP is a phase, but rather just the possibility.<sup>3</sup>
  - ▷ Nevertheless, I argue that this result has a number of interesting consequences.

## 1.1 Contents of the presentation

§2: Background on PGs and intermediate landing sites

§3: Confirming the nature of the PG

§4: The position and significance of relative clauses

§5: The syntactic/semantic derivation of PGs in relative clauses

§6: An asymmetry with stacked relative clauses

§7: Implications for the analysis of extraction from DP

§8: Conclusion

▷ To optimize the flow of this handout for online presentation, I've used endnotes rather than footnotes, so check the end of this document for more.

## 2 Background: PGs and intermediate landing sites

- A PG is a gap whose interpretation depends on A'-movement external to, and structurally crossing, the containing constituent. Below we see PGs in sentential adjuncts:

(7) *PGs in sentential adjuncts*

- a. **Who**<sub>1</sub> did you forget about  $t_1$  [ ] after talking to **PG**<sub>1</sub> [ ]?
- b. This is a dish [ $\emptyset_2$  that I know a lot about  $t_2$  [ ] because I make **PG**<sub>2</sub> every week [ ]].
- c. [**What kind of cake**]<sub>3</sub> would you eat a piece of  $t_3$  [ ] if I decided to bring **PG**<sub>3</sub> to the party [ ]?

- That a given gap is indeed “parasitic” is clearest when in an island, since this shows that the PG was not formed by straightforward extraction.

▷ Sentential adjuncts like those used above are indeed generally islands:

(8) *Sentential adjunct island*

- a. \*?? Tell me [**which paper**]<sub>1</sub> you ate fried chicken for lunch [ ] after giving them comments on  $t_1$  [ ]].
- b. \*?? [**What assignment**]<sub>2</sub> did you go home [ ] because you need to finish  $t_2$  tonight [ ]?
- c. \*?? I think I know [**what kind of pet**]<sub>3</sub> you'd move out of town [ ] if your roommate bought  $t_2$  [ ]].

▷ In reality PGs can occur in a wide variety of constituents, though sentential adjuncts are convenient for introducing the basic properties of PGs.

- **Question:** Why can a PG and its antecedent be separated by an island?
- **A potential answer:** A PG is not formed by movement from an island, but rather, by movement of a separate silent operator **within the island** (Chomsky 1986; Brown-ing 1987; Nissenbaum 2000; Nissenbaum and Schwarz 2011, a.o.):<sup>4</sup>

(9) *PG as trace of null operator*

**Who**<sub>1</sub> did you forget about **t**<sub>1</sub> [<sub>AdjunctP</sub> **OP** after talking to **t**<sub>OP(=PG)</sub> ]?

- Importantly, Nissenbaum (2000) argues that PG interpretation requires the operator-hosting phrase to adjoin to a **landing site of A'-movement**.
  - ▷ As mentioned above, much work argues that movement is successive-cyclic when it exits a phase, and thus forms intermediate landing sites in phase edges:

(10) *Successive-cyclic movement from vP and CP*

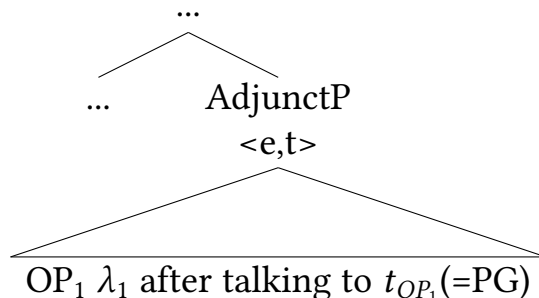
**What** did you say [<sub>CP[Phase]</sub> **t** that<sub>C</sub> you<sub>S</sub> will<sub>T</sub> [<sub>vP[Phase]</sub> **t** eat<sub>v-V</sub> **t** ] ]?

! Nissenbaum (2000) argues that the intermediate landing site formed by successive-cyclic movement from vP facilitates PGs in sentential adjuncts of the sort just shown.

- In particular, his ingredients for a PG are the following:

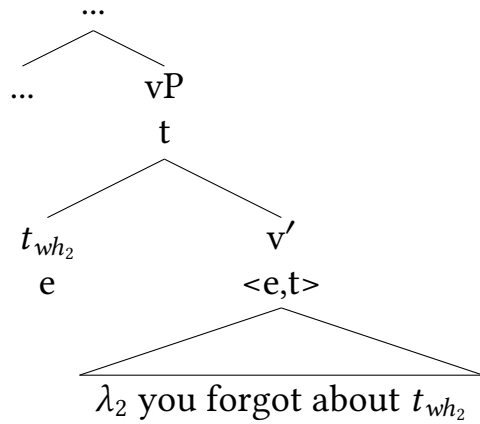
#1 Movement of the PG-forming operator to the edge of the sentential adjunct, which triggers the semantic rule of Predicate Abstraction (Heim and Kratzer 1998), changing it from type *t* to a derived predicate of type  $\langle e,t \rangle$ :

(11) *Null operator movement inside adjunct forms a clausal predicate*



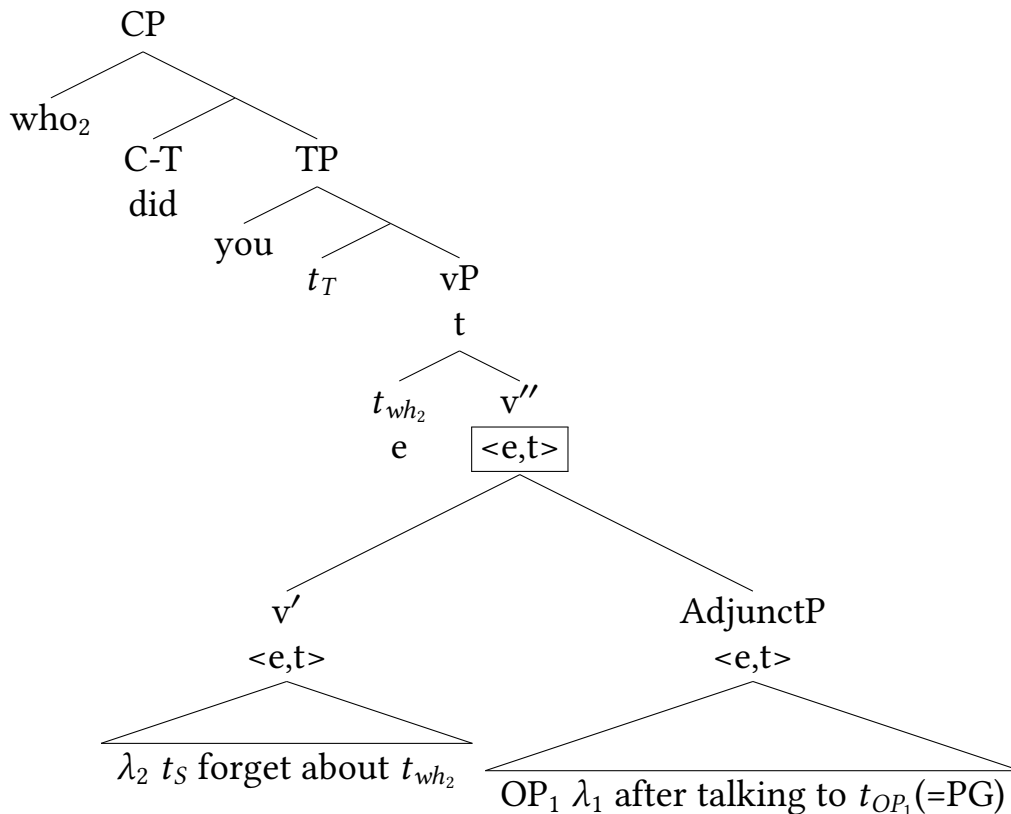
#2 Successive-cyclic movement from vP, triggering an application of Predicate Abstraction within vP as well, creating a second  $\langle e,t \rangle$  position there:<sup>5</sup>

(12) Successive-cyclic A'-movement creates an  $\langle e,t \rangle$  node in  $vP$



#3 Merge of the operator-hosting adjunct to the  $\langle e,t \rangle$  position in  $vP$ . Since both of these constituents are type  $\langle e,t \rangle$ , the semantic operation Predicate Modification (Heim and Kratzer 1998) can combine them, yielding an interpretable structure:

(13) Predicate Modification of  $vP$  with PG-containing island



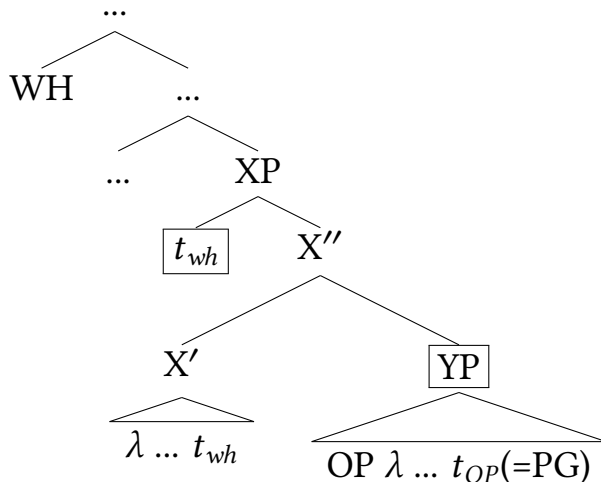
▷ Here the (boxed)  $\langle e,t \rangle$  function created by merge of the adjunct to  $v'$  is saturated by the intermediate type  $e$  trace of successive-cyclic A'-movement from  $vP$ .

★ This simultaneously binds the trace in VP corresponding to the true gap, as well as the trace of the moved operator in the adjunct. **A PG has thus been derived.**

! **Important point:** The semantic reflex of successive-cyclic movement creates a position where a PG-containing phrase can be successfully interpreted.

▷ **General prediction:** If a PG-containing phrase can be interpreted in a given position, that position must be a possible landing site for successive-cyclic movement.

(14) *Schema for PG-hosting phrase adjoined to intermediate landing site*



▷ Legate (2003) uses this reasoning to argue for the possibility of successive-cyclic movement in various verbal constituents.

★ I will use this reasoning to show how PGs in relative clauses indicate the possibility of movement via the edge of NP.

### 3 Confirming the parasitic nature of the gap

- Before explaining in detail how PGs in relative clauses are derived, here I will confirm that these gaps indeed behave like PGs of the usual sort.

#1 It is a defining characteristic of PGs that they are illicit in the absence of a licensing A'-movement, upon which their interpretation is "parasitic":

(15) *Usual PGs require a licensing movement*

- Who<sub>1</sub> did you forget about t<sub>1</sub> [after talking to PG<sub>1</sub>]?
  - \* I forgot about John<sub>1</sub> [after talking to PG<sub>1</sub>].
- This is a dish [∅<sub>2</sub> that I know a lot about t<sub>2</sub> [because I make PG<sub>2</sub> every week]].
  - \* I know a lot about [fried chicken]<sub>2</sub> [because I make PG<sub>2</sub> every week].

- As expected, PGs in relative clauses are unacceptable without a licensing A'-movement:

(16) *Extraction from NP required for PG in relative clause*

- a. I painted [a portrait of Mary<sub>1</sub> [that unfortunately didn't satisfy **her**<sub>1</sub>/\*PG<sub>1</sub>]].
- b. I've noticed [an aspect of John<sub>2</sub> [that makes me want to avoid **him**<sub>2</sub>/\*PG<sub>2</sub>]].
- c. Mary took [pictures of [a person]<sub>3</sub> [that weren't that flattering to **them**<sub>3</sub>/\*PG<sub>3</sub>]].

#2 Separating a PG-containing island from the licensing movement chain by a larger island is generally illicit (Kayne 1983; Chomsky 1986; Cinque 1990; Postal 1994):

(17) *PG licensing across multiple islands fails*

- a. *Relative clause island plus adjunct island*  
\* Tell me who<sub>1</sub> you talked to t<sub>1</sub> [after meeting a person [who likes PG<sub>1</sub>]].
- b. *Subject island plus adjunct island*  
\* Durian is a fruit [which<sub>1</sub> I tried t<sub>1</sub> for the first time [after [a fan of PG<sub>1</sub>] visited me]].
- c. *Adjunct island in adjunct island*  
\* Guess who<sub>1</sub> I ironically ran into t<sub>1</sub> [after taking the other hallway [because I wanted to avoid PG<sub>1</sub>]].

• This fact emerges automatically from the null operator theory of PGs, since operator movement should be island-bounded just like other forms of movement.

▷ For this theory, the PG-forming operator only needs to move to the edge of the containing island, but not actually cross it:

(18) *Operator movement to edge of containing island*

Who<sub>1</sub> did you forget about t<sub>1</sub> [ [ OP after talking to t<sub>OP</sub>(=PG) ] ]?

▷ But if the PG-hosting structure that adjoins within the licensing movement path contains an embedded island that the operator must cross, such movement fails:

(19) *PG-forming operator cannot cross an island to reach edge of larger island*

\* Who<sub>1</sub> did you insult t<sub>1</sub> [ [ [ OP after meeting a guy [ [ who likes t<sub>OP</sub>(=PG) ] ] ] ] ]?

• As expected, an additional island included in this way prevents the formation of a PG in a relative clause by extraction from NP:

(20) *Additional island in relative clause prevents PG licensing*

- a. *Relative clause island*  
\* Who<sub>1</sub> did Mary take [pictures of t<sub>1</sub> [∅<sub>REL</sub> that t<sub>REL</sub> were hilarious to everyone [**who has met PG<sub>1</sub> before**]]]]?



- b. *Subject island*  
 \* That's the manager which<sub>2</sub> I know [an employee of  $t_2$  [who<sub>REL</sub> thinks  $t_{REL}$  that [every message from **PG**<sub>2</sub>] causes a problem]]].
- c. *Complex NP island*  
 \* This person<sub>4</sub>, I painted [a portrait of  $t_4$  [ $\emptyset_{REL}$  that  $t_{REL}$  unfortunately started [the rumor that I dislike **PG**<sub>4</sub>]]].

#3 Previous literature has observed that a PG in an embedded island is possible, in fact, if the larger island also contains a co-referent PG (Kayne 1983; Longobardi 1984):

(21) *Recursive PG licensing*

- a. a person who<sub>1</sub> I hang out with  $t_1$  [because [friends of **PG**<sub>1</sub>] admire **PG**<sub>1</sub>] (Nissenbaum 2000, p. 26, ex. 13c)
- b. Guess [which food]<sub>1</sub> I can't help but eat  $t_1$  [despite really fearing **PG**<sub>1</sub> [because there are carcinogens in **PG**<sub>1</sub>]].

- We can understand this as A'-movement of the operator in the larger island crossing over, and thus licensing a second PG in, the embedded island:

(22) *PG-forming operator cannot cross an island to reach edge of larger island*

a person who<sub>3</sub> I like  $t_3$  [ [ OP<sub>1</sub> because [ [ OP<sub>2</sub> friends of  $t_2$  ] ] admire  $t_1$  ] ]

- Similarly, a PG in a relative clause licensed by extraction from NP can itself license a PG in an additional island embedded in the relative clause:

(23) *PG in relative clause can license an additional embedded PG*

- a. *Additional PG in sentential adjunct*  
 Who<sub>1</sub> did Mary take [pictures of  $t_1$  [ $\emptyset_{REL}$  that  $t_{REL}$  weren't very flattering to **PG**<sub>1</sub> [because she put an awful wig on **PG**<sub>1</sub>]]]?
- b. *Additional PG in subject*  
 That's the manager which<sub>2</sub> I know [an employee of  $t_2$  [who<sub>REL</sub>  $t_{REL}$  thinks that [every message from **PG**<sub>2</sub>] reveals the stupidity of **PG**<sub>2</sub>]]].

- ★ Thus PGs in relative clauses formed by extraction from NP behave precisely as expected of PGs in general. I will therefore proceed in analyzing them as such.

## 4 The position and significance of relative clauses

- With the above considerations in mind, next let's consider in greater detail the position of relative clauses, and what this entails about the account of PGs within them:

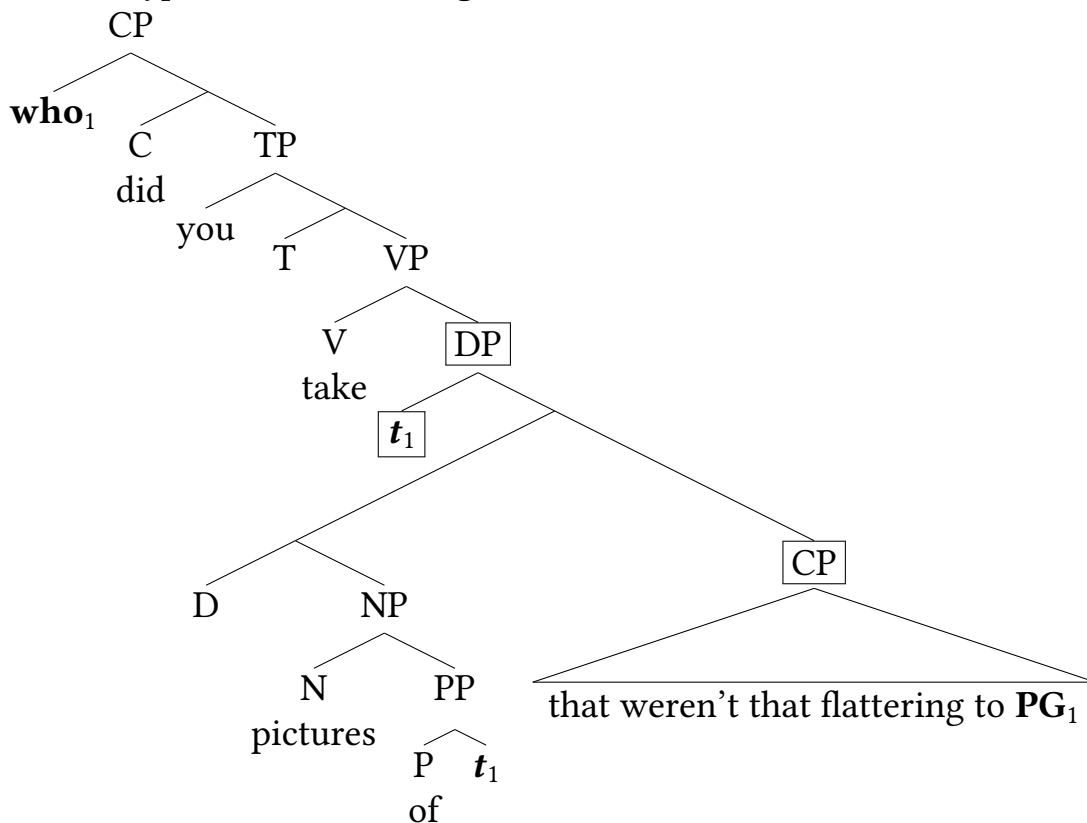
(24) *PG in relative clause licensed by extraction from NP*

- Who**<sub>1</sub> did Mary take [pictures of  $t_1$  [that weren't that flattering to **PG**<sub>1</sub>]]?  
(Citko 2014, ex. 105)
- That's the manager **which**<sub>2</sub> I know [an employee of  $t_2$  [who's got a very intense grudge against **PG**<sub>2</sub>]].
- Let me tell you **who**<sub>3</sub> I've noticed [an aspect of  $t_3$  [that really makes me want to avoid **PG**<sub>3</sub>]].
- [**This person**]<sub>4</sub>, I painted [a portrait of  $t_4$  [that unfortunately was unable to satisfy **PG**<sub>4</sub>]].

- Building from the concepts about PGs described above, Citko (2014) suggests that this pattern may constitute evidence for successive cyclic movement from DP.

▷ This analysis entails that the relative clause can be merged in the projection of D:

(25) *Citko's hypothesis: PG-bearing relative clause adjoined in DP*



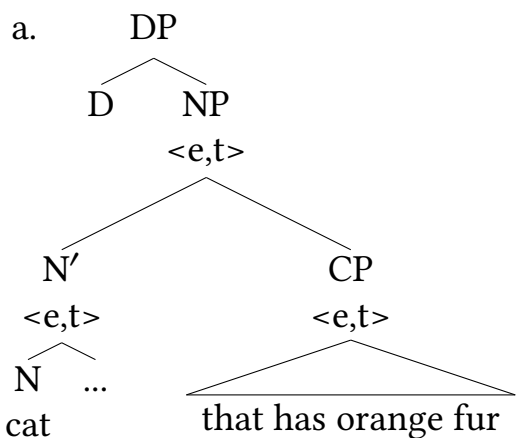
▷ A number of works do take DP to be a phase, and thus another domain which movement from must be successive-cyclic (Heck and Zimmermann 2004; Bošković 2005, 2014, 2016; Newell 2008; Syed and Simpson 2017, a.o.).

▷ If relative clauses could be merged to DP, the possibility of PGs in relative clauses could be taken as evidence for successive-cyclic movement from DP.

• However, much work has argued that (restrictive)<sup>6</sup> relative clauses are adjective-like predicates that attach to NP, below any determiners or quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975, a.o.).

• Following Heim and Kratzer (1998), I assume that both NPs and relative clauses are predicates of individuals  $\langle e, t \rangle$ , which combine via Predicate Modification:

(26) *Structure and interpretation of an NP with a restrictive relative clause*



b.  $\{x \mid x \text{ is cat}\}_{[[N']]} \cap \{x \mid x \text{ has orange fur}\}_{[[CP]]}$   
 $= \{x \mid x \text{ is cat and } x \text{ has orange fur}\}_{[[NP]]}$

• **Some supporting syntactic evidence:**

▷ Relative clauses can be included within a segment of NP that is subjected to *one*-replacement:

(27) *Relative clauses and “one”-replacement* (Bhatt 2015, 32a)

Bill admires the very tall [**student who came to Tom’s lecture today**].

Antony admires the very short **one**.

(*one* substitutes for ‘ $[_{N'} \text{ [student] [who came to Tom’s lecture today]}$ ’)

▷ NP-ellipsis can include relative clauses, but leave the rest of the DP behind:

(28) *Relative clause and NP ellipsis*

I brought four cakes to the party. Mary liked [two [cakes [that I brought]]],

but Bill liked [all four [cakes-[that I brought]]]!

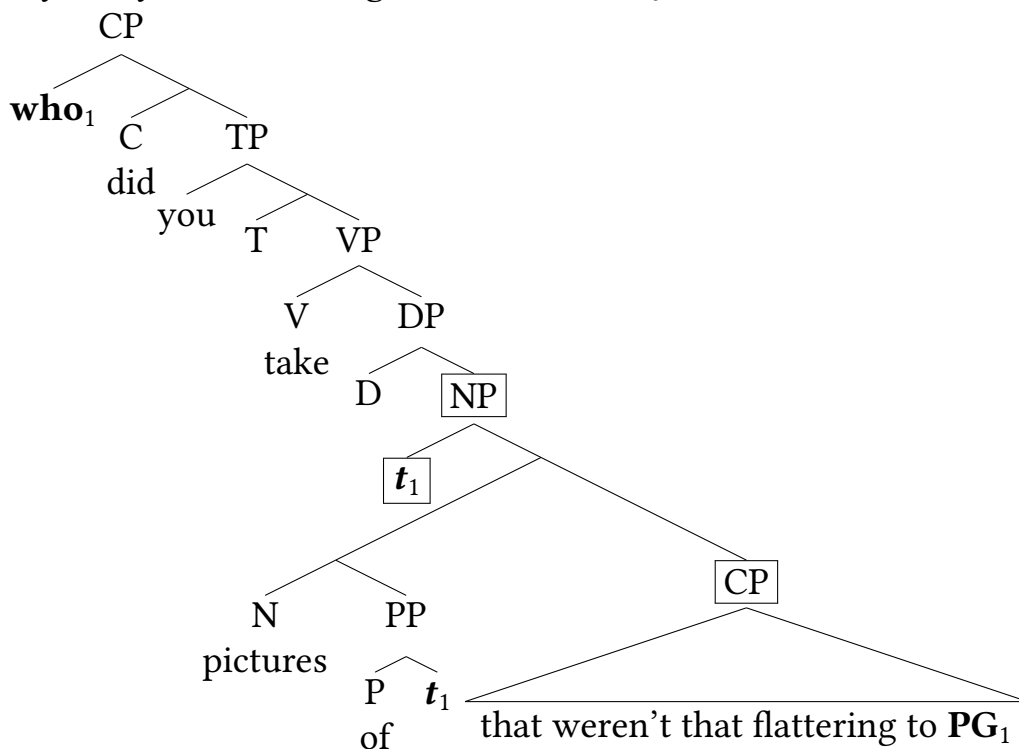
- ▷ The quantificational determiner *every* c-commands and thus can license NPIs like *ever* and *any* in a relative clause of the same nominal, but not within the containing clause, which it does not c-command (Ladusaw 1979; Overfelt 2015a, a.o.):

(29) *NPI licensing by “every”*

- [<sub>DP</sub> **Every** [<sub>NP</sub> guest [who ate **any** of the potato salad]] became ill.
- \* [<sub>DP</sub> **Every** [<sub>NP</sub> guest [who became ill]] ate **any** of the potato salad. (Overfelt 2015a, ex. 10)
- [<sub>DP</sub> **Every** [<sub>NP</sub> student [who has **ever** chosen to study syntax]] loves *wh*-movement.
- \* [<sub>DP</sub> **Every** [<sub>NP</sub> student [who loves *wh*-movement]] has **ever** chosen to study syntax.

★ **The point:** If (restrictive) relative clauses attach to NP, then PG-licensing in a relative clause by extraction from NP actually indicates the possibility of successive cyclic A'-movement through the NP edge:

(30) *My analysis: PG-bearing relative clause adjoined to NP*



✓ This finding is consistent with the works mentioned above arguing that a sub-DP constituent like NP is a phase.

- Next I discuss the derivation of such examples in greater detail, and then explore some further implications and more general consequences.

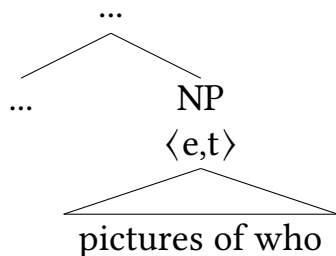
## 5 The derivation of PGs in relative clauses

- Here I will provide the derivation for the following representative sentence:

(31) *The example about to be derived*  
**Who**<sub>1</sub> did Mary take [pictures of **t**<sub>1</sub> [that weren't that flattering to **PG**<sub>1</sub>]]?<sup>7</sup>

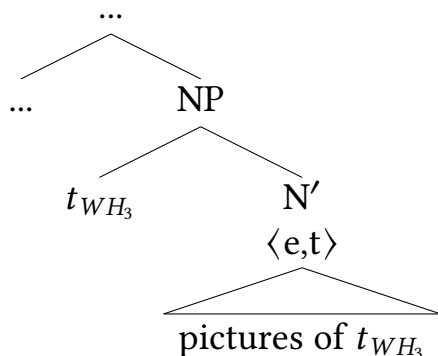
- If the basic denotation of NP is  $\langle e, t \rangle$ ...

(32) *NP before sub-extraction*



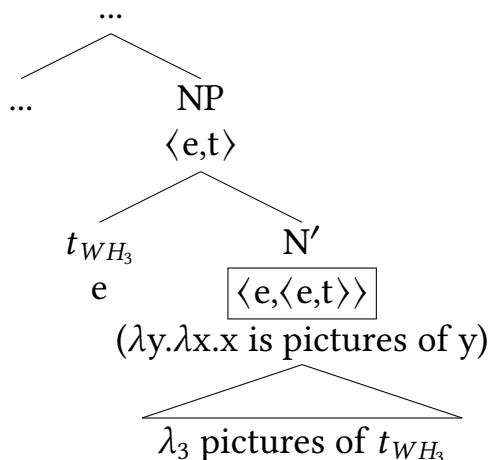
- ...then when successive-cyclic movement through the NP edge occurs...

(33) *Successive-cyclic movement through NP edge*



- ...this will trigger Predicate Abstraction and create a two-place predicate in the NP:

(34) *Predicate Abstraction due to intermediate movement in NP*



▷ In this structure, the semantic argument position added by Predicate Abstraction is immediately saturated by the type  $e$  trace of movement through the NP edge.

▷ This yields a type  $\langle e,t \rangle$  NP, fit to combine with a determiner or quantifier as usual.

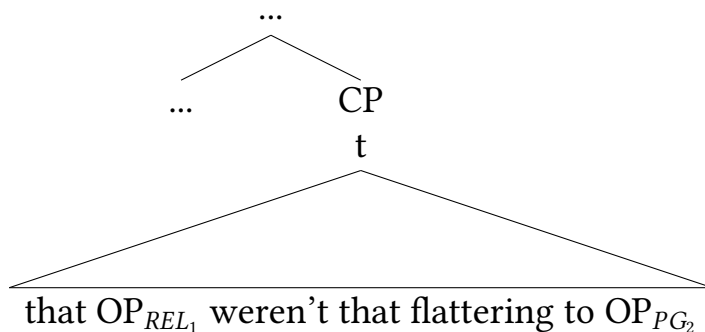
! Importantly, the intermediate  $\langle e,\langle e,t \rangle \rangle$  position in this NP facilitates the interpretation of a PG in a relative clause.

• Before showing explicitly why this is the case, however, it is necessary to address the construction of the PG-containing relative clause.

▷ Here I will assume that both the gap of relativization and the PG are each formed by movement of an operator.

• Prior to such movement, the relative clause in the relevant sentence is as follows:

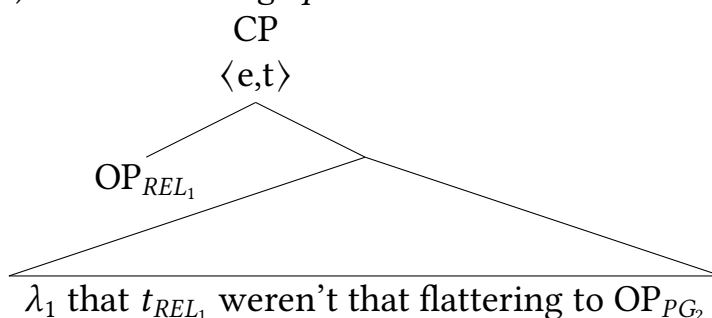
(35) *PG-containing relative clause pre-movements*



▷ I argue that the correct interpretation emerges from these operators forming crossing paths, with the higher one moving first, and the lower one “tucking-in” (Richards 1997, 1999) to a position below it in the clause edge.<sup>8</sup>

• Thus I will assume that first the relativizing operator moves to the edge of this CP, consequently applying Predicate Abstraction to its sister node. Assuming semantic vacuity of the operator, the CP is thus type  $\langle e,t \rangle$ :<sup>9</sup>

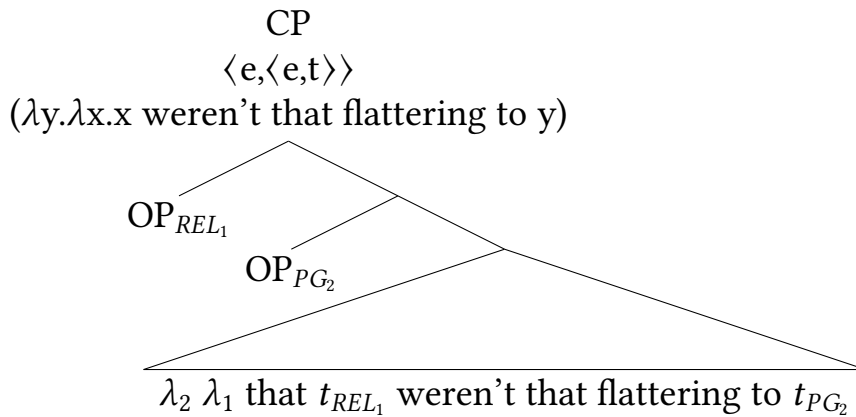
(36) *Relativizing operator movement*



▷ If the derivation ended here, this would be a basic relative clause (aside from the yet un-moved PG-forming operator in it).

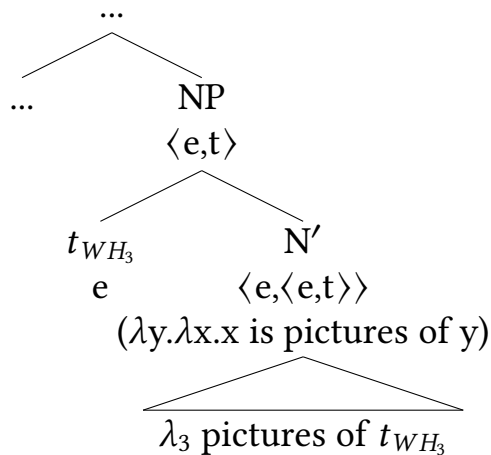
- Next the PG-forming operator moves, tucking-in below the relativizing operator and triggering another instance of Predicate Abstraction.
- Since Predicate Abstraction has applied twice, the relative clause is now type  $\langle e, \langle e, t \rangle \rangle$ :

(37) *Movement of PG-forming operator*<sup>10</sup>



- This relative clause, and the N' sister of the intermediate trace of movement through NP (shown once more below), are both type  $\langle e, \langle e, t \rangle \rangle$ .

(38) *Semantic result of movement through NP edge*

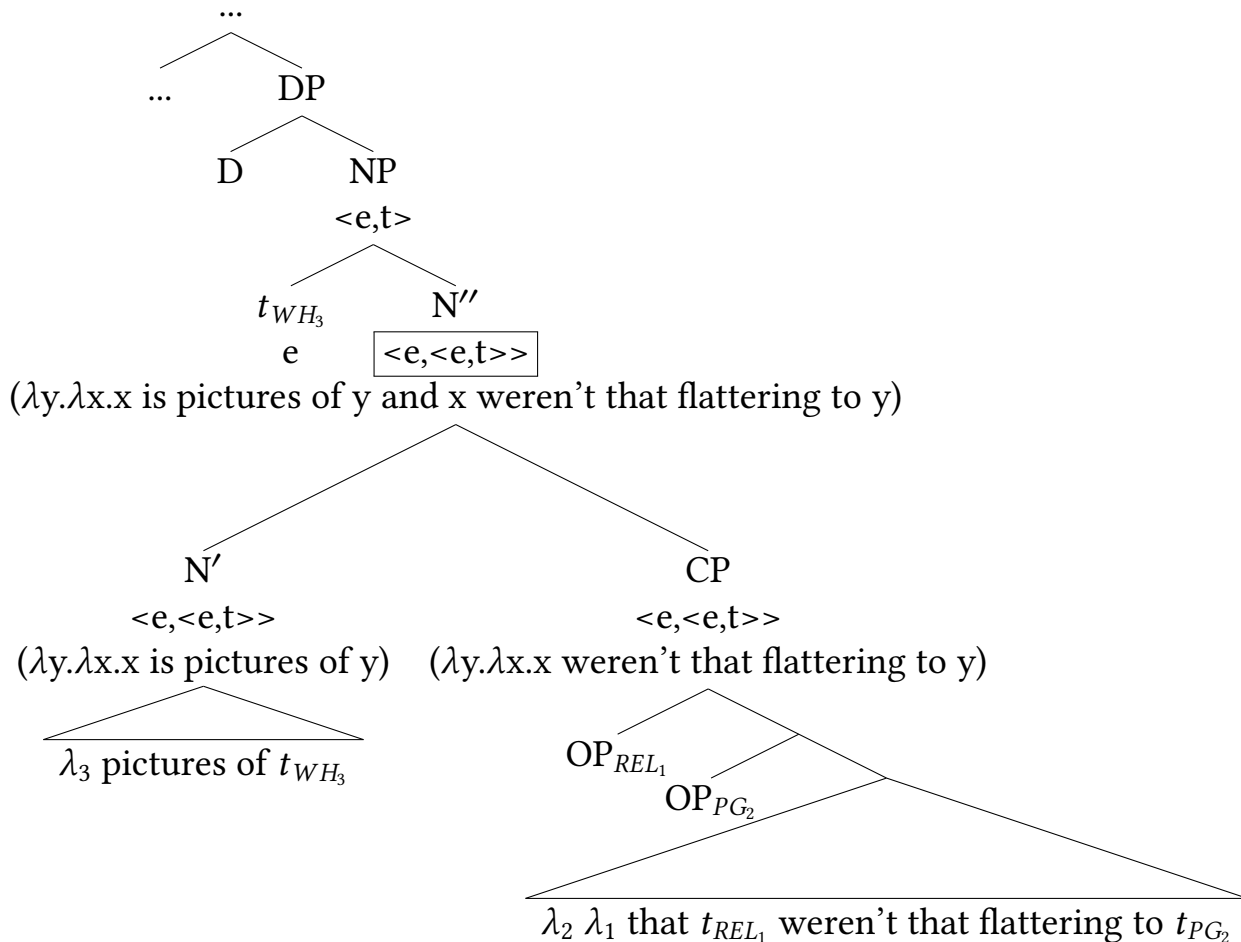


▷ I assume that Predicate Modification is an instance of a more general mechanism that can semantically combine any two nodes of the same semantic type (see [Par-tee and Rooth 1983](#); [Nissenbaum 2000](#); [Nissenbaum and Schwarz 2011](#)).

▷ If this is so, then the PG-bearing relative clause can be interpreted upon merging to the N' above, since both are type  $\langle e, \langle e, t \rangle \rangle$ .

- The result of this merger is the boxed two-place predicate N'' shown below:<sup>11</sup>

(39) Licensing of PG in relative clause



(= Who<sub>1</sub> did Mary take [**pictures of  $t_1$  [that weren't that flattering to PG<sub>1</sub>]]?)**

- The first semantic argument position of the boxed function is saturated by the trace of successive cyclic movement through NP.
  - ▷ This yields a type  $\langle e, t \rangle$  NP, denoting a set of entities that are pictures of, but not flattering to, the referent of the extracted phrase *who*.
  - ▷ This NP is fit to undergo Functional Application with D/Q as usual, and the derivation will successfully converge on an interpretable result.
- ★ **The point:** Since a PG-bearing relative clause is a two-place predicate,<sup>12</sup> successive-cyclic movement from NP must occur to achieve a successful interpretation.<sup>13</sup>
- In what follows, I discuss a few further consequences of this conclusion.<sup>14</sup>
  - ▷ See [Davis \(2020b\)](#) for potential additional evidence for movement via the NP edge.

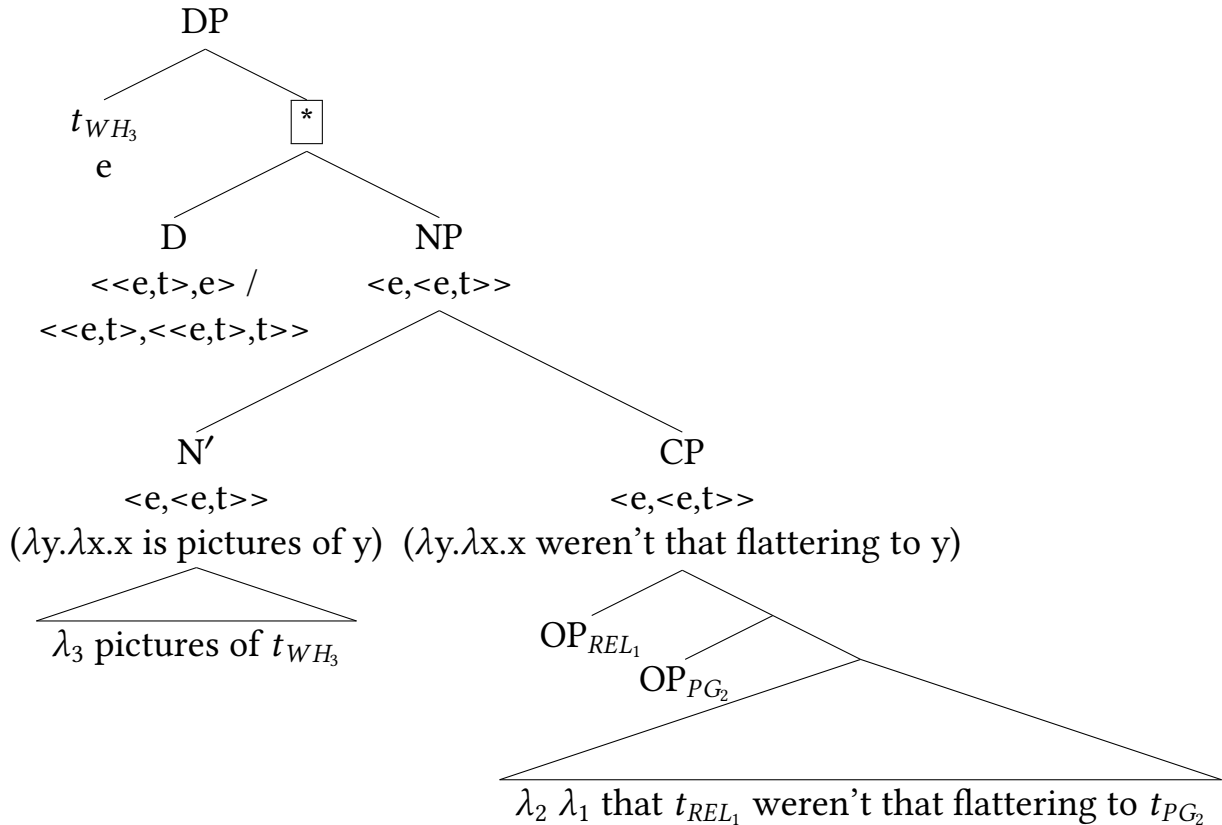


## 5.1 Why movement via spec-DP is not sufficient

- Nissenbaum (2000) proposes that a moved phrase and the corresponding  $\lambda e$  created by Predicate Abstraction can sometimes be somewhat non-local.
- If this is so, it is conceivable that the PG facts investigated here actually involve movement via spec-DP, but that non-local Predicate Abstraction applies to the NP dominated by the DP that movement passes through.
- In this case, the NP would still be type  $\langle e, \langle e, t \rangle \rangle$  as described above, and could combine with a PG-bearing relative clause.

! However, if there is no trace of movement in the NP edge, this constituent will combine with D before combining with the intermediate trace, causing a type mismatch:

(40) *Movement through spec-DP with abstraction at NP is uninterpretable*



- Since a type  $\langle e, \langle e, t \rangle \rangle$  NP cannot combine with a D that outputs an individual ( $\langle \langle e, t \rangle, e \rangle$ ) or with a quantificational determiner ( $\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle$ ), this derivation will fail.
- ★ In contrast, successive-cyclic movement via the edge of NP results in immediate saturation of the  $\langle e, \langle e, t \rangle \rangle$  position in NP created by Predicate Abstraction, yielding a type  $\langle e, t \rangle$  NP fit to combine with D as usual, as we saw above.

## 6 An asymmetry with stacked relative clauses

- Here I'll discuss an asymmetry that arises when multiple potential PG-hosting constituents are present, which the above account facilitates an explanation for.
- [Nissenbaum \(2000\)](#) observed that when one clause hosts two sentential adjuncts, both can have a PG:<sup>15</sup>

(41) *Multiple sentential adjuncts*

a. *Both without a PG*

Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [without even reading reviews about **it**] [after getting funding from the department for **it**].

b. *Both with a PG*

Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [without even reading reviews about **PG**<sub>1</sub>] [after getting funding from the department for **PG**<sub>1</sub>].

- However, if only one adjunct has a PG, it must be the innermost one:

(42) *Only the inner of two adjuncts can be the lone PG-bearer*

a. Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [without even reading reviews about **PG**<sub>1</sub>] [after we get our next paycheck].

b. \* Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [after we get our next paycheck] [without even reading reviews about **PG**<sub>1</sub>].

- I report that the same asymmetry holds for an NP with stacked relative clauses:

(43) *PGs in stacked relative clauses*

a. Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that weren't very flattering to **PG**<sub>8</sub>] [that unfortunately really embarrassed **PG**<sub>8</sub>].

b. Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that weren't very flattering to [him<sub>8</sub>/**PG**<sub>8</sub>]] [that unfortunately turned out blurry].

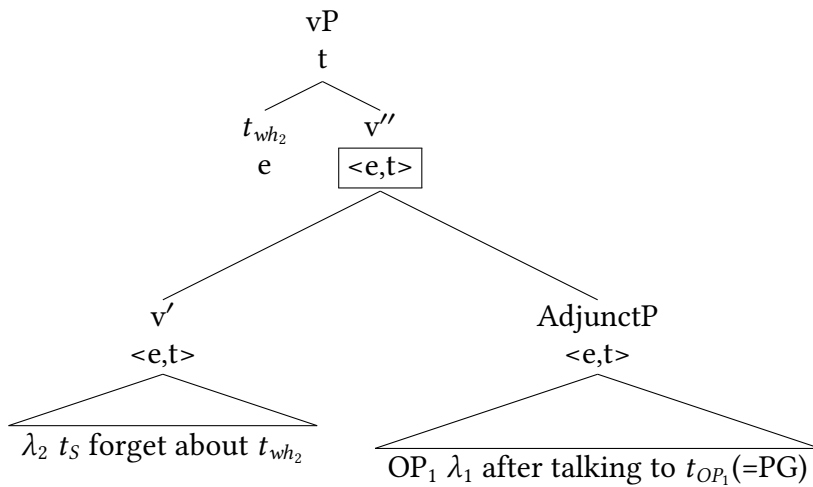
c. Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that unfortunately turned out blurry] [that weren't very flattering to [him<sub>8</sub>/\***PG**<sub>8</sub>]].

- Nissenbaum's account of the PG asymmetry in stacked sentential adjuncts can be straightforwardly extended to these relative clause facts.

▷ Recall that for Nissenbaum, PGs in sentential adjuncts are licensed by successive cyclic A'-movement through spec-vP.

- ▷ This triggers Predicate Abstraction and creates an  $\langle e,t \rangle$  position to which a PG-bearing adjunct can be merged.

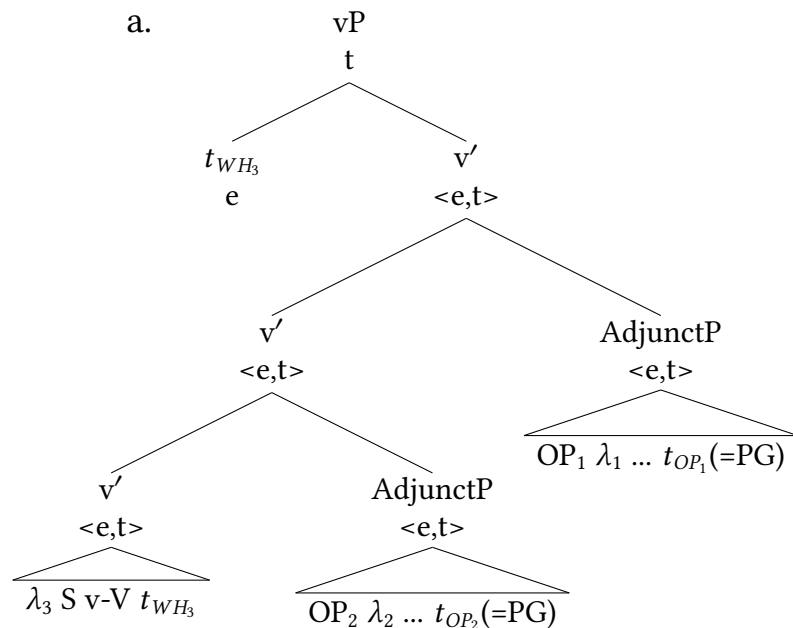
(44) *Predicate Modification of vP with PG-containing island*



- Nissenbaum argues that multiple PG-bearing sentential adjuncts can simply be merged one after the other straightforwardly.

- ▷ Since these adjuncts combine with the vP by Predicate Modification, in principle, any number of them could be included in the same way.

(45) *Two PG containing adjuncts in one vP*

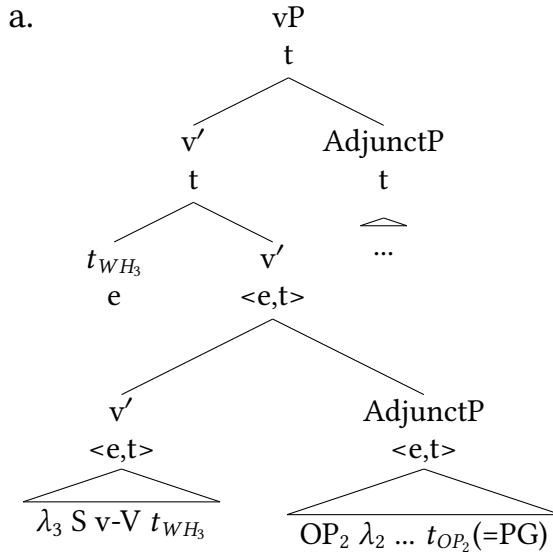


- b. Guess [which computer]<sub>1</sub> we'll try to buy t<sub>1</sub> [without even reading reviews about **PG**<sub>1</sub>] [after getting funding from the department for **PG**<sub>1</sub>].

- While a sentential adjunct containing a PG is type  $\langle e,t \rangle$  as we've seen, a sentential adjunct that lacks a PG will simply be type  $t$ .

- Since such an adjunct cannot combine with the  $\langle e,t \rangle$  node formed by successive cyclic movement from  $vP$ , it must adjoin above the landing site of that movement.
- ▷ Thus if one adjunct contains a PG, but another does not, the latter will end up outermost if the two co-occur:

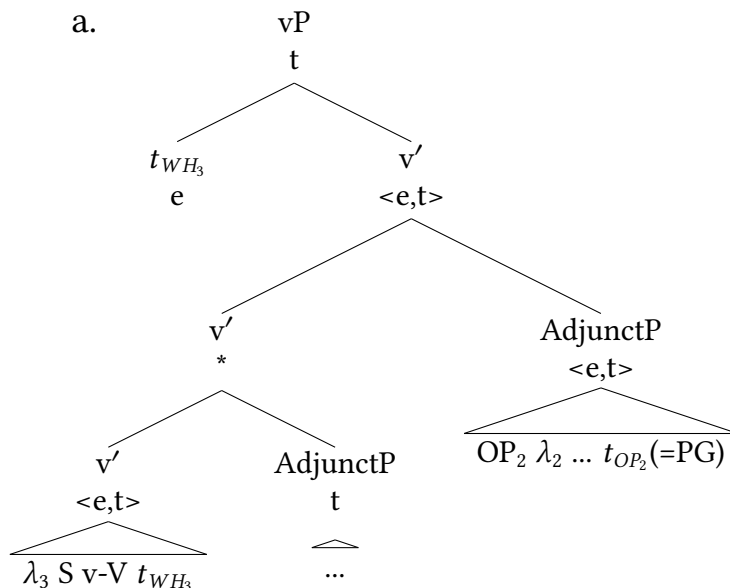
(46) *Lower adjunct with PG, higher adjunct without*



- b. Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [without even reading reviews about **PG**<sub>1</sub>] [after we get our next paycheck].

- For the same reason, it not possible for the PG-less adjunct to merge structurally beneath the PG-containing one.
- Since this region of the  $vP$  is a predicate (type  $\langle e,t \rangle$ ) due to the effect of Predicate Abstraction, merger of a PG-less adjunct here will result in a type mismatch.

(47) *No PG-less adjunct below PG-containing one*

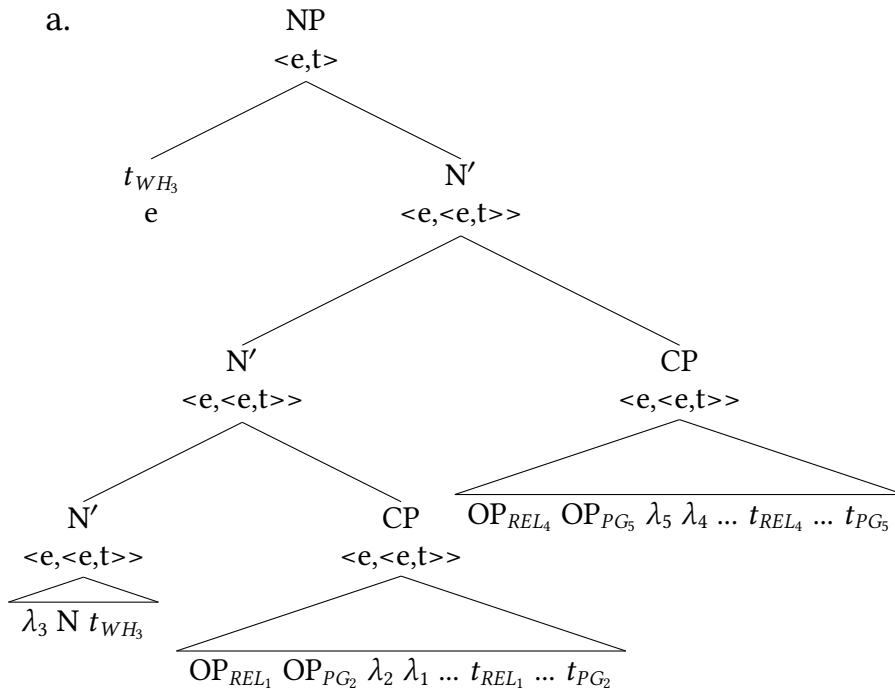


- b. \* Guess [which computer]<sub>1</sub> we'll try to buy  $t_1$  [after we get our next paycheck] [without even reading reviews about **PG**<sub>1</sub>].

✓ Similar reasoning, involving higher semantic types, captures the relative clause facts.

- If an NP exited by successive-cyclic extraction contains a node of type  $\langle e, \langle e, t \rangle \rangle$  as argued above, any number of PG-containing relative clauses can combine with this position via generalized Predicate Modification:

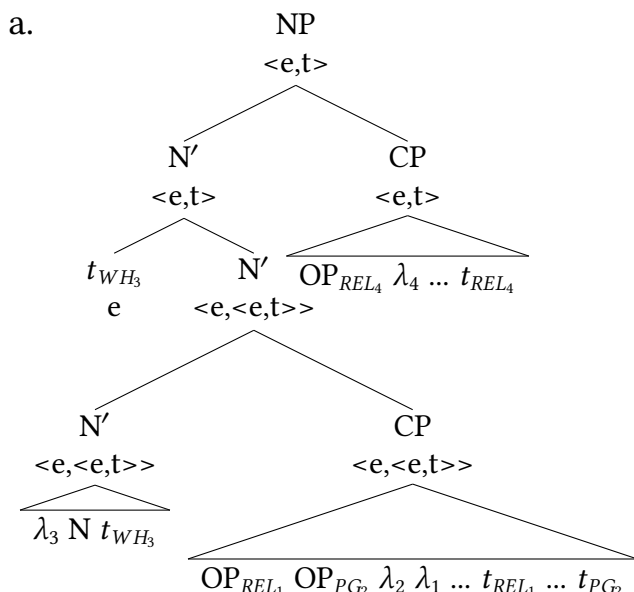
(48) *Stacked PG-containing relative clauses*



- b. Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that weren't very flattering to **PG**<sub>8</sub>] [that unfortunately really embarrassed **PG**<sub>8</sub>].

- It is also possible to adjoin a PG-containing relative clause below the landing site of extraction from NP, and a PG-less relative clause above it:

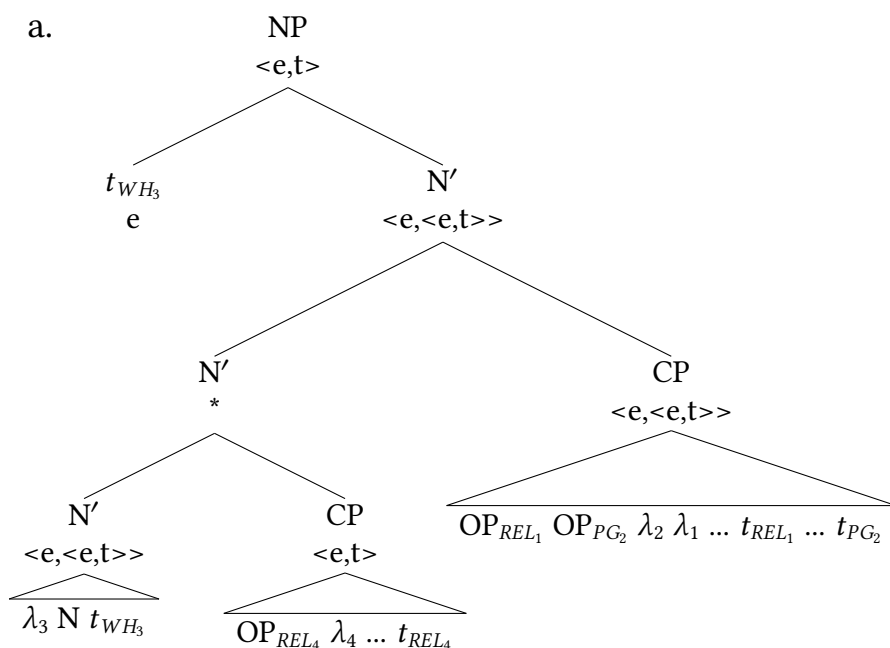
(49) *PG-containing relative clause below PG-less one*



b. Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that weren't very flattering to **PG**<sub>8</sub>] [that unfortunately turned out blurry].

- In contrast, a PG-less relative clause cannot be merged beneath a PG-containing one.
- A PG-containing relative clause is type  $\langle e, \langle e, t \rangle \rangle$  and thus must be merged below the trace of extraction from NP. However, a PG-less relative clause of type  $\langle e, t \rangle$  will yield a type mismatch if merged into this region of the NP:

(50) *No PG-less relative clause below PG-containing one*



b. \*Guess [which actor]<sub>8</sub> I took pictures of  $t_8$  [that unfortunately turned out blurry] [that weren't very flattering to **PG**<sub>8</sub>].

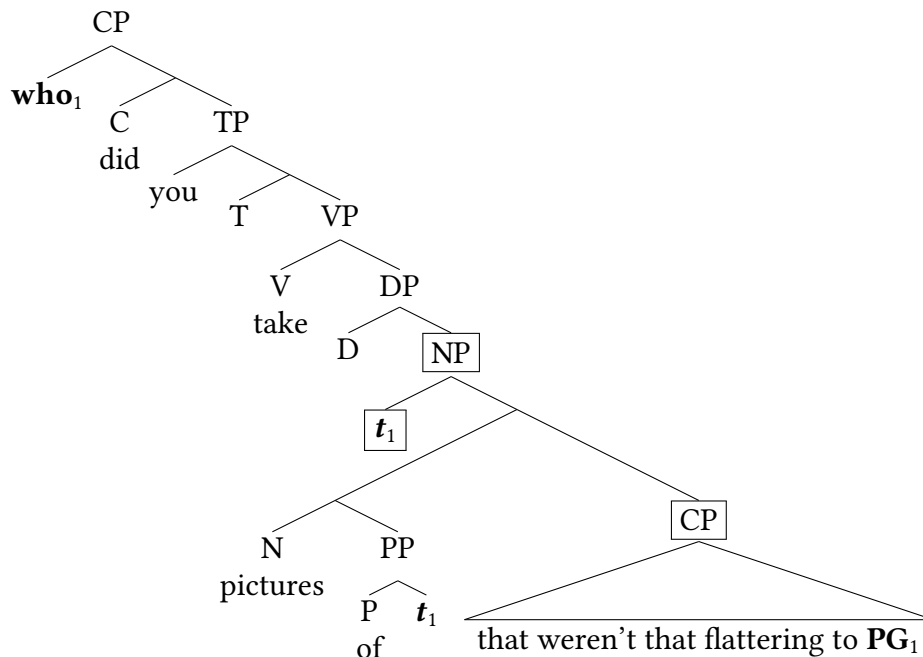
- Thus a PG-less relative clause must be merged higher than any PG-containing ones.

- ★ **Summary:** The possibility of adjunction either above or below the trace of extraction from vP or NP, combined with independent semantic type considerations, predicts the PG asymmetry in stacked adjuncts that we see in reality.<sup>16</sup>

## 7 Implications for the analysis of extraction from DP

- A few works have claimed that extraction from NP/DP is not in fact possible, and that when it appears to happen, some form of re-analysis or base generation is occurring (Bosque and Gallego 2014; Reeve 2018).
- The possibility of PG-licensing in relative clauses by extraction from NP indicates that this view is incorrect.
  - ▷ Given the well-established fact that the constituent containing a PG must be crossed by the licensing movement chain, it is unclear why PGs in relative clauses are possible if movement from NP/DP is illusory.

(51) *Extraction from NP crosses relative clause as required for PG licensing*



! More importantly, the proposal that movement can pass through the NP edge has implications for theories about the interaction of locality and sub-extraction.

- Bošković (2005, 2016), extending insights from previous research (Uriagereka 1988; Corver 1990, 1992), argues that the presence of D constrains extraction from NP.
- Bošković focuses on left branch extraction (Ross 1967, a.o.) of elements originating in the edge of NP, such as adjectives.

- Such extraction is possible in many but not all languages.
- English is among those that ban it, but many Slavic languages like Serbo-Croatian do permit it, though the phenomenon is by no means Slavic-specific:

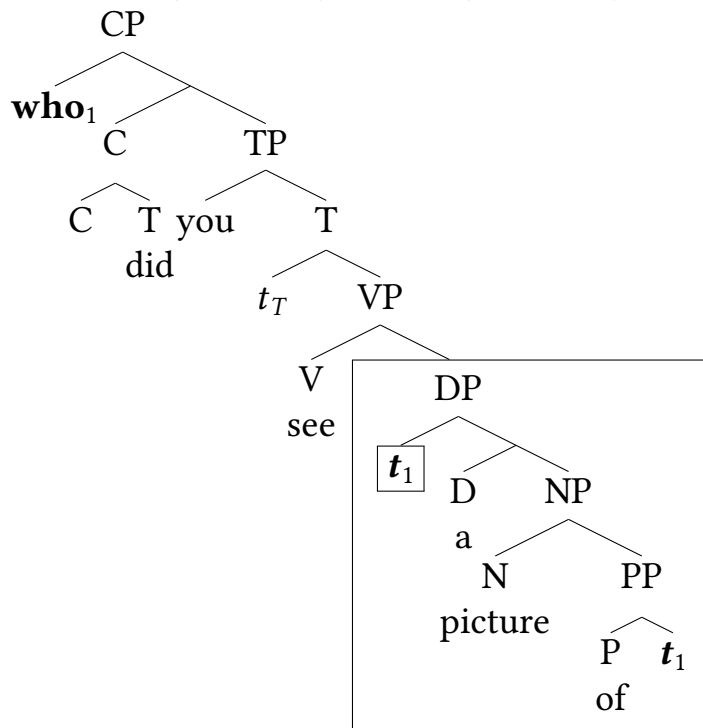
(52) *Not all languages permit left branch extraction* (Bošković 2016, ex. 16-17)

- \* **Expensive**<sub>1</sub> he loves [<sub>DP</sub> ∅<sub>D</sub> *t*<sub>1</sub> cars].  
(English)
- Skupa**<sub>1</sub> on voli [<sub>NP</sub> *t*<sub>1</sub> kola].  
expensive he loves cars  
(Serbo-Croatian)

- **Bošković's proposal about extraction from NP/DP:**

- ▷ DP is a phase, thus movement from DP must pass through spec-DP.
- ▷ Movement from the complement of NP to spec-DP, and then onward, is licit:

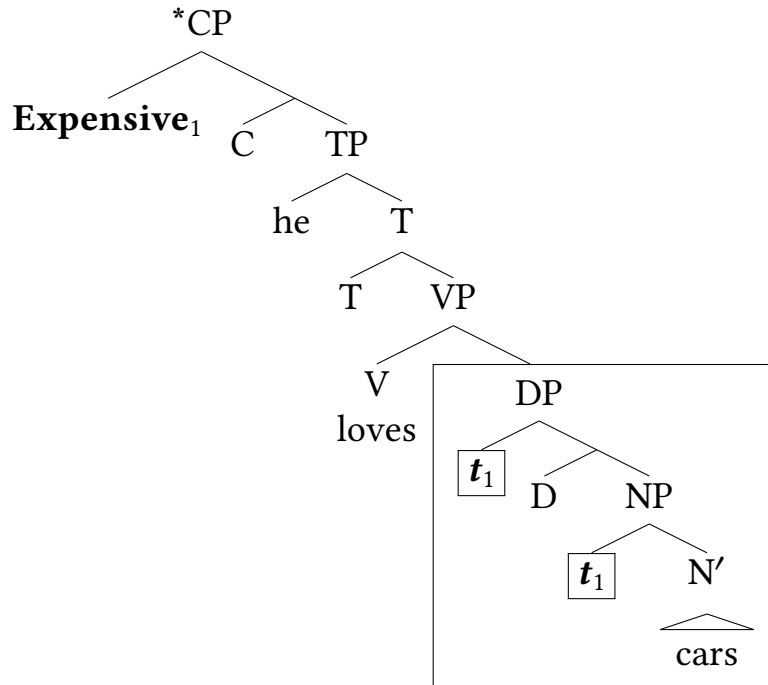
(53) *Extraction from complement of NP via spec-DP*



- ▷ **Importantly in contrast**, for Bošković movement from a non-complement position in NP to spec-DP is illicitly short, given a certain definition of *anti-locality* (Bošković, 1997; Ishii, 1999; Grohmann, 2003; Abels, 2003; Erlewine, 2016, a.o.).
- ▷ Hence left branch extraction of an adjective, for instance, would require an illegal step of movement from the NP edge to the DP edge in a language like English:

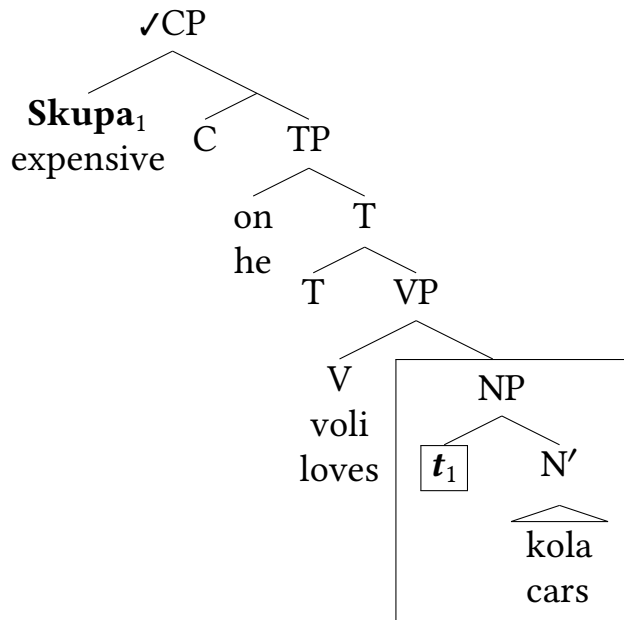


(54) *Anti-local extraction from adjunct/specifier of NP through spec-DP*



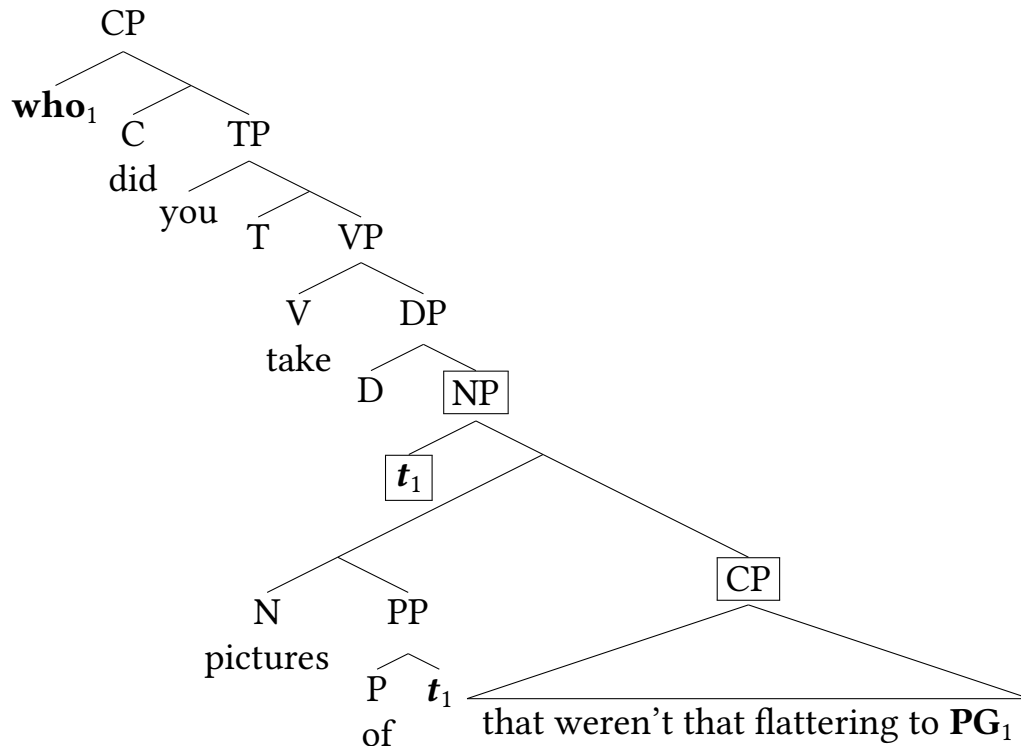
▷ In contrast, in languages like Serbo-Croatian, Bošković proposes that there is no D projection. Hence left branch extraction directly from NP is possible:

(55) *Legal left branch extraction directly from NP edge in Serbo-Croatian*



★ Relevant to these concepts is my argument that, at least when a PG in a relative clause is involved, English must permit successive-cyclic movement via the NP edge.

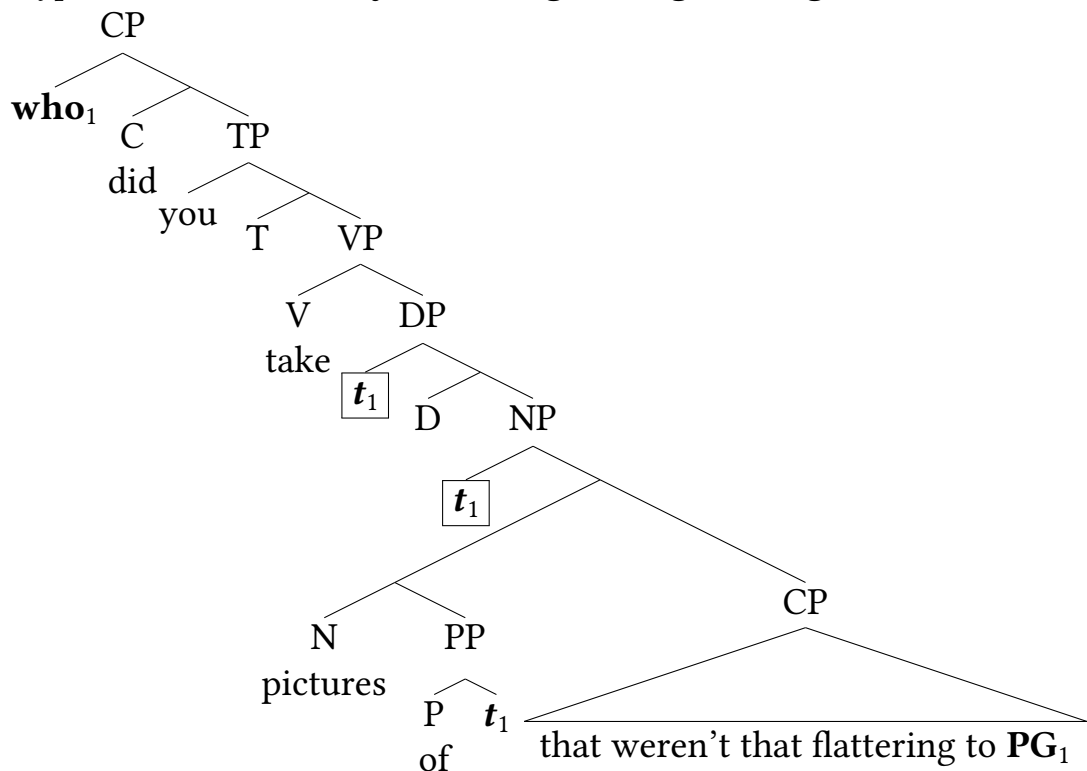
(56) *Extraction from NP licenses PG in relative clause*



! If my arguments are correct, Bošković's account of the ban on left branch extraction in languages like English is inaccurate in some way.

▷ Either the relevant version of anti-locality is incorrect<sup>17</sup>, and movement from the NP edge to the DP edge is in principle permitted...

(57) *Hypothetical extraction from NP edge through DP edge*



- ▷ ...or DP is not a phase, at least in English (Sabbagh 2007; Chomsky et al. 2019; Davis 2019; Zyman To appear), and thus movement via spec-DP is unnecessary.


★ Either way, Bošković’s proposal cannot be maintained.

- I will not resolve this conflict here. Bošković’s proposal may in any case be an over-generalization: see, for instance, Fanselow and Féry (2013) and Pankau (2019) for discussion of some potential counterexamples to it.<sup>18</sup>

## 8 Conclusion

- Here I have argued that the licensing of PGs in relative clauses by extraction from NP reveals the possibility of successive-cyclic movement via the NP edge.

(58) *Extraction from NP crosses relative clause as required for PG licensing*  

$$[ \text{WH}_4 \text{ S V } [_{DP} \text{ D } [_{NP} \boxed{t_4} [_{N''} [_{N'} \text{ N } t_4 ] ] [_{RC} \dots \text{PG}_4 ] ] ] ] ]$$


- Such movement is predicted by research arguing for the phasehood of a constituent like NP, and adds to the body of evidence that movement in the sub-DP domain is at least possible.<sup>19</sup>
- This result has consequences for a variety of phenomena. Here I focused on implications for theories of sub-extraction from NP/DP, but see the following notes for additional relevant considerations.

★ Finally, if you are a native speaker of a language that isn’t English, I’d love to know if your language either is or is not capable of this phenomenon!

## Notes

<sup>0</sup>Thanks to comments from Tanya Bondarenko, Patrick Elliott, Danny Fox, Sabine Iatridou, Elise Newman, David Pesetsky, Norvin Richards, and the attendees of Linglunch at MIT. See chapter 7 of Davis (2020b) for further discussion of these topics.

<sup>1</sup>See Manlove (2016) and references therein for other relevant discussion.

<sup>2</sup>Aside from Citko (2014), the only other work I know to have considered such examples is Matushansky (2005), who reports the judgment in (i). Citko (2014) cites this example and offers (5a) below as an alternative, but does not attempt to explain what might distinguish the two. Examples of this form are certainly somewhat marked, which I suspect simply stems from the fact that they are inherently multi-gap structures, and thus naturally have a relatively high processing burden.

(i) \*Who<sub>1</sub> did Mary tell a story about t<sub>1</sub> [that really impressed PG<sub>1</sub>]]?  
 (Matushansky 2005, p. 168)

I have found that these examples tend to be more acceptable when a moderate amount of phonological material separates the gap of relativization from the PG. For instance, (ii) improves on (i):

(ii) Who<sub>1</sub> did Mary tell a story about  $t_1$  [that genuinely and absolutely impressed PG<sub>1</sub>]]?

I speculate that greater linear distance between the gaps makes them easier to distinguish, thus making the configuration easier to process.

<sup>3</sup>It is, however, worth noting that the NP edge is not available as a final landing site for any movement process in English. (This contrasts with the DP-internal movements that [Simpson and Syed \(2016\)](#) and [Syed and Simpson \(2017\)](#) examine in Bangla, for instance.) This fact indicates that, if there is indeed movement through the NP edge in English as I argue, this cannot simply be the result of further movement after the application of some independent movement process into that position. Such movement must either be forced by some more general factor (such as phase theory, or any comparable theory of cyclic domains and the locality of movement), or alternatively we might posit that movement through intermediate positions can occur freely without any direct motivation, as long as independent locality constraints don't interfere. The English-internal evidence that I am aware of does not provide a way to distinguish between these hypotheses.

<sup>4</sup>This is in contrast to "shared antecedent" theories of PGs, for which a null operator is not involved, but rather genuine extraction of a variety resembling ATB movement. [Nissenbaum \(2000\)](#) and [Nissenbaum and Schwarz \(2011\)](#) for arguments against this approach. As [Nissenbaum \(2000\)](#) discusses, asymmetries in reconstruction indicate that PG configurations are not reducible to ATB structures. Furthermore, as described in section 3, a characteristic of PGs is that they can be separated from their licenser by only one island, though a PG in an embedded island is possible if the larger island also contains a co-referent PG. While this is an automatic prediction of the null operator theory of PGs supported here, it is less clear how an analysis of PGs as formed by genuine extraction can account for these intricacies. Further, it is unclear how the asymmetry analyzed in section 6 would arise under an ATB-like theory of PGs.

<sup>5</sup>I adopt from Nissenbaum the simplifying assumption that vPs and vP modifiers (such as sentential adjuncts) are type t, modulo A'-movement within them triggering Predicate Abstraction. As Nissenbaum (2000, p. 47) notes, this is a simplification because it ignores the presence of temporal and event arguments, but enriching the semantic type of these constituents does not make any important difference for the account of PGs. In particular, given a more general version of the rule of Predicate Modification that allows constituents of the same semantic type to be combined (which is independently required to handle adjuncts containing multiple PGs, as we'll see shortly), the account described here functions the same whether the type of vPs and their adjuncts is t, or something more complex.

<sup>6</sup>Much work in this vein also proposes that non-restrictive relative clauses, by contrast, may indeed adjoin to (what we would consider in contemporary terms to be) DP rather than NP. Because non-restrictive or "appositive" relative clauses are most suited to modifying proper names and definite descriptions, both of which are islands for extraction, the PG-licensing facts I am concerned with here cannot be straightforwardly tested for non-restrictive relatives.

<sup>7</sup>This example uses the relational noun *picture (of)*. For convenience I do not elaborate here on the internal semantic composition of such noun phrases, since regardless of how this occurs, these must end up with an  $\langle e, t \rangle$  denotation like  $\lambda x.x$  is *picture of John*. If this were not the case, such noun phrases would not be the right type to undergo adjunction of adjectives and relative clauses, or to undergo Functional Application with D/Q.

<sup>8</sup>[Nissenbaum \(2000\)](#) similarly proposes that overlapping PG-forming operators must form crossing paths. See chapter 7 of [Davis \(2020b\)](#) for an explicit working-out of why this is so.

<sup>9</sup>In addition to the operator movement analysis of relative clauses assumed here, previous literature has also argued for *head-raising* analyses in which the relativized NP moves from within the relative clause itself, as well as *matching* analyses in which a phrase syntactically identical to the head (though at least partially deleted at PF) moves within, though not beyond, the relative clause. See [Bhatt \(2015\)](#) for a recent overview. All these analyses rely on movement of some variety, and any movement posited must ultimately have the effect of turning the relative CP into a predicate that modifies an NP. For this reason, the analysis of PGs in relative clauses is not affected in any vital way by the choice of relativization analysis.

<sup>10</sup>Here I have assumed that after movement of the relativizing operator and subsequent Predicate Abstraction, tucking-in of the PG-forming operator applies Predicate Abstraction to the sister node of its landing site, thus "stacking" another semantic argument position on top of that formed by movement of the relativizing operator. The result of this derivation is that the semantic argument positions created by each instance of operator movement are structurally in reverse order relative to the moved operators that formed them. As we see in the following diagrams, such a derivation correctly captures the meaning of the sentence under consideration. See note 13 for further discussion.

<sup>11</sup>Here I make the simplifying assumption that adjunction of the relative clause applies after successive-cyclic movement within NP. See [Zyman \(To appear\)](#) for independent evidence that adjunction to a given phase follows the application of movement within it.

<sup>12</sup>If the operators in the relative clause truly move with crossing paths as shown here, we make an additional prediction, given the following finding from Nissenbaum about PGs in multiple movement contexts:

- (i) *PGs and multiple specifiers* (a consequence of [Nissenbaum \(2000\)](#), see further [Fox and Nissenbaum 2018](#); [Davis 2020b](#))  
When multiple phrases form specifiers of vP upon successive cyclically A'-moving from it, a single PG in a sentential adjunct of that vP can only be licensed by the structurally higher moved phrase.

In isolation, relativizing and PG-forming operators can both license (additional) PGs. But given (i), when the relative clause in the configuration under consideration contains a PG-bearing sentential adjunct, that PG should only be license-able by the relativizing operator, which is the higher one in contexts like (39). This is true:

- (ii) Guess who<sub>1</sub> I painted [a silly portrait of  $t_1$ ]<sub>2</sub> [that John likes to give copies of \_\_\_<sub>2</sub> to friends of PG<sub>1</sub>...  
...[**in order to make them want to buy PG<sub>2</sub>**]] / \*...[**in order to introduce them to PG<sub>1</sub>**]]

<sup>13</sup>All examples of PG-containing relative clauses shown so far have involved the gap of relativization preceding the PG. A further and potentially surprising fact is that reversing the gaps is not acceptable, as (i) shows. Here the intended PG is marked in the usual way, while the gap intended to correspond to relativization is underlined. These examples avoid placing any of the gaps in subject position, in order to rule out any potential confounds stemming from locality considerations unique to subject extraction.

- (i) *Relativization gap must precede PG*
- Who<sub>1</sub> did you paint [a silly portrait of  $t_1$ ]<sub>2</sub> [that John likes to give copies of \_\_\_<sub>2</sub> to friends of PG<sub>1</sub>]?
  - \*?? Who<sub>1</sub> did you paint [a silly portrait of  $t_1$ ]<sub>2</sub> [that John likes to send friends of PG<sub>1</sub> copies of \_\_\_<sub>2</sub>]?
  - Let me tell you [which animal]<sub>1</sub> I made [a statue of  $t_1$ ]<sub>2</sub> [that I intend to send \_\_\_<sub>2</sub> to a farmer of PG<sub>1</sub>].
  - \*?? Let me tell you [which animal]<sub>1</sub> I made [a statue of  $t_1$ ]<sub>2</sub> [that I intend to send a farmer of PG<sub>1</sub> an exact copy of \_\_\_<sub>2</sub>].

Note that when examining the sentences in (i), we do not in fact know, upon first impression, which is the gap of relativization and which is the PG. It would be descriptively adequate to state that in these sentences the head of the relative clause always co-refers with the first gap, and the phrase extracted from NP with the second gap. If we assume that Predicate Abstraction in NP triggered by successive cyclic extraction from it will always form the outer  $\lambda e$  of the resulting type  $\langle e, \langle e, t \rangle \rangle N'$  (as shown in the preceding diagrams), and if we maintain that the two operators in the relative clause must always form crossing paths (resulting in Predicate Abstraction in the reverse order as shown above and described further in note 10), then this is indeed what we expect. The outer  $\lambda e$  of the type  $\langle e, \langle e, t \rangle \rangle$  relative clause will always correspond to the inner of the two moved operators, which in turn always corresponds to the second gap in the relative clause. Since the outer  $\lambda e$  of the relative clause is united with the outer  $\lambda e$  of the relevant  $N'$  by Predicate Modification, the fact that the outer  $\lambda e$  of the function created by the merger of these constituents is saturated by the phrase extracted from NP means that the second gap in the relative clause will always co-refer with that phrase. Consequently, the result will always be a configuration in which the gap of relativization precedes the PG.

<sup>14</sup>In my judgment, it is possible for PG-hosting relative clauses to extrapose:

- (i) a. Who<sub>1</sub> did Mary take [pictures of  $t_1$   $t_2$ ] yesterday [that weren't that flattering to PG<sub>1</sub>]<sub>2</sub>?  
b. Let me tell you who<sub>3</sub> I've noticed [an aspect of  $t_3$   $t_4$ ], just now, [that really makes me want to avoid PG<sub>3</sub>]<sub>4</sub>.

If these PGs depend on the relative clause being interpreted as adjoined to an NP that has been passed through by successive cyclic A'-movement, then this fact may serve as evidence for the theory of adjunct extraposition as late merge after covert movement of the "source" phrase (Fox and Nissenbaum 1999; Nissenbaum 2000; Fox 2002; Johnson 2012; Overfelt 2015a). Under such an analysis, in (i) the relevant DP covertly moves, and the head of the covert movement chain is targeted by external merge of the relative clause. For this analysis the relative clause is thus interpreted in precisely the same way as usual, though the nominal structure it is merged to happens to be covert.

<sup>15</sup>Though the original observation is Nissenbaum's, the examples in (41-42) are mine. Nissenbaum's original examples alternate between using a PG versus a co-indexed pronoun to illustrate the contrast, but the judgment here is clearer if we include no such pronoun in the gap-less adjuncts.

<sup>16</sup>It is worth asking why it is not possible to create the illicit configurations in (47) and (50) by merging the PG-less constituent even lower, to a segment of vP/NP that is below the region affected by Predicate Abstraction. If as Nissenbaum (2000) suggests Predicate Abstraction is not a mechanism that introduces a distinct  $\lambda$ -node into the syntactic tree (contra Heim and Kratzer 1998) but rather essentially a type-shifting operation, then there is not necessarily a distinct syntactic position where lower merger of the sort just described could actually successfully occur. Alternatively, adjunction too deeply within a given domain may be independently illicit, as a variety of works have argued (Tada 1993; Sauerland 1998; Stepanov 2001; Stanton 2016; Safir 2018). See chapter 6 of Davis (2020b) for further discussion of this concept.

<sup>17</sup>The relevant concept of anti-locality could be correct but inapplicable to this context, if the nominal domain in fact contains additional projections between NP and DP, as Syed and Simpson (2017) note. This consideration makes salient a weakness of theories relying on anti-locality: any apparent violation of anti-locality can be accommodated by proposing additional structure, but such proposals are difficult to falsify, since the absence of null structure is not easy to prove.

<sup>18</sup>Yet another possibility is that DPs are phases and the relevant notion of anti-locality is correct, but that left branch extraction is not derived by straightforward extraction in the way Bošković argues. Left branch extraction has, for instance, also been argued to be the result of remnant movement (Franks and Progovac 1994; Starke 2001; Kayne 2002; Bašić 2008, 2009; Abels 2003, 2012, a.o.) or distributed deletion at PF (Faneslow and Čavar 2002; Bošković 2001, 2015; Fanselow and Féry 2013; Bondarenko and Davis 2019, 2020, a.o.).

<sup>19</sup>To whatever extent these findings support the presence of a nominal internal phase, they also converge with an intuition expressed by previous literature that there is a structural analogy between clauses and nominals (Abney 1987; Szabolsci 1994; Syed and Simpson 2017), particularly if vP is taken to be a phase.

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