



Here 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 (2):<sup>2</sup>

(2) *PGs in relative clauses licensed by extraction from the same NP*

- a. Who<sub>1</sub> did Mary take [[pictures of  $t_1$ ]<sub>2</sub> [that \_\_\_<sub>2</sub> weren't that flattering to **PG**<sub>1</sub>]]? (Citko 2014: ex. 105)
- b. That's the teacher who<sub>1</sub> I know [[a student of  $t_1$ ]<sub>2</sub> [who's \_\_\_<sub>2</sub> had a very intense grudge against **PG**<sub>1</sub> since last year]].
- c. Bill is very picky about art. [This kind of person]<sub>1</sub>, I could never paint [[an image of  $t_1$ ]<sub>2</sub> [that \_\_\_<sub>2</sub> would be able to satisfy **PG**<sub>1</sub> even a little]].
- d. Mary is the one 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> at every chance he gets].

The main point of this paper is as follows: 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 PGs depend on successive-cyclic movement of their licensing phrase through the edge of the phrase to which the PG-container adjoins (Nissenbaum 2000; Legate 2003; Overfelt 2015; Davis 2020, a.o.), then PGs in relative clauses of the sort shown above reveal the availability of an intermediate landing site in the NP edge. I argue that this result has interesting implications for a number of other topics about NPs.

## 2 Background: PGs and intermediate landing sites

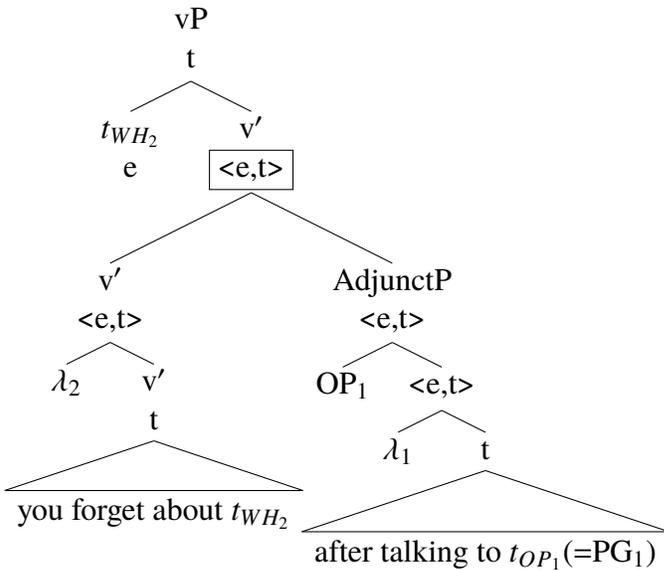
It is well-known that a PG and its antecedent (=“licenser”) can be separated by an island. (Use of an island also makes it clear that the gap is indeed “parasitic”.) I assume following previous research that this is so because PGs do not involve movement from an island, but rather, island-bounded movement of a separate operator (Contreras 1984; Chomsky 1986; Browning 1987; Nissenbaum 2000, a.o.). This is illustrated with an adjunct island in (3):

(3) **Who**<sub>1</sub> did you forget about  $t_1$  [ $\boxed{\text{AdjunctP OP after talking to } t_{OP}(=PG_1)}$  ]?

Nissenbaum (2000) argues that many PGs are formed by the operator-hosting phrase adjoining to an intermediate landing site of successive-cyclic movement. His account of PGs in sentential adjuncts like that in (3), which I extend to PGs in relative clauses, is as follows.

The PG-forming operator moves to the edge of the island, triggering Predicate Abstraction (Heim and Kratzer 1998). If the island is a sentential adjunct as in (3), its original type  $t$  is thus raised to  $\langle e,t \rangle$  (assuming semantic vacuity of the operator). Also, the licensing phrase that ultimately binds the PG successive-cyclically A'-moves through vP. This triggers Predicate Abstraction in the vP, creating an  $\langle e,t \rangle$  position in it (which is immediately saturated by the trace of that successive-cyclic movement). The type  $\langle e,t \rangle$  adjunct can adjoin to the  $\langle e,t \rangle$  node in vP, and combine with it by Predicate Modification (Heim and Kratzer 1998). This conjoins their denotations, creating another  $\langle e,t \rangle$  node in vP, as in (4). This third  $\langle e,t \rangle$  node, boxed in (4), is saturated by the intermediate trace of successive-cyclic A'-movement from vP.<sup>3</sup> Consequently, the A'-moved phrase which left that intermediate trace binds its original trace in VP, and the operator's trace in the adjunct, which is the PG.<sup>4</sup>

(4) *The derivation of a PG in an adjunct of vP (partial structure for (3) above)*



Importantly, under this account the PG-containing island must combine with a position created by successive-cyclic movement of the PG-licensing phrase, since due to Predicate Abstraction such a position is a predicate that will be saturated by a trace of that licensing phrase. Significantly, this syntax/semantics for PGs makes a more general prediction (5):

- (5) **Prediction:** If a PG-containing phrase can be interpreted when adjoined to a given position, that position must be a possible (intermediate) landing site for movement.

Several works have argued for and expanded upon this prediction (Nissenbaum 1998, 2000; Legate 2003; Abels and Bentzen 2009; Overfelt 2015; Davis 2020). Here I use this reasoning to argue that PGs in relative clauses reveal the possibility of movement via the edge of NP.

## 2.1 The position of relative clauses and its significance

Citko (2014) briefly discusses the existence of PGs in relative clauses, which she suggests constitute evidence for successive-cyclic movement from the DP phase, given a prediction about PGs like that in (5) above. Many recent works do indeed take DP to be a phase (Heck and Zimmermann 2004; Bošković 2005, 2016; Newell 2008; Newell and Piggott 2014; Syed and Simpson 2017; Simpson and Park 2019, a.o.). However, as Citko notes, PGs in relative clauses only yield evidence for DP-phasehood if relative clauses can be merged in the projection of D. However, much literature has identified syntactic and semantic evidence that (restrictive) relative clauses must attach to NP, below any determiners or quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975; Heim and Kratzer 1998; Donati and Cecchetto 2011; Bhatt 2015, a.o.). Following this point of consensus in the literature, I adopt the view in Heim and Kratzer (1998) that NPs and (PG-less) relative clauses are both predicates of individuals  $\langle e, t \rangle$ , which merge together and are interpreted via Predicate Modification, after which the NP combines with D/Q (type  $\langle \langle e, t \rangle, e \rangle$  or  $\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle$ ).

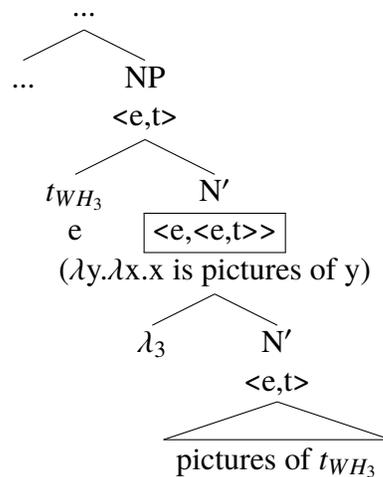
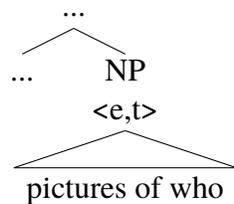
Importantly, if relative clauses are merged in NP, then PG-licensing in a relative clause

by extraction from NP indicates the possibility of successive cyclic movement from NP. The next section shows this by demonstrating the derivation of the sentence in (2a) above.

### 3 The derivation of PGs in relative clauses

Since NPs are usually type  $\langle e,t \rangle$  (6a), then when successive-cyclic movement through the NP edge occurs, such movement will trigger Predicate Abstraction in the NP and create a type  $\langle e, \langle e,t \rangle \rangle$   $N'$ , as in (6b). The first  $\lambda e$  of this two place predicate, which Predicate Abstraction created, is saturated by the type  $e$  trace left by successive-cyclic movement from NP. This saturation yields a typical type  $\langle e,t \rangle$  NP, ready to combine with D/Q.

- (6) a. *Before movement from NP*                      b. *After movement from NP*

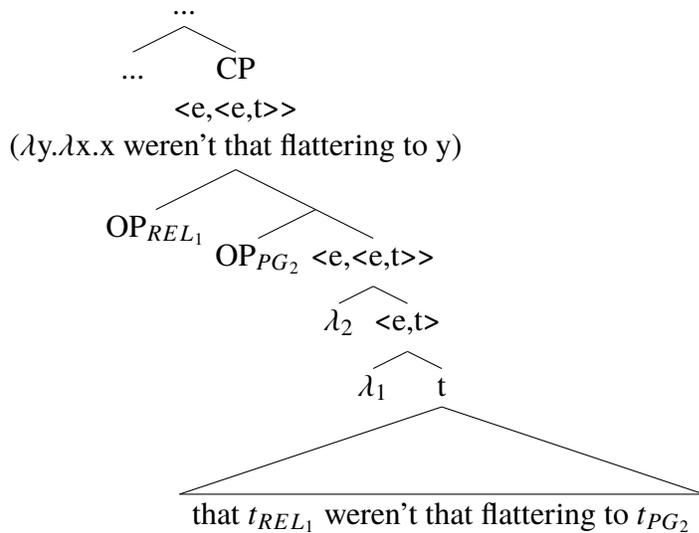


Importantly, this intermediate  $\langle e, \langle e,t \rangle \rangle$  position in the NP facilitates the interpretation of a PG-bearing relative clause, whose derivation I demonstrate next.

I assume that the gap of relativization, and the PG in the relative clause, are each formed by movement of an operator (though see note 6). The correct interpretation emerges from these two operators forming crossing paths, with the higher one moving first, and the lower one “tucking-in” (Richards 1997, a.o.) below it in the relative clause’s edge. Both of these operator movements trigger Predicate Abstraction, making the relative clause type  $\langle e, \langle e,t \rangle \rangle$ , as illustrated in (7) below. (In the absence of the PG operator, this would be the

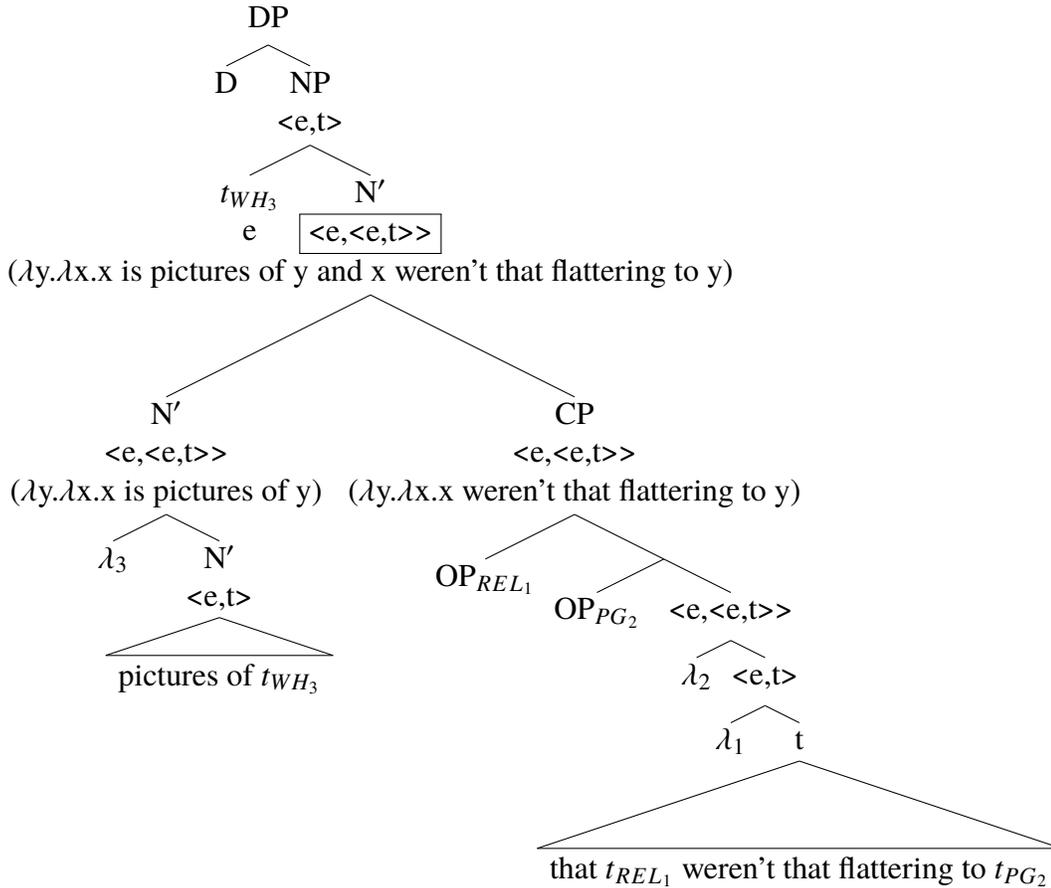
derivation of a normal relative clause.) Following Heim and Kratzer (1998), I assume that Predicate Abstraction inserts a  $\lambda e$  on top of the sister of the landing site of a moved phrase. Assuming that this process occurs in a maximally local way, when a PG-forming operator tucks-in below a relativizing one as in (7), the former will insert its corresponding  $\lambda e$  above that previously formed by movement of the latter. The result is two stacked semantic argument positions, in reverse order relative to the phrases whose movements formed them:

(7) *Derivation of a PG-containing relative clause*



We have just seen that a PG-containing relative clause like (7) is type  $\langle e, \langle e, t \rangle \rangle$ . We saw in (6b) above that the  $N'$  sister of an intermediate trace formed by successive-cyclic movement from NP is also  $\langle e, \langle e, t \rangle \rangle$ . Assuming a more general version of Predicate Modification that can combine the denotations of any two nodes of the same semantic type (Partee and Rooth 1983; Nissenbaum 2000; Nissenbaum and Schwarz 2011), the PG-containing relative clause and this  $N'$  can thus be merged together and interpreted.<sup>5</sup> In the structure in (8) below, which partially represents example (2a) above, we see a boxed type  $\langle e, \langle e, t \rangle \rangle$   $N'$  that is the result of such merger. Here the first  $\lambda e$  of that boxed function is saturated by the trace of successive cyclic movement through NP. This licenses the PG and yields a type  $\langle e, t \rangle$  NP, fit to undergo Functional Application with D/Q as usual.

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



In summary, a PG-bearing relative clause is a two-place predicate, whose interpretation depends on it merging to another two-place predicate. Since relative clauses adjoin inside of NPs, which are usually type  $\langle e,t \rangle$ , successive-cyclic movement from NP (not DP) must occur to create a two-place predicate N' that the PG-bearing relative clause can merge to.<sup>6</sup>

### 3.1 On the order of the gaps

In all PG-containing relative clauses shown so far, the gap of relativization precedes the PG. Interestingly, reversing the order of these gaps causes degradation, as (9) shows:

(9) a. This is Mary, 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>].

- b. \*?? This is Mary, who<sub>1</sub> I painted [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>].
- c. Guess [which philosopher]<sub>1</sub> I made [a sculpture of  $t_1$ ]<sub>2</sub> [that I intend to send \_\_\_<sub>2</sub> to a fan of PG<sub>1</sub>].
- d. \*?? Guess [which philosopher]<sub>1</sub> I made [a sculpture of  $t_1$ ]<sub>2</sub> [that I intend to send a fan of PG<sub>1</sub> an exact copy of \_\_\_<sub>2</sub>].

I argue that this is what we expect: First, assume that Predicate Abstraction in NP triggered by successive cyclic extraction always forms the outer  $\lambda e$  of the resulting type  $\langle e, \langle e, t \rangle \rangle$  N', as in (6b) above. Second, assume that in the PG-hosting relative clause, the higher of the two operators moves first, and the second tucks-in below it, as we saw in (7-8). As described above, if Predicate Abstraction applies in a cyclic and local way, the operator that moves second and tucks-in will trigger insertion of a corresponding  $\lambda e$  above the  $\lambda e$  formed by the prior movement of the first operator. The result is two stacked semantic argument positions, in reverse order relative to the operators whose movement formed them. Given these considerations, the outer  $\lambda e$  of the type  $\langle e, \langle e, t \rangle \rangle$  PG-containing 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. Predicate Modification unites the outer  $\lambda e$  of the  $\langle e, \langle e, t \rangle \rangle$  PG-containing relative clause with the outer  $\lambda e$  of the  $\langle e, \langle e, t \rangle \rangle$  N' that the relative clause merges to, as in (8), yielding yet another  $\langle e, \langle e, t \rangle \rangle$  constituent. The first  $\lambda e$  of that resulting function will be saturated by the trace of the phrase that A'-moves from NP. Consequently, the extracted phrase will always bind both its actual trace in NP, as well as whatever the second gap in the relative clause happens to be. This is just as (9) showed.<sup>7</sup>

#### 4 An asymmetry with stacked relative clauses

Nissenbaum (2000) observed that when one vP hosts two sentential adjuncts, both can have a PG, but when only one of the adjuncts has a PG, it must be the inner of the two (10):

- (10) a. 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>].
- b. Guess [which computer]<sub>1</sub> I'll try to buy  $t_1$  [without even reading reviews about **PG**<sub>1</sub>] [after I get my next paycheck].
- c. \*?? Guess [which computer]<sub>1</sub> I'll try to buy  $t_1$  [after I get my 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 (11):

- (11) 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 **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 **PG**<sub>8</sub>].

Nissenbaum's account of (10) is as follows. As (4) above shows, successive-cyclic movement from vP creates an  $\langle e, t \rangle$   $v'$  via Predicate Abstraction, which a PG-containing adjunct (also  $\langle e, t \rangle$ ) can combine with by Predicate Modification. Predicate Modification can occur more than once and thus add multiple PG-containing adjuncts (10a). In contrast, an adjunct that lacks a PG is type  $t$ , and cannot combine with the  $\langle e, t \rangle$   $v'$ . However, the  $\langle e, t \rangle$   $v'$  is saturated by the trace of successive-cyclic movement and yields a vP node of type  $t$ , as (4) shows, to which a PG-less adjunct can adjoin (since their types match). Thus if a PG-containing and PG-less adjunct are merged into one vP, the latter must be merged structurally higher (above the trace of successive-cyclic movement), as (10b-c) shows.

Similar reasoning captures the relative clause facts in (11). Successive-cyclic movement from NP creates an  $\langle e, \langle e, t \rangle \rangle$   $N'$ , which is saturated by the trace of that movement to yield

a usual type  $\langle e, t \rangle$  NP, as (6b) showed. Multiple PG-containing relative clauses can be merged to that  $\langle e, \langle e, t \rangle \rangle$  N' (11a). However, a PG-less relative clause (type  $\langle e, t \rangle$ ) can only merge above the trace of successive-cyclic movement, and thus will always be merged structurally above (and thus linearly rightward of) a PG-containing relative clause, as the contrast in (11b-c) shows. In summary, the same reasoning (though with different semantic types) explains the facts in (10) and (11), since both of these patterns arise from independent principles about the semantics of successive-cyclicity and adjunction.

## 5 Implications for the analysis of left branch extraction from NP/DP

This paper's argument is relevant to a proposal from Bošković (2005, 2016) about left branch extraction (LBE; Ross 1967, a.o.) of elements like adjectives. While such LBE is banned in many languages like English (13), others such as Serbo-Croatian permit it (12):

- (12) Skupa<sub>1</sub> on voli [<sub>NP</sub> t<sub>1</sub> kola]. (Serbo-Croatian LBE, Bošković 2016: ex. 17)  
 expensive he loves cars

Bošković argues that in languages that allow LBE, nominal phrases are bare NPs that lack D. In contrast, he argues that the phasehood of DP blocks LBE in languages where D is present. Specifically, he argues that since DP is a phase extraction from DP must pass through spec-DP, but extraction of an adjective from the NP edge to the DP edge is banned by *anti-locality* (Grohmann, 2003; Abels, 2003, 2012, a.o.). Consequently, such LBE is banned in a language like English where, by assumption, D is always present (13):

- (13) \* Expensive he loves [<sub>DP</sub> t D [<sub>NP</sub> t cars ] ] (No LBE in English)  
 ↑—————↑—————|

I have argued that PGs in relative clauses reveal that movement through the NP edge is possible. This entails, contra Bošković, either that anti-locality is not relevant here<sup>8</sup>, or that DP is not a phase (Sabbagh 2007; Chomsky et al. 2019; Davis 2021, Zyman to appear) and

thus movement from the NP edge need not be followed by movement to spec-DP.

Bošković (2005) suggests another analysis that avoids this conflict, inspired by Abney (1987). Bošković suggests that in languages without D, when an adjective merges to NP, NP projects so that the nominal constituent can be selected as an argument (14a). In contrast, he argues that in languages with D the adjective projects when it merges to NP, and that later merger of D ensures that this constituent can be selected as an argument (14b). Bošković argues that when D is present, adjective LBE is banned because the adjective phrase (AdjP) does not form a constituent that excludes the NP. In contrast, AdjP is an exclusive constituent in the D-less configuration, which thus permits AdjP LBE.

- (14) a.  $[_{NP} \text{ AdjP } N]$  (LBE allowed)      b.  $[_{DP} D [_{AdjP} \text{ Adj } [_{NP} N ]]]$  (No LBE)

This analysis has no conflict with this paper's findings. However, this cannot be the full story, since there are many other elements relevant to LBE (possessors, demonstratives, numerals, and so on). Further discussion of LBE is beyond the scope of this paper.

## 6 Conclusion

I have argued that PGs in relative clauses reveal successive-cyclic movement from NP. This is predicted by works arguing that NP is a phase, and has implications for several topics about the syntax/semantics of NP. If NP is indeed a phase, we predict that such movement is obligatory, not merely possible. I leave this for future work to investigate.

## Notes

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<sup>1</sup>Several of these works re-cast NP as nP, which is formed when the nominalizing  $n^0$  selects a lexical root. This proposal does not affect this paper's analysis. Syed and Simpson argue for the phasehood of a DP-internal QP, not specifically NP. Their proposal nevertheless converges closely with works arguing for an NP phase.

<sup>2</sup>Aside from [Citko \(2014\)](#), which I discuss in section 3, the only other work I know to have mentioned such examples is [Matushansky \(2005\)](#), who reports that they are ungrammatical. However, 12/16 individuals who have provided me with their judgments (plus several anonymous conference reviewers) accept this PG configuration. As [Engdahl \(1983\)](#) notes, there is considerable inter-speaker variation in the acceptability of PGs, so I will not dwell on the fact that not all speakers accept these relative clause examples.

<sup>3</sup>Unlike Nissenbaum, I assume that successive-cyclic movement in vP precedes merger of the adjunct, following works arguing that adjuncts merge late ([Lebeaux 1988](#); [Stepanov 2001](#); [Zyman To appear](#), a.o.). Late adjunction renders the intermediate trace of the licenser and its corresponding  $\lambda_2$  non-local in (4). These elements were local before adjunction, however, and after adjunction the structure remains interpretable.

<sup>4</sup>Here I have adopted from Nissenbaum the simplifying assumption that vPs and vP modifiers (like sentential adjuncts) are type t, modulo A'-movement within them triggering Predicate Abstraction. Heim and Kratzer implement Predicate Abstraction by inserting a node bearing an index co-referent with the variable that corresponds to the traces(s) of movement, and converting this into a  $\lambda$ -term at LF. For simplicity, I diagram the nodes inserted by Predicate Abstraction as bearing a  $\lambda$  with the relevant index.

<sup>5</sup>Building on footnote 3, I assume that the relative clause adjoins after successive-cyclic movement in NP.

<sup>6</sup>Aside from the operator analysis assumed here, there are at least two other analyses of relativization. (See [Bhatt \(2015\)](#) for an overview.) One is the *matching* analysis, for which what moves in the relative clause is not an operator, but an NP identical to the "head" of the relative clause, though partially deleted at PF. This analysis is compatible with this paper's arguments, since it only differs in proposing that the relevant moving element has some internal structure. There is also the *raising* analysis, for which the NP that heads the relative clause originates within it. The influential raising analysis in [Kayne \(1994\)](#) involves the head NP moving to the edge of the relative CP, and that CP then being selected by D. Above, I argued that when extraction from NP licenses a PG in a relative clause, such extraction saturates an  $\langle e, \langle e, t \rangle \rangle$  segment of NP to which the PG-containing relative clause adjoins (8), yielding a type  $\langle e, t \rangle$  NP that combines with D/Q as usual. However, in a raising analysis, the sister of D/Q would not be NP, but CP. This analysis requires assuming that D/Q can select CP in this context, and that this CP has NP semantics (since Functional Application with D/Q would fail otherwise). However, these issues are resolved by [Cecchetto and Donati \(2015\)](#), who argue for a general theory of labeling for which in raising relatives, movement of the "head" noun re-labels the relative CP as NP. See [Henderson \(2007\)](#) for another raising analysis that achieves the same result by other means.

<sup>7</sup>It is also possible that this fact is a manifestation of the *path containment condition* (Pesetsky 1982).

<sup>8</sup>There is evidence that anti-locality is indeed not applicable here. English sometimes shows DP-internal adjective fronting (Bresnan 1973), which following Adger (2003) is movement of the adjective to spec-DP:

(i) He's [<sub>DP</sub> **that reliable**]<sub>i</sub> a [<sub>NP</sub> *t*<sub>1</sub> man]]. (Adapted from Bresnan 1973: ex. 111a)

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