Parasitic gaps in relative clauses and successive-cyclic extraction from noun phrases[0]

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Abstract: Much recent research argues that certain phrases demarcate syntactic boundaries, or *phases*, which yield effects such as successive-cyclicity. A growing body of work, much of which focuses on morpho-phonology, argues that NP is also a phase. I argue that parasitic gaps in relative clauses licensed by extraction from NP constitute evidence for successive-cyclic movement from NP, which is predicted by works taking NP to be a phase, and which has implications for additional topics about syntax/semantics in the NP.

1 Introduction

This paper adds to a body of research using parasitic gaps (PGs; Engdahl 1983; Nissenbaum 2000; Culicover and Postal 2001, a.o.) to explore the nature of movement. Specifically, this paper examines what a particular variety of PG entails about movement within and from nominal phrases. Many recent works argue that movement is successive-cyclic when exiting *phases* (Chomsky 2000, 2001, a.o.), which constrain the length of syntactic dependencies in a way that forces step-by-step movement. For a recent overview of phase theory and successive-cyclicity, see Citko (2014). Generally, vP, CP, and sometimes DP are taken to be phases. A growing body of research in both syntax and morpho-phonology argues that there is also a phase below D—in essence, NP (Marvin 2003; Newell 2008; Embick and Marantz 2008; Embick 2010; Newell and Piggott 2014; Simpson and Syed 2016; Syed and Simpson 2017; Simpson and Park 2019, a.o.).[1] Importantly, if NP is a phase, we predict that movement from it must pass through its edge (1):

(1) *Prediction: Successive-cyclic movement via edge of NP (as well as CP, vP, etc.)*

Who did you take $[_{DP}$ a $[_{NP}$ $\boxed{t}$ $[_{N'}$ 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 (2):

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

a. Who$_1$ did Mary take [[pictures of $\boldsymbol{t}_1$]$_2$ [that __$_2$ weren't that flattering to **PG**$_1$]]? (Citko 2014: ex. 105)

b. Bill is very picky about art. [This kind of person]$_1$, I could never paint [[an image of $\boldsymbol{t}_1$]$_2$ [that __$_2$ would be able to satisfy **PG**$_1$ even a little]].

c. Mary is the one who$_1$ I painted [a silly portrait of $\boldsymbol{t}_1$]$_2$ [that John likes to give copies of __$_2$ to friends of **PG**$_1$ at every chance he gets].

d. John has a kitten $\varnothing_1$ that I'm gonna buy [[a toy for $\boldsymbol{t}_1$]$_2$ [that __$_2$ I think will be likely to entertain **PG**$_1$]].

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 implications for a number of other topics about NPs.

Aside from Citko (2014), which I discuss in section 2.1, the only other work I know to have mentioned such examples is Matushansky (2005), who reports that they are ungrammatical. However, 17/25 individuals whose judgments I have received corroborate the facts I discuss here, though many note that the construction is marked.[2] As Engdahl (1983) notes, there is inter-speaker variation in the acceptability of PGs. For this reason, I will not dwell on the fact that not all speakers accept these examples, and instead I focus on implications for the grammar of those who do. It is clear that many speakers accept examples of the form in (2), which are at the core of this paper's arguments.

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):

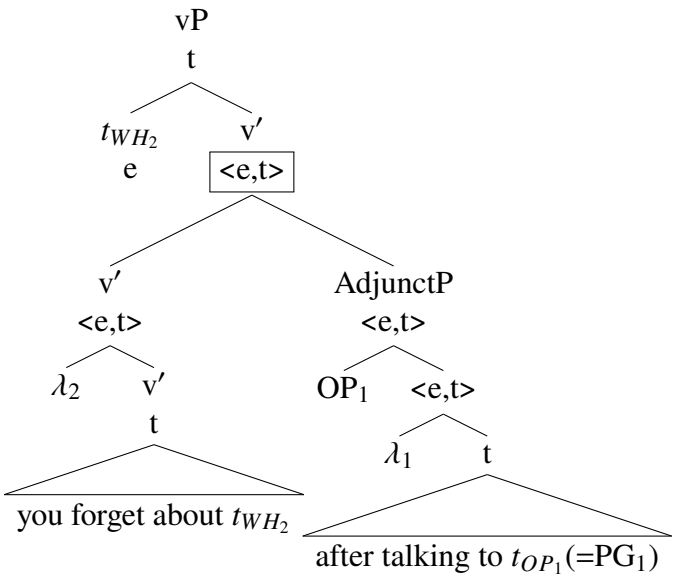
(3) *PG in adjunct island formed by operator movement*

Who$_1$ did you forget about $\boldsymbol{t}_1$ [$_{AdjunctP}$ **OP** after talking to $\boldsymbol{t}_{\mathbf{OP}}$(=**PG**$_1$)]?

Nissenbaum (2000) argues that such 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 <e,t> (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 <e,t> position in it (which is immediately saturated by the trace of that successive-cyclic movement). The type <e,t> adjunct can adjoin to the <e,t> node in vP, and combine with it by Predicate Modification (Heim and Kratzer 1998). This conjoins their denotations, creating another <e,t> node in vP, as diagrammed in (4) below. This third <e,t> node, boxed in (4), is saturated by the intermediate trace of successive-cyclic A′-movement from vP.[3] Consequently, the A′-moved phrase which left that intermediate trace binds its original trace in VP, and the operator's trace in the adjunct. The latter of these is what we identify as the PG.[4]

(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. Consequently, this syntax/semantics for PGs makes a more general prediction (5):

(5) *Prediction about PGs and successive-cyclicity*

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.

A variety of works have defended 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 NP edge.

2.1 The position of relative clauses and its significance

Citko (2014) notes the existence of PGs in relative clauses, which she suggests show evidence for successive-cyclic movement from the DP phase, given the above prediction. Many recent works do take DP to be a phase (Bošković 2005, 2016; Newell and Piggott 2014; Simpson and Park 2019, a.o.). However, as Citko notes, PGs in relative clauses only yield

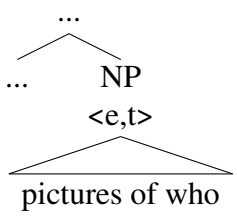
evidence for DP-phasehood if relative clauses can be merged in the projection of D. However, there is much syntactic and semantic evidence that (restrictive) relative clauses must attach to NP, below any determiners or quantifiers (Quine 1960; Stockwell et al. 1973; Partee 1975; Heim and Kratzer 1998; Donati and Cecchetto 2011; Bhatt 2015, a.o.). Thus I adopt the view in Heim and Kratzer (1998) that NPs and (PG-less) relative clauses are both predicates of individuals <e,t>, which merge together and are interpreted via Predicate Modification, after which the NP combines with D/Q (type <<e,t>,e> or <<e,t>,<<e,t>,t>>).

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.

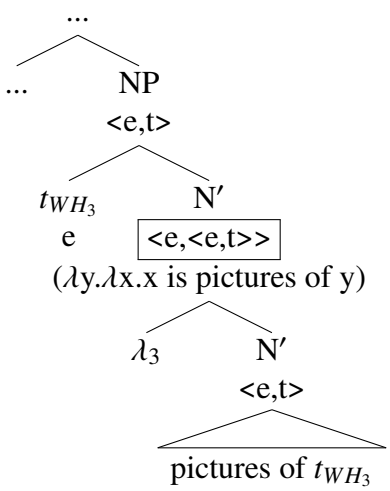
3 The derivation of PGs in relative clauses

Since NPs are usually type <e,t> (6a), then when successive-cyclic movement through the NP edge occurs, such movement will trigger Predicate Abstraction in the NP and create a type <e,<e,t>> N′, as in (6b). The first λe 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 <e,t> NP, ready to combine with D/Q.

(6) a. *Before movement from NP*



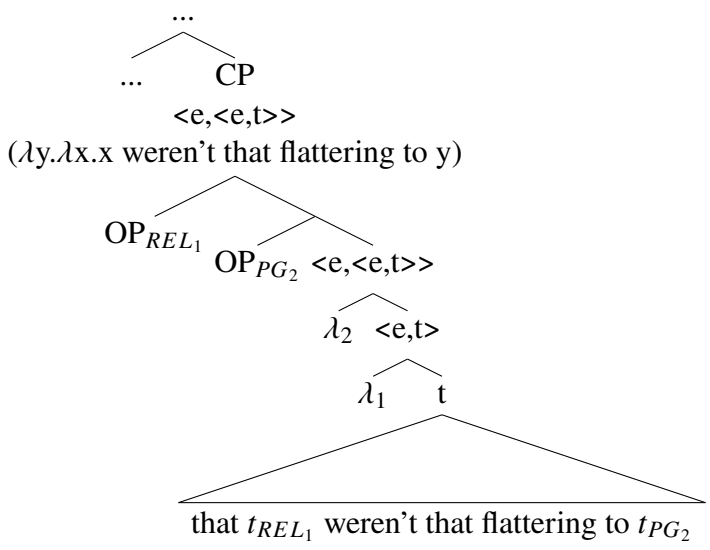
b. *After movement from NP*



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

For the moment I assume that the gap of relativization, and the PG in the relative clause, are each formed by movement of an operator. 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 <e,<e,t>>, as illustrated in (7) below. A PG-less relative clause is derived in the same way except that it has only the relativizing operator, thus a normal relative clause is type <e,t> as discussed above, rather than <e,<e,t>>. Following Heim and Kratzer (1998), I assume that Predicate Abstraction inserts a λe over the sister of the landing site of a moved phrase. Further, I assume that this process occurs in a derivational and local way. Thus when a PG-forming operator tucks-in below a relativizing one as in (7), the former inserts its corresponding λe above the λe previously added by movement of the latter. The result is two stacked λe positions, in reverse order compared to the operators whose movements formed them:[5]

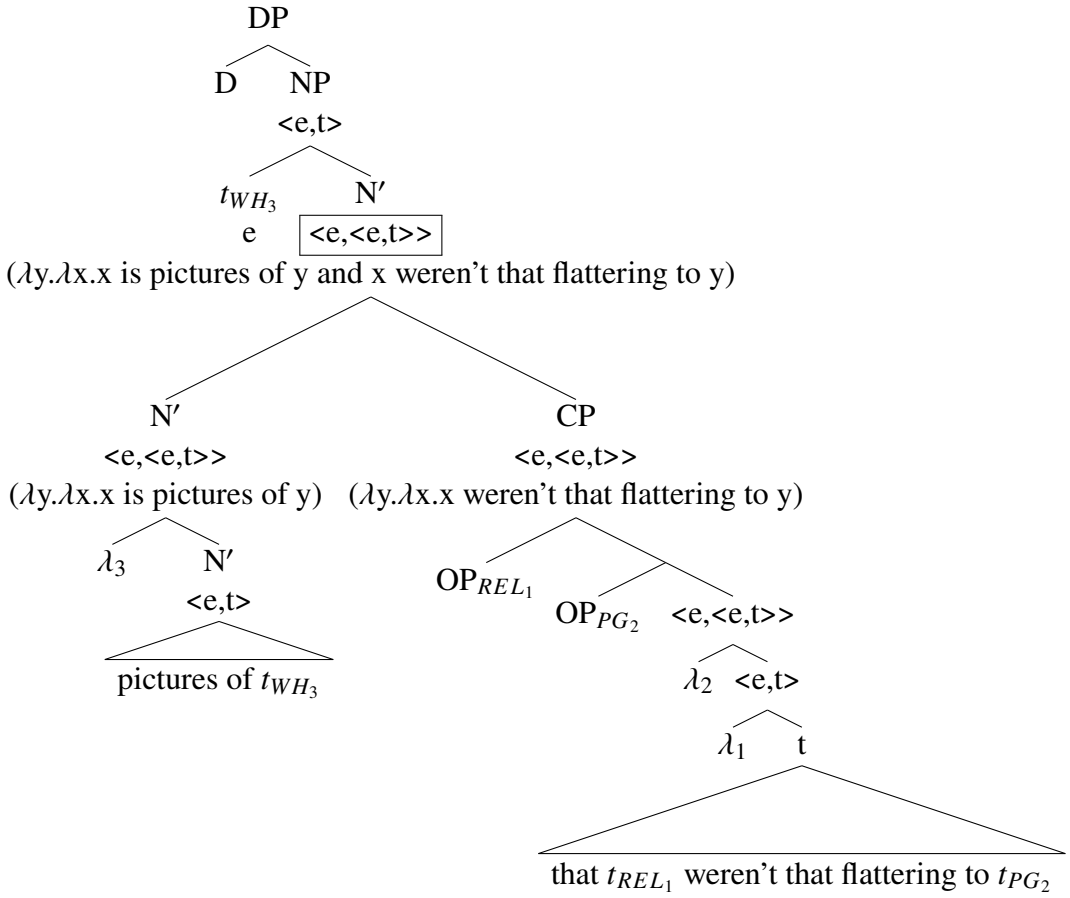
(7) *Derivation of a PG-containing relative clause*



We have just seen that a PG-containing relative clause like (7) is type <e,<e,t>>. We

saw in (6b) above that the N′ sister of an intermediate trace formed by successive-cyclic movement from NP is also <e,<e,t>>. 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.[6] In the structure in (8) below, which partially represents example (2a) above, we see a boxed type <e,<e,t>> N′ that is the result of such merger. Here the first λe of that boxed function is saturated by the trace of successive cyclic movement through NP. This licenses the PG and yields a type <e,t> NP, fit to undergo Functional Application with D/Q as usual.

(8) Who$_1$ did Mary take **[pictures of t_1 [that weren't that flattering to PG$_1$]]**?



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 <e,t>, 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.

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 (9):

(9) a. Guess [which computer]$_1$ we'll try to buy t_1 [without even reading reviews about **PG**$_1$] [after getting funding from the department for **PG**$_1$].

b. Guess [which computer]$_1$ I'll try to buy t_1 [without even reading reviews about **PG**$_1$] [after I get my next paycheck].

c. * Guess [which computer]$_1$ I'll try to buy t_1 [after I get my next paycheck] [without even reading reviews about **PG**$_1$].

I report that the same asymmetry holds for an NP with stacked relative clauses (10):

(10) a. Guess [which actor]$_8$ I took pictures of t_8 [that weren't very flattering to **PG**$_8$] [that unfortunately really embarrassed **PG**$_8$].

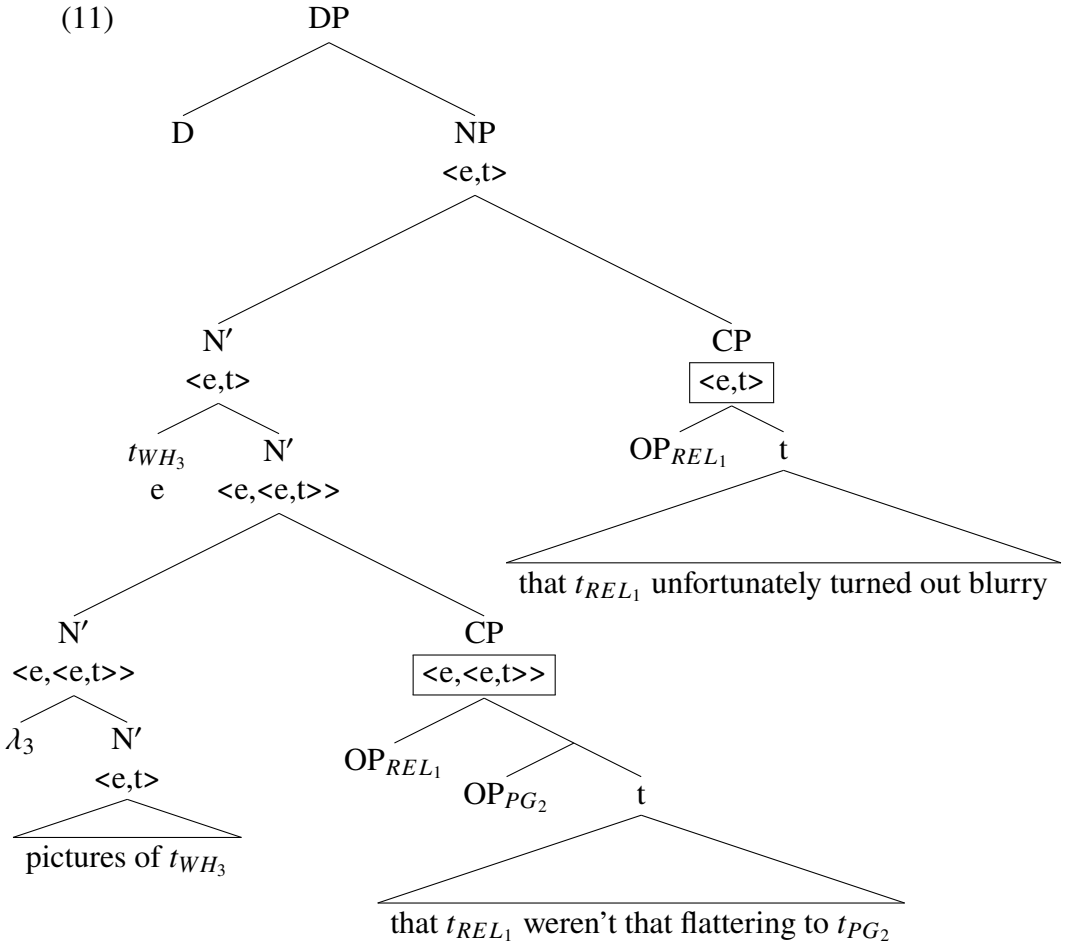
b. Guess [which actor]$_8$ I took pictures of t_8 [that weren't very flattering to **PG**$_8$] [that unfortunately turned out blurry].

c. * Guess [which actor]$_8$ I took pictures of t_8 [that unfortunately turned out blurry] [that weren't very flattering to **PG**$_8$].

Nissenbaum's account of (9) is as follows. As (4) showed, successive-cyclic movement from vP creates an <e,t> v′ via Predicate Abstraction, which a PG-containing adjunct (also <e,t>) can combine with by Predicate Modification. Predicate Modification can occur more than once and thus add multiple PG-containing adjuncts (9a). In contrast, an adjunct that

lacks a PG is type t, and cannot combine with the <e,t> v′. However, the <e,t> v′ is saturated by the trace of successive-cyclic movement and yields a vP node of type t, as (4) showed, to which a PG-less adjunct can adjoin since their types match. Thus if a PG-containing and PG-less adjunct are merged in one vP, the latter must be merged higher, above the trace of successive-cyclic movement, as (9b-c) shows. Similar reasoning captures the relative clause facts in (10). Successive-cyclic movement from NP creates an <e,<e,t>> N′, which is saturated by the trace of that movement to yield a usual type <e,t> NP, as (6b) showed. Multiple PG-containing relative clauses can be merged to that <e,<e,t>> N′ (10a). However, a PG-less relative clause (type <e,t>) can only merge above the trace of successive-cyclic movement, and thus will always be attached structurally above (and thus rightward of) a PG-containing relative clause, as (10b-c) show. This is diagrammed in (11) below.

(11)



In summary, the same reasoning (though with different semantic types) explains the facts in (9) and (10). Both of these patterns arise automatically from independent principles about the semantics of successive-cyclicity and adjunction.

5 PG-licensing under matching and raising analyses of relative clauses

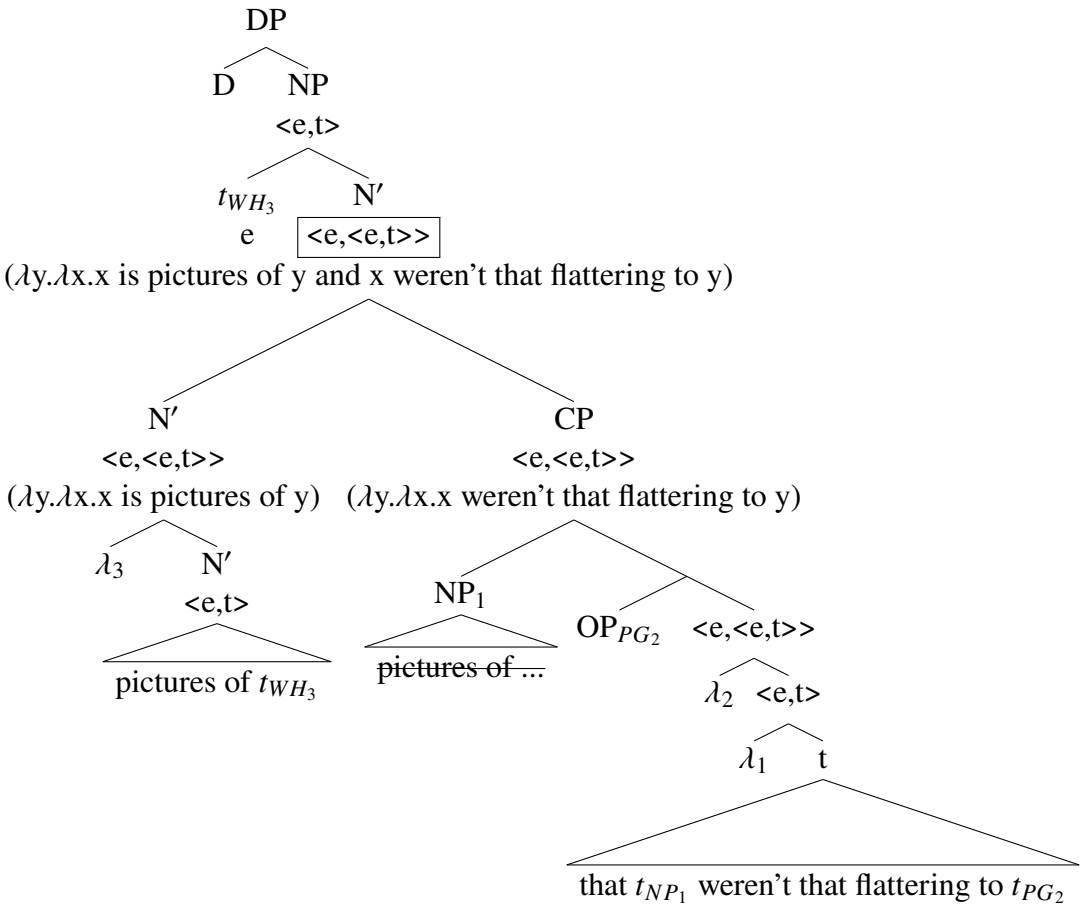
Above I have assumed following Heim and Kratzer (1998) that in relative clauses a relativizing operator moves to the clause edge, triggering Predicate Abstraction. There are at least two other analyses of relativization (see Sauerland 1998; Henderson 2007; Sichel 2018 for background). One is the *matching* analysis, under which what moves in the relative clause is not an operator, but an elided NP structurally identical to the "head" of the relative clause. This analysis is compatible with this paper's arguments, since it only differs in proposing that the A-bar moved constituent in the relative clause has some internal structure.

(12) *Relativization via movement of deleted matching phrase*
This is the $[_{NP}\ [_{N'}$ picture $[_{CP}\ [_{NP}$ ~~picture~~$]_1\ \lambda_1$ that I like t_1]]]

Like operator movement, this NP movement must not saturate the λe that it creates, or else the containing CP would not be type <e,t>, and thus it would be unable to combine with NP via Predicate Modification. Therefore this relativizing NP movement must be assumed to reconstruct, as is typical for A-bar movements in general.

In (13) below we see a diagram for PG-licensing in a relative clause formed by a matching derivation. The only difference between this diagram, and the one in (8) above which assumed the presence of a relativizing operator, is that OP_{REL} in (8) is replaced with a moved and elided NP matching the relative clause's "head" in (13):

(13) *PG in a relative clause assuming the matching analysis*
Who_1 did Mary take **[pictures of t_1 [that weren't that flattering to PG_1]]**?



There is also the *raising* analysis of relative clauses, for which the NP that heads the relative clause originates inside of it, and reaches its surface position by movement. Specifically, the relevant NP moves to the specifier of the relative CP, and that CP is itself then selected by D, as shown in (14) below. In this situation, we would expect movement of the NP to trigger Predicate Abstraction at C′, making the C′ type <e,t>, and allowing it to combine with the NP via Predicate Modification. Their conjoined meaning will be inherited by the CP node, which then combines with D. The semantics of this configuration is no different than the relativization scenarios we have already discussed, except that the conjoined meaning of NP and CP/C′ is received by CP in this case, not NP, since CP is the sister of D:

(14) *Relativization via NP raising to spec-CP*

These are the $[_{CP_{<e,t>}}\ [_{NP_{<e,t>}}$ pictures$]_1\ [_{C'_{<e,t>}}\ \lambda_1$ that I like t_1]]

If a relative clause is an adjunct to NP as in the operator and matching analyses, successive-cyclic extraction through spec-NP can license a PG in the relative clause, since this movement creates an <e,<e,t>> N′ that can combine with the relative CP of the same type. However, at first glance, in a raising configuration like (14) above a similar derivation would fail. I have shown in (8) and (13) above that positing tucking-in of the PG-operator below the relativizing movement creates the correct interpretation. Similarly, in a raising derivation the PG-operator presumably tucks-in below the raised NP, stacking its λe above the λe that the raised NP created, as (15) below shows. This yields a type <e,<e,t>> C′, which is the sister of the raised NP in spec-CP. Notice that here the trace of movement through spec-NP immediately saturates the <e,<e,t>> N′ that it creates, yielding a type <e,t> NP. This NP cannot semantically combine with its sister, the type <e,<e,t>> C′, by either Functional Application or Predicate Modification. Thus such a structure is uninterpretable:

(15) *Relativization via raising: Successive-cyclic movement from NP + PG in relative clause = predicted type mistmatch between NP and C′*

WH$_3$ ... D *[$_{CP}$ $\boxed{[_{NP_{<e,t>}}\ t_3\ [_{N'_{<e,<e,t>>}}\ \lambda_3\ [_{N'_{<e,t>}}$ pictures of $t_3]]]}_1$ [$\boxed{C'_{<e,<e,t>>}}$ OP$_2$ $\lambda_2\ \lambda_1$ [$_{C'_t}$ that t_{NP_1} were not flattering to t_2(=PG)]]]

To remedy this, I adopt the modified raising analysis in Henderson (2007). While some works have argued that matching and raising are both possible (see Sauerland 1998), Henderson argues that the phenomena taken to be indicative of a such a hybrid view can be accounted for by subsuming matching under raising, using *sideward movement*. This operation relies on the copy theory of movement (Chomsky 1995, a.o.), and involves the copying of a syntactic element from within one constituent and then externally merging it to another (Nunes 2004). Specifically, Henderson argues that after the head NP raises to spec-CP in the relative clause (16a), that NP is then copied and externally merged to D in a second syntactic workspace (16b), after which the previously constructed relative clause is then adjoined in

the instance of NP that combined with D (16c). The lower instance of the sideward-moved NP is then deleted at PF via the typical lower copy deletion process.

(16) a. *Raise NP in relative clause*
[$_{CP}$ [$_{NP}$ **book**]$_1$ that John read t_1]

b. *Copy and externally merge raised NP to D in separate syntactic workspace*
[$_{DP}$ D [$_{NP}$ **book**]]

c. *Adjoin relative clause in sideward-moved NP, PF-delete lower NP copy*
[$_{DP}$ D [$_{NP}$ [$_{N'}$ **book** [$_{CP}$ [$_{NP}$ ~~**book**~~]$_1$ that John read t_1]]]]

We thus achieve a raising relative, without the assumption that D exceptionally selects CP rather than NP in such cases. This analysis is also straightforwardly compatible with late-merging the relative clause to the head NP (Lebeaux 1991; Sauerland 1999; Nissenbaum 2000), which is not possible for the original raising analysis, as Henderson shows. Notice that the final constituency of raising as derived via sideward movement is the same as what we expect under a matching analysis. Therefore we can analyze PG-licensing in a raising relative like (16c) in the same way as in the matching scenario shown in (13) above.[7]

6 Implications for the analysis of left branch extraction

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 (18), others such as Serbo-Croatian permit it (17):

(17) Skupa$_1$ on voli [$_{NP}$ t_1 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, 2012, a.o.). Consequently, such LBE is banned in a language like English where, by assumption, D is always present (18):

(18) * Expensive he loves $[_{DP}$ *t* D $[_{NP}$ *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[8], or that DP is not a phase (Sabbagh 2007; Chomsky et al. 2019; Davis 2021) 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 (19a). 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 (19b). 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.

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

This labeling analysis, unlike the anti-locality one, is compatible with this paper's findings.

7 Conclusion

PGs in relative clauses reveal successive-cyclic movement from NP, which is predicted by works arguing that NP is a phase. This proposal makes correct predictions about PGs in cases with multiple relative clauses, and fits with various analyses of relativization.

Notes

[0]Acknowledgments redacted.

[1]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.

[2]These individuals range from about 20 to 60 years old, and consist mostly of American speakers, but also three British and two Australian ones. This set includes both non-linguists (all university students) and linguists. Aside from some linguists who offered their judgments after seeing this work in presented form (7 people), the data here was offered to the individuals in written format for judgment with no prior indication of what contrasts were being sought. First baseline examples with a PG in a clausal adjunct like (3) were shown, followed by the basic relative clause PG examples in (2), and finally the multiple PG examples in (10).

[3]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, a.o.). Late adjunction renders the intermediate trace of the licenser and its corresponding λ_2 non-local in (4). These elements were local before adjunction, however, and after adjunction the structure remains interpretable.

[4]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 λ-term at LF. For simplicity, I diagram the nodes inserted by Predicate Abstraction as bearing a λ with the relevant index.

[5]Assuming that insertion of a λe by Predicate Abstraction occurs in a local and derivational way necessitates tucking-in the PG operator below the relativizing one, as shown here. However, if λe-insertion is not so strictly determined, we could place these operators in opposite order and arrange the instances of λe as needed to ensure interpretability. This difference in implementation does not affect this paper's analysis.

[6]Building on footnote 3, I assume that the relative clause adjoins after successive-cyclic movement in NP.

[7]A similar result could be achieved following 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.

[8]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 [$_{DP}$ [**that reliable**]$_1$ a [$_{NP}$ t_1 man]]. (Adapted from Bresnan 1973: ex. 111a)

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