Quantifier Scope Constraints in ACD: Implications for the Syntax of Relative Clauses

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1. Overview

It is widely assumed that restrictive relative clauses (RCs) can have two potential structures; a raising structure, (1), where the NP of the DP hosting the RC originates inside the RC and a matching structure, (2), where the NP is generated outside of the RC which in turn contains an identical (matched) but elided version of the same NP (Vergnaud 1974, Carlson 1977, Sauerland 1998, Bhatt 2002, Hulsey and Sauerland 2006). In both structures, it is assumed that the D of the host DP exists solely outside of the RC.

(1) Raising: …[$_{DP}$ every [$_{CP}$ book$_i$ that Mary read t_i]].

(2) Matching: …[$_{DP}$ every [$_{NP}$ book [$_{CP}$ ~~book$_i$~~ that Mary read t_i]]].

This paper presents an empirical generalization (the ACD-Scope Generalization) about scope restrictions for DPs hosting a RC with Antecedent Contained Deletion, indicating that elements inside the RC seem to have an active role in determining the scope of the host DP. We argue that explaining this interaction requires an amendment to the matching analysis such that there is not only a copy of the NP but a copy of the entire host DP including D inside the RC, (3).

(3) … [$_{DP}$ every [$_{NP}$ book [$_{CP}$ ~~every book~~ that Mary read t_i]]].

2. Scope Restrictions in ACD – the empirical puzzle

2.1. Antecedent Contained Deletion

Antecedent Contained Deletion (ACD) occurs when elided material, here the VP marked by _____, is properly contained within the expression that serves as its antecedent, (4) (cf. Sag 1976 etc.).

(4) John read every book that Mary did _____.

The acceptability of (4) is paradoxical since ellipsis is subject to a general identity/parallelism constraint between the ellipsis and its antecedent, which cannot be obeyed if the former is properly contained in the latter. The paradox can be resolved by raising the object DP hosting the RC and ellipsis site outside of the antecedent VP as in (5) (Sag 1976, etc).[1]

(5) [John read t_i] [$_{DP}$ every book that Mary did _____].

Raising the object DP covertly to a clausal node as indicated in (5) is an instance of QR and should be, all things being equal, subject to the same locality constraints that QRing an object DP is that has no ACD site attached to it. In the next section we show that this is not the case. Specifically, we show that the scope possibilities of an object DP with an ACD RC are constrained in ways that the scope possibilities of an object DP without an ACD RC are not.

[1] We follow Fox and Nissenbaum (1999) and Fox (2002) in assuming that the object DP is moved to the right.

2.2. Quantifier Scope Restrictions in ACD Structures

In standard RCs, both surface and inverse scope seem to be available for sentences like (6)a,b between the matrix subject (*a professor*) and the host object-DP (*every book…*), regardless of the semantic properties of the RC internal subject (*Mary/a student*).

(6) a. A professor read every book that Mary wrote.
  Surface Scope: A single professor read every book that Mary wrote
  Inverse Scope: Every book that Mary wrote is such that a (different) professor read it

b. A professor read every book that a student wrote.
  Surface Scope: A single professor read every book that a student wrote
  Inverse Scope: Every book a student wrote is such that a (different) professor read it

Surprisingly however, in RCs with an ACD site there are unexpected scope restrictions for the host DP.[2] E.g. in (7)a, we observe that inverse scope of the object-DP *every book that Mary did* over the matrix subject *a professor* is difficult compared (6)a. In (7)b, however, which differs only in that the RC subject is the indefinite *a student*, inverse scope seems as easy as in standard RCs, (6)a,b.[3]

(7) a. A professor read every book that Mary did. *Inverse Scope ($\forall > \exists$)
  b. A professor read every book that a student did. Inverse Scope ($\forall > \exists$)

We argue that the contrast in (7) is an instantiation of a larger generalization, (8):

(8) **ACD-Scope Generalization:**
In a sentence of the form [… Op_1 ….[DP … Op_2 …<VP>]], where Op_1 is a matrix operator, the DP is the host DP containing a RC with an ACD site, and Op_2 an operator inside the RC, the DP can have inverse scope over Op_1 only if the DP and Op_2 are scopally non-commutative.

The data in (9) confirms that scopal (non)-commutativity between the host DP and the RC subject is the driving force behind the scope restriction observed in (7), as *every book* and *every boy* are scopally commutative, predicting correctly that inverse scope should not be available.

(9) a. A girl read every book that every boy did. *Inverse Scope ($\forall > \exists$)
  b. A girl read every book that a boy did. Inverse Scope ($\forall > \exists$)

The data in (10) and (11) show that the generalization is not DP-specific, but extends to other scope-taking operators. In (10), the inverse scope reading of the host DP over the matrix negation is only available when the RC also contains a scope taking element, in this case another negative operator. In fact, as (10)b shows, when the RC does contain negation, surface scope is not allowed.

(10) a. Mary didn't read every book that John did. *Inverse Scope ($\forall$>not)
  b. Mary didn't read every book that John didn't. *Surface Scope (not>$\forall$)

Similarly, in (11), inverse scope of the host DP over the modal operator *can* is only possible when RC also contains a modal operator.

(11) Sue kissed two boys at the party last night. Mary can kiss at most one boy, but …
  a. … she is allowed kiss every boy that Sue kissed/#did. *Inverse Scope ($\forall$>allow)
  b. … she is allowed to kiss every boy that Sue was allowed to. Inverse Scope ($\forall$>allow)

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[2] The lack of inverse scope in (7)a is similar to data mentioned in Wilder (2003) and concerning long distance ACD, which we cannot discuss here because of space limitations.
[3] This contrast is rather reminiscent of Fox's '95 Scope Economy generalization exemplified below.
  a. A boy read every book and Mary did too. *Inverse Scope
  b. A boy read every book and a girl did too. Inverse Scope
However, because scope inside the RC is always fixed (the host DP *every book* is necessarily above the relative-clause subject *Mary*/*a student*), the conditions that govern Scope Economy do not seem to apply.

3. A Focus Semantic Account

3.1. Licensing Ellipsis

Following Heim (1997, etc.) we assume that ellipsis licensing relies on a focus semantic notion of contrast rather than simple identity between ellipsis and antecedent constituent. Specifically, we assume with Rooth (2006) that ellipsis of VP_2 is possible only if there is a constituent (EC) containing VP_2 that appropriately contrasts with an antecedent constituent (AC) containing VP_1 …

(12) $[_{AC} \ldots VP_1 \ldots][_{EC} \ldots \langle VP_2 \rangle \ldots]$

… where α *contrasts appropriately* with β iff the ordinary semantic value of β entails the grand union of the focus semantic value of α: $[[\beta]]^o \vDash \cup([[\alpha]]^f)$. Thus, to license ellipsis, (13) must hold.

(13) $[[AC]]^o \vDash \cup([[EC]]^f)$.

Following this, (14) shows a basic calculation, where (a) represents the sentence (capital letters indicate F-marking), (b) the focus semantic value of EC (the constituent containing the ellipsis), (c) the grand union of the focus semantic value of EC, and (d) the relationship between the ordinary semantic value of AC and the grand union of the focus semantic value of EC, where entailment licenses ellipsis.

(14) a. Mary likes John and SUE does, too.
b. $[[$SUE does <like John>$]]^f$ = {that Sue likes John, that Mary like John, that Bill likes John,…}
c. $\cup[[$SUE does <like John>$]]^f = \exists x[x \in Alt(Sue)$ & x likes John]
d. Mary likes John $\vDash \exists x[x \in Alt(Sue)$ & x likes John]

3.2. Licensing ACD – a solution to the empirical puzzle

We propose to extend this focus-based theory of ellipsis licensing to ACD structures. Such an extension requires that there is a point in the derivation where there are two constituents that can in principle stand in the required entailment relationship. To ensure this we assume that AC is the matrix clause with the host DP but without the RC and that EC is the RC, again with a copy of the host DP. Hence, we assume that the host DP is part of the semantic calculation of both $[[EC]]^o$ and $[[AC]]^f$. (15) illustrates how the system works for basic ACD sentences, where (a) represents the sentence, (b) a sketch of the assumed LF[4], (c) the grand union of the focus semantic value of EC, and (d) the relation between $[[AC]]^o$ and $\cup([[EC]]^f)$. If the entailment relationship in (d) holds, ellipsis is licensed.

(15) a. Mary read every book that John did.
b. [Every [$book_x$ [$John_y$ <y read x>]] [$Mary_z$ z read x]]
c. $\cup([[$every $book_x$ [$John_y$ y read x] $]]^f) = \cup($that every $book_x$ [y read x]: $y \in D_e\})$
$= \exists y[y \in Alt(John)$ & [every $book_x$ [y read x]]]
d. [every $book_x$ [$Maryl_z$ z read x]] $\vDash \exists y[y \in Alt(John)$ & [every $book_x$ [y read x]]]

This system predicts the ACD-Scope generalization, (8) - only when there is a scopally active operator in the EC can inverse scope be properly licensed. Calculations are given in (16) - (18). See appendix for further calculations, including cases with surface scope, negation, and modal operators[5].

(16) a. A girl read every book that a BOY did. every book > a girl
b. [Every [$book_x$ [a boy_y <y read x>]] [a $girl_z$ z read x]]
c. $\cup([[$every $book_x$ [a BOY_y y read x]]$])^f = \exists P[P \in Alt(boy)$ & [every $book_x$[a P_z z read x]]]
d. [every $book_x$ [a $girl_y$ y read x]] $\vDash \exists P[P \in Alt(boy)$ & [every $book_x$[a P_z z read x]]]

[4] Following Heim '97, the quantified object is always above the matrix subject in AC, because quantified objects must QR to at least VP, and AC cannot contain any unbound variables.

[5] This system also correctly captures the facts for negation and modals, such that without a scope taking operator in the RC, inverse scope is out, and with a scope taking operator, surface scope is out. See appendix.

(17) a. A girl read every book that JOHN did. *every book > a girl

b. [Every [book$_x$ [John$_y$ <y read x>]] [a girl$_z$ z read x]]

c. $\cup$([[every book$_x$ [John$_y$ y read x]]])^f = $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]

d. [every book$_x$ [a girl$_z$ z read x]] $\not\models$ $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]

(18) a. A girl read every book that every BOY did. *every book > a girl

b. [Every [book$_x$ [every boy$_y$ y read x]] [a girl$_z$ z read x]]

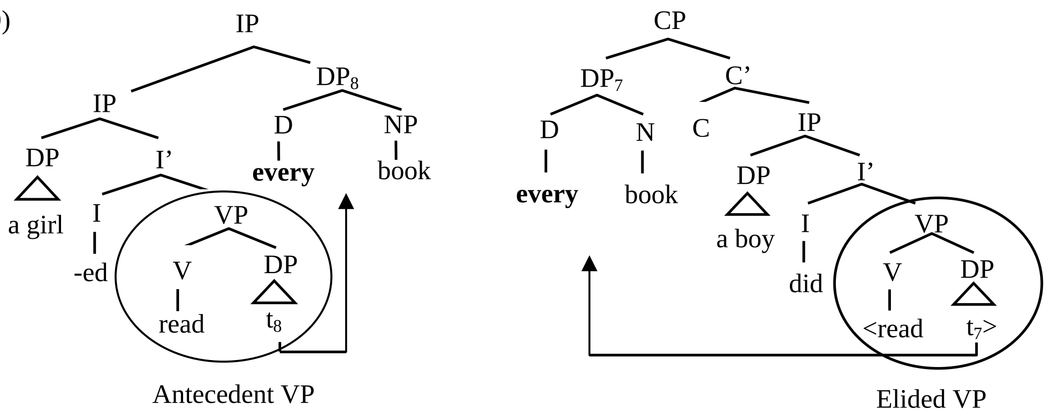
c. $\cup$([[every book$_x$[every BOY$_y$ y read x]]])^f

= $\exists$P[P $\in$ Alt(boy) & [every book$_x$ [every P$_y$ y read x]]]

d. [every book$_x$ [a girl$_z$ z read x]] $\not\models$ $\exists$P[P $\in$ Alt(boy) & [every book$_x$[every P$_y$ y read x]]]

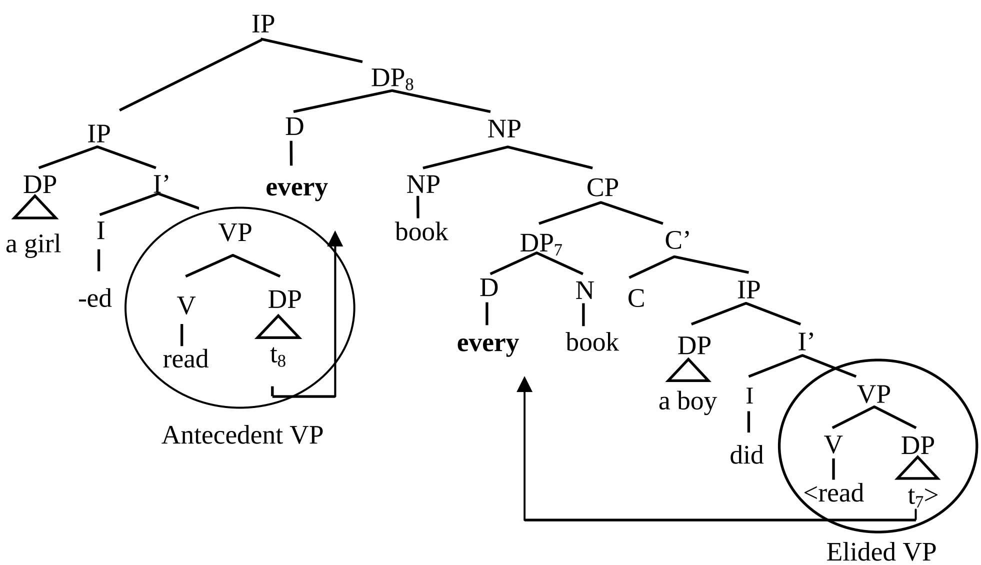
One of the most important aspects of this analysis, is that to license ACD, the determiner of the host DP needs to be active in both AC and EC. Derivationally, there needs to be separate domains, each with access to the DP, that are able to properly contrast. (19) shows the two cyclic domains (phases) that need enter into the ellipsis licensing algorithm.

(19)



However, it's also clear that there are not two active DP copies at the final point in the derivation

(20)



Thus we are presented with a theoretically puzzle – we need to reconcile the demands of the ellipsis licensing algorithm, which requires access to two full DPs, (19), with the final RC structure, which has only one, (20). Thus, any successful analysis of these RCs needs to provide:

a) two properly contrasting constituents (AC and EC), each with access to the host DP

b) a way to merge these two constituents into a single tree, with correct semantics and spell out.

4. Implications for the Syntax of Restrictive Relative Clauses

The clearest way for both the matrix clause (AC) and the RC (EC) to have access to the host DP is to assume that the host DP does in fact exist inside the RC at some point during the derivation. Though no currently endorsed analysis of RCs includes the determiner of the host DP inside the RC, there are two candidate analyses of RCs, raising and matching, that might be modified to accommodate what we need, (21), (22).

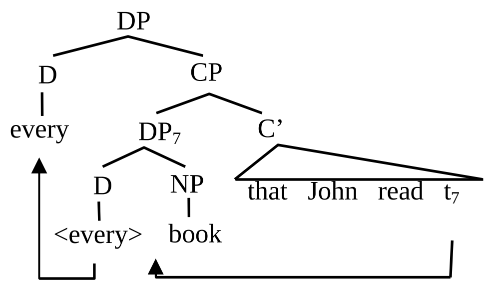
(21) … [$_{DP}$ every [$_{CP}$ ~~every~~ book$_i$ that Mary read t_i]].

(22) … [$_{DP}$ every [$_{NP}$ book [$_{CP}$ ~~every book$_i$~~ that Mary read t_i]]].

4.1. Amended Raising: "D-Raising"

An amended version of the raising analysis would assume that the entire host DP raises from the RC internal trace position to SpecCP, which is then followed by the determiner alone raising and projecting (see Donati 2006).

(21)' Amended D-raising:

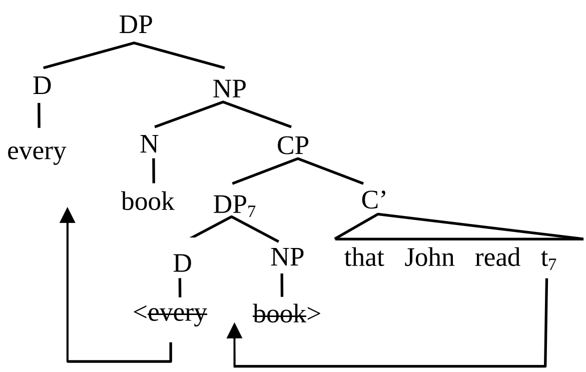


However, this structure raises a fundamental problem for the ellipsis licensing algorithm - in D-Raising structures, all copies of the host DP are part of a single chain moved from inside the RC object position to SpecCP. This means that there is no point in the derivational history when both AC and EC can contain the DP simultaneously, which would mean that ellipsis could never be licensed.

4.2. Amended Matching

An amended version of the matching analysis assumes that there is a full copy of the host DP inside the RC. It raises to SpecCP and undergoes deletion under identity as the RC is merged with the external copy of the host DP.

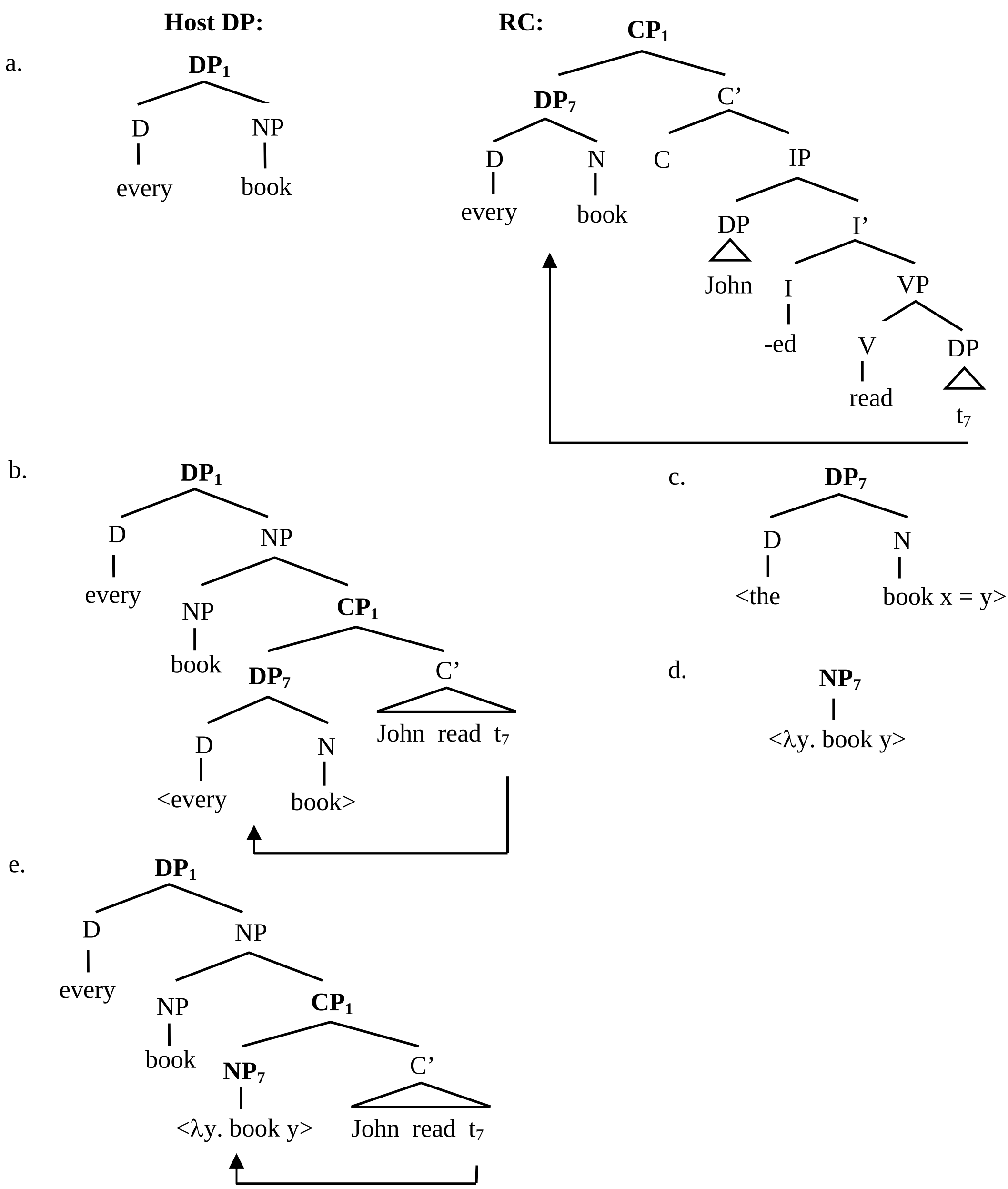
(22)' Amended Matching*:*



Thus, in amending matching structures, there are two separate copies of the host DP – one in the matrix clause, and one in the RC (c.f. Chomsky 1965). We argue that it is at this point in the derivation that the ellipsis is licensed, giving both the EC and the AC access to identical copies of the host DP. Then, to achieve the final spell-out, the RC is late (counter-cyclically) merged into the host DP (Fox and Nissenbaum 1999, Fox 2002, Hulsey and Sauerland 2006), giving rise to a single tree with one spelled-out copy of the DP.

To produce an interpretable LF while avoiding semantic problems (Partee 1975), late merge needs to trigger type-shifting of the RC-internal DP, in addition to deletion of RC internal copy. (23) sketches the steps in the proposed derivation. In (a), there are two distinct copies of the host DP, one as the matrix object, and one as the RC object. In (b), the RC is merged and the RC internal copy is deleted under identity. In (c) the deleted DP undergoes trace conversion (Fox 2002), going from type $\langle et,t\rangle$ to e. In (d) the converted DP undergoes type shifting (Partee 1987), moving from type e to type $\langle e,t\rangle$, a predicate. This results in (e) as the LF for the DP and its attached RC.

(23) Late Merge of RC, given Amended Matching



4.3. Empirical Predictions

We have so far shown that, for a theory of ellipsis licensing that captures the ACD Scope Generalization, the most feasible structure is an amended version of the matching analysis of RCs. However, to see if these theoretical considerations bear out, we must also consider the empirical predictions.

Using a series of diagnostics presented in Hulsey and Sauerland (2006), we argue that RCs with ACD sites do in fact have an underlying matching structure. Note that the minimally different standard RC does not always have a matching structure, indicating that the presence of an ACD site is a driving force behind the structure of these RCs.

Condition A of the Binding Theory demands that an anaphor must be bound at some point in the derivation. Thus, if a RC incurs a condition A violation when the host DP contains an anaphor that is bound inside the RC, it is indicative of matching structure, as the high copy of anaphor will never be in c-command domain of binder:

Raising: [$_{DP}$ every [$_{CP}$ every picture of himself$_1$ [that John$_1$ did <every picture of himself$_1$>]]]

Matching: *[$_{DP}$ every [$_{NP}$ picture of **himself** [$_{CP}$ every picture of himself$_1$ [that John$_1$ did <every picture of himself$_1$>]]]]

(24) shows that when the RC has an ACD site, a condition A violation occurs, indication that the RC has indeed a matching structure.

(24) a. A girl saw every picture of himself that John sent
b. *A girl saw every picture of himself that John did condition A violation → **matching**

Similarly, **variable binding** requires c-command between the binder and its bound variable pronoun. Thus, in a matching structure co-indexation of the pronoun *him$_1$* with the RC internal subject *a boy$_1$* as sketched below can only occur via co-reference, which in turn requires that the RC subject *a boy* is interpreted referentially.

Raising: [$_{DP}$ every [$_{CP}$ every picture of him$_1$ [that a boy$_1$ did <every picture of him$_1$>]]]

Matching: [$_{DP}$ every [$_{NP}$ picture of **him$_1$** [$_{CP}$ every picture of him$_1$ [that a boy$_1$ did <every picture of him$_1$>]]]]

Since a referentially construed indefinite is scopally inert, co-reference between *him* and *a boy* makes inverse scope of the host DP in (25)c as unavailable as it is in (25)a.

(25) a. A girl saw every picture of him$_i$ that John$_i$ did *∀>∃
b. A girl saw every picture of him$_i$ that a boy$_i$ sent ∃>∀,∀>∃
c. A girl saw every picture of him$_i$ that a boy$_i$ did *∀>∃
*∀>∃ → co-indexing by co-reference, not variable binding → **matching**

Extraposition provides us we a third testing ground for our amended matching analysis. Temporal adjuncts, which mark the edge of VP, that split RC and host DP indicate late merge of RC. Late merge has been shown to be available only for matching structures (cf. Hulsey&Sauerland'06). Thus, if a RC changes in meaning or acceptability with the addition of a temporal adjunct, it is not a matching structure. However, if the adjunct does not affect the RC, it must have a matching structure. Applied to our cases, this means that the ACD scope generalization should not be affected when the RC is extraposed. (26) shows that this is indeed so.

(26) a. A girl read every book (yesterday) that a boy did ∀>∃
b. A girl read every book (yesterday) that John did *∀>∃
No change in grammaticality or scope given extraposition → **matching**

These empirical tests show that RCs that contain ACD sites must have an underlying matching structure, rather than an underlying raising structure. This combined with the evidence that the host DP must be semantically active inside the RC strongly suggests that RCs of this sort must have an underlying matching structure with two full copies of the DP.

5. Conclusion

In this paper, we presented a novel generalization about scope restrictions in ACD (the ACD–Scope Generalization), arguing that elements inside the RC have an effect on the possible scope of the RC host DP. We offered a focus semantic account of the ACD-Scope Generalization extending Rooth (2006). Crucially, this account requires that the host DP is accessible to both the matrix clause and the RC for the purpose of ellipsis licensing. To accommodate this requirement, we proposed an amendment to RC syntax such that RCs with ACD require a full copy of the host DP inside the RC. A modified matching analysis can best accommodate the theoretical demands of ellipsis licensing and RC spell out, and is supported empirically by the ACD-Scope Generalization and a series of structure diagnostics.

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Appendix – Focus calculations of ACD

To account for the fact that (17) and (18) are acceptable at all, we assume that the matrix subject is construed as a concealed definite [the$_x$ λy. girl(y) and y = x] (a "specific indefinite"), as in (27). In (28), there is a P (namely λy. girl(y) and y = the salient girl) such that every book was read by every x in P. (Note that scoping the matrix subject over the object is not an option, following Heim'97 - the AC would contain an unbound variable.)

(27) a. A girl read every book JOHN did. — a girl > every book
b. [Every [book$_x$ [John$_y$ <y read x>]] [the girl$_z$ z read x]]
c. $\cup$([[every book$_x$ [John$_y$ y read x]]])^f = $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]
d. [every book$_x$ [the girl$_z$ z read x]] $\vDash$ $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]

(28) a. A girl read every book every BOY did. — a girl > every book
b. [Every [book$_x$ [every boy$_y$ y read x]] [the girl$_z$ z read x]]
c. $\cup$([[every book$_x$ [every BOY$_y$ y read x]]])^f =
$\exists$P[P $\in$ Alt(boy) & [every book$_x$ [every P$_z$ z read x]]]
d. [every book$_x$ [the girl$_z$ z read x]] $\vDash$ $\exists$P[P $\in$ Alt(boy) & [every book$_x$[every P$_z$ z read x]]]

The proposal extends to the cases where Op$_1$ and Op$_2$ are not DPs but negative or modal operators. We illustrate this in (29) - (31) using negation. Specifically, we observe that if the matrix contains negation and the RC does not, inverse scope is disallowed (29), and if both contain negation, DP must take wide scope over the matrix negation/modal operator, (30). (Compare to baseline *Mary didn't read every book John bought*.)

(29) a. Mary didn't read every book JOHN did. — * every > not
b. [Every [book$_x$ [John$_y$ <y read x>]] [not [Mary$_z$ z read x]]
c. $\cup$([[every book$_x$ [John$_y$ y read x]]])^f = $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]
d. [every book$_x$ [not [Mary$_z$ z read x]]] $\nvDash$ $\exists$y[y $\in$ Alt(John) & [every book$_x$[y read x]]]

(30) a. Mary didn't read every book JOHN didn't. — *not >every
b. not [[Every [book$_x$ [not [John$_y$ <y read x>]]] [Mary$_z$ z read x]]
c. $\cup$([[every book$_x$ [John$_y$ [not [y read x]]]]])^f =
$\exists$y[y $\in$ Alt(John) & [every book$_x$ [not [y read x]]]
d. [every book$_x$ [Mary$_z$ z read x]] $\nvDash$ $\exists$y[y $\in$ Alt(John) & [every book$_x$ [not [y read x]]]

To explain the acceptability of (31), where the RC has negation but the matrix doesn't, we assume that negation inside the RC is F-marked. Alternatives are other propositional operators (e.g. the "yes"-counterpart of *not*), which justify the entailment.

(31) a. Mary read every book JOHN DIDn't.
b. [[Every [book$_x$ [not [John$_y$ <y read x>]]] [Mary$_z$ z read x]]
c. $\cup$([[every book$_x$ [John$_y$ [not [y read x]]]]])^f
= $\exists$y[y$\in$Alt(John)&$\exists$f[f$\in$Alt(not) & [every book [f ([y read x])]]
d. [every book$_x$ [Mary$_z$ z read x]] $\vDash$
$\exists$y[y$\in$Alt(John)&$\exists$f[f$\in$Alt(not) & [every book$_x$ [f ([y read x])]]

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