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WCCFL 26
April 28, 2007

Antecedent-Contained Deletion as VP sharing*

1 Introduction

(1) John read every book Mary did

- The canonical perspective:
  - (1) is an instance of VP ellipsis (VPE)
  - Problem: There is no appropriate antecedent for VPE in (1)
  - The solution: covert DP movement (QR/extraposition) out of the matrix VP produces an appropriate antecedent

(2) a. DP movement:
John [$_{VPk}$ read t] [[every book] that Mary did [$_{VPi}$ read t]]
QR/extraposition

b. VP ellipsis:
John [$_{VPk}$ read t] [[every book] that Mary did [$_{VPi}$ ~~read t~~]]

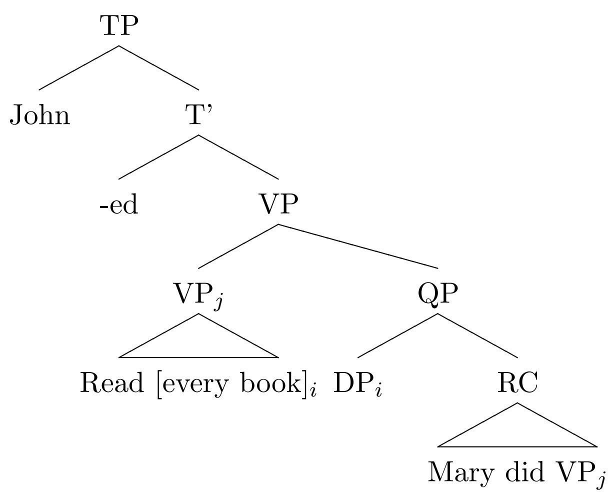
- The puzzle: We will observe that the DP movement required for (2a) does not pattern like QR or extraposition
- Our proposal:
  - the VP in the matrix and in the relative clause is the same VP
  - A' movement of the DP in the relative clause produces the effect of movement in the matrix

*We thank Noam Chomsky, Danny Fox, Jorge Hankamer, Irene Heim, Chris Kennedy, Ivona Kučerová, Idan Landau, Winnie Lechner, Ad Neeleman, David Pesetsky, and Shoichi Takahashi, and the audiences at MIT Ling-Lunch and LF Reading Group and at Paris DEC-ENS for helpful comments and discussion

(3) a. Relative clause formation:
[every book] [Mary did [$_{VPi}$ read t]
A′movement

b. VP movement:
[$_{VPi}$ read t] [[every book] Mary did t]

(4)



2 Background and puzzles

2.1 is ACD driven by QR?

(5) Sag (1976)'s generalization: scope corresponds to the size of the elided VP

(6) Betsy's father wants her to read everything her boss does $< e >$

(7) a. The embedded VP ellipsis: Betsy's father wants her to read everything her boss ~~reads~~ ($want > \forall$)

b. The matrix VP ellipsis: Betsy's father wants her to read everything her boss ~~wants her to read~~ ($*want > \forall$) (Sag, 1976 p. 73)

- Sag's proposal: identity conditions on VP ellipsis apply at LF
- ACD can be analyzed using VP ellipsis if the quantified DP is not part of the antecedent VP at LF:

  - Step I: QR moves the DP out of the antecedent VP (8a)
  - Step II: Reconstruction of the elided VP via LF identity (8b)

- The DP is moved out of the antecedent VP by QR

(8) John [$_{VP}$ read every book Mary did $< e >$]
  a. [every book Mary did $< e >$] [John [$_{VP}$ read t]]
  b. [every book that Mary [$_{VP}$ read t]] [John [$_{VP}$ read t]]

(9) Betsy's father [$_{VP}$wants her to read everything her boss does $< e >$]
  a. [everything her boss does $< e >$] [Betsy's father [$_{VP}$ wants her to read t]]
  b. [everything her boss [$_{VP}$ wants her to read t]] [Betsy's father [$_{VP}$ wants her to read t]]

2.2 Puzzles for QR

2.2.1 Wide scope ACD

- The proposed *DP* movement is too local to account for all possible ACD configurations

- QR is generally clause bound (cf. May 1985)

(10) I told someone that the fire destroyed every book ($*\forall > \exists$)

- Wilder (2003) discusses cases of wide scope ACD where the ellided VP contains a tensed complement clause

- Under the canonical perspective Wide scope ACD would require long distance QR (cf. Cecchetto, 2004)

- We observe that wide scope ACD can license scope reversal between quantifiers across tensed clauses (11), which is otherwise not attested (12)

(11) The president told *some reporter* that a war was breaking out in *every country* the ambassador did ($\forall > \exists$)

(12) The president told *some reporter* that a war was breaking out in *every country* the ambassador visited ($*\forall > \exists$)

2.2.2 Negation

- As von Fintel and Iatridou (2003) discuss, facts from epistemic modals add to a set of diagnostics that distinguish between ACD and regular QR

- Other diagnostics they mention include the bleeding of Condition C (not shown here), and the ability to cross negation

(13) John didn't touch every dessert ($*?$*every* $\prec$ *not*)

(14) John said that Mary will not pass every student that we predicted he would (*every* $\prec$ *not*)

2.2.3 The question

- If ACD is dependent on QR, why is it not constrained in the same way?

2.3 Is ACD driven by extraposition?

(15) Tiedeman (1995): in wide scope ACD, the relative clause must appear to the right of all VP internal material:

a. John believes everyone is a genius that Mary does

b. * John believes everyone that Mary does is a genius

- Fox (2002): ACD requires extraposition of the relative clause (see also Baltin 1987; Wilder 2003)

(16) a. covert DP movement:
John [$_{VP1}$ read t] [every book]
covert DP movement

b. Late merge of the relative clause:
John [$_{VP1}$ read t_i] [[every book]$_i$ [op_k that Mary did [$_{VP2}$ read t_k]]]

c. VP ellipsis:
John [$_{VP1}$ read t] [[every book] that Mary did [$_{VP2}$ ~~read t~~]]

- As the relative clause is outside the antecedent VP, the containment puzzle dissolves

2.4 Puzzles for extraposition

2.4.1 The Right-Roof Constraint

- Extraposition is subject to the Right-Roof Constraint

(17) John will [$_{VP}$ claim [$_{CP}$ that the fire destroyed **every book** yesterday **that I wrote**]]

(18) * John will [$_{VP}$ claim [$_{CP}$ that the fire destroyed **every book**] tomorrow] **that I wrote**

- ACD, as long as it is string vacuous, is not subject to this constraint:

(19) John will [$_{VP}$ claim [$_{CP}$ that the fire destroyed **every book**]] **that I will** <~~**claim**~~>

2.4.2 Reconstruction

- Extraposition is not compatible with reconstruction of the head of the relative clause (Hulsey and Sauerland, 2006)

(20) I saw the picture of himself$_i$ that John$_i$ liked

(21) * I saw the picture of himself$_i$ yesterday that John$_i$ liked (Hulsey and Sauerland 2006 12,13)

- ACD constructions allow (for many speakers) reconstruction

(22) I bought the same picture of himself$_i$ that John$_i$ did

2.4.3 The question

- If ACD is dependent on extraposition, why is it not constrained in the same way?

2.5 Summary

(23) Two generalizations regarding ACD:

1. The scope of the DP is (at least) at the height of the antecedent VP (and hence ACD looks like QR)
2. The relative clause surfaces to the right of all VP internal material (and hence ACD looks like extraposition)

(24) Ingredients of the canonical analysis of ACD:

- Covert movement of the pivot DP out of the matrix VP
  1. Option I: QR (Sag, 1976; May, 1985)
  2. Option II: Extraposition (Baltin, 1987; Fox, 2002)
- Ellipsis of the embedded VP

(25) Problem: Both variants of the canonical analysis under-generate

- Question: Is there an alternative way to capture the generalizations in (23)?

3 An alternative account: ACD as VP-sharing

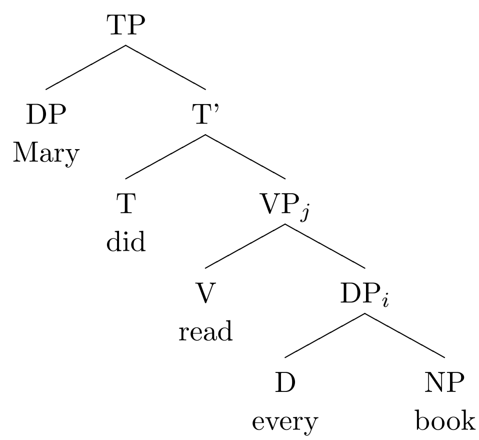
3.1 A change in perspective

- The canonical account:
  - Cause: movement of the DP out of the matrix VP
  - Result: LF-parallelism that licenses ellipsis of the embedded VP
- Our proposal:
  - Cause: movement of the DP to the edge of the embedded clause and subsequent movement of the embedded VP into the matrix clause
  - Result: the matrix VP external position of the DP

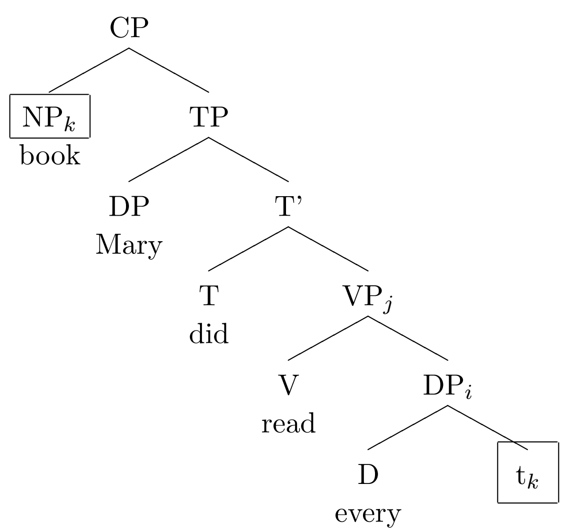
3.2 How it works

(26) John read every book Mary did

(27) a. Embedded clause:

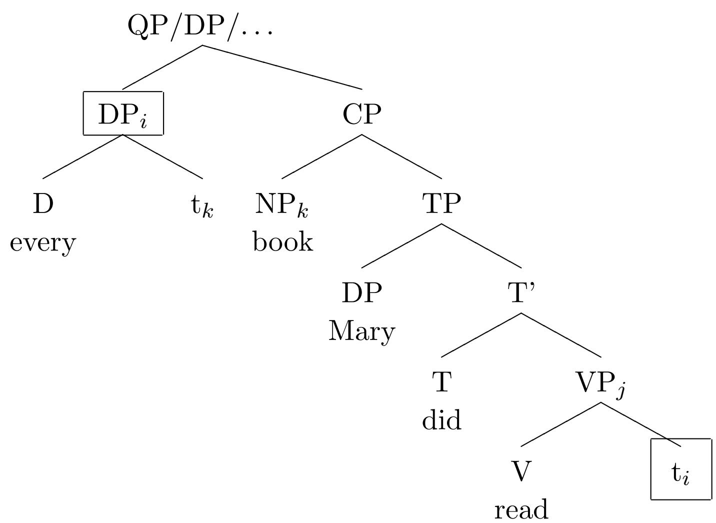


b. NP_k moves and forms a relative clause:[1]

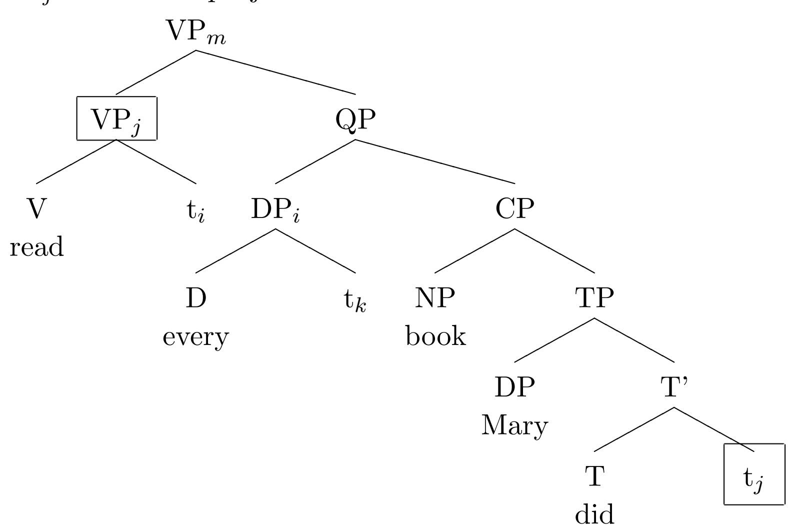


c. DP_i moves and forms the head of the relative clause:

[1]We will talk about movement and use traces in what follows. Elsewhere we discuss such operations in terms of re-merge (Bachrach and Katzir, 2007). For current purposes this choice is not important.



d. VP_j moves and projects:[2]

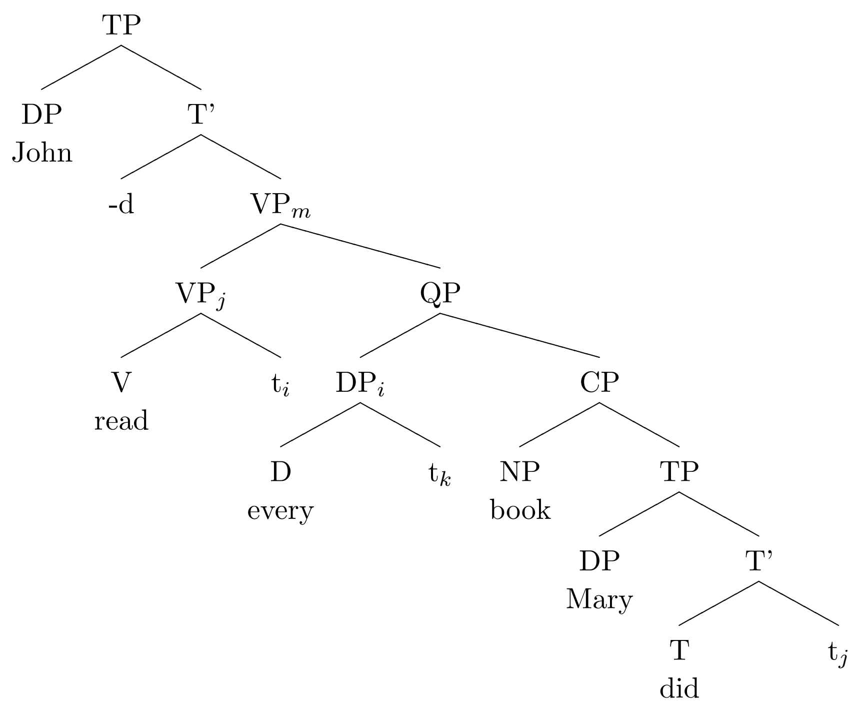


e. Finally, the matrix clause is completed:

[2]We make the following assumption about locality in relative clauses:

i. Spellout of a relative clause RC occurs in the configuration $[XP\ RC]$, where XP is a *pronounced* constituent

We use (i) to allow raising from within RC (of DP,NP, cf. Kayne, 1994,Bianchi, 1999; but also of VP) while ensuring that the RC remains an island for subsequent extraction.



4 How this helps

4.1 Surface order

4.1.1 Why ACD looks like extraposition

- VP-movement outside of the CP gives rise to a [VP CP] order
- ⇒ same order as in extraposition of CP to the right of VP

4.1.2 Why ACD is not extraposition

- Extraposition and rightward movement are subject to the Right-Roof Constraint

(28) The president told some reporter that a war was breaking out (*during the press conference) in every country (*during the press conference) that the ambassador visited

(29) . . . [$_{VP}$ told some reporter [$_{CP}$ that . . . [every country]]]

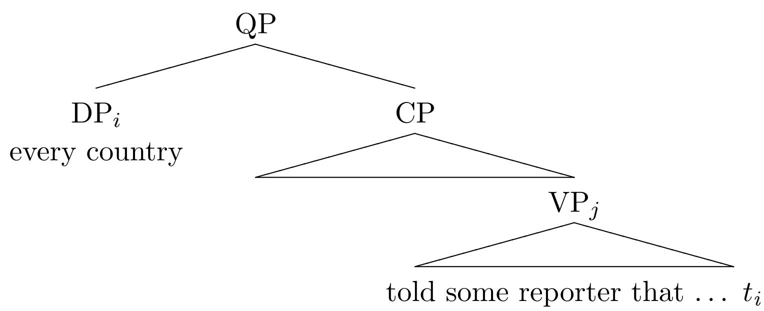
RRC violation

- As we saw, ACD is not restricted by the RRC

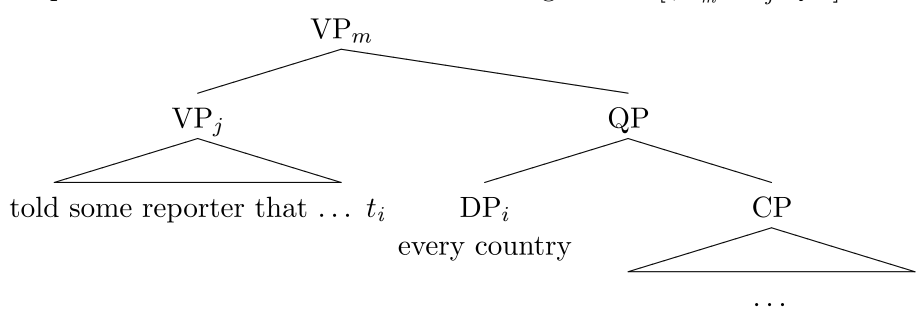
(30) The president told some reporter that a war was breaking out in every country the ambassador did

- Under the current approach, ACD is derived by leftward A'-movement (31), which is not subject to the RRC
- Subsequent VP-movement ensures the $[VP\ CP]$ order

(31) Step I: A'-movement of [every country], not bound by tensed clauses



(32) Step II: VP-movement – creates the configuration $[_{VP_m} VP_j\ QP]$



4.2 Interpretation

- Some assumptions about interpretation

(33) Quantifier types:

a. Quantifiers can be interpreted *in situ* as direct objects of transitive verbs
b. In that case they are of type $<< e, et >, et >$
c. They take a transitive verb (type $< e, et >$) and turn it into a 1-place predicate

(34) Movement and interpretation:

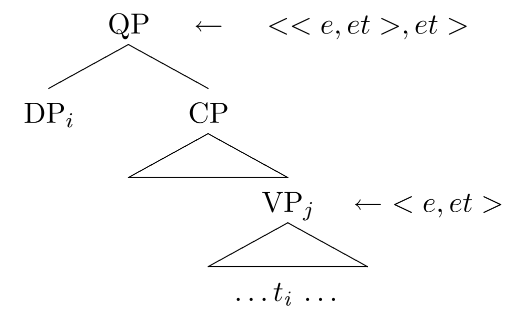
a. Following Heim and Kratzer (1998), when XP_i moves out of a containing YP, the following configuration is possible: $[XP_i\ \lambda_i\ [_{YP}\ \ldots\ t_i\ \ldots]]$ (where λ_i is a binder index)

b. However, we allow both the high occurrence of XP_i and the binder index λ_i to be optional

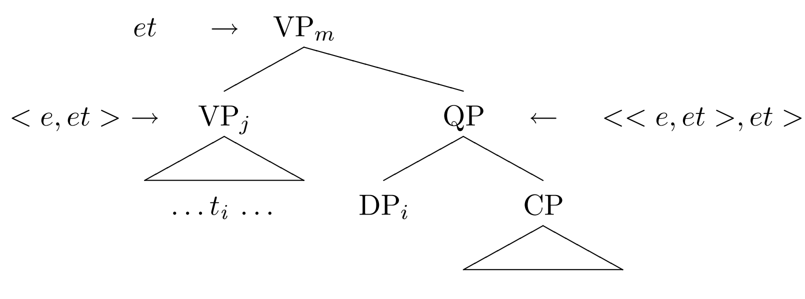
c. That is, for purposes of interpretation the configuration is the following (using parentheses for optionality): $[(XP_i)\ (\lambda_i)\ [_{YP}\ \ldots\ t_i\ \ldots]]$

4.2.1 Why ACD looks like QR

(35)



(36)



- Consequence: Sag's Generalization

4.2.2 Why ACD is not QR

- Recall that QR is bound by tensed clauses ((12) above, repeated here):

(37) The president told some reporter that a war was breaking out in every country the ambassador visited ($*\forall > \exists$)

(38) ... $[_{VP}$ told some reporter $[_{CP}$ that ... [every country]]]

Impossible QR

- As we saw, ACD is not restricted by tensed clauses ((30) above, repeated here)

(39) The president told some reporter that a war was breaking out in every country the ambassador did ($\forall > \exists$)

- Under the current approach, ACD has a different derivation (31)
- The relevant movement is A'-movement inside the relative clause
- $\Rightarrow$ ACD not bound by tensed-clauses
- Subsequent VP-movement now ensures that the QP is interpreted at the correct height

4.3 Interim summary: the relevant form of locality

- ACD is not subject to the locality constraints associated with covert DP movement (as in QR or extraposition)
- In our account covert DP movement was replaced by A' movement
- The cases of long-distance ACD that we saw were possible because A' movement inside the relative clauses was possible
- For example, (30) above (repeated as (40a)) was good because the relative clause is well formed, as in (40b)

(40) a. The president told some reporter that a war was breaking out in every country the ambassador did
b. This is the country that the ambassador told some reporter that a war was breaking out in

- We further predict that when the relative clause is ill-formed, the corresponding ACD will be impossible
- Tanaka (2007), discussing the paradigm of Kennedy (1994), observes that this is in fact the case:

(41) (Tanaka, 2007:6–7)
a. * Polly read a book on every shelf Eric did
b. * Every shelf Op_i Eric read a book on t_i is broken

5 Conclusion

- Antecedent Contained Deletion has been often analyzed along the following lines:
  - Two distinct VPs do not initially satisfy the conditions for ellipsis
  - Covert (or rightward) movement from the matrix VP fixes the problem, making it an appropriate antecedent for ellipsis of the relative-clause VP
- This perspective is challenged by a number of cases where the matrix VP contains barriers for the relevant kind of DP-movement
- We suggested an alternative view, in which the matrix VP and the relative-clause VP are identical
- Under this view, an independently needed A'-movement inside the relative clause, which is not subject to the relevant constraints on movement, gives rise to the appearance of extraction from the matrix VP
- This change of perspective required two significant assumptions:
  - VP can raise from inside a relative clause and adjoin to it
  - A moved element does not necessarily bind its trace
- The new analysis opens new questions regarding the nature of VP movement and its relation to VP ellipsis

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A More puzzles

A.1 Epistemic modals

- Von Fintel and Iatridou (2003) observe that quantifiers cannot take scope over epistemic modals
- (42) can only mean that it is possible that every student has left

(42) Every student may have left (p. 175)
  a. * every $\succ$ may
  b. may $\succ$ every

- Apparent counterexample (von Fintel and Iatridou, 2003, pp. 182-184): ACD

(43) John thinks that Sarah must have played on every piano that we had predicted he would

A.2 Condition C

- Condition C can be bled by ACD but not by regular QR (Fiengo and May, 1994; Fox, 2000):

(44) a. ?? I reported him$_i$ to [every cop that John$_i$ was afraid of]
  b. I reported him$_i$ to [every cop that John$_i$ was afraid I would]

A.3 A linearization puzzle

Jacobson (in press) observed the following contrast:

(45) John said that the company will put on the market every stock Bill did

(46) John said that the company will put every stock Bill did on the market

- (45) allows for a wide scope ACD reading (Bill said..)
- (46) allows only the narrow scope reading (Bill put..)
- This contrast is surprising under the LF movement analysis. Why should QR be sensitive to the linear position of the target DP?
- In our discusison later, we will see that this contrast is also problematic for the extraposiiton account

B Can ACD motivate QR?

- Cecchetto (2004): the exceptional QR needed for long-distance ACD can be derived under the following assumptions

(47) QR is restricted by
  a. Scope Economy (Fox, 2000)
  b. Phases (Chomsky, 2001)

(48) ACD provides the motivation for QR at intermediate steps

- In simple QR (not in ACD), there is no motivation for the quantifier to leave its first CP
- Since CP is a phase, the quantifier is frozen and cannot keep moving
- In ACD, the need to resolve the problem of infinite regress allows the quantifier to keep moving cyclically until it reaches the right height
- Problem: elsewhere it looks like QR cannot be motivated by satisfying the conditions for VPE
- Specifically, VPE as a trigger for QR seems incompatible with Fox (2000)'s Scope Economy
- Observation (Sag, 1976; Williams, 1977): ellipsis can disambiguate scope (49)
- Observation (Hirschbühler, 1982): ellipsis does not always disambiguate (50)
- The crucial factor: QR is independently motivated in the second conjunct in (50)
- (Examples based on Fox, 1995)

(49) a. A boy admires every teacher ($\exists > \forall$, $\forall > \exists$)
  b. A boy admires every teacher, and Mary does too ($\exists > \forall$, $*\forall > \exists$)

(50) Some boy admires every teacher, and some girl does too ($\exists > \forall$, $\forall > \exists$)

- Asymmetry between first and second conjunct

(51) Mary admires every teacher, and some boy does too ($\exists > \forall$, $\forall > \exists$)

C VP internal ACD

- In section (A.3) we discussed a linearization puzzle for the LF movement perspective:

(52) John said that the company will put on the market every stock Bill did

(53) John said that the company will put every stock Bill did on the market

- One of the consequences of the VP movement analysis is that the relative clause must always appear to the right of all VP internal material
- This prediction is similar to the one made by the extraposition analyses (Baltin, 1987; Fox, 2002)
- Larson and May (1990) point out apparent counterexamples for this prediction:

(54) I gave a book on linguistics that you did to Mary

- (54) poses no problems to the QR (w/o extraposition) analysis
- As QR is an LF operation, this approach makes no predictions regarding the surface position of the relative clause
- Under our analysis, (54) can only be derived by rightward movement of *to Mary*:

(55) a. I [[$_{VP}$ gave to Mary a book on linguistics] [that you did]]→
b. I [[[VP gave t$_i$ a book on linguistics] [that you did]] [to Mary]$_i$]

- Rightward movement (unlike ACD) is bound by the Right Roof Constraint
- Is VP internal ACD sensitive to the RRC?
- The contrast above provides an affirmative answer to this question
- (52) is ambiguous between a narrow scope (put..) and a wide scope reading (say..):
    1. John said that the company will put on the market every stock Bill put on the market

2. John said that the company will put on the market every stock Bill said the company will put on the market

- (46) has only the narrow scope reading
- This is predicted by our analysis since the generation of the string in (46) via rightward movement from the narrow scope structure does not violate the RRC while a similar movement in the case of wide scope ACD does:

(56) Narrow scope - no RRC violation:

a. John said that the company will [[$_{VP}$ put on the market]$_i$ [every stock Bill did VP$_i$]] →

b. John said that the company will [[$_{VP}$ put t$_k$]$_i$ [every stock Bill did VP$_i$]] [on the market]$_k$

(57) Wide scope -RRC violation:

a. John [[$_{VP}$ said that the company will put on the market]$_i$ [every stock Bill did VP$_i$]] →

b. * John[[$_{VP}$ said that the company will put t$_k$]$_i$ [every stock Bill did VP$_i$]] [on the market]$_k$

- This result is not expected under the LF movement account of ACD as no rightward movement is assumed to take place
- cf. Fox (2002) for other arguments for a rightward movement account for apparent VP internal ACD
- This contrast is also surprising under the extraposition perspective of ACD
- The RRC must be violated to produce the acceptable wide scope ACD in (52)
- Why can rightward movement violate the RRC in ACD but not in a non-ACD movement?

C.1 Jacobson's CG approach

- Jacobson (in press), working with a Categorial Grammar formalism, accounts for the contrast between (53) and (52) by constraining the *wrap* operation that allows the formation of constituents out of discontinuous strings

- This constraint is reminiscent of the RRC as it allows *put* and *on the market* in (53) to combine but disallows the combination of *say that the company will put* and *on the market* in the same sentence
- This constraint explains the lack of the wide scope reading in (53)
- As noted by Jacobson, this constraint wrongly rules out the wide scope reading in (58)

(58) John said that the company will put every stock on the market Bill did (~~say...~~)

- As discussed above, In our proposal (58) (under the wide scope reading) is predicted to be grammatical
- (58) differs from (52) only in that no heavy NP shift took place within the shared VP

D Comparison with Fox (2002)

- Fox (2002), building on Baltin (1987): ACD is licensed via extraposition of the relative clause
- Fox and Nissenbaum (1999): Extraposition is the result of QR +late merger of the relative clause
- Fox: ACD in two steps:
  - Step I: extraposition
  - Step II: VP ellipsis
- (16), repeated here:

(59) a. covert DP movement:
John [$_{VP1}$ read t] [every book]
covert DP movement

b. Late merge of the relative clause:
John [$_{VP1}$ read t_i] [[every book]$_i$ [op_k that Mary did [$_{VP2}$ read t_k]]]

c. VP ellipsis:
John [$_{VP1}$ read t] [[every book] that Mary did [$_{VP2}$ ~~read t~~]]

D.1 Some points of comparison

- Our account shares the following properties with Fox (2002)

(60) a. The pivot is interpreted at the height of the VP (accounting for the scope generalizations of Sag and Williams)
b. The relative clause is not generated within the VP (condition C bleeding)
c. The DP and the relative clause can be nonadjacent
d. The relative clause is to the right of all VP internal material

- On the other hand, the analysis of Fox (2002) has several properties that are not

(61) a. ACD is expected to be subject to the locality constraints on QR and extraposition, such as clause-boundedness and the Right-Roof Constraint
b. The system requires interleaving of overt and covert movement and the assumption that QR is rightward movement
c. Late merge is an available operation

E Discontinuous ACD

- The pivot DP in ACD is not always adjacent to the relative clause

(62) John received **every invitation letter** from the white house **that Mary did**

- Tiedeman (1995): for certain cases of wide scope ACD, discontinuity is in fact required

(63) I expect that everyone will visit Mary that you do

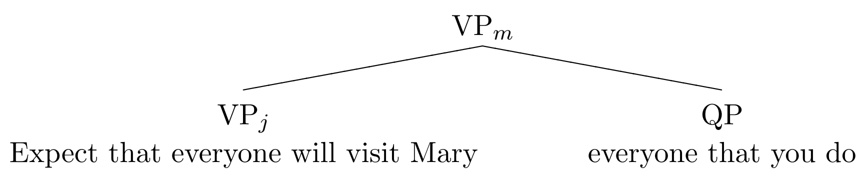
(64) * I expect that everyone that you do will visit Mary

(65) * I expect that will visit Mary everyone that you do

- In our system, these facts are the consequence of:
  - VP movement to the left of the relative clause (ruling out 64)
  - General linearization principles that require the DP to be pronounced VP internally (ruling out 65)

- Our linearization algorithm:
  When merging together two syntactic objects A, B (where A reflexively precedes B) to form a new object C, the order in C must respect the following conditions:
  1. Edge alignment: The right edge of A must precede the right edge of B, and the left edge of A must precede the left edge of B
  2. Conservativity: Orders established within A and B must be preserved
- When the VP moves and re-merges with QP in (63) the following configuration holds:

(66)



(67) Impossible orders within VP_m:

a. * expect that will visit Mary everyone that you do → ruled out by conservativity

b. * expect that everyone that you do will visit Mary → ruled out by edge alignment

F Semantics

F.1 General framework

F.1.1 Preliminaries: terminology for syntax

(68) A syntactic structure is a set of nodes

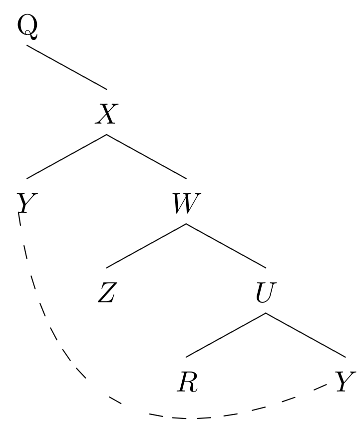
(69) Each node is a 3-tuple of the form <*address,category,[daughter_list]*>

a. *address*: a unique label taken from the set $\{x_1, x_2, x_3, \ldots\}$

b. *category*: a syntactic category

c. *[daughter_list]*: a list of addresses (the addresses of the node's daughters)

(70) Example: (70a) is just a way to visualize (70b)

a. 

b. Nodes: $\{< x_1, R, \emptyset >, < x_2, Y, \emptyset >, < x_3, U, [x_1, x_2] >, < x_4, Z, \emptyset >, < x_5, W, [x_4, x_3] >, < x_6, X, [x_2, x_5] >, < x_7, Q, [x_6] >\}$

(71) We use a reflexive notion of dominance: a node X will be said to *dominate* a node Y iff

a. X is Y, or

b. X has a daughter that dominates Y

(72) Condition on structures: no node is dominated by its daughter

(73) This ensures that all our structures are directed, acyclic graphs

(74) For trees, the notions of dominance and of complete dominance are identical: if two nodes X and Y dominate a node Z then either X dominates Y or Y dominates X

(75) Once multiple dominance is allowed, it becomes possible for X and Y to dominate Z without either of X and Y dominating the other: X and Y both dominate Z but neither *completely dominates* it

(76) We assume a notion of complete dominance argued for in (Bachrach and Katzir, In press):

(77) A node X *completely dominates* a node Y iff

a. X is the only mother of Y

b. X completely dominates every mother of Y

(78) The set of nodes completely dominated by X will be called the *Complete Dominance Domain* of X, written *CDD*(X)

(79) In example (70a) above, which corresponds to the schematic configuration of movement, Y is merged twice: once as a daughter of U and once as a daughter of X

(80) Notice: while X dominates Y, it does not completely dominate it according to (77)

(81) Explanation: X is neither the only mother of Y nor does it completely dominate every mother of Y (since it does not completely dominate itself)

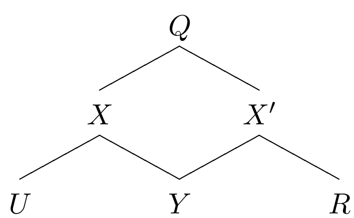
(82) While X does not completely dominate Y, X's mother Q *does* completely dominate Y

(83) Another example: in (86), Y is shared by X and X'. Neither X nor X' is the only mother of Y, and neither of them completely dominates every mother of Y (since neither dominates the other)

(84) Consequently, Y is not completely dominated by either X or X'

(85) As before, while Y is not completely dominated by X (or X'), it is completely dominated at X's mother Q

(86)



F.2 Constructing λ-expressions

(87) Each node $X \in G$ is mapped onto a set of semantic representations, or λ-expressions, that we will denote by $\Sigma(X)$

(88) Note: our concern here is in how these λ-expressions are formed. We will have nothing to say about how these λ-expressions are interpreted within a model

(89) We use sets rather than unique values in order to account for ambiguities, and more importantly because of the way in which our mechanism for variable binding will work

(90) Two kinds of semantic contributions: atomic and compositional

(91) Atomic contributions are of two types: lexical entries (things like $\lambda z.$(**walks** z) or **john**) and variables (things like x_{13})

(92) Lexical entries: $\forall X \in G. [\![\text{X}]\!] \subset \Sigma(X)$

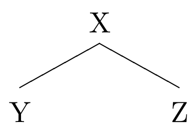
(93) The variable for a node is simply its address: a node like $<x_{13}, NP, [x_9, x_{12}]>$ will contribute the variable x_{13} to the semantic value[3]

(94) Variables: $\forall X \in G.address(X) \in \Sigma(X)$

(95) Compositionality: the part in which the λ-expressions of smaller structures combine to form the λ-expressions of a larger one

(96) Assuming binary branching for convenience, the relevant configurations are of the form:

(97)



(98) The basic mode of combination for two sisters is concatenation: two semantic values, σ and τ, form the pair $(\sigma\ \tau)$

(99) It is convenient to think of such a pair as an input to a rule like *Function Application* (Heim and Kratzer, 1998): σ is a function that takes τ as its argument

(100) More precisely, the pair $(\sigma\ \tau)$ is the potential input to a rule of β-reduction: if σ is of the form $\lambda x.u$ then $(\sigma\ \tau)$ can be simplified to $u[\tau/x]$, the result of substituting τ for each occurrence of x in u.[4]

(101) To simple pair formation (104a) we need to add the counterpart of λ-abstraction

(102) Following Heim and Kratzer (1998), we relate abstraction to syntactic movement, though our version (104b) will be somewhat looser

(103) Specifically,

a. λ-abstraction is optional

(104) Term formation: for all $X, Y, Z \in G$, if X is the mother of Y and Z in G then

a. $\forall \sigma \in \Sigma(Y).\forall \tau \in \Sigma(Z).(\sigma\ \tau) \in \Sigma(X)$

b. If $Y \in Dominance(Z)$, and if $y = address(Y)$, then $\forall \sigma \in \Sigma(Y).\forall \tau \in \Sigma(Z).(\sigma\ \lambda y.\tau) \in \Sigma(X)$

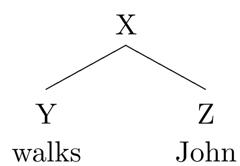
(105) Example:

a. John walks

[3] We use uppercase to denote nodes, and lowercase for addresses/variables. For example, if R is a node, r will be its address.

[4] Assuming that no accidental binding occurs and that the types are compatible.

b.



(106) G contributes two values for each terminal node: a lexical entry and a free variable

(107) a. $\lambda x.(\textbf{walks}\ x) \in \Sigma(Y)$

b. $y \in \Sigma(Y)$

(108) a. $\textbf{john} \in \Sigma(Z)$

b. $z \in \Sigma(Z)$

(109) For the nonterminal X, G contributes only a free variable:

(110) $x \in \Sigma(X)$

(111) Compositionality contributes several values to the meaning of X:

(112) a. $(y\ z) \in \Sigma(X)$

b. $(y\ \textbf{john}) \in \Sigma(X)$

c. $(\lambda x.(\textbf{walks}\ x)\ z) \in \Sigma(X)$

d. ☞ $(\lambda x.(\textbf{walks}\ x)\ \textbf{john}) \in \Sigma(X)$

(113) From this final combination we can obtain the final representation (114) via β-reduction

(114) $(\textbf{walks john}) \in \Sigma(X)$

F.3 The type(s) of quantifiers

(115) Assumption: by default,

a. quantifiers are interpreted *in situ*

b. scope reversal is mediated by verbal semantics

(116) (Scope reversal can still be mediated by movement in certain cases)

(117) Interpretation *in situ* makes use of a type schema for quantifiers: $<< e, \alpha t >, \alpha t >$

(118) Examples:

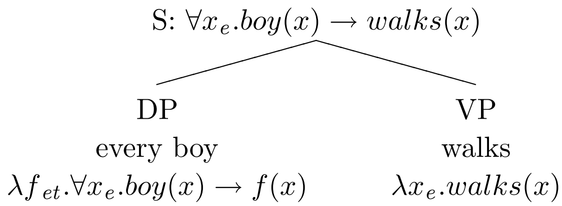
a. $[\![\text{ every boy }]\!] = \lambda f_{<e,\alpha t>}.\lambda h_\alpha.\forall x_e.boy(x) \rightarrow f(x)(h)$

b. $[\![\text{ some boy }]\!] = \lambda f_{<e,\alpha t>}.\lambda h_\alpha.\exists x_e.boy(x) \wedge f(x)(h)$

(119) In subject position:

a. $\alpha = \emptyset$:
$[\![$ every boy $]\!] = \lambda f_{<e,\emptyset t>}.\lambda h_{\emptyset}.\forall x_e.boy(x) \rightarrow f(x)(h) =$
$\lambda f_{et}.\forall x_e.boy(x) \rightarrow f(x)$

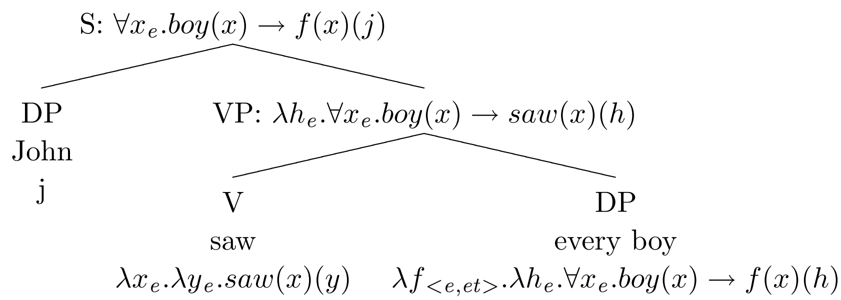
b.



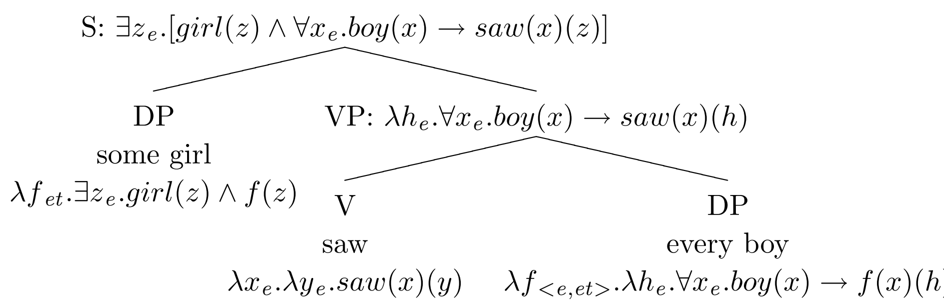
(120) In object position:

a. $\alpha = e$:
$[\![$ every boy $]\!] = \lambda f_{<e,et>}.\lambda h_e.\forall x_e.boy(x) \rightarrow f(x)(h)$

b.



(121) In both subject and object position:



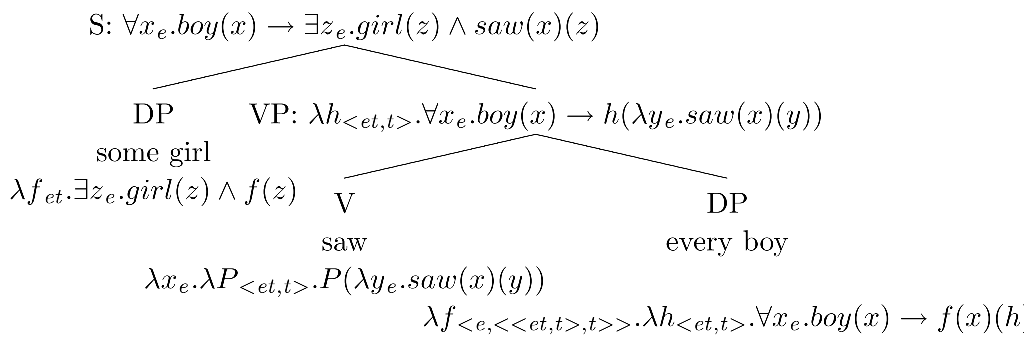
(122) Scope reversal:

a. $[\![\ saw_{<e,et>}\ ]\!] = \lambda x_e.\lambda y_e.saw(x)(y)$

b. $[\![\ saw_{<e,<<et,t>,t>>}\ ]\!] = \lambda x_e.\lambda P_{<et,t>}.P(\lambda y_e.saw(x)(y))$

(123) To combine with $saw_{<e,<<et,t>,t>>}$, the object quantifier is instantiated with $\alpha =< et, t >$:
$[\![$ every boy $]\!] = \lambda f_{<e,<<et,t>,t>>}.\lambda h_{<et,t>}.\forall x_e.boy(x) \rightarrow f(x)(h)$

(124) $\forall \succ \exists$

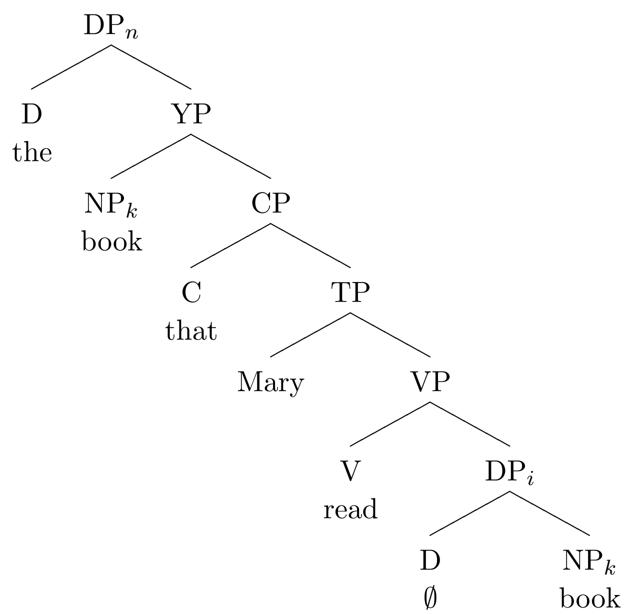


F.4 Relative clauses

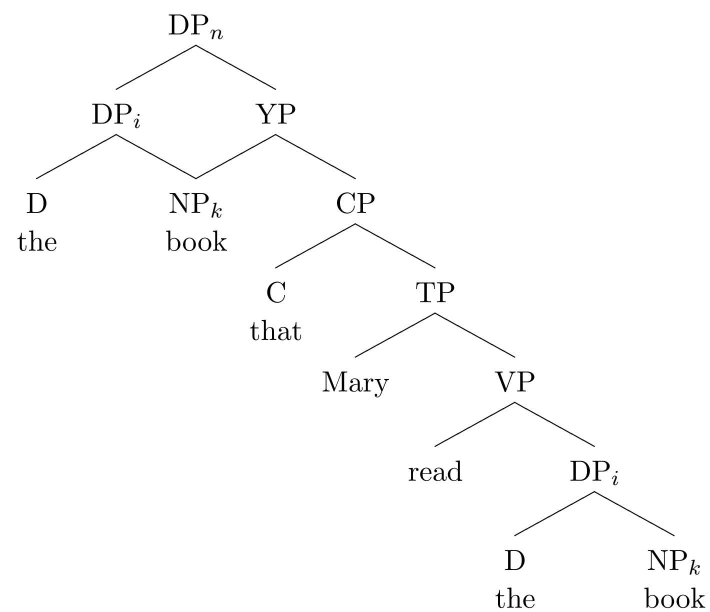
(125) The book that Mary read

(126) Two structures for relative clauses

a. External D (NP-Raising)



b. DP-Raising



(127) In both cases the head NP_k raises alone

(128) In both cases the semantics of YP is of type et

(129) $[\![\ YP \ ]\!] = \lambda x_e.book(x) \wedge read(x)(m)$

(130) In an external D structure, YP combines with D like any other predicate

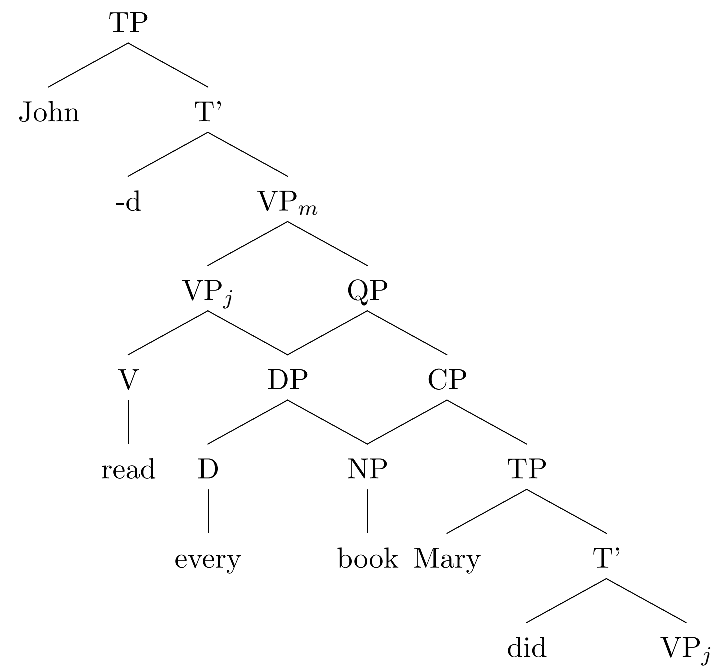
(131) In a DP-raising structure, we assume the following:

a. Since NP_k has moved out of DP_i, it can be abstracted over:
$\lambda f_{et}.the(f) \in [\![\text{ DP}_i \ ]\!]$

b. DP_i can now apply to YP:
$[\lambda f_{et}.the(f)](lambdax_e.book(x) \wedge read(x)(m)) \in [\![\text{ DP}_n \ ]\!]$
$\Rightarrow \ the(\lambda x_e.book(x) \wedge read(x)(m)) \in [\![\text{ DP}_n \ ]\!]$

F.5 ACD

(132)



(133) Some semantic values:

a. $\lambda x_e.book(x) \wedge read(x)(m) \;\in\; [\![\text{ CP }]\!]$

b. $\lambda f_{et}.\lambda h_{<e,et>}.\lambda z_e.\forall x_e.f(x) \rightarrow h(x)(z) \;\in\; [\![\text{ D }]\!]$

c. $\lambda f_{et}.\lambda h_{<e,et>}.\lambda z_e.\forall x_e.f(x) \rightarrow h(x)(z) \;\in\; [\![\text{ DP }]\!]$

d. $\lambda h_{<e,et>}.\lambda z_e.\forall x_e.(book(x) \wedge read(x)(m)) \rightarrow h(x)(z) \;\in\; [\![\text{ QP }]\!]$

e. $\lambda y.read(x_3)(y) \;\in\; [\![\text{ VP}_j\text{ }]\!]$

f. $\lambda x.\lambda y.read(x)(y) \;\in\; [\![\text{ VP}_j\text{ }]\!]$

g. $\lambda z_e.\forall x_e.(book(x) \wedge read(x)(m)) \rightarrow read(x)(z) \;\in\; [\![\text{ VP}_m\text{ }]\!]$

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