Quantification and Grammar

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Chapter 7'

7.1 The problem of quantifiers in object position

- The instances of quantifying DPs we have looked at so far were in subject position.

(1a) [$_{DP}$ every linguist [$_{VP}$ offended John].
(1b) John [$_{VP}$ offended [$_{DP}$ every linguist]].

- (1a) is true just in case the set of linguistics is included in the set of those who offended John. The determiner denotes the relation between two sets. The first set (the restrictor set) is provided by the common noun "'linguist", the second by the VP "offended John".

- But what if "every linguist" occurs in object position as in (1b)? Shouldn't we assume that "every" still denotes a relation between two sets? But then, which two sets? The restrictor set can be the set of linguists again, and the second set should be the set of those who offended John, but this set is not denoted by any constituent.

7.1 The problem of quantifiers in object position (cont)

- The dilemma becomes even more dramatic when we consider sentences with multiple quantifier phrases. (2) is ambiguous and has the two readings in (2'). How can we compute such statements in a compositional way from plausible syntactic structures?

(2) Some publisher offended every linguist.

(2'a) $\{x : x \text{ is a publisher}\} \cap \{x : \{y : y \text{ is a linguist}\} \subseteq \{z : z \text{ offended } z\}\} \neq \emptyset$.

(2'b) $\{x : x \text{ is a linguist}\} \subseteq \{x : \{y : y \text{ is a publisher}\} \cap \{z : z \text{ offended } x\} \neq \emptyset\}$.

7.1 The problem of quantifiers in object position (cont)

- We have a type mismatch: “every linguist” is of type $<<e,t>,t>$ but “offended” is of type $<e,<e,t>>$. These can’t combine by FA.

- Medieval scholars tried to solve the problem of quantifiers in object position, but failed. Frege finally found a solution. Modern linguists take two approaches. We will look at one approach of each type.

- Some follow Frege and assume that sentences are constructed in stages, so that at some stage, the arguments positions of predicates might be occupied by traces or pronouns that are related to quantifier phrases via a syntactic relationship. of movement (Quantifier Lowering, Quantifier Raising, Quantifying in).

- Others avoid displacement and try to interpret quantifiers *in situ* by using Cooper Storage or by manipulating the flexibility of type theory.

7.2 Repairing the type mismatch *in situ*

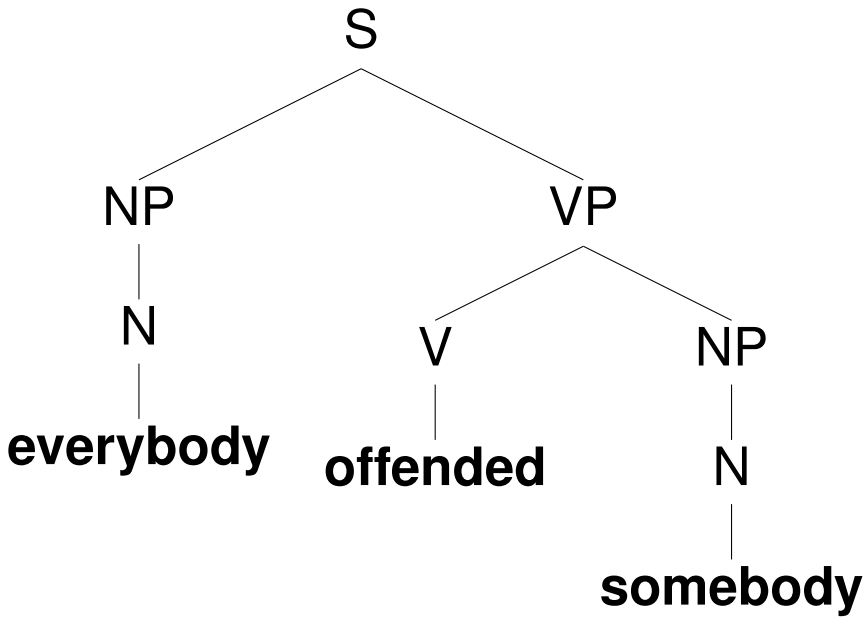
7.2.1 An example of a "flexible types" approach

- We can optionally change the semantic type of the object or the verb. Here we illustrate the former.

- We assume that all quantifier phrases are ambiguous between an $<< e, t >, t >$ and an $<< e, < e, t >>, < e, t >>$ interpretation:

[[**everybody**$_1$]] = λf $\in$ D$_{<e,t>}$. for all persons x $\in$ D, f(x) = 1.
[[**everybody**$_2$]] = λf $\in$ D$_{<e,<e,t>>}$. [λx $\in$ D . for all persons y $\in$ D, f(y)(x) = 1].
[[**somebody**$_1$]] = λf $\in$ D$_{<e,t>}$. there is some person x $\in$ D such that f(x) = 1.
[[**somebody**$_2$]] = λf $\in$ D$_{<e,<e,t>>}$. [λx $\in$ D . there is some person y $\in$ D, such that f(y)(x) = 1].

7.2.1 An example of a “flexible types” approach (cont.)



7.2.1 An example of a “flexible types” approach (cont.)

⟦[$_S$**everybody**$_1$[$_{VP}$**offended somebody**$_2$]]⟧ = 1
iff
⟦**everybody**$_1$⟧ (⟦[$_{VP}$**offended somebody**$_2$]⟧) = 1
iff
for all persons x, ⟦[$_{VP}$**offended somebody**$_2$]⟧(x) = 1
iff
for all persons x, ⟦**somebody**$_2$⟧(⟦**offended**⟧)(x) = 1
iff
for all persons x, there is some person y, such that ⟦**offended**⟧(y)(x) = 1
iff
for all persons x, there is some person y, such that x offended y.

7.2.1 An example of a "flexible types" approach (cont.)

- This proposal implies that all English quantifier phrases are multiply ambiguous.

- As far as the syntax goes, any quantifier phrase with any subscript can occur in any position. If a quantifier appears in the wrong position, its mother node is not interpretable, and the structure is automatically ruled out.

- Quantifying determiners will also be multiply ambiguous. We need them to be of type $< et, << e, et >, et >>$:

(2) $[\![\mathbf{a}_2]\!]$ = λf $\in$ $D_{<e,t>}$. [λg $\in$ $D_{<e,<e,t>>}$. [λx $\in$ D . for some y $\in$ D, f(y) = 1 and g(y)(x) = 1]].

7.2.1 An example of a “flexible types” approach (cont.)

- Since all determiners would be multiply ambiguous in this way, we need a lexical, type-shifting rule to predict the different readings:

(3) For every lexical item δ_1 with a meaning of type $< et, < et, t >>$, there is a (homophonous and syntactically identical) item δ_2 with the following meaning of type $< et, << e, et >, et >>$:

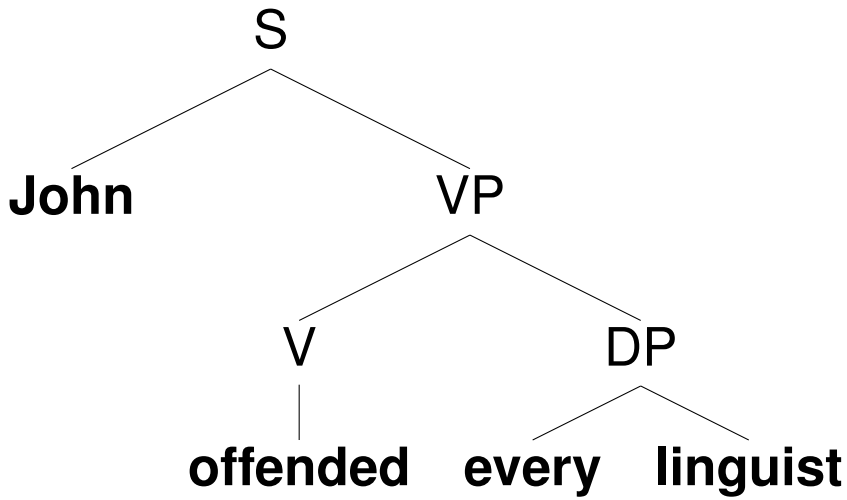
$[\![\delta_2]\!]$ = λf ∈ $D_{<e,t>}$. [λg ∈ $D_{<e,<e,t>>}$. [λx ∈ D . $[\![\delta_1]\!]$(f)(λz ∈ D, g(z)(x))]].

7.3 Repairing the type mismatch by movement

- We will now pursue in more depth an approach which preserves the original assumption that the determiner is unambiguous and can only be combined with two 1-place predicates.

- Since the overt structure in (1) does not contain two such predicates, we need to create a new structure which does, by moving the DP “every linguist”.

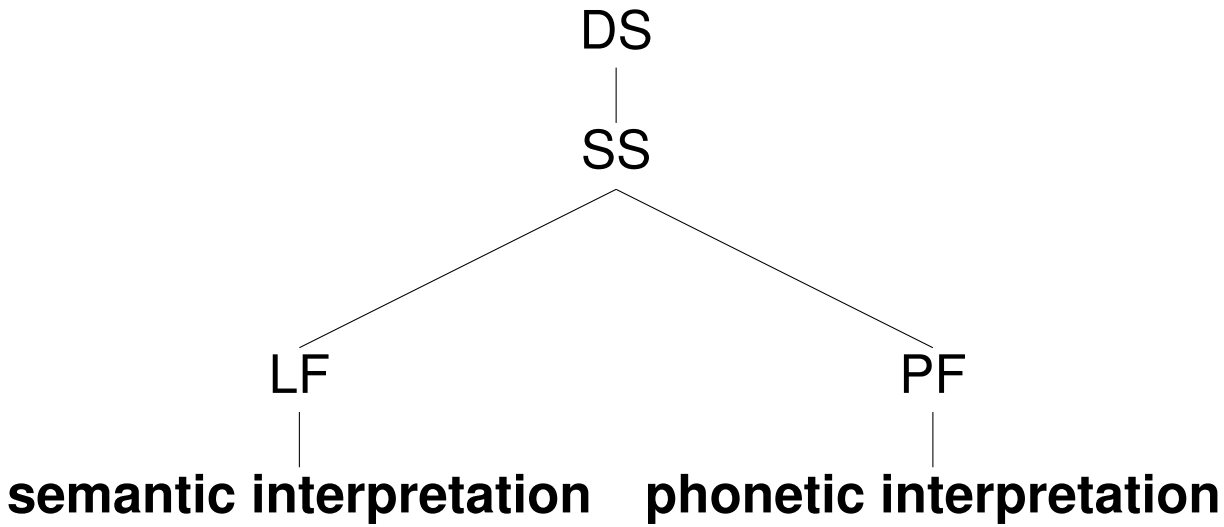
(1)



7.3 Repairing the type mismatch by movement (cont.)

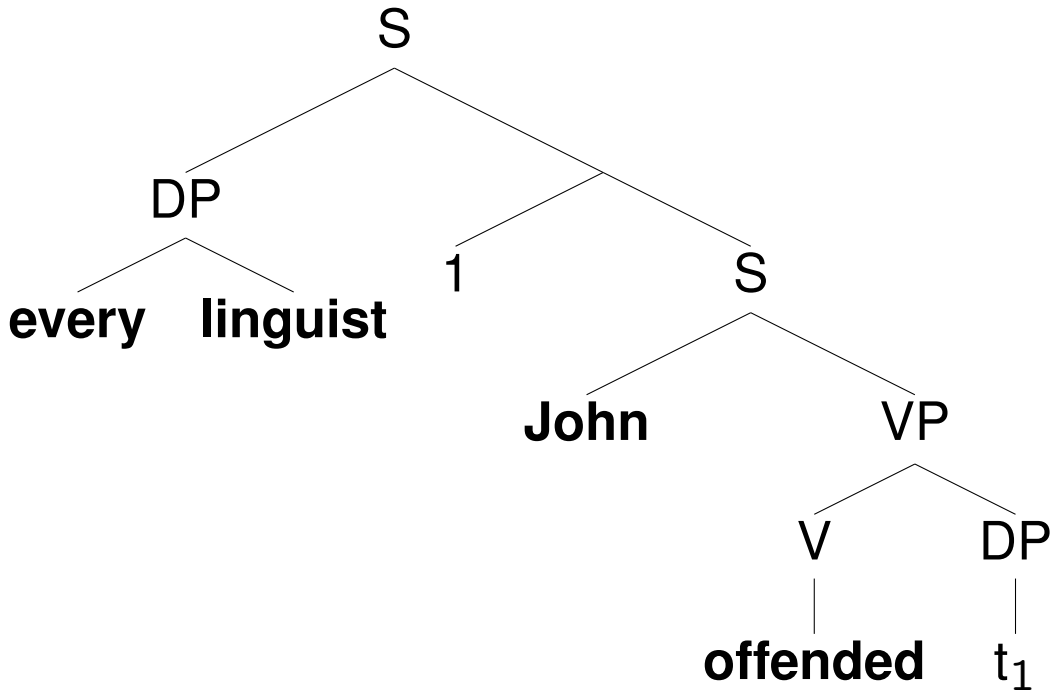
- We assume a model of grammar like the inverted Y model of Government Binding Theory.

- Semantic interpretation applies to representations on a level of logical form (LF), which is transformationally derived from S(urface) Structure (SS) via movement which leaves a trace.



7.3 Repairing the type mismatch by movement (cont.)

(3)



(4) *Predicate Abstraction* (PA)

Let α be a branching node with daughters β and γ, where β dominates only a numerical index i. Then for any variable assignment a, $[\![\alpha]\!]^{a} = \lambda x \in D.\ [\![\gamma]\!]^{a^{x/i}}$.

7.3 Repairing the type mismatch by movement (cont.)

(Bottom S-node):

For any a: ⟦**John offended $\mathbf{t}_1$**⟧ =1 iff John offended a(1).

(Abstract):

λx $\in$ D . John offended x.

(Top S-node):

⟦(3)⟧ = 1 iff for every x such that x is a linguist, John offended x.

- The movement operation effected two crucial changes: it provided the transitive verb with an argument of type e, and the moved quantifier phrase with an argument of type $< e, t >$.

7.5 Choosing between quantifier movement and *in situ* interpretation: three standard arguments

- We have introduced two types of solution to the problem of quantifiers in object position: an *in situ* account using type-shifting, and a movement account using quantifier raising. So far, the choice between them seems to be open.

- But maybe we an find some independent evidence for one approach over the other if we broaden our scope of linguistic phenomena.

- It has been argued that the movement approach has a decided advantage in dealing with three phenomena: scope ambiguity, antecedent-contained deletion, and bound-variable anaphora.

- On the other hand, proponents of the *in situ* approach have developed ever more sophisticated answers to these problems; but it is still instructive to look at the phenomena.

7.5.1 Scope ambiguity and “inverse” scope

- If all quantifiers are interpreted in their surface positions, then a given surface structure with two or more quantifiers in it can receive only only one reading, unless we admit ever more complicated types.

- For example (1) has two readings. It can mean there is somebody who offended everybody, or it can mean that for everybody, there is someone whom s/he offended.

- On the *in situ* approach, we predict only the first reading.

(1) Somebody offended everybody.

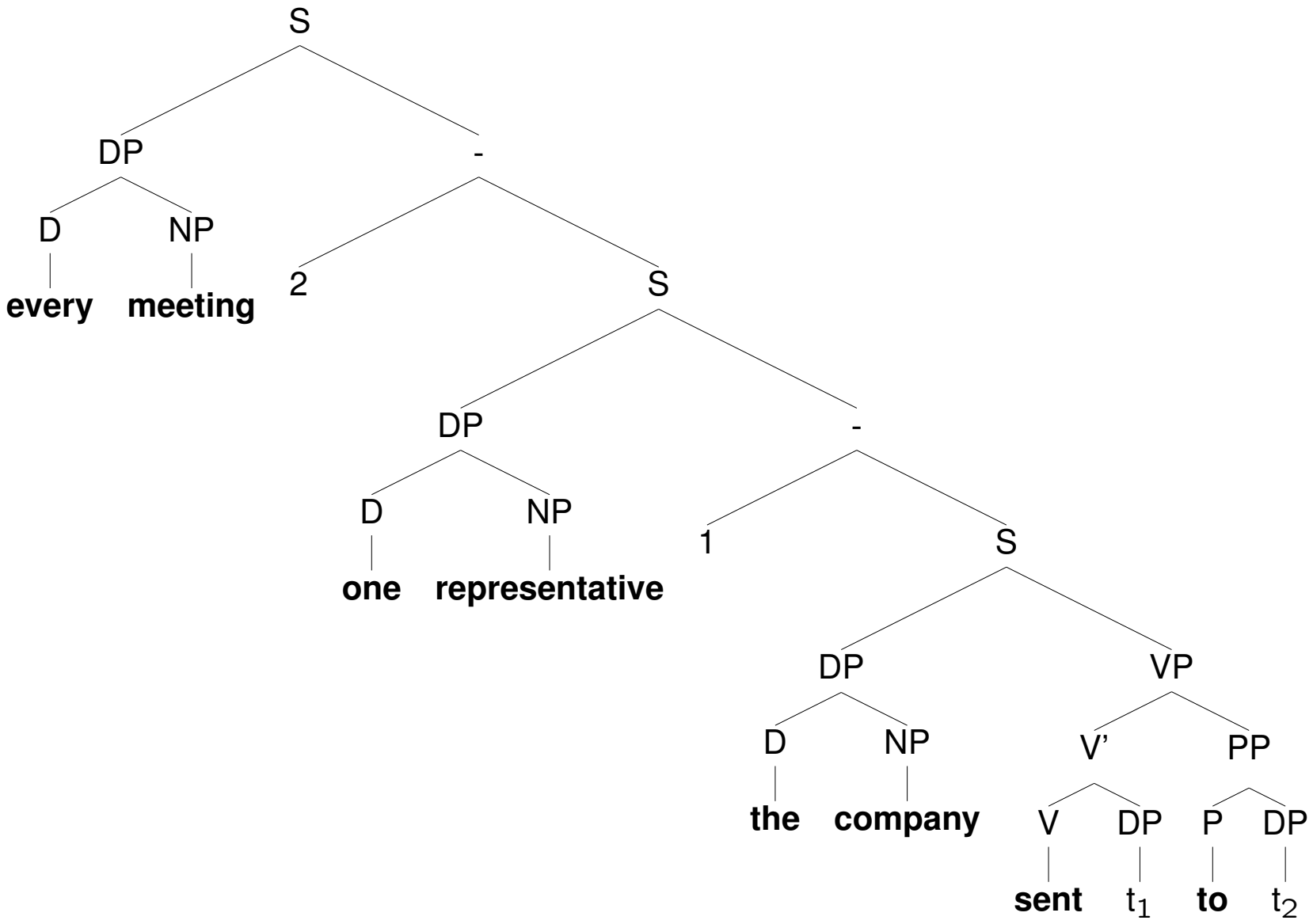
7.5.1 Scope ambiguity and “inverse” scope (cont.)

- Once we move quantifiers, however, it is trivial to derive several distinct and truth-conditionally non-equivalent LFs from a given SS.

- For example, we can derive at least the LFs in (3) and (4) from the SS of sentence (2):

(2) The company sent one representative to every meeting.

(3)


S
DP
-
D
NP
every
meeting
2
S
DP
-
D
NP
one
representative
1
S
DP
VP
D
NP
the
company
V'
PP
V
DP
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sent
t1
to
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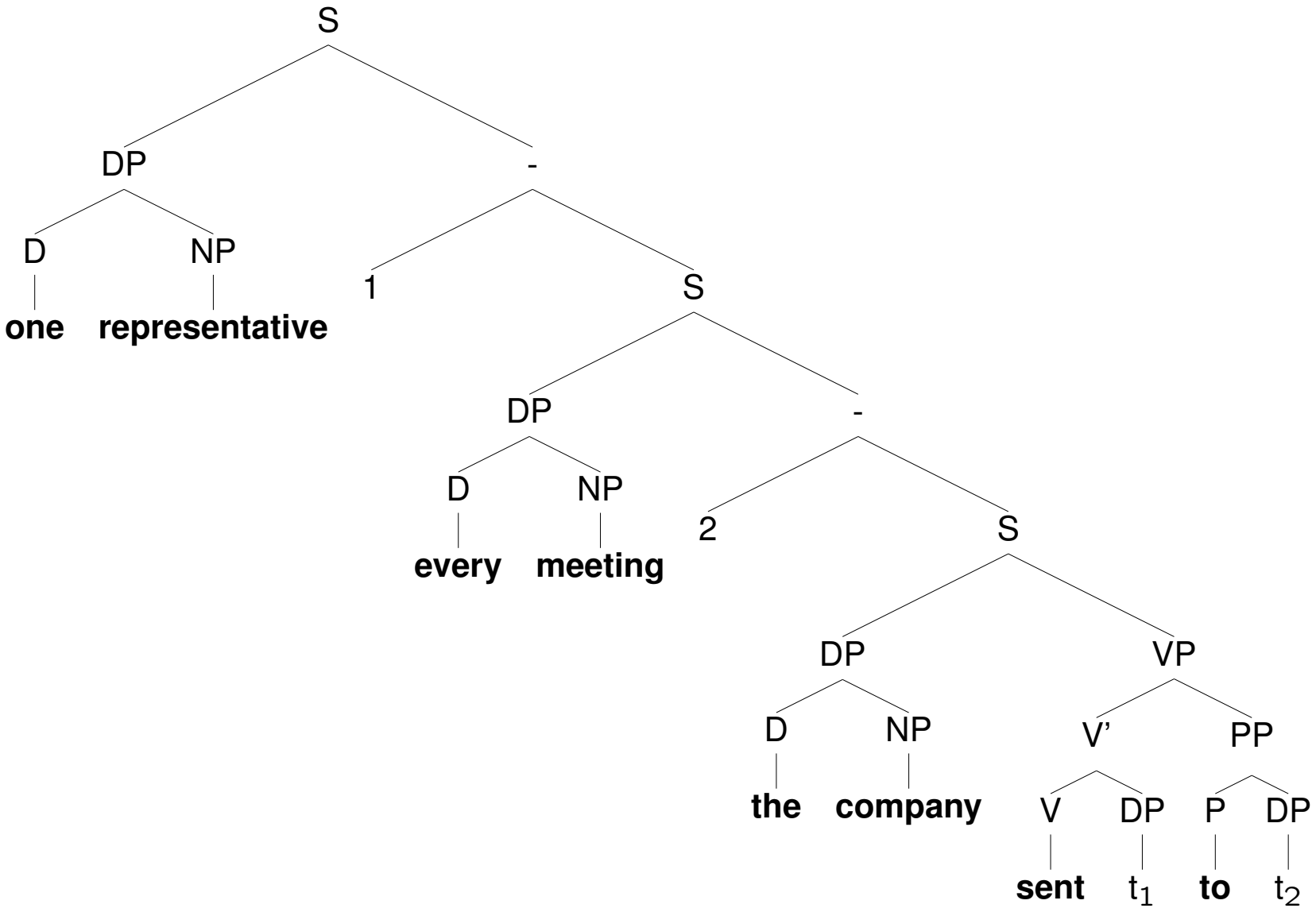
(4)


S
DP
-
D
NP
1
S
one
representative
DP
-
D
NP
2
S
every
meeting
DP
VP
D
NP
V'
PP
the
company
V
DP
P
DP
sent
t1
to
t2

7.5.1 Scope ambiguity and "inverse" scope (cont.)

(5) *Scenario*: There is exactly one company, c.
There are exactly two representatives, r_1 and r_2.
There are exactly three meetings, m_1, m_2, and m_3.
c sent r_1 to m_1, r_2 to both m_2 and m_3, and nobody else to anything else.

(6) *Claim 1*: Given the facts in (5), $[\![(3)]\!] = 1$.
Claim 2: Given the facts in (5), $[\![(4)]\!] = 0$.

- Here is a proof of claim 2.

7.5.1 Scope ambiguity and "inverse" scope (cont.)

(i) Work out the extension of the larger predicate abstract in (4):

Let's abbreviate that predicate by "α":

α := **1[every meeting 2[the company sent t_1 to t_2]]**

Now let x $\in$ D be an arbitrary individual. Then:

$[\![\alpha]\!]$(x) = 1

iff

$[\![$**every meeting 2[the company sent t_1 to t_2]**$]\!]^{\emptyset^{x/1}}$ = 1

iff

$[\![$**every meeting**$]\!]([\![$**2[the company sent t_1 to t_2]**$]\!]^{[1\rightarrow x]})$ = 1

iff

for every y $\in \{m_1, m_2, m_3\}$: $[\![$**2[the company sent t_1 to t_2]**$]\!]^{[1\rightarrow x]}$(y) = 1

iff

for every y $\in \{m_1, m_2, m_3\}$: $[\![$**the company sent t_1 to t_2**$]\!]^{[1\rightarrow x]^{y/2}}$ = 1

iff

for every y $\in \{m_1, m_2, m_3\}$: $[\![$**the company sent t_1 to t_2**$]\!]^{[1\rightarrow x,2\rightarrow y]}$ = 1

iff

for every y $\in \{m_1, m_2, m_3\}$: $[\![$**sent t_1 to t_2**$]\!]^{[1\rightarrow x,2\rightarrow y]}$(c) = 1

iff
for every y $\in \{m_1, m_2, m_3\}$: $[\![\textbf{sent}]\!]([\![\textbf{t}_1]\!]^{[1\rightarrow x,2\rightarrow y]})\ ([\![\textbf{t}_2]\!]^{[1\rightarrow x,2\rightarrow y]})$ (c) = 1
iff
for every y $\in \{m_1, m_2, m_3\}$: c sent $[\![\textbf{t}_1]\!]^{[1\rightarrow x,2\rightarrow y]}$ to $[\![\textbf{t}_2]\!]^{[1\rightarrow x,2\rightarrow y]}$
iff
for every y $\in \{m_1, m_2, m_3\}$: c sent x to y.
iff
c sent x to m_1, m_2, m_3.

According to (5), no individual x satisfies this condition, so we have determined:
for no x $\in$ D : $[\![\alpha]\!]$(x) = 1.

(ii) it follows that there is no x $\in$ D such that $[\![\textbf{representative}]\!]$(x) = 1 and $[\![\alpha]\!]$(x) = 1.
According to the lexical entry of $[\![\textbf{one}]\!]$, this implies that:
$[\![\textbf{one}]\!]([\![\textbf{representative}]\!])([\![\alpha]\!])$ = 0.
But $[\![\textbf{one}]\!]([\![\textbf{representative}]\!])([\![\alpha]\!]) = [\![(4)]\!]$, so we have proved our claim 2.

7.5.2 Antecedent-contained deletion

(8) I read every book that you did.

- Antecedent-Contained VP Deletion as in (8) is an instance of VP deletion, as in (9)-(11).

(9) I read *War and Peace* before you did.
(10) I went to Tanglewood even though I wasn't supposed to.
(11) You may very well put this experience behind you, but you shouldn't think that you really have to.

- Suppose that a VP is deleted in the derivation from SS to PF. This VP is not pronounced but is available for semantic interpretation. This deletion is licensed by a preceding VP that has the same shape.

7.5.2 Antecedent-contained deletion

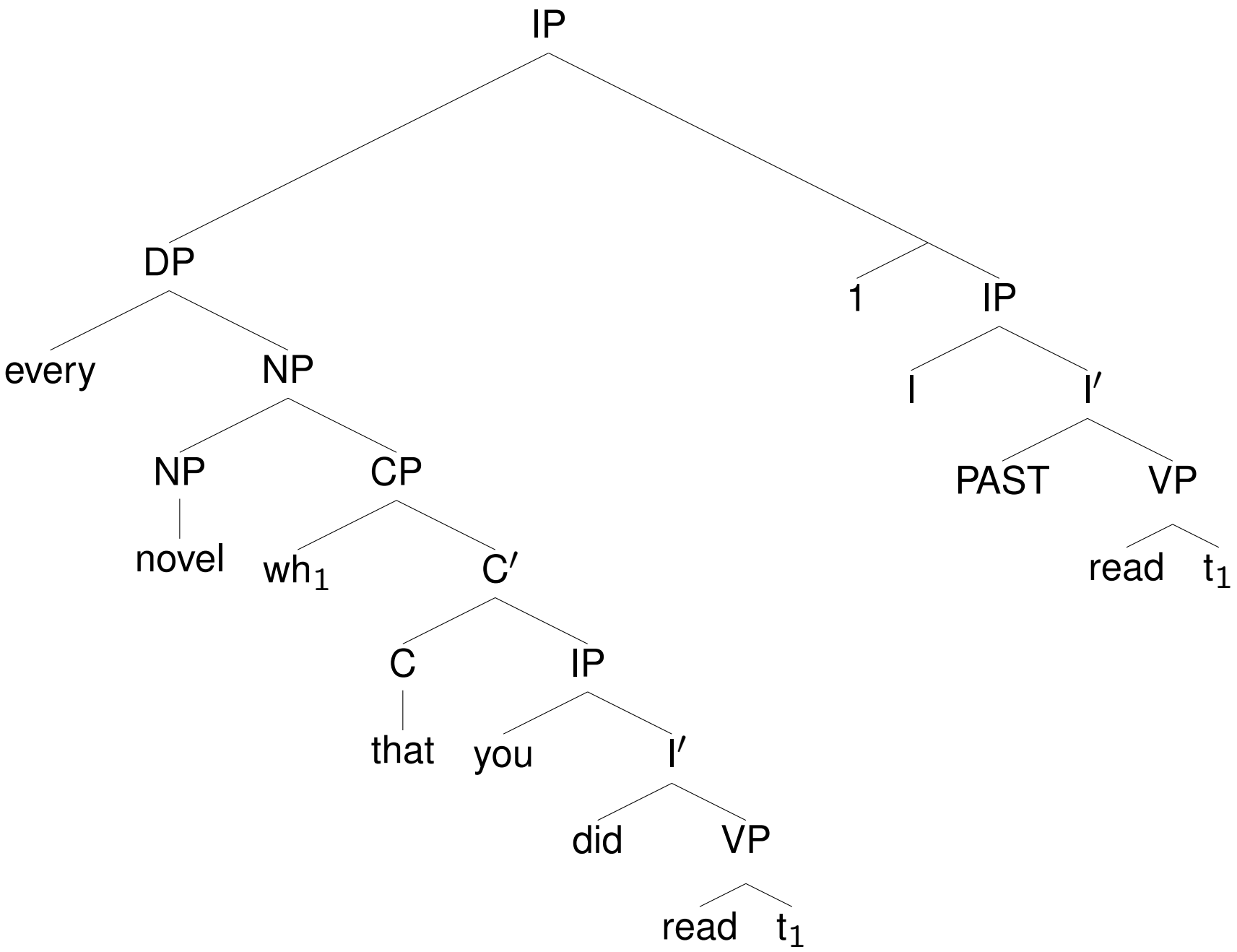
- With sentences (9)-(11), it is easy to see what the licensing VP would be.

- In (8), however, what has to be deleted is the verb **read** and a trace that is bound by the relative pronoun.

- The surface structure of (8) does not seem to provide an antecedent VP that looks the same. If the object quantifier phrase in (8) is allowed to move out however, we obtain the right antecedent VP. The LF for (8) is shown in (8').

- So for Antecedent-Contained VP Deletion we seem to need object movement anyway, so we might as well use the same mechanism to resolve the type mismatch with quantified objects. An additional mechanism of type-shifting is, at best, redundant.

(8’)


IP
DP
1
IP
every
NP
I
I′
NP
CP
PAST
VP
novel
wh1
C′
read
t1
C
IP
that
you
I′
did
VP
read
t1

7.5.3 Quantifiers that bind pronouns

(12) Mary blamed herself.
(13) No woman blamed herself.
(14) Every woman blamed herself.

- Sentences (12)-(14) contain reflexive pronouns, which are necessarily anaphoric. If a pronoun is used anaphorically, its value is determined by its antecedent.

- If the antecedent is a proper name, then a pronoun that is anaphorically related to it might simply inherit the proper name's referent as its semantic value.

7.5.3 Quantifiers that bind pronouns (cont.)

- But what if the antecedent is a quantifier phrase? (13) and (14) are not synonymous with (13') and (14').

- Hence we don't seem to be able to claim that reflexives always inherit the denotation of their antecedent.

(13') No woman blamed no woman.
(14') Every woman blamed every woman.

- Pronouns like **he**, **she**, **it** can also be anaphorically related to quantifier phrases, and again they don't simply inherit the denotations of their antecedents:

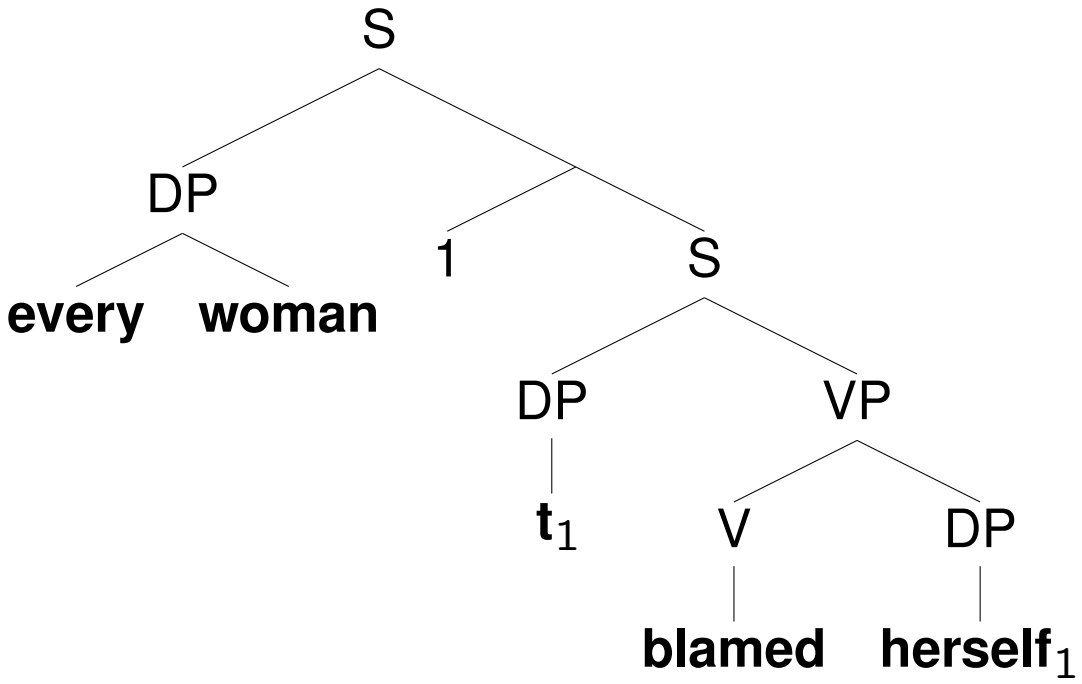
(15) No man noticed the snake next to him.
(16) We showed every woman a newspaper article with a picture of her.

7.5.3 Quantifiers that bind pronouns (cont.)

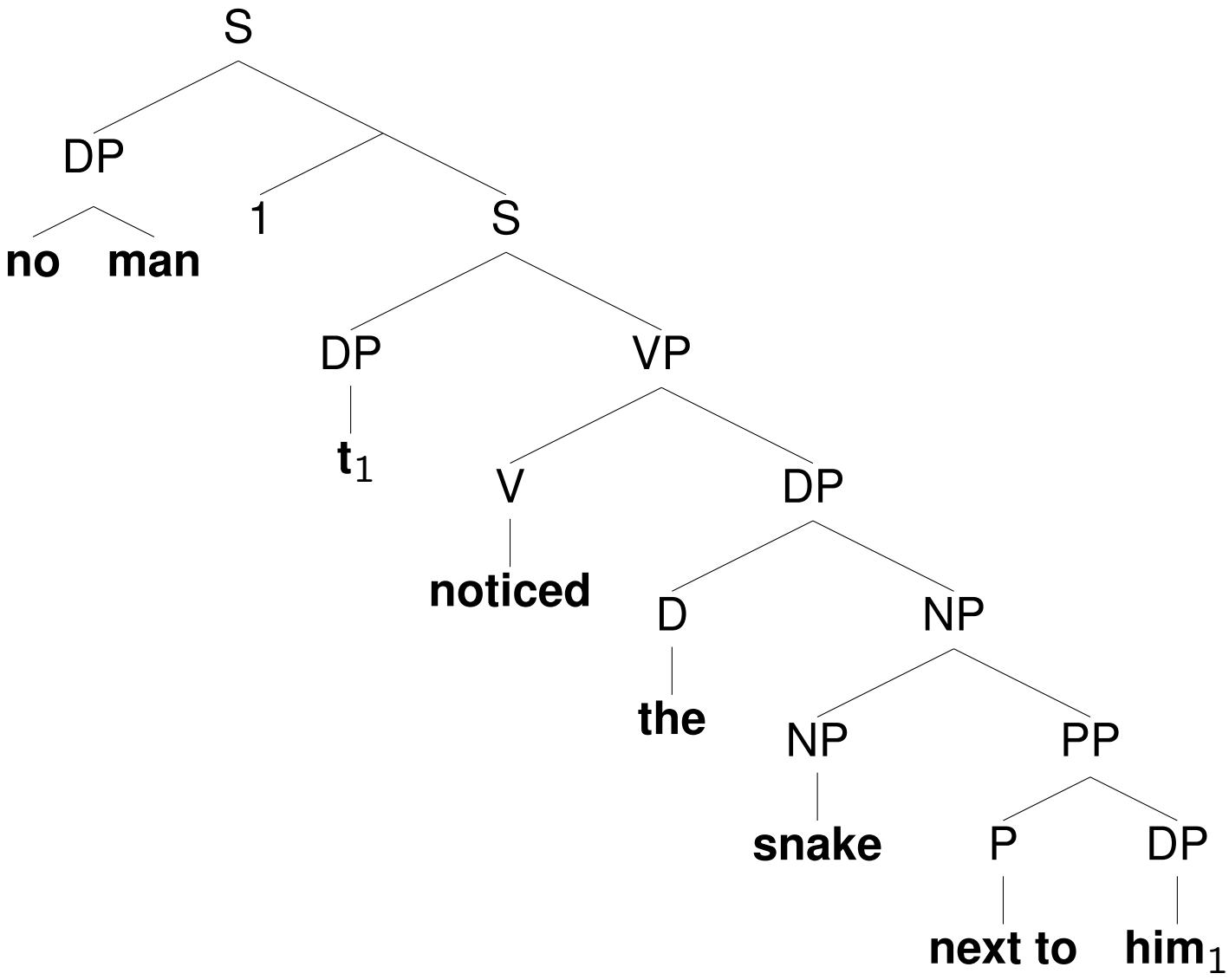
- So how should we interpret theses reflexives and pronouns?
- It seems that they behave as bound variables.
- Can we continue our treatment of bound pronouns from our treatment of them in relative clauses?
- On the quantifier movement approach, the matter is straightforward. Although subject quantifiers are not forced to move in order to avoid a type mismatch, there is no reason why they shouldn't be *allowed* to move.
- Suppose we exercise this option, and also choose to co-index the pronoun with the trace left by the moved quantifier. This leads to the following representations:

7.5.3 Quantifiers that bind pronouns (cont.)

(17)



(18)


S
DP
1
S
no
man
DP
VP
t1
V
DP
noticed
D
NP
the
NP
PP
snake
P
DP
next to
him1

7.5.3 Quantifiers that bind pronouns (cont.)

- The rules for interpreting these structures are already in place.
- Look up, in particular, the Traces and Pronouns rule. “Pronoun” can apply to reflexives as well as ordinary pronouns.
- On a pure *in situ* approach to quantifiers, it is less obvious how to derive the appropriate meanings.
- See text for one *in situ* approach. It requires a new composition rule, which is costly.
- The movement approach to quantifiers seems superior.