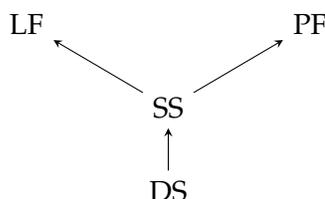


## Variables and Quantifier Raising

### 1. Transformations in grammar

- The Government and Binding theory (Chomsky 1973) assumes four levels of representations, forming a “Y-structure”.



- *Deep Structure* (DS): Where the derivation begins.
  - *Surface Structure* (SS): Where the word order matches what we see.
  - *Phonological Form* (PF): Where the words are realized as sounds.
  - *Logical Form* (LF): The input to semantic interpretation.
- Overt movement (e.g., overt *wh*-movement) takes place at the transformation from DS to SS; covert movement (e.g., quantifier raising) takes place at the transformation from SS to LF.

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| <p>(1) <i>Wh</i>-movement</p> <p>a. <i>Deep structure</i><br/>I know [Mary saw whom].</p> <p>b. <i>Surface structure</i><br/>I know [whom<sub>i</sub> Mary saw t<sub>i</sub>].</p> | <p>(2) Quantifier raising</p> <p>a. <i>Surface structure</i><br/>I didn't see someone.</p> <p>b. <i>Surface structure</i><br/>Someone<sub>i</sub> [I didn't see t<sub>i</sub>].</p> |
|--|---|

- Ellipsis takes place at the transformation from SS to PF:

- |  |   |
|--|---|
| <p>(3) a. Andy invited Mary, but Jenny didn't invite Mary.</p> <p>b. Andy invited Mary, but Jenny didn't <del>invite Mary</del>.</p> | <p><i>Surface structure</i></p> <p><i>Phonological form</i></p> |
|--|---|

### 2. Overt phrasal movement

#### 2.1. Relative clauses again

- Recall: Relative clauses are one-place predicates (of type  $\langle e, t \rangle$ ). The formation of a relative clause involves overt *wh*-movement.

- (4) Jenny invited [<sub>Rel</sub> whom<sub>i</sub> Mary likes t<sub>i</sub>].

In Homework 5, we explored ways to define the *wh*-word and combine the *wh*-word with its sister node. But, how is this sister node, a one-place predicate, derived compositionally? Two new rules help to interpret the *wh*-trace and create a predicate that *whom* can combine with:

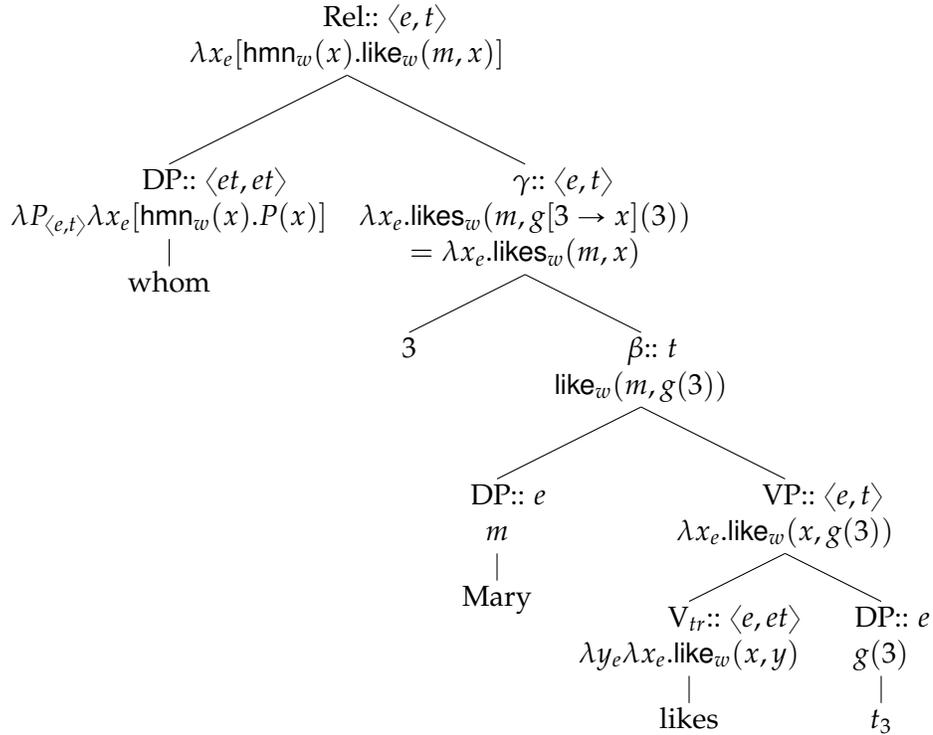
- (5) **Trace Rule**  
If  $\alpha$  is a trace,  $g$  is a variable assignment and  $i \in \text{DOM}(g)$ , then  $[[\alpha_i]]^{w,g} = g(i)$ .

(6) **Predicate Abstraction**

For a branching node  $[\gamma n \beta]$  where  $n$  is an index,  $\llbracket \gamma \rrbracket^{w,g} = \lambda x. \llbracket \beta \rrbracket^{w,g[x \rightarrow x]}$ .

- Composing a relative clause

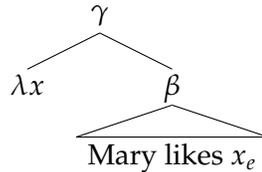
(7)



NB: Predicate Abstraction returns a predicate independent from the assignment function  $g$  and choice of the trace index:

$$(8) \quad \llbracket \gamma \rrbracket^{w,g} = \lambda x_e. \text{likes}_w(m, g[3 \rightarrow x])(3) \\ = \lambda x_e. \text{likes}_w(m, x)$$

For convenience, we commonly write the node  $\gamma$  as follows:



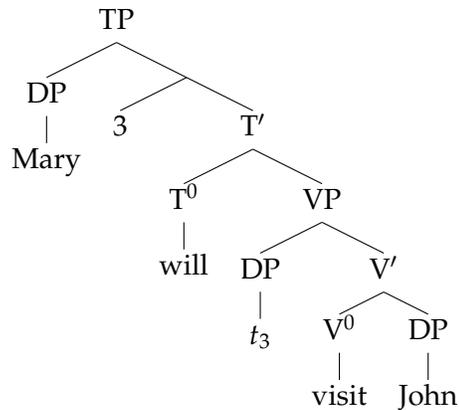
Here the abstraction operator ' $\lambda x$ ' corresponds to the trace index '3' in (7). Note that it is part of the object language, not a meta-language notation:

$$(9) \quad \left[ \left[ \begin{array}{c} \gamma \\ \lambda x \quad \beta \end{array} \right] \right]^{w,g} = \lambda u. \llbracket \beta \rrbracket^{w,g[x \rightarrow u]}$$

## 2.2. Subject movement

- Assuming VP-internal subject hypothesis (that the subject of a sentence is generated in the specifier of VP and is moved to the specifier of TP), we can capture the seeming SS/LF mismatch.

(10) Mary will visit John.



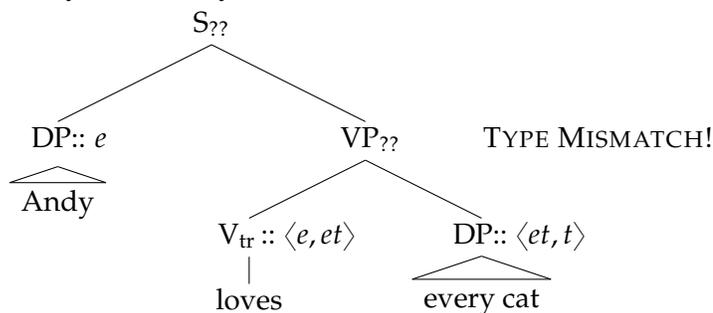
Exercise: Draw a tree diagram isomorphic to the surface structure of (11) and then compose it.

(11) Mary is not from China.

## 3. Quantifier raising

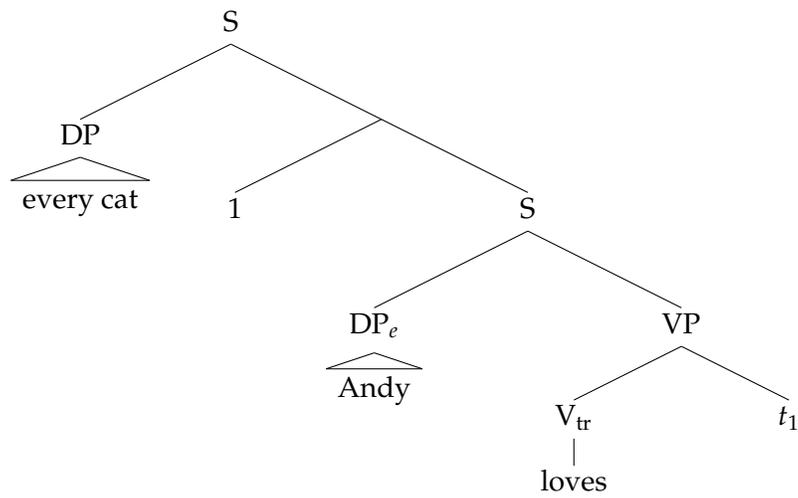
- Puzzle:** A **type-mismatch** arises when a generalized quantifier appears at a non-subject position.

(12) Andy loves every cat.



- This problem can be resolved by a covert LF movement of the generalized quantifier, called **Quantifier Raising (QR)**. In syntax, the generalized quantifier *every cat* is moved to the left edge of the sentence, leaving a trace. In semantics, we interpret this trace as a variable of a matching type (type *e* here), and then abstract over this trace and create a predicate via Predicate Abstraction.

(13)



- **Exercise:** Compose the meaning of (13) using Trace Rule and Predicate Abstraction.
- **If a generalized quantifier occurs at a subject position, does it move at all?**

The modern syntactic theory says "Yes". But this movement is not driven by type-mismatch, but by syntactic reasons. It occurs at the transformation from DS to SS.