Syntactic Theory

Long Distance Dependencies in HPSG

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Long Distance Dependencies

- Long Distance Dependencies are also called *unbounded dependency constructions* in HPSG literature
- *Strong* UDCs, or *filler-gap* constructions: an overt constituent in a nonargument position that can be thought of as strongly associated with (or filling) the gap or trace
- *Weak* UDCs: no overt filler in a nonargument position; a constituent in an argument position that is interpreted as co-referential with the trace

Examples of Unbounded Dependency Constructions

- *Strong* UDCs

  (1) Kim$_1$, Sandy loves _$_1$. (topicalization)

  (2) I wonder [who$_1$ Sandy loves _$_1$]. (wh-question)

  (3) This is the politician [who$_1$ Sandy loves _$_1$]. (wh-relative clause)

  (4) It's Kim [who$_1$ Sandy loves _$_1$]. (it-cleft)

  (5) [What$_1$ Kim loves _$_1$] is Sandy. (pseudocleft)

- *Weak* UDCs

  (6) I bought it$_1$ for Sandy to eat _$_1$. (purpose infinitive)

  (7) Sandy$_1$ is hard to love _$_1$. (tough construction)

  (8) This is the politician$_1$ [Sandy loves _$_1$]. (relative clause)

  (9) It's Kim$_1$ [Sandy loves _$_1$]. (it-cleft)

Filler-Gap Constructions

- *nonlocal* has two features: INHERITED and TO-BIND, both have feature SLASH and a set *local* as their values
- For the analysis of strong UDCs, the following lexical entry is assumed for the trace

$$\textit{word}\left[\begin{array}{ll}\text{PHON} & \langle\rangle \\ \text{SYNSEM} & \left[\begin{array}{ll}\text{LOCAL} & \boxed{1} \\ \text{NONLOCAL} & \left[\begin{array}{ll}\text{INHER}\,|\,\text{SLASH} & \{\boxed{1}\} \\ \text{TO-BIND}\,|\,\text{SLASH} & \{\}\end{array}\right]\end{array}\right]\end{array}\right]$$

- The contents of the INHER|SLASH set are passed up the tree via the NONLOCAL feature principle (to be introduced)

NONLOCAL Feature Principle

NONLOCAL feature principle

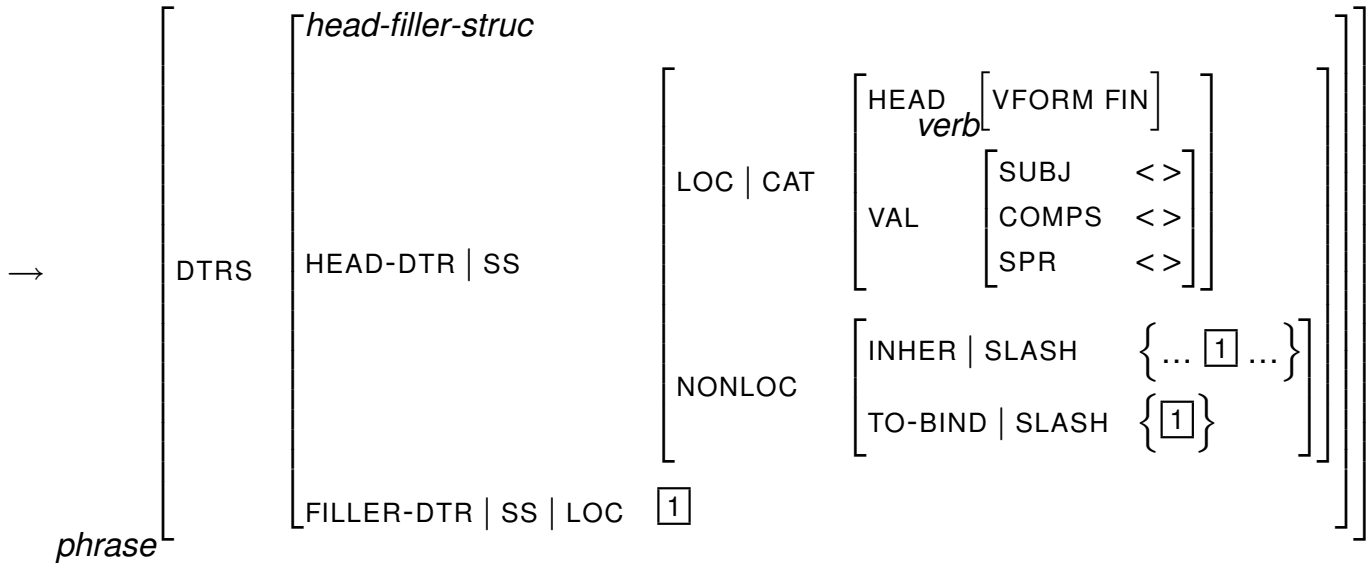
In a headed phrase, for each nonlocal feature F $\in$ {SLASH, QUE, REL}, the value of SYNSEM|NONLOCAL|INHERITED|F is the set difference of the union of the values on all the daughters and the value of SYNSEM|NONLOCAL|TO-BIND|F on the HEAD-DTR

$$ph\left[\text{DTRS}\quad \text{head-struc}\right] \rightarrow \left[\begin{array}{ll} \text{SS}\,|\,\text{NONLOC}\,|\,\text{INHERITED}\,|\,\text{F} & \boxed{1} \cup \boxed{2} - \boxed{3} \\ \text{DTRS} & \left[\begin{array}{ll} \text{HEAD-DTR}\,|\,\text{SS}\,|\,\text{NONLOC} & \left[\begin{array}{ll} \text{INHERITED}\,|\,\text{F} & \boxed{1} \\ \text{TO-BIND}\,|\,\text{F} & \boxed{3} \end{array}\right] \\ \text{NONHEAD-DTR}\,|\,\text{SS}\,|\,\text{NONLOC}\,|\,\text{INHERITED}\,|\,\text{F} & \boxed{2} \end{array}\right] \end{array}\right]$$

- In this lecture we are only focusing on the SLASH feature

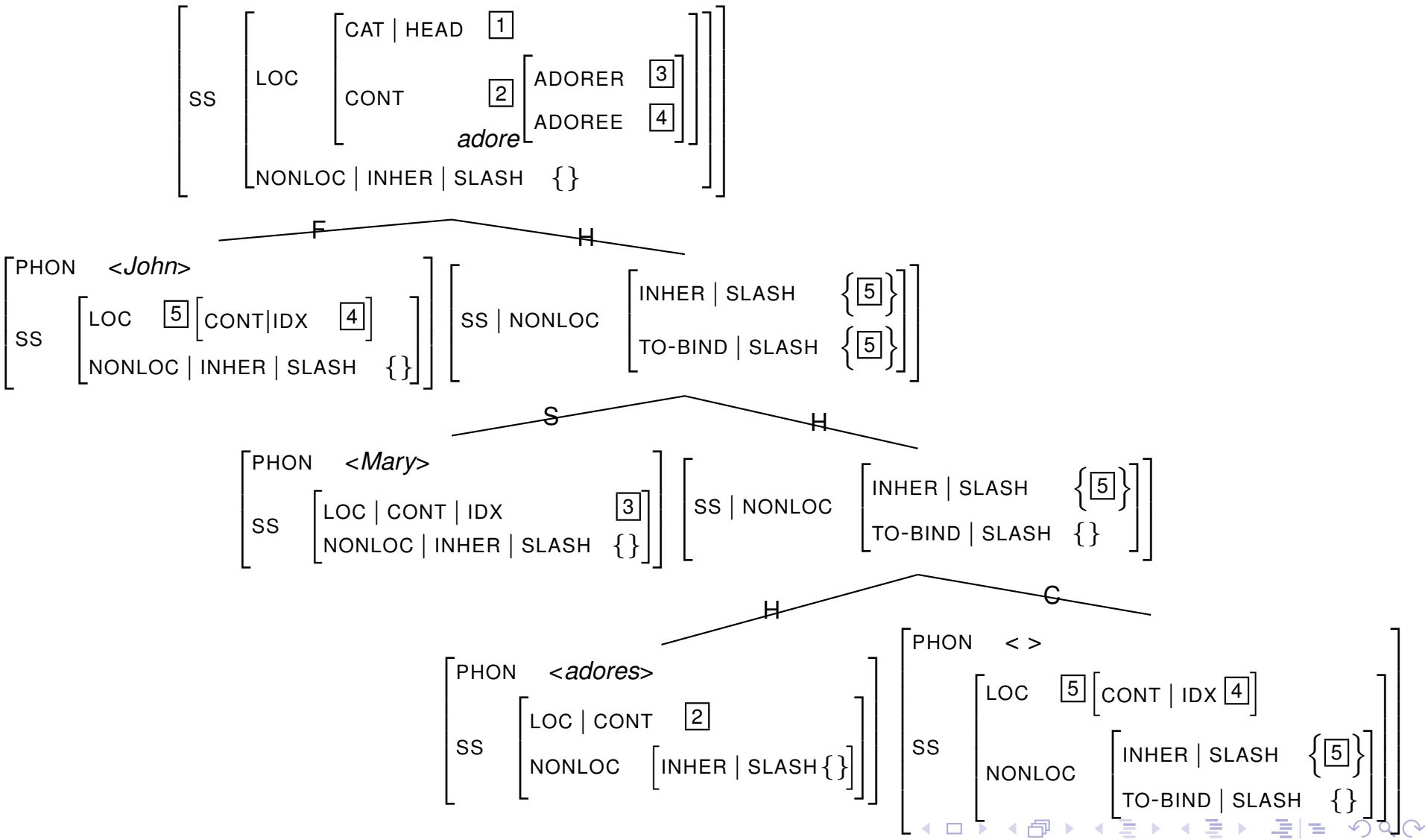
Head-Filler Schema

To fill the gap with the constituent in nonargument location (filler), an extra ID schema is needed



- The LOCAL value of the trace will be token identical to the LOCAL value of the filler
- The TO-BIND|SLASH value of the head daughter is freely instantiated

An Example of Filler-Gap Construction



Some Remarks on Trace-based Analysis

- Traces are introduced as place-holders to the dislocated constituent
- The trace puts its LOCAL value in INHER|SLASH, which will be later bound to the LOCAL value of the filler
- Notice that as a subpart of the filler's LOCAL value, syntactic and semantic constraints are satisfied via unification
- The use of empty categories (e.g. signs corresponding to empty strings in the sentences) is controversial

Traceless Extraction

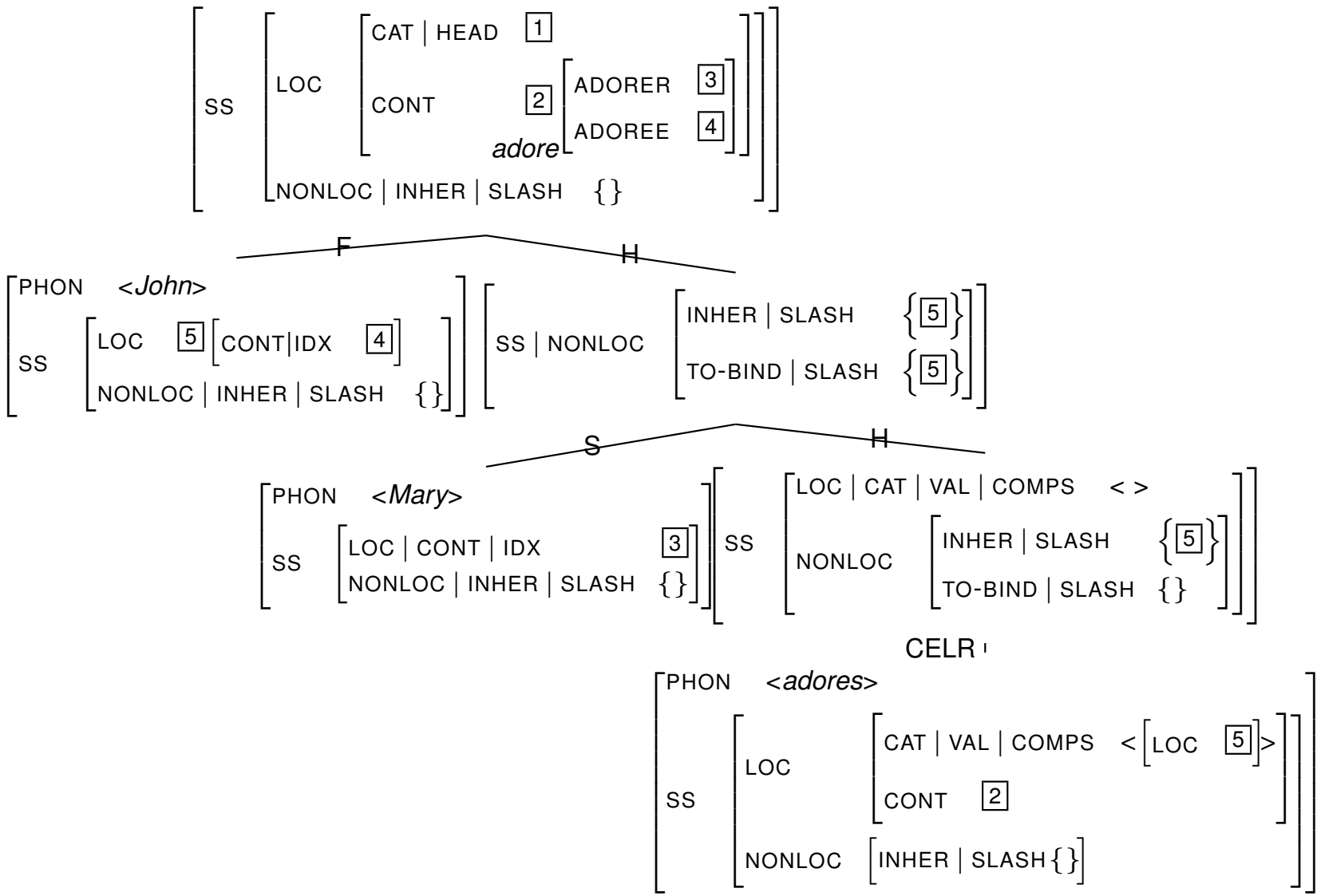
Instead of relying on an empty lexical item (trace), we can assume that the heads are SLASHed via lexical rules

Complement Extraction Lexical Rule (CELR)

$$\left[\text{SS}\ \left[\begin{array}{ll}\text{LOC} \mid \text{CAT} \mid \text{VAL} \mid \text{COMPS} & <\ldots\left[\text{LOC}\ \boxed{1}\right]\ldots> \\ \text{NONLOC} \mid \text{INHER} \mid \text{SLASH} & \boxed{2}\ \text{set(local)}\end{array}\right]\right] \mapsto \left[\text{SS}\ \left[\begin{array}{ll}\text{LOC} \mid \text{CAT} \mid \text{VAL} \mid \text{COMPS} & <\ldots> \\ \text{NONLOC} \mid \text{INHER} \mid \text{SLASH} & \boxed{2} \cup \left\{\boxed{1}\right\}\end{array}\right]\right]$$

A synsem is removed from the head's COMPS list, and its local value is added to the head's INHER|SLASH

Traceless Extraction (Example)



Subject Extraction

- The CELR only allows extraction from complement positions
- What about the following sentences?

  (10) Who adores John?

  (11) Who$_1$ does Kim think _$_1$ adores John?

- The first sentence can be just treated as ordinary head-subject structures (no evidence of wh-movement, no auxiliary insertion)
- The second sentence contains an unbounded dependency, and needs a lexical rule allowing subject extraction

Subject Extraction (Cont.)

Subject Extraction Lexical Rule (SELR)

$$\left[\text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{VAL} \mid \text{COMPS} \quad <\ldots\left[\text{LOC} \mid \text{CAT} \quad \begin{bmatrix}\text{VAL} \mid \text{SUBJ} & <> \\ \text{MARKING} & \text{unmarked}\end{bmatrix}\right]\ldots>\right] \mapsto$$

$$\left[\text{SS} \quad \begin{bmatrix}\text{LOC} \mid \text{CAT} \mid \text{VAL} \mid \text{COMPS} & <\ldots\left[\text{LOC} \mid \text{CAT} \mid \text{VAL} \mid \text{SUBJ} \quad <\left[\text{LOC} \quad \boxed{1}\right]>\right]\ldots> \\ \text{NONLOC} \mid \text{INHER} \mid \text{SLASH} & \{\boxed{1}\}\end{bmatrix}\right]$$

- SELR allows subject extraction, but only out of unmarked embedded clauses (Fixed Subject Condition (Bresnan 1972)), disallowing the following sentence

  (12) * Who$_1$ does Kim think that _$_1$ adores John?

- Note that SELR applies to the matrix verb (“think” in the given example)

Subject Extraction Example

The sign for “think” before and after the application of SELR are sketched here

$$\begin{bmatrix} \text{PHON} & \langle \text{think} \rangle \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \text{NP} \rangle \\ \text{COMPS} & \langle \text{S[unmarked]} \rangle \end{bmatrix} \end{bmatrix} \mapsto$$

$$\begin{bmatrix} \text{PHON} & \langle \text{think} \rangle \\ \text{SS} & \begin{bmatrix} \text{LOC} \mid \text{CAT} \mid \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \text{NP} \rangle \\ \text{COMPS} & \langle \text{VP} \begin{bmatrix} \ldots \mid \text{SUBJ} & \langle \begin{bmatrix} \text{LOC} & \boxed{1} \end{bmatrix} \rangle \end{bmatrix} \rangle \end{bmatrix} \\ \text{NONLOC} \mid \text{INHER} \mid \text{SLASH} & \{ \boxed{1} \} \end{bmatrix} \end{bmatrix}$$

Try to work out the complete analysis using SELR by yourself!

Adjunct Extraction

- Extraction of adjuncts is subject to complicated semantic and pragmatic restrictions, but grammatical examples do seem to exist:

  (13) Kim thinks Mary has adored John for 10 years.

  (14) [For how many years]$_1$ does Kim think Mary has adored John $\__1$?

Adjunct Extraction Lexical Rule (AELR)

$$\left[\text{SS} \mid \text{LOC} \left[\begin{array}{l}\text{CAT} \mid \text{VAL} \mid \text{COMPS} \quad \langle \ldots \boxed{1} \text{S}\left[\text{SS} \mid \text{LOC} \mid \text{CONT} \quad \boxed{2}\right] \ldots \rangle \\ \text{CONT} \mid \text{SOA-ARG} \quad \boxed{2}\end{array}\right]\right] \mapsto$$

$$\left[\text{SS} \left[\begin{array}{l}\text{LOC} \mid \text{CONT} \mid \text{SOA-ARG} \quad \boxed{3} \\ \text{NONLOC} \mid \text{INHER} \mid \text{SLASH} \quad \left\{\left[\begin{array}{l}\ldots \mid \text{MOD} \quad \boxed{1} \\ \ldots \mid \text{CONT} \quad \boxed{3}\end{array}\right]\right\}\end{array}\right]\right]$$

- Again, AELR applies on the matrix verb (“think”)

Tough Constructions

The following examples illustrate another type of UDC:

(15) Sandy$_1$ is impossible (for anyone) to fool _$_1$.

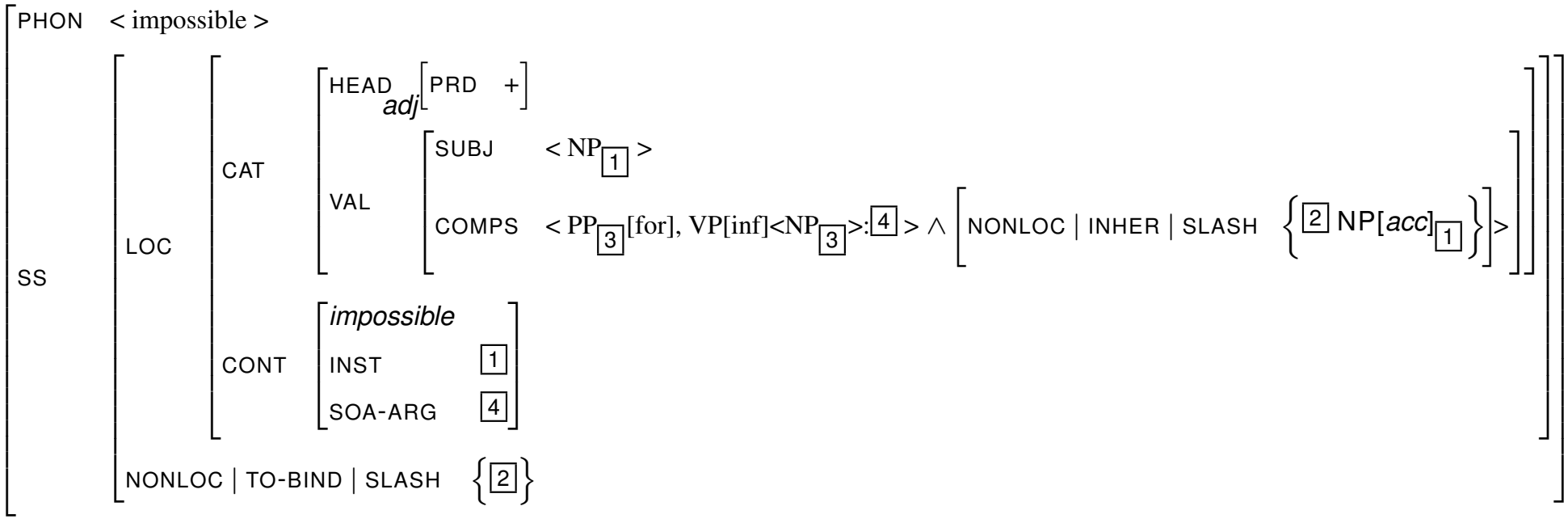
(16) Sandy$_1$ is impossible to imagine people succeeding in fooling _$_1$.

These cases differ from the UDCs we have seen so far in two ways:

- There is no (syntactic) filler. The gaps in both sentences are coindexed with Sandy, but Sandy is the subject of “is”, and receives a semantic role for “impossible”.
- *Tough* constructions are licensed by a particular class of lexical items
  - adjectives like *tough*, *easy*, *nice*
  - nouns like *(a) pleasure*, *(a) bother*
  - verbs like *cost*, *take*

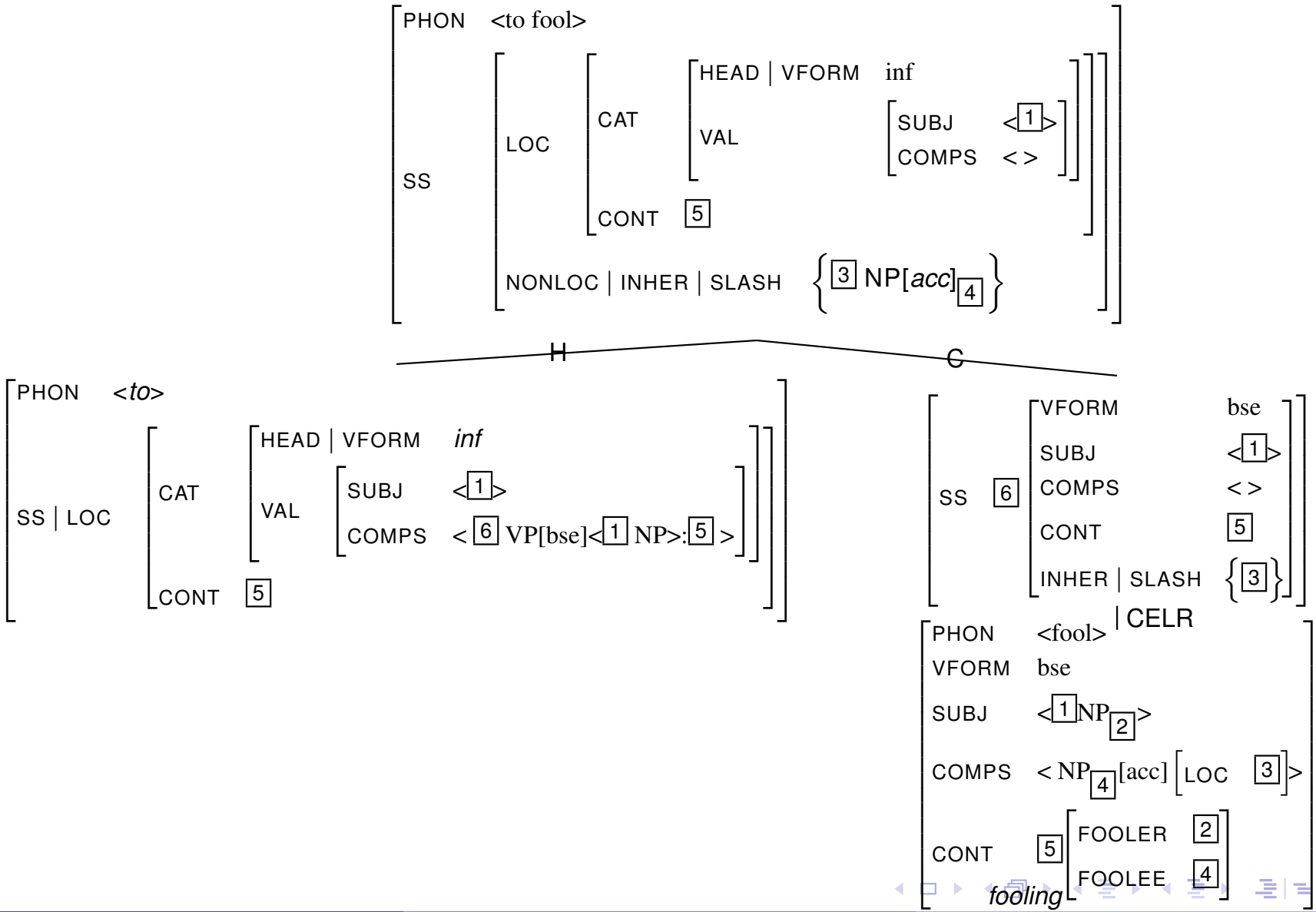
Tough Constructions (Cont.)

The words involved in TOUGH constructions are assumed to subcategorize for SLASHed infinitival VP complements:

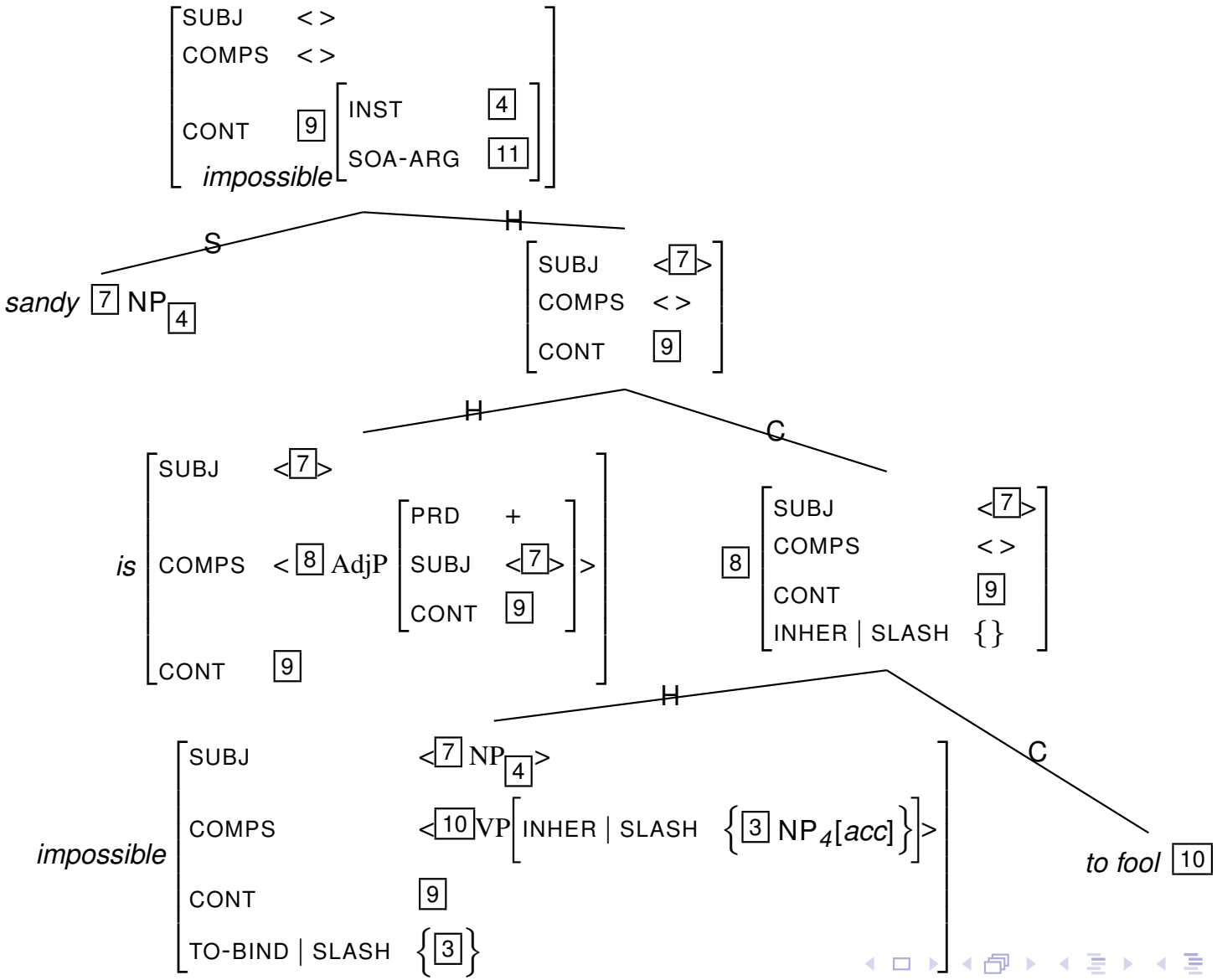


! Note the slight notational inconsistency here: SLASH take a set of *local* values instead of *synsems*

Tough Constructions (Cont.)



Tough Constructions (Cont.)



References I

Pollard, C. J. and Sag, I. A. (1994).
Head-Driven Phrase Structure Grammar.
University of Chicago Press, Chicago, USA.