

Ling 566

Oct 17, 2017

How the Grammar Works

Overview

- What we're trying to do
- The pieces of our grammar
- Two extended examples
- Reflection on what we've done, what we still have to do
- Reading questions

What We're Trying To Do

- Objectives
 - Develop a theory of knowledge of language
 - Represent linguistic information explicitly enough to distinguish well-formed from ill-formed expressions
 - Be parsimonious, capturing linguistically significant generalizations.
- Why Formalize?
 - To formulate testable predictions
 - To check for consistency
 - To make it possible to get a computer to do it for us

How We Construct Sentences

- The Components of Our Grammar
 - Grammar rules
 - Lexical entries
 - Principles
 - Type hierarchy (very preliminary, so far)
 - Initial symbol (S, for now)
- We combine constraints from these components.
 - Q: What says we have to combine them?

An Example

A cat slept.

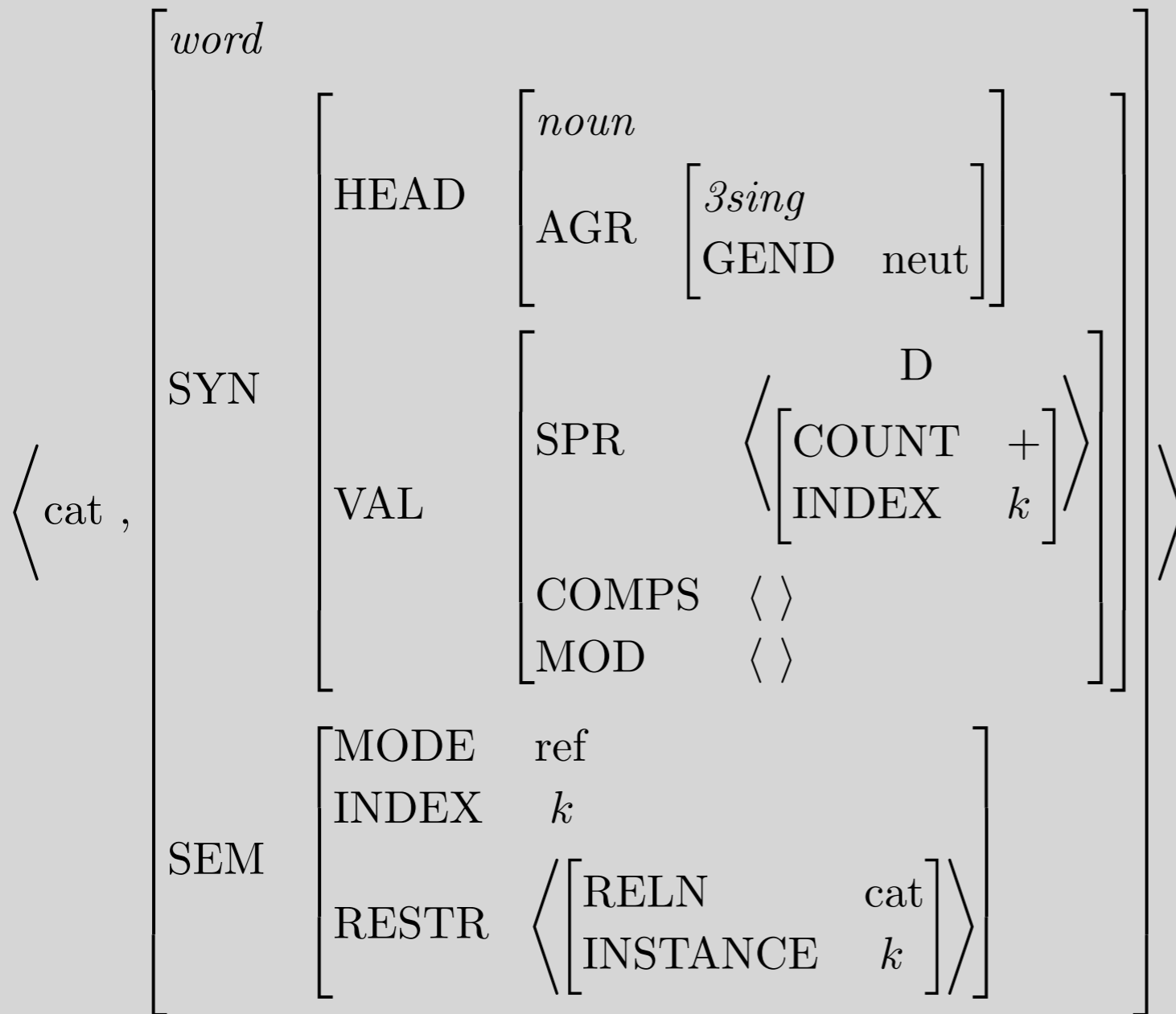
- Can we build this with our tools?
- Given the constraints our grammar puts on well-formed sentences, is this one?

Lexical Entry for *a*

$\langle a, \rangle$	$\left[\begin{array}{l} \text{word} \\ \\ \text{SYN} \\ \\ \text{SEM} \end{array} \right.$	$\left[\begin{array}{l} \text{HEAD} \\ \\ \text{VAL} \\ \\ \text{MODE} \\ \text{INDEX} \\ \text{RESTR} \end{array} \right.$	$\left[\begin{array}{l} \text{det} \\ \text{AGR} \\ \text{COUNT} \\ \\ \text{COMPS} \\ \text{SPR} \\ \text{MOD} \\ \\ \text{none} \\ j \\ \left\langle \left[\begin{array}{l} \text{RELN} \\ \text{BV} \end{array} \right] \right\rangle \end{array} \right.$	$\left[\begin{array}{l} \\ \\ 3sing \\ + \\ \\ \langle \rangle \\ \langle \rangle \\ \langle \rangle \\ \\ \\ a \\ j \end{array} \right.$	\rangle
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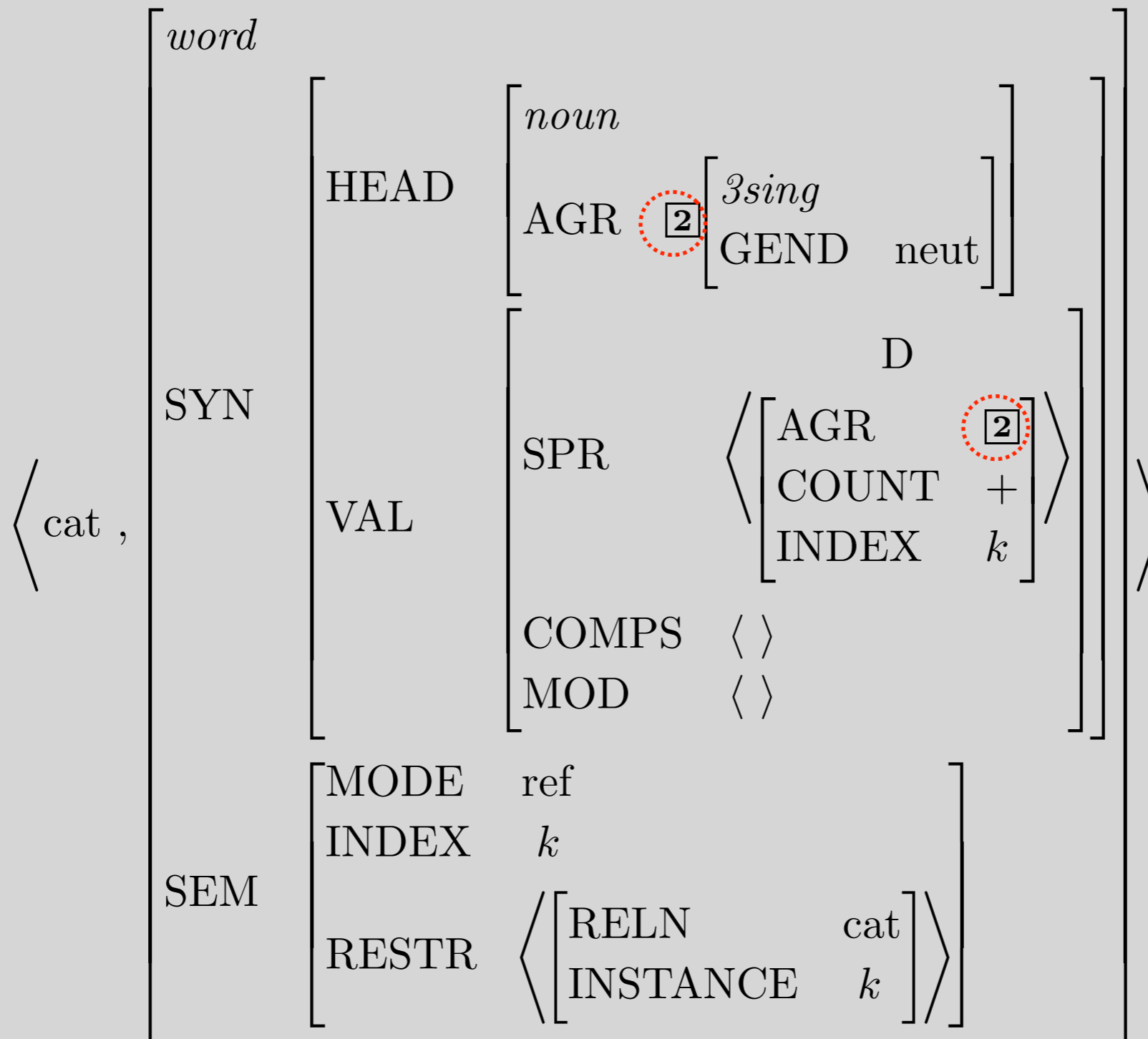
- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?

Lexical Entry for *cat*

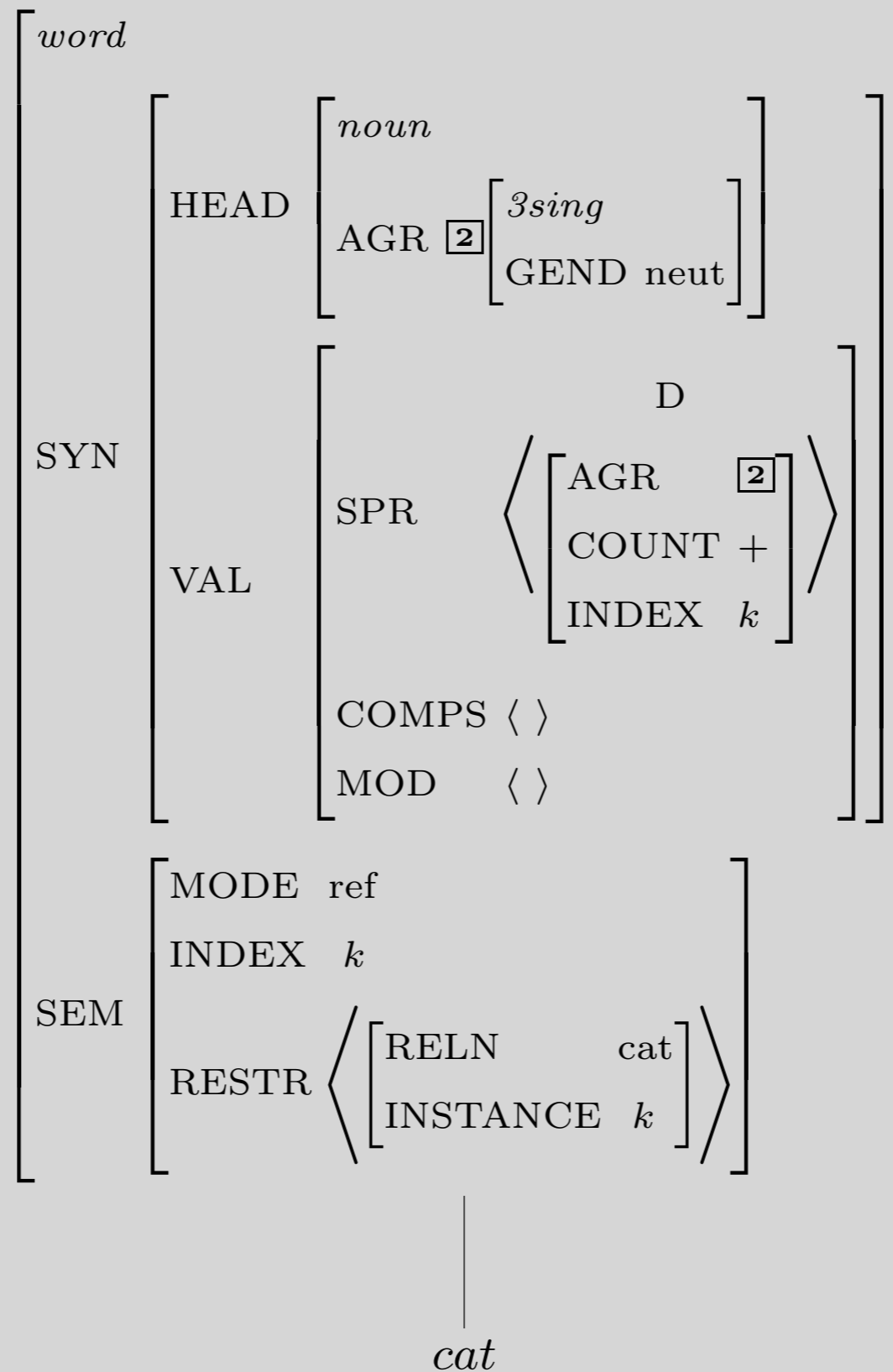


- Which feature paths are abbreviated?
- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?

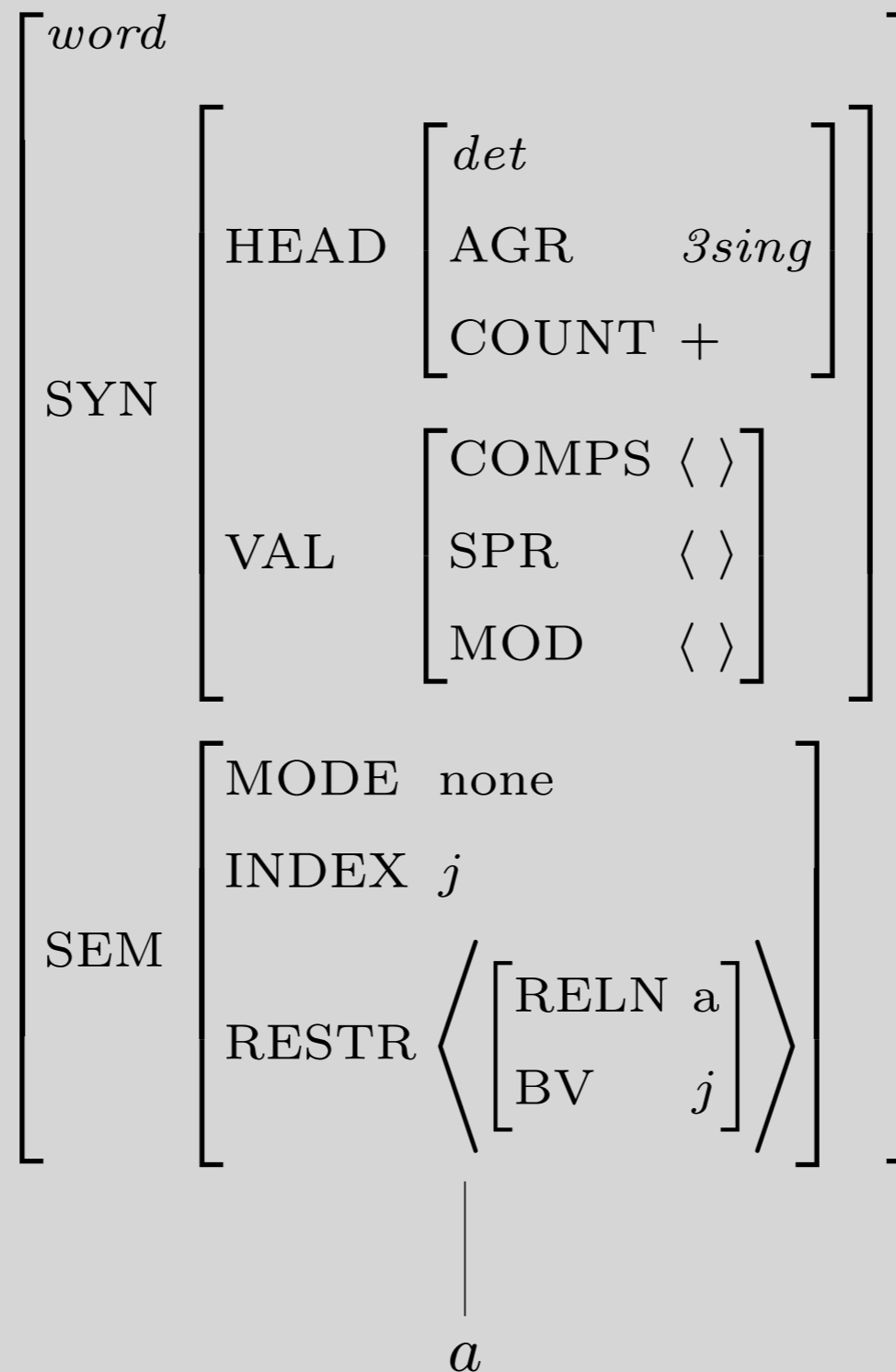
Effect of Principles: the SHAC



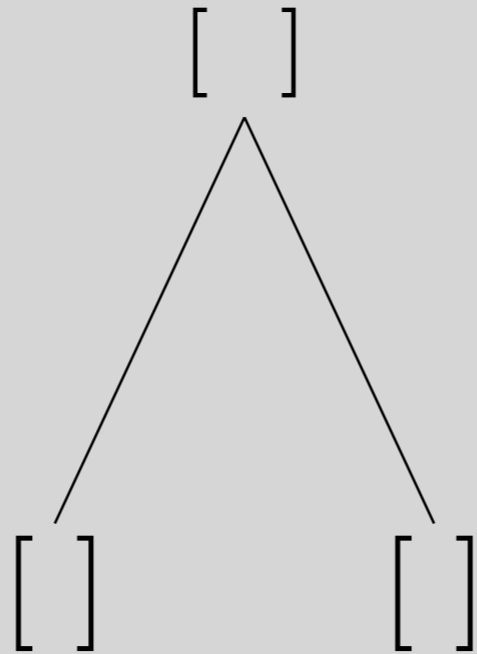
Description of Word Structures for *cat*



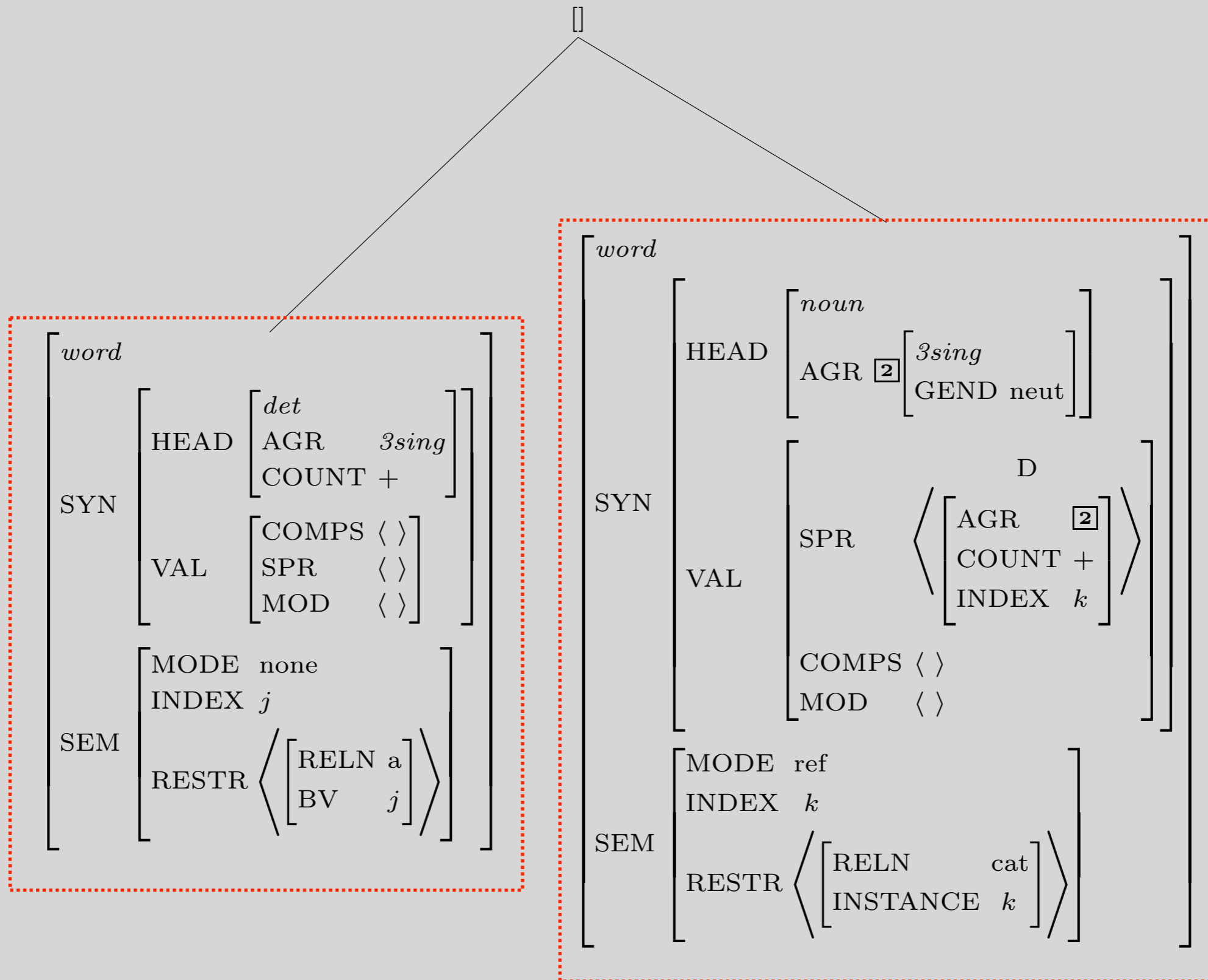
Description of Word Structures for a



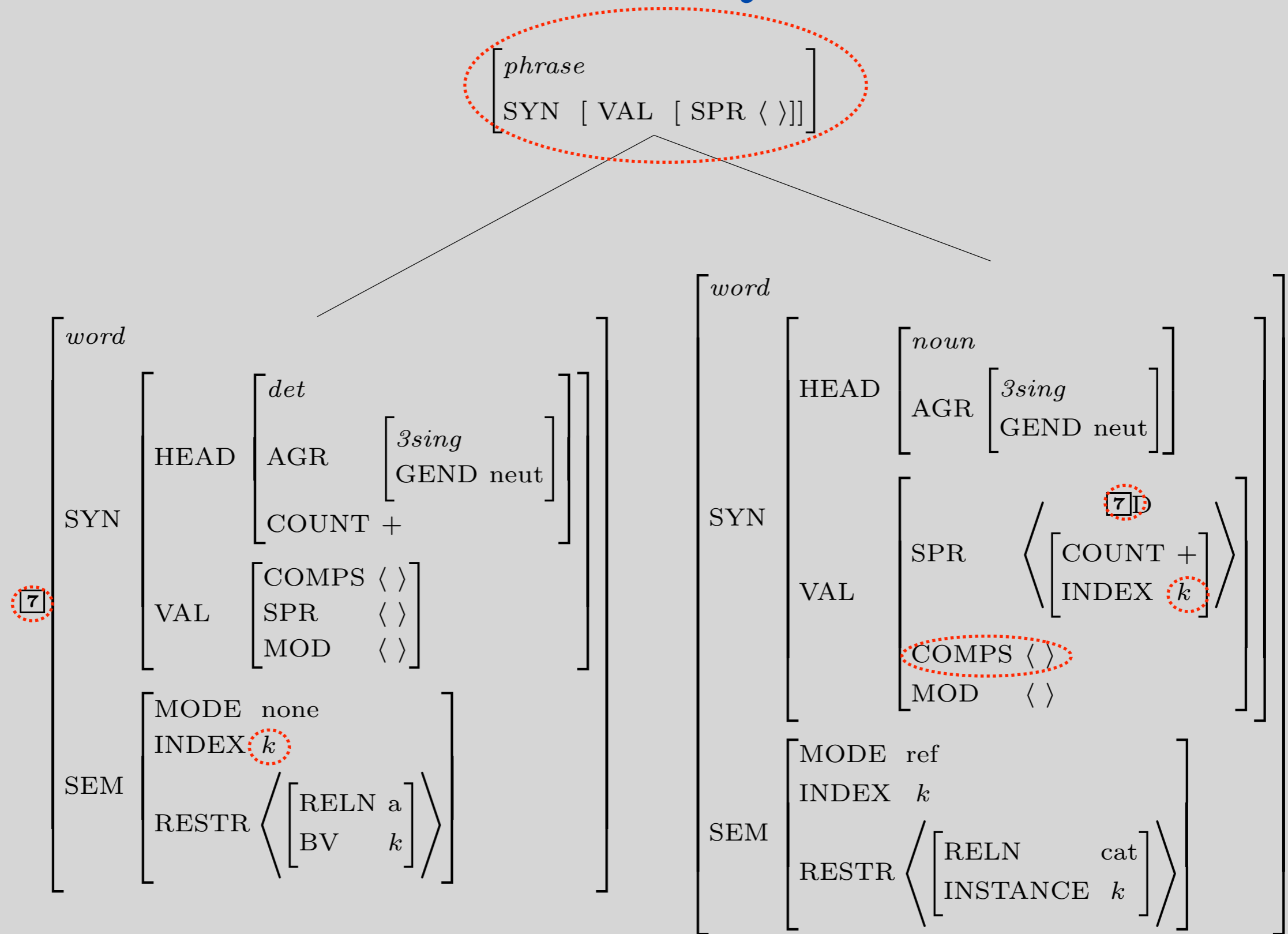
Building a Phrase



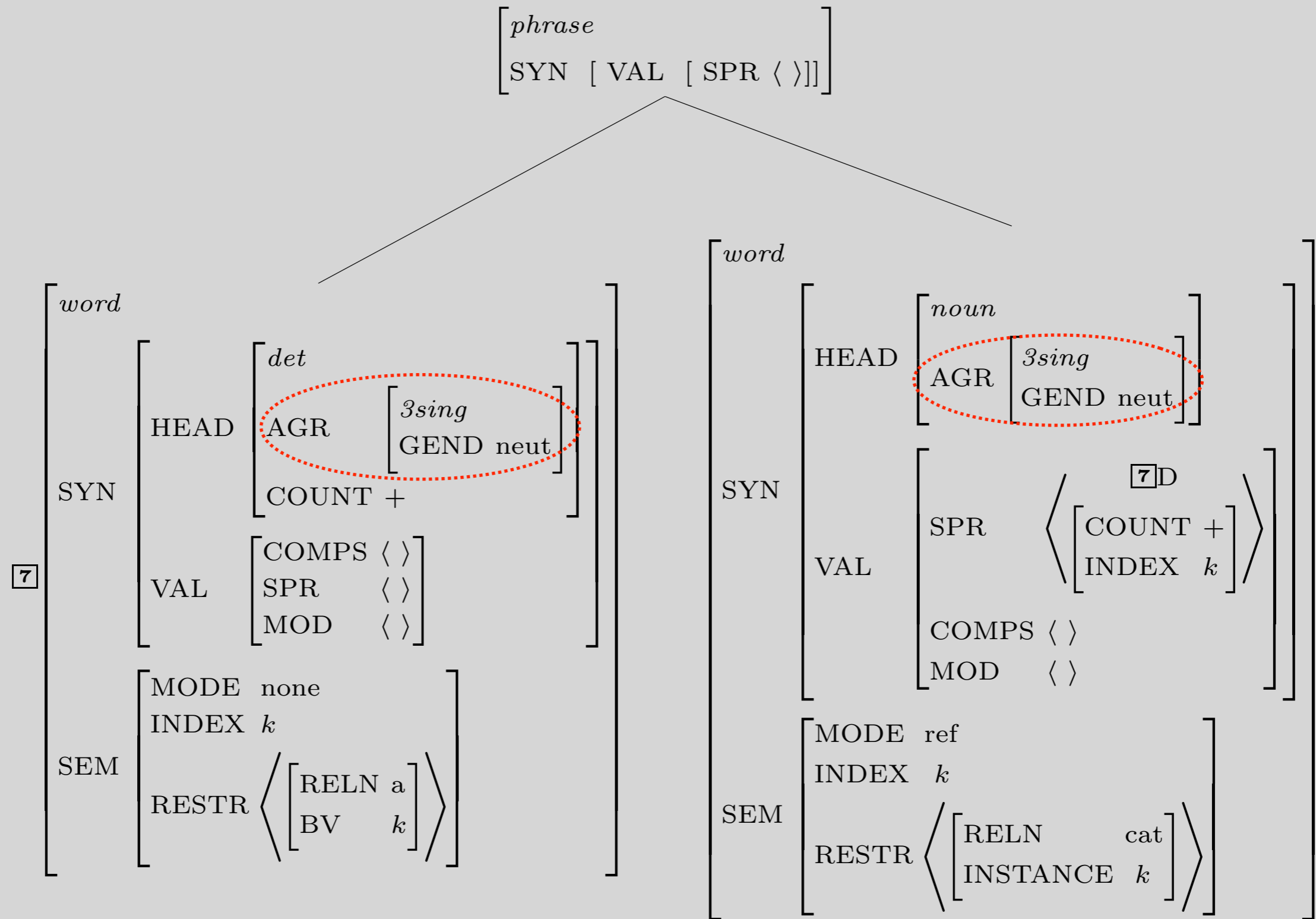
Constraints Contributed by Daughter Subtrees



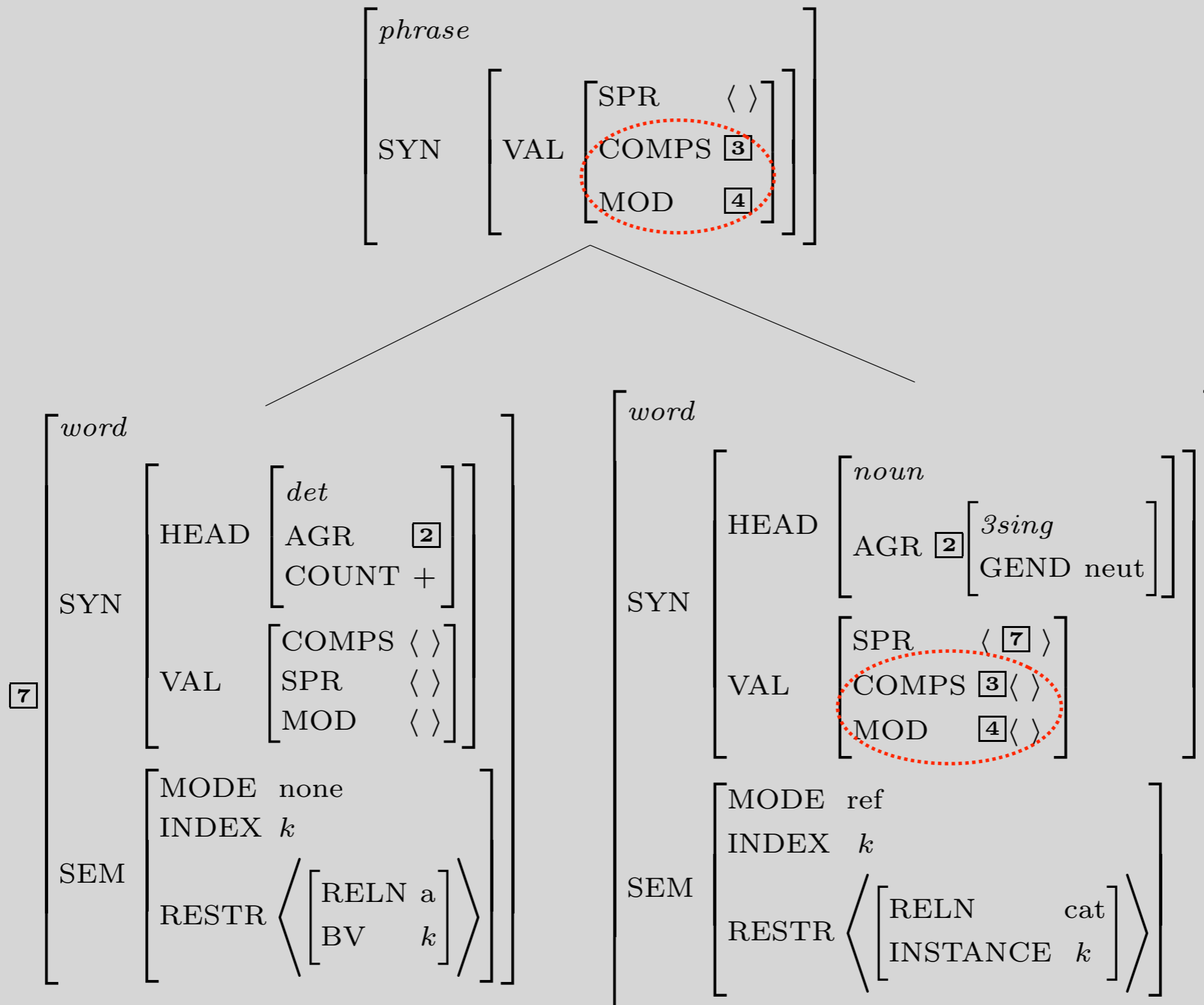
Constraints Contributed by the Grammar Rule



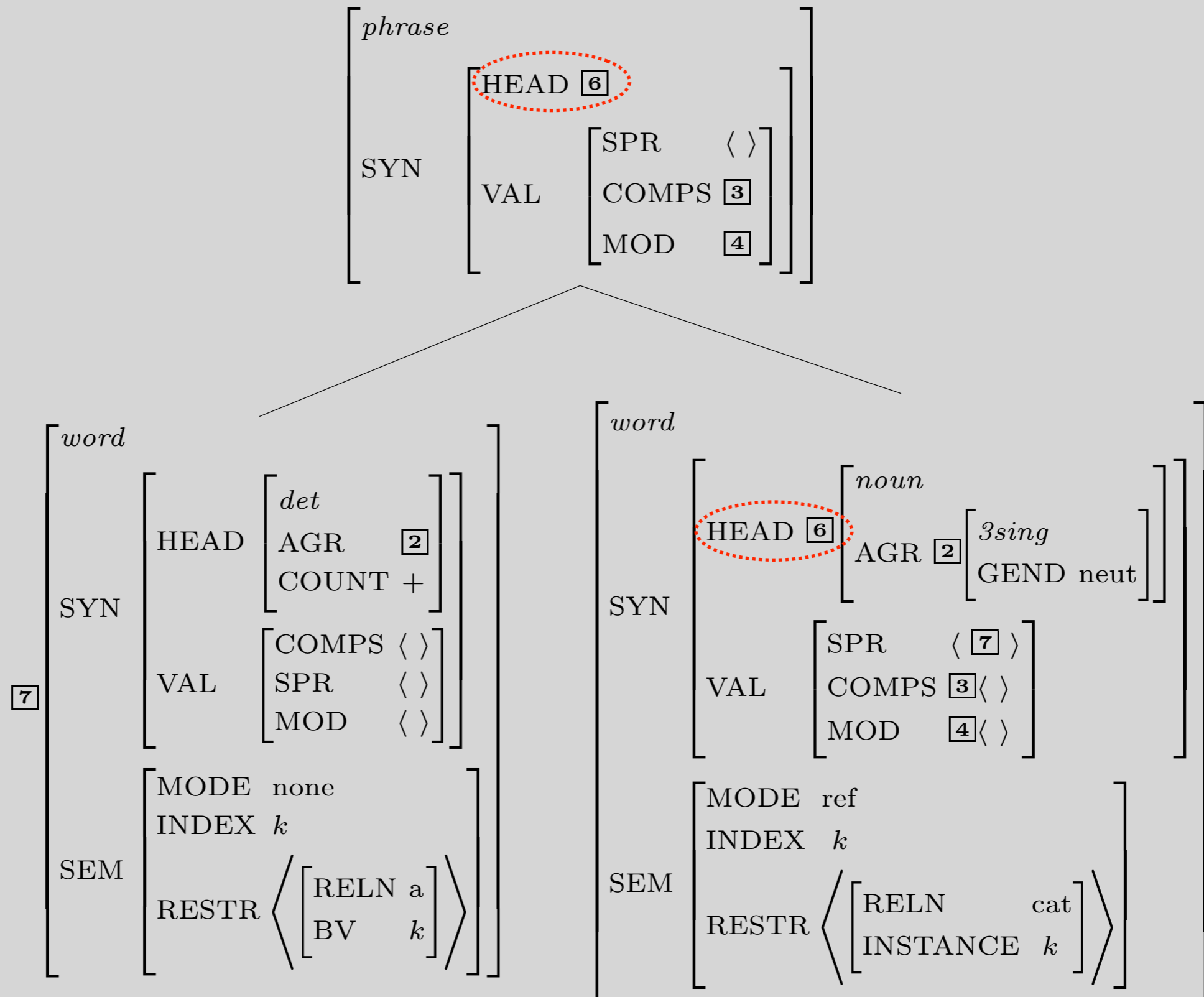
A Constraint Involving the SHAC



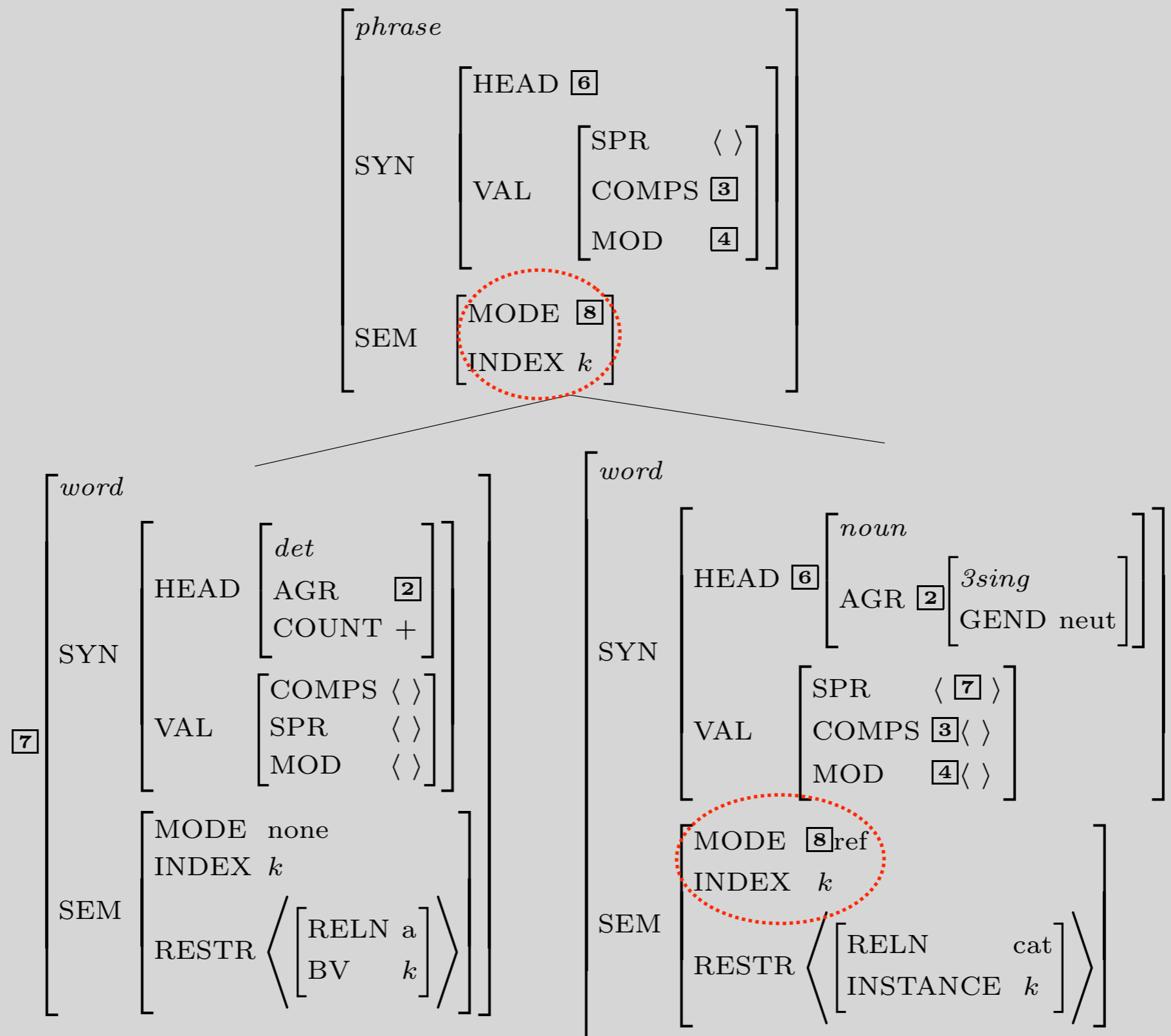
Effects of the Valence Principle



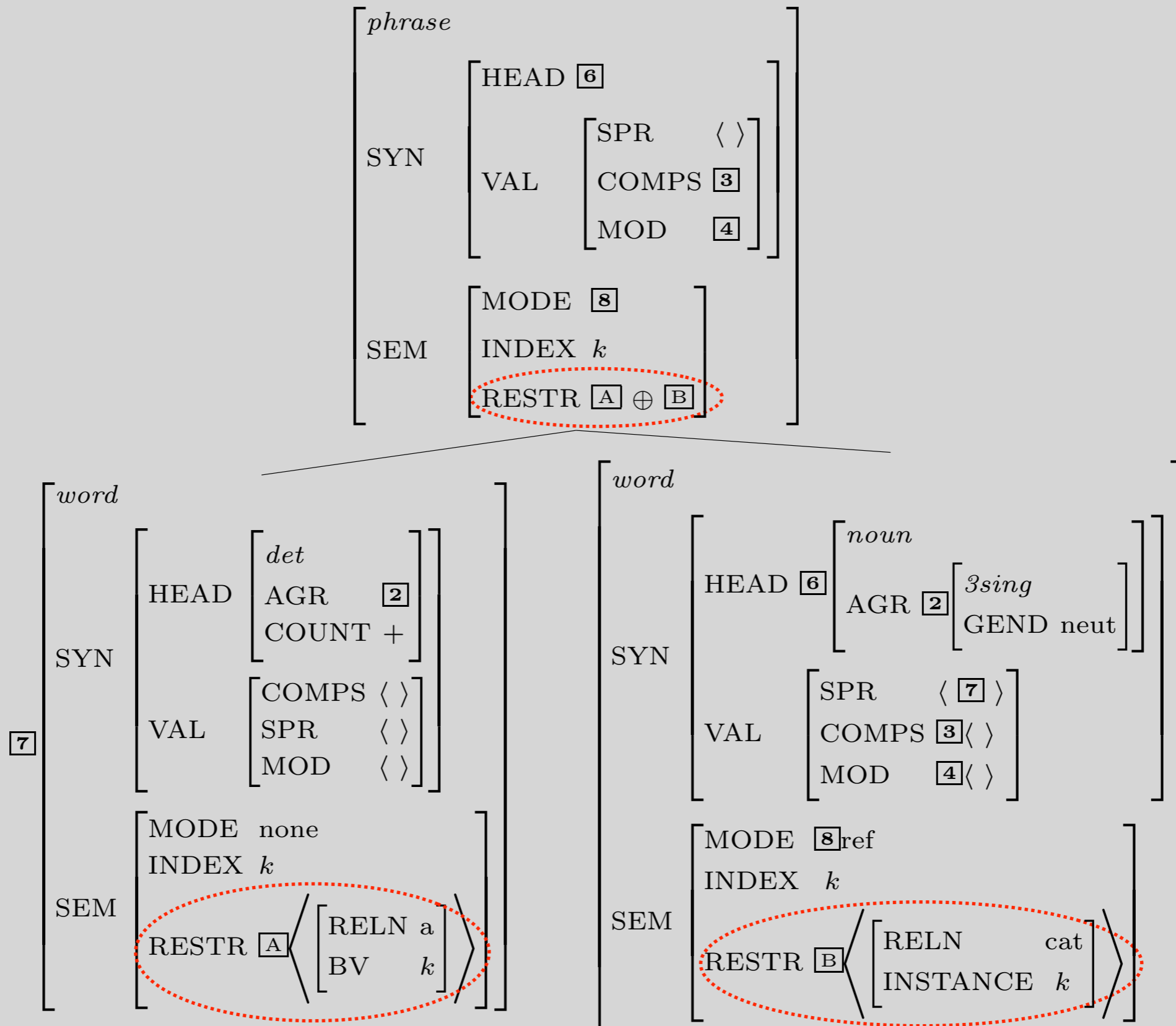
Effects of the Head Feature Principle



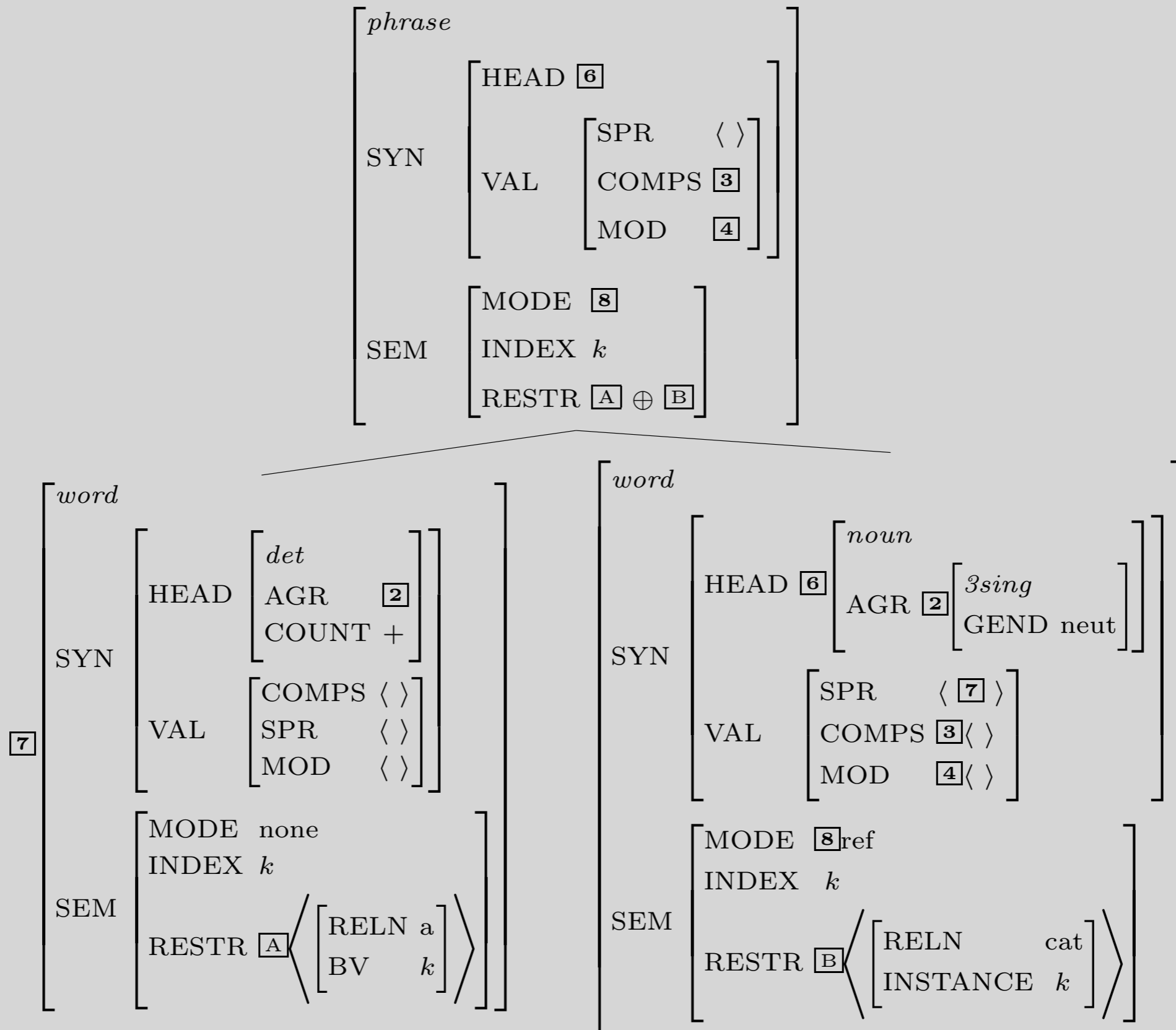
Effects of the Semantic Inheritance Principle



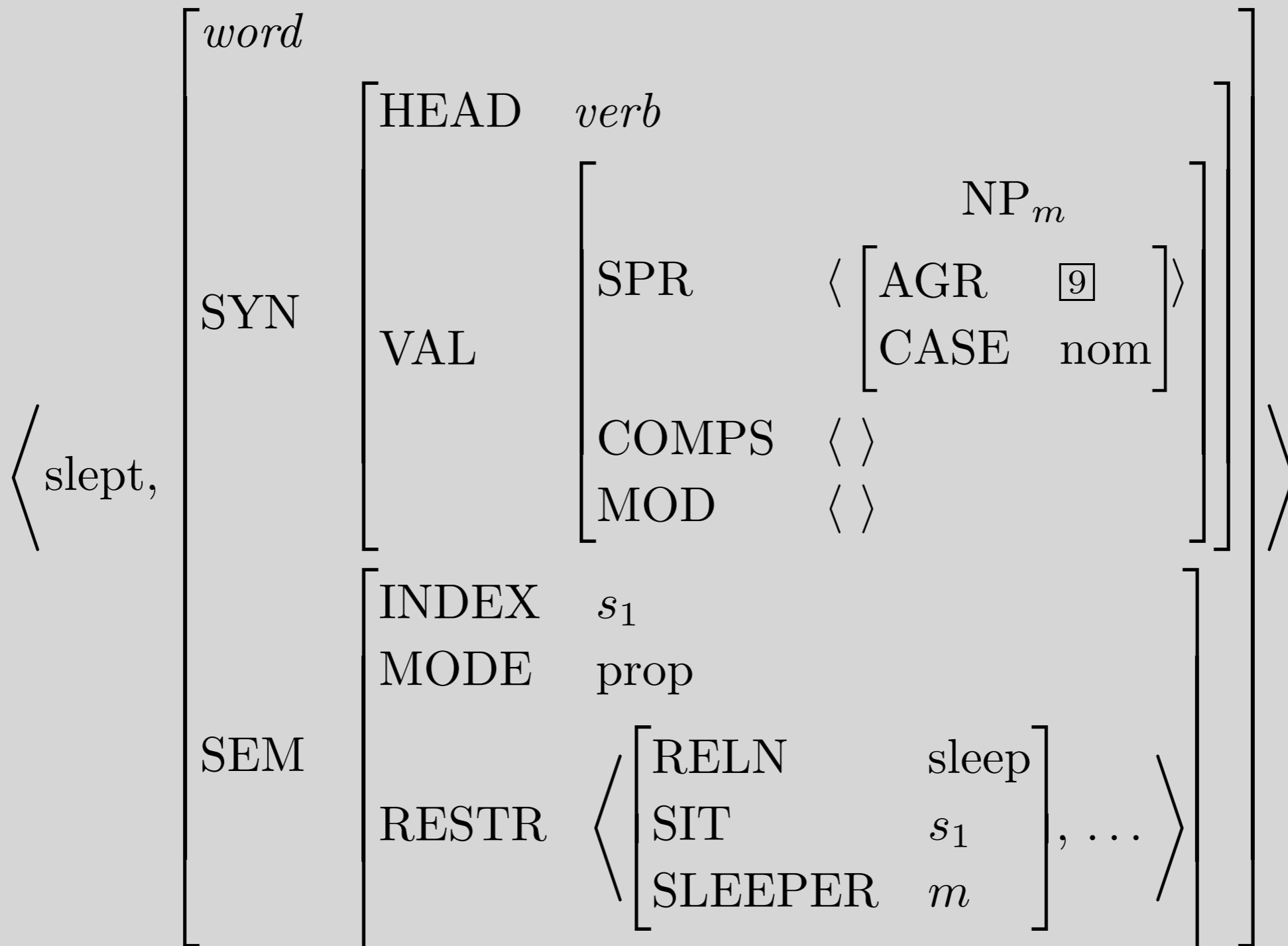
Effects of the Semantic Compositionality Principle



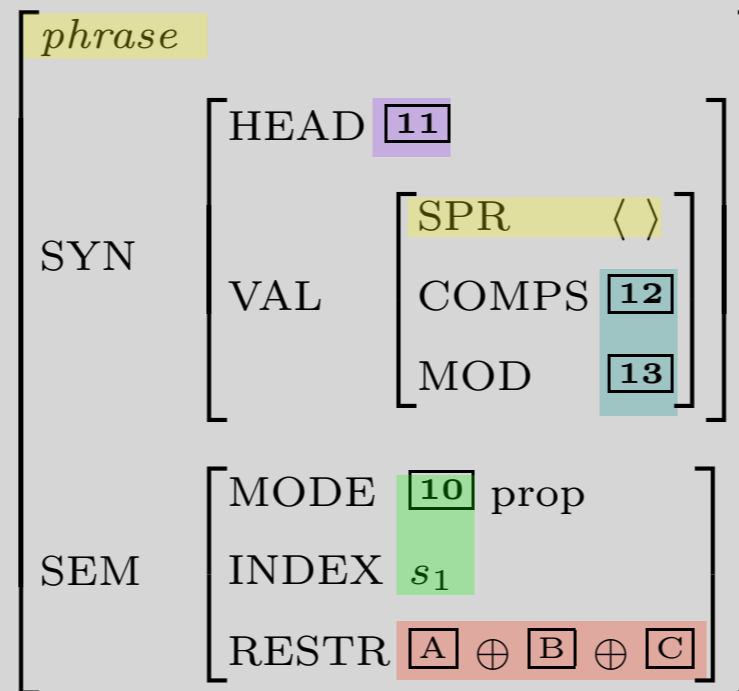
Is the Mother Node Now Completely Specified?



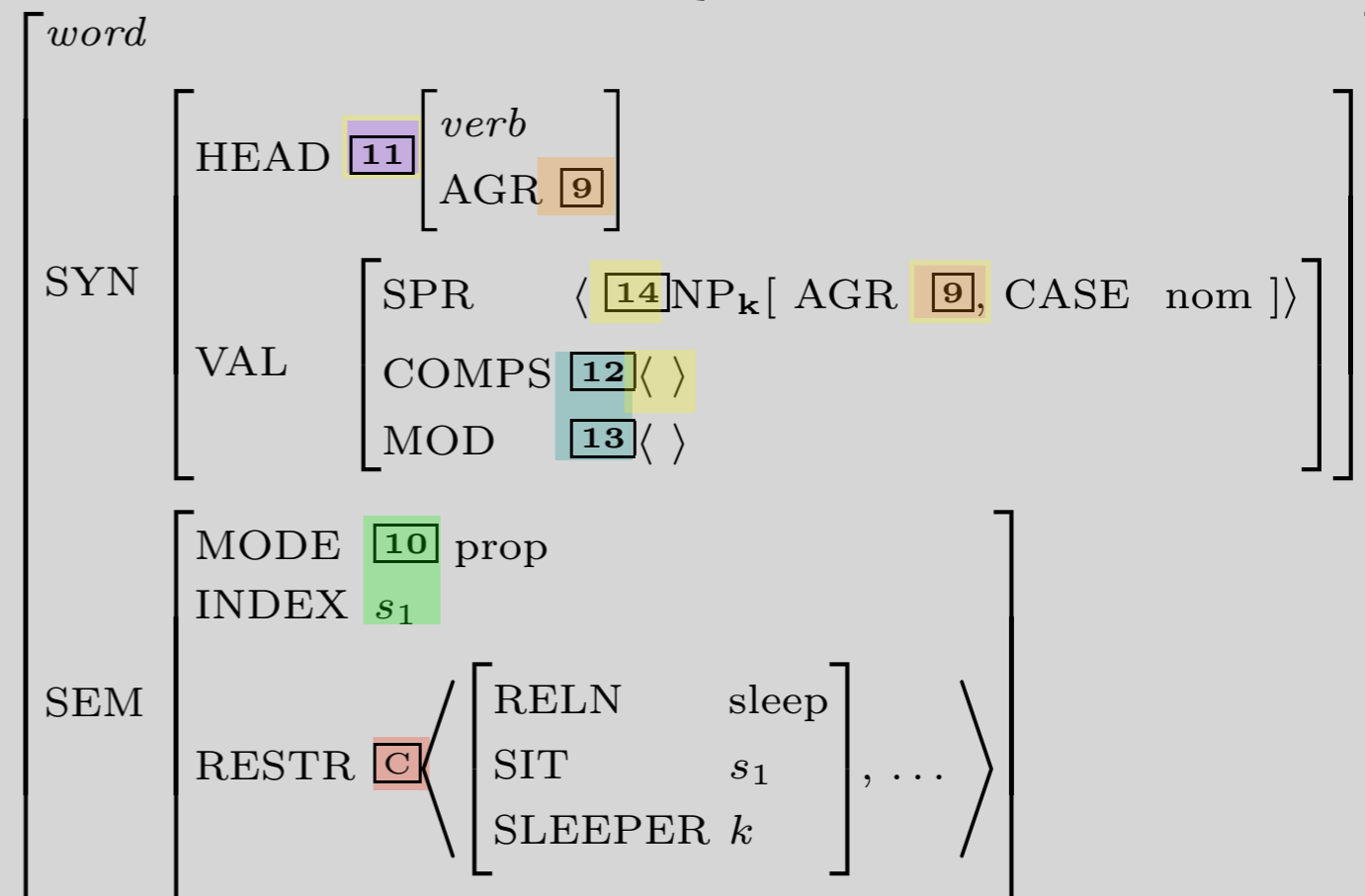
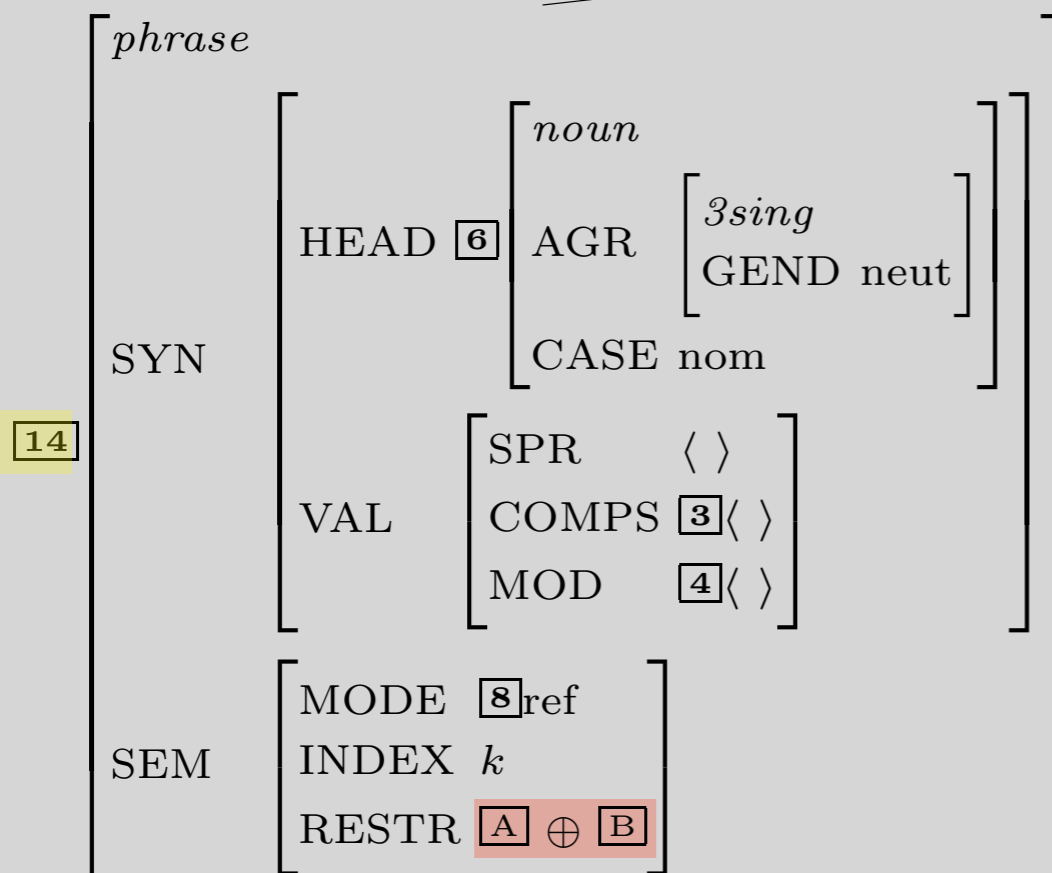
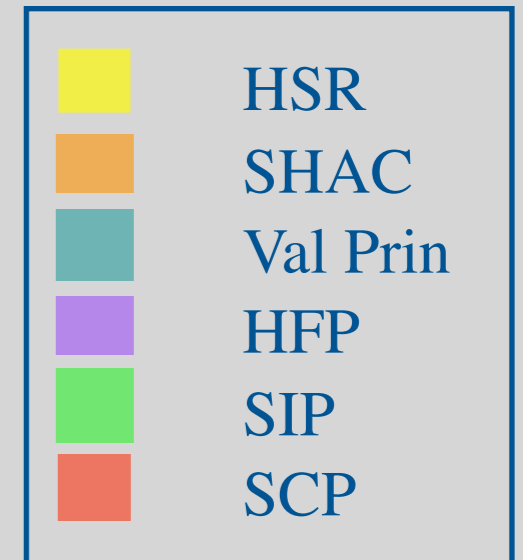
Lexical Entry for *slept*



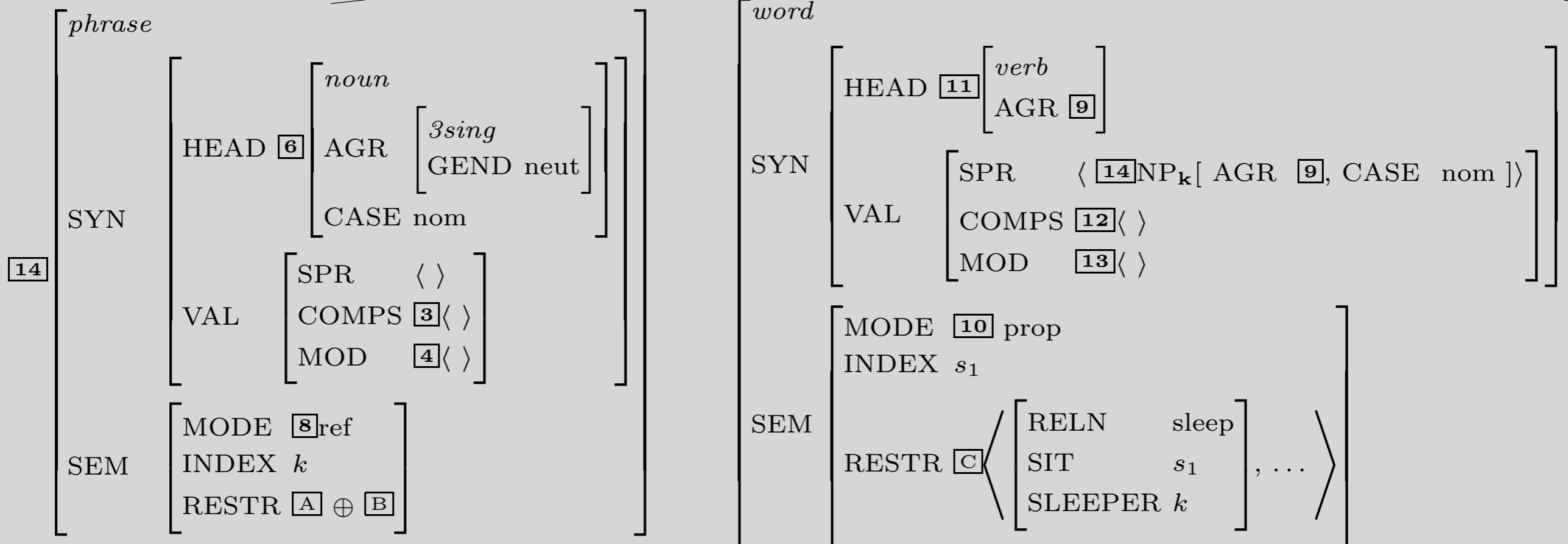
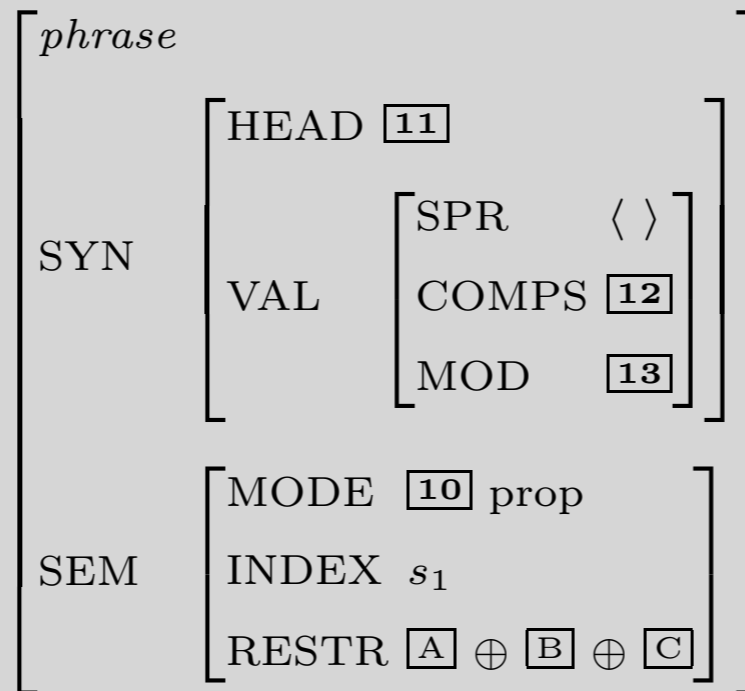
Another Head-Specifier Phrase



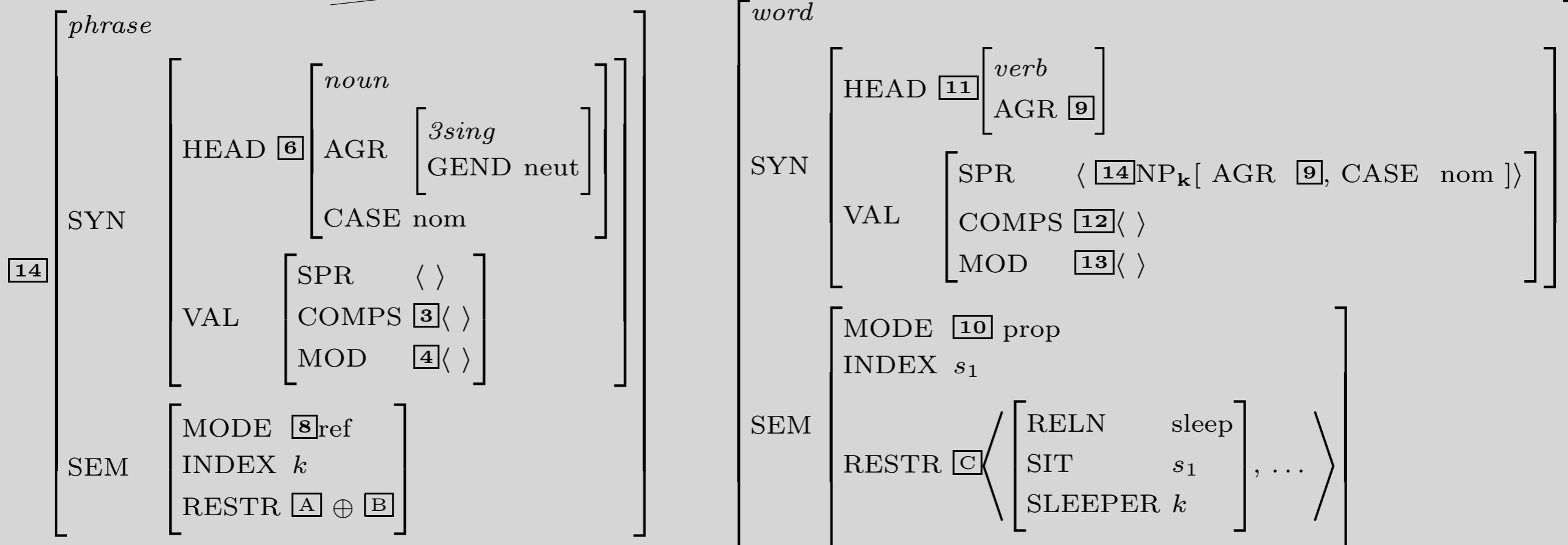
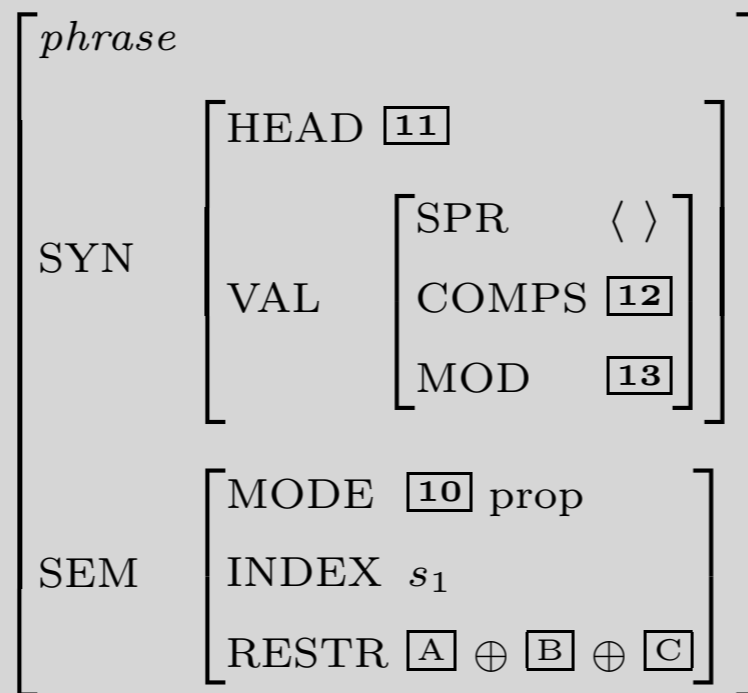
Key



Is this description fully specified?



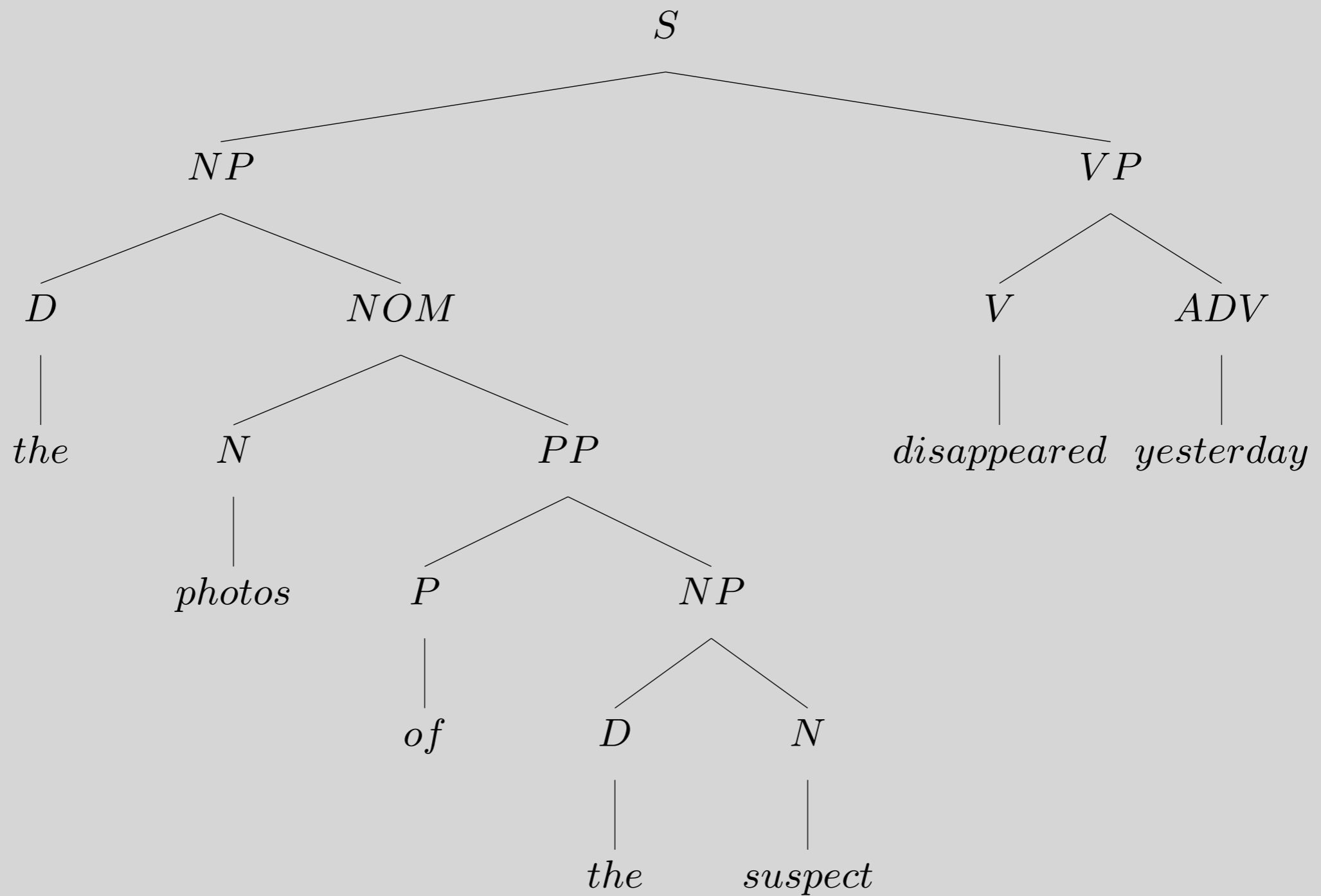
Does the top node satisfy the initial symbol?



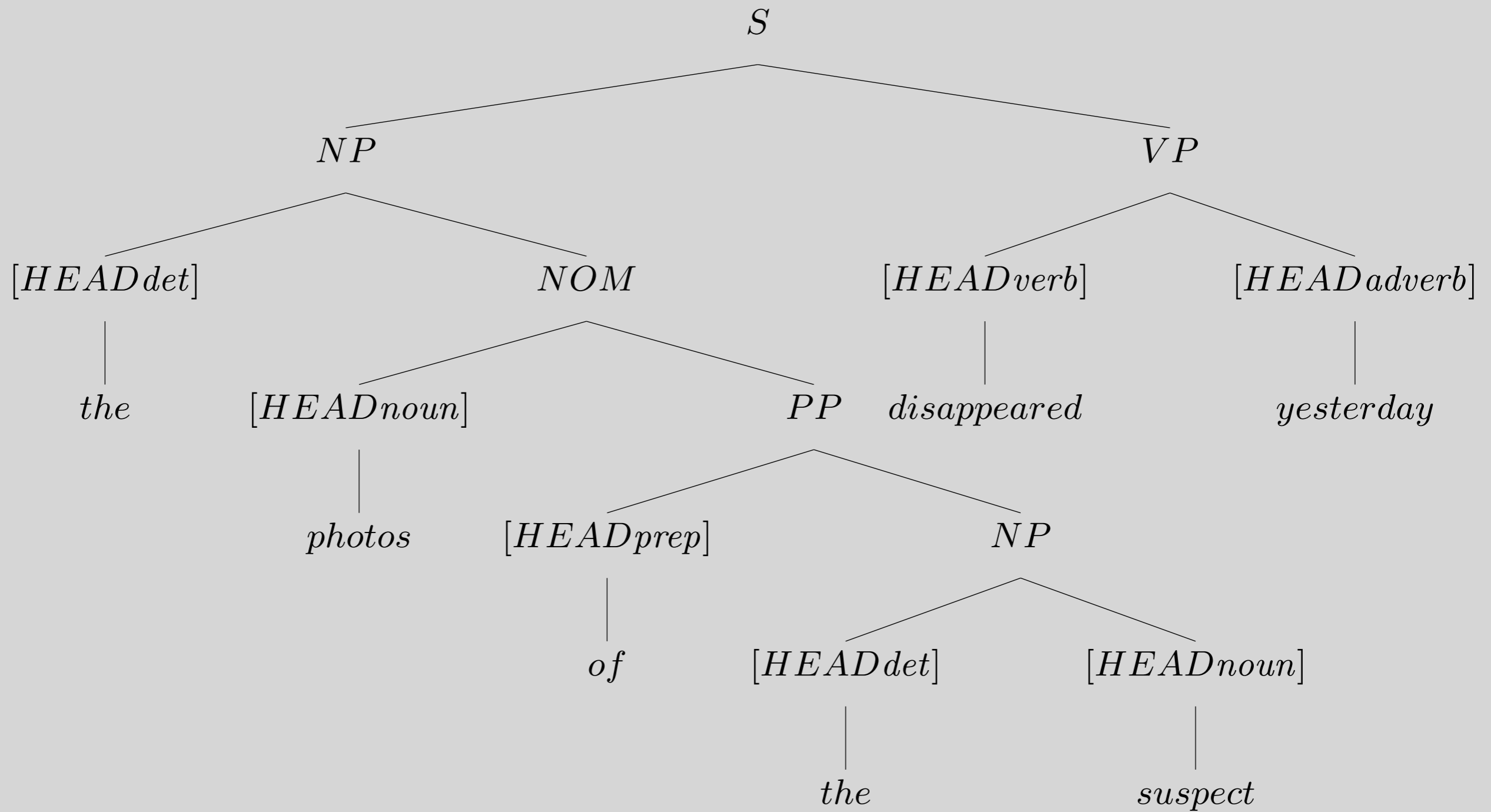
RESTR of the S node

$$\left\langle \begin{bmatrix} \text{RELN} & a \\ \text{BV} & k \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{sleep} \\ \text{SIT} & s_1 \\ \text{SLEEPER} & k \end{bmatrix}, \dots \right\rangle$$

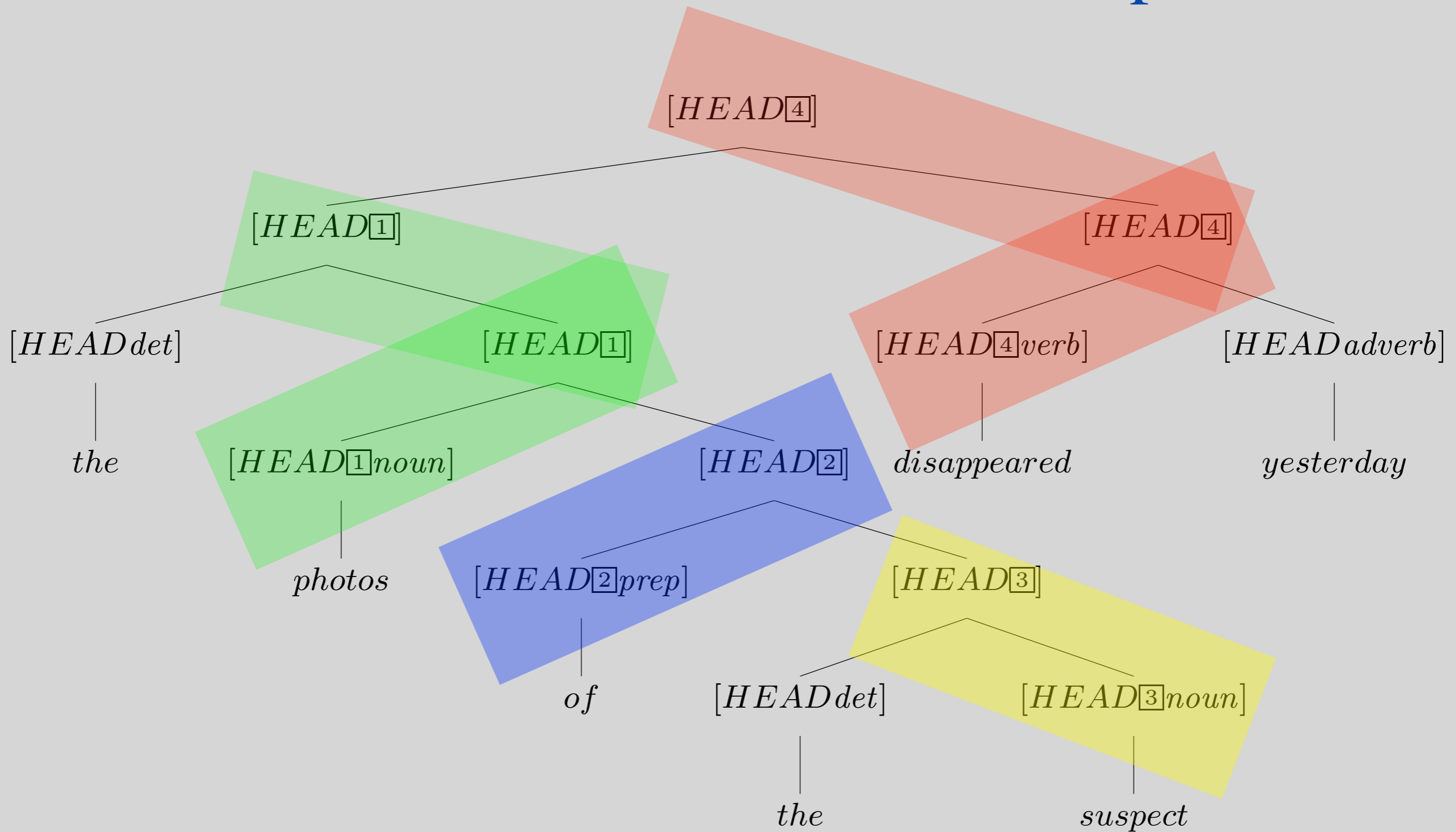
Another Example



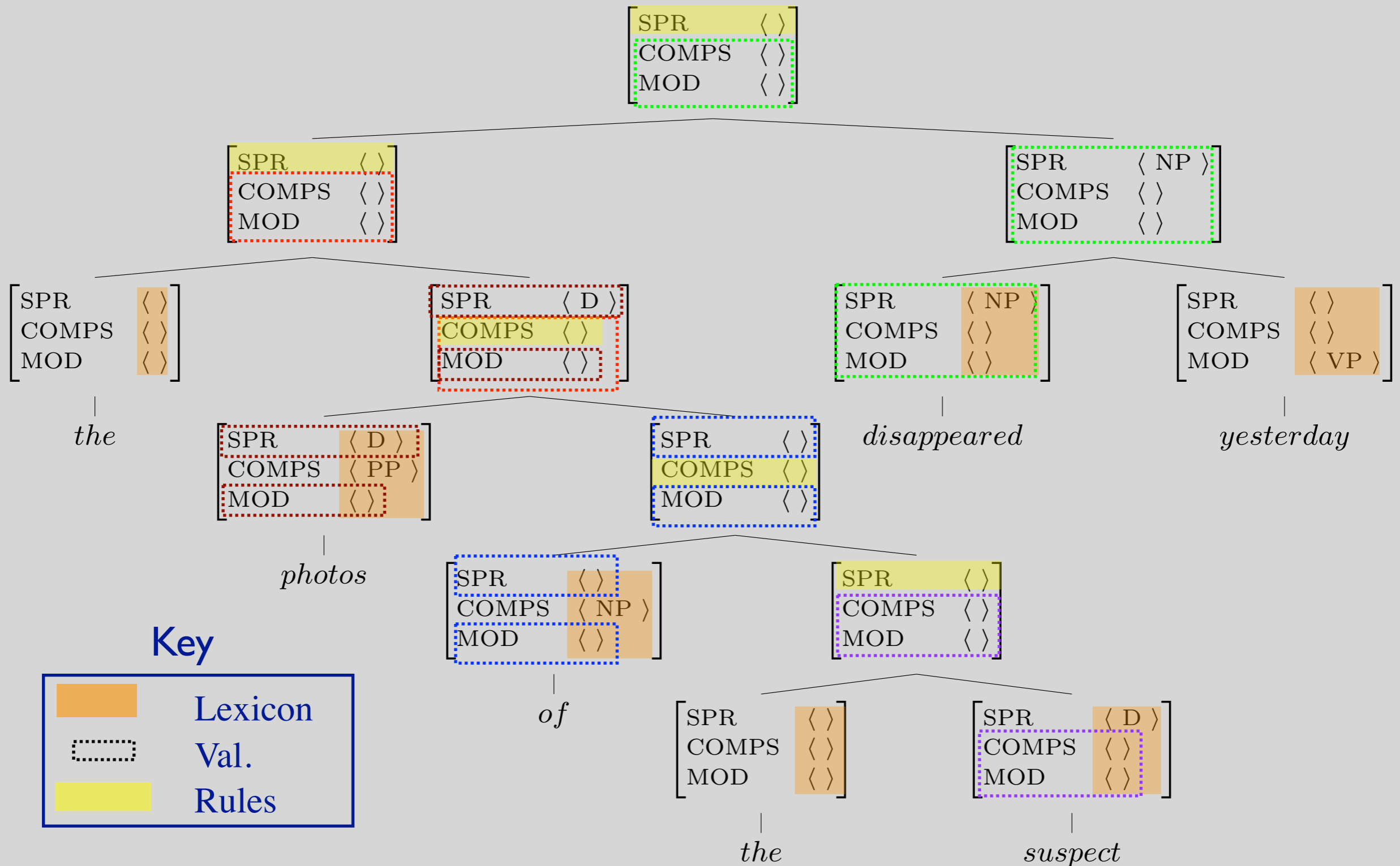
Head Features from Lexical Entries



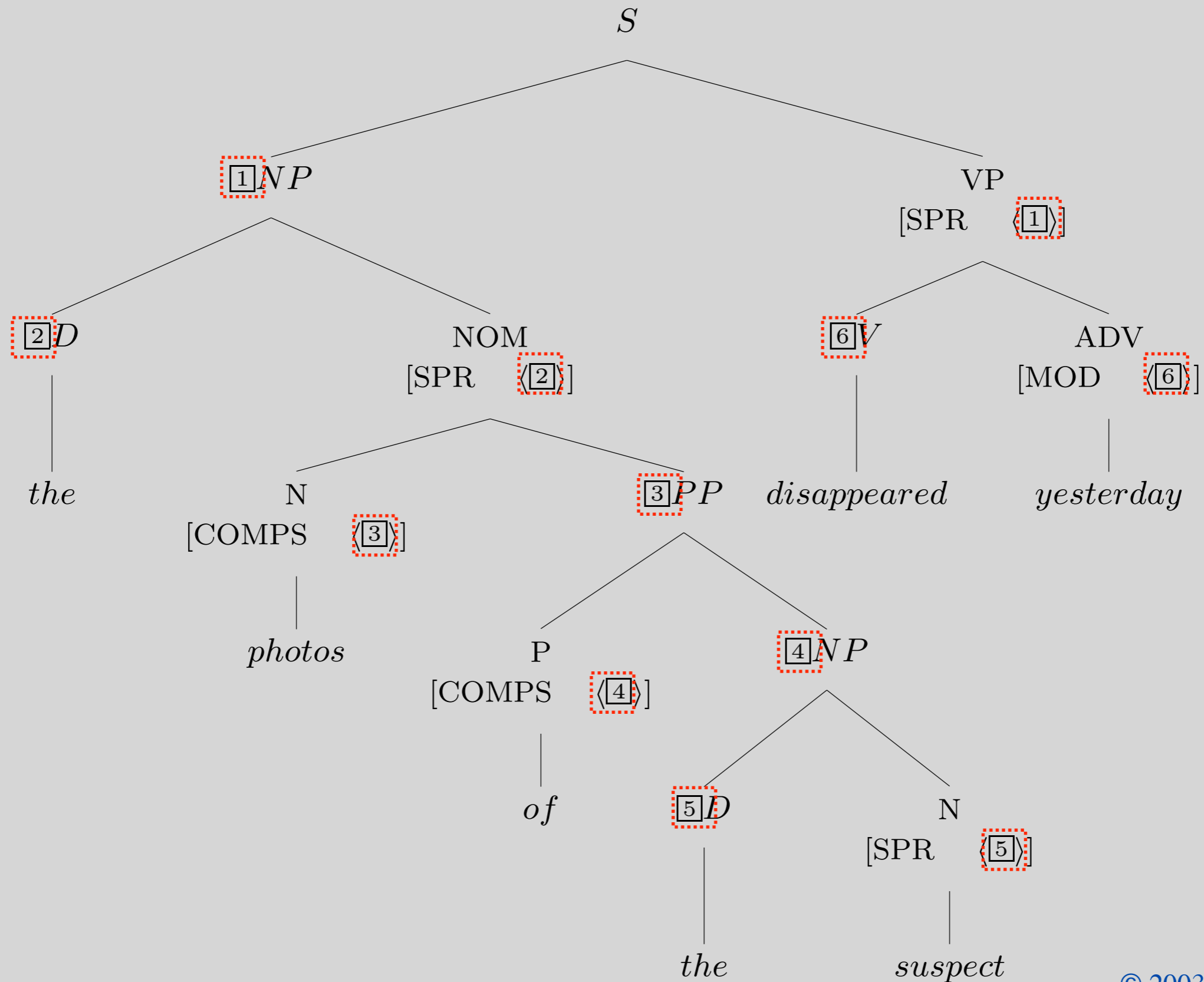
Head Features from Lexical Entries, plus HFP



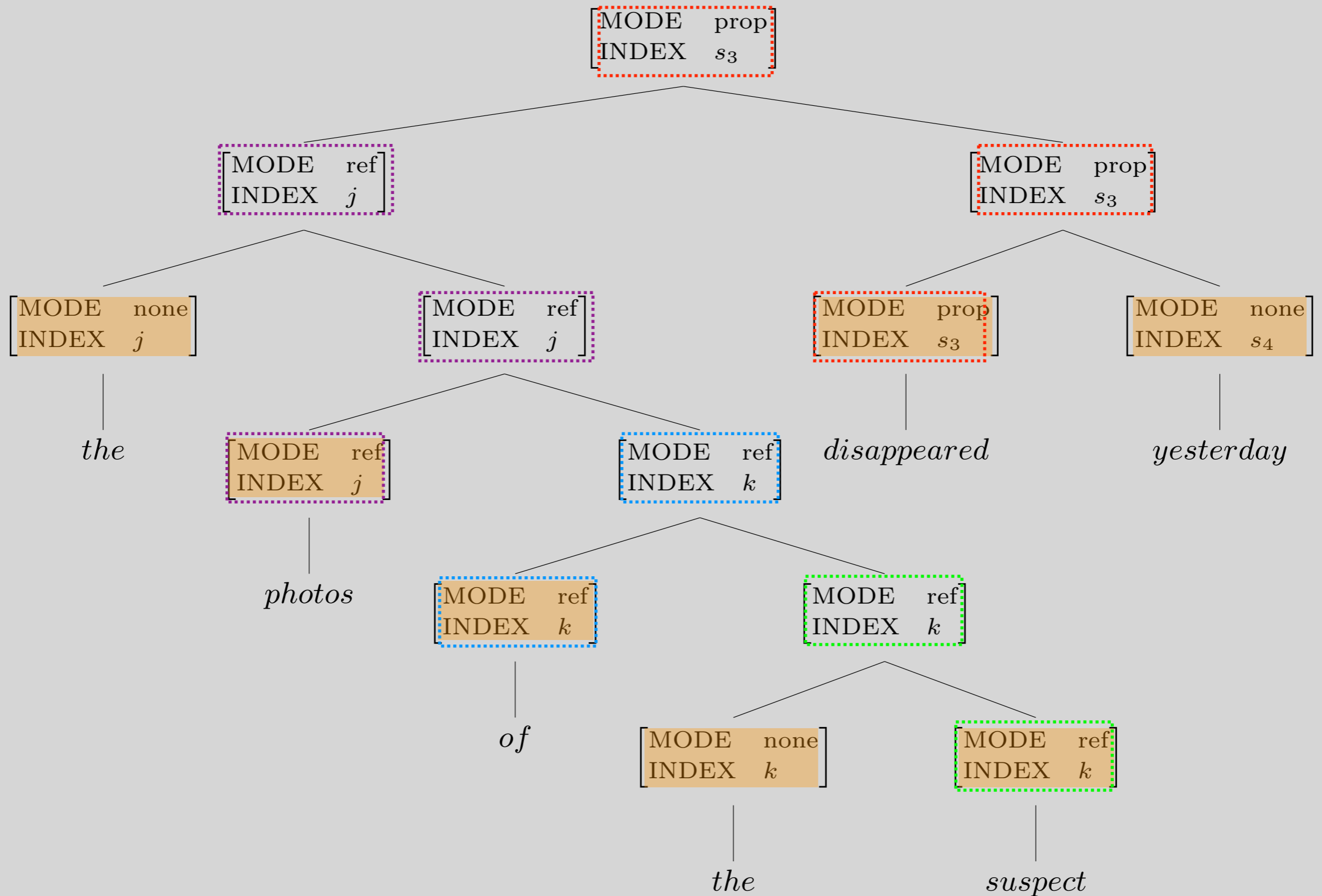
Valence Features: Lexicon, Rules, and the Valence Principle



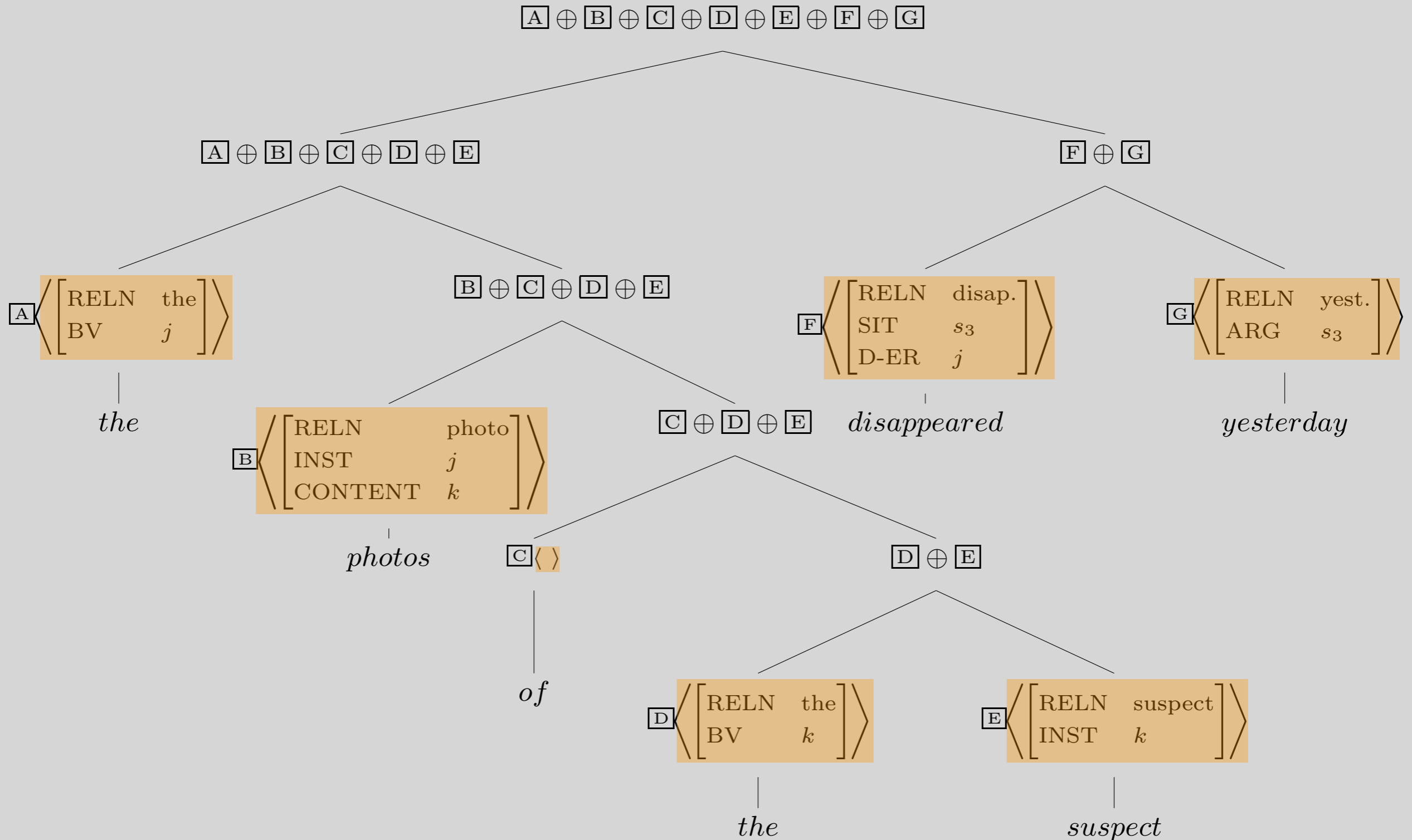
Required Identities: Grammar Rules



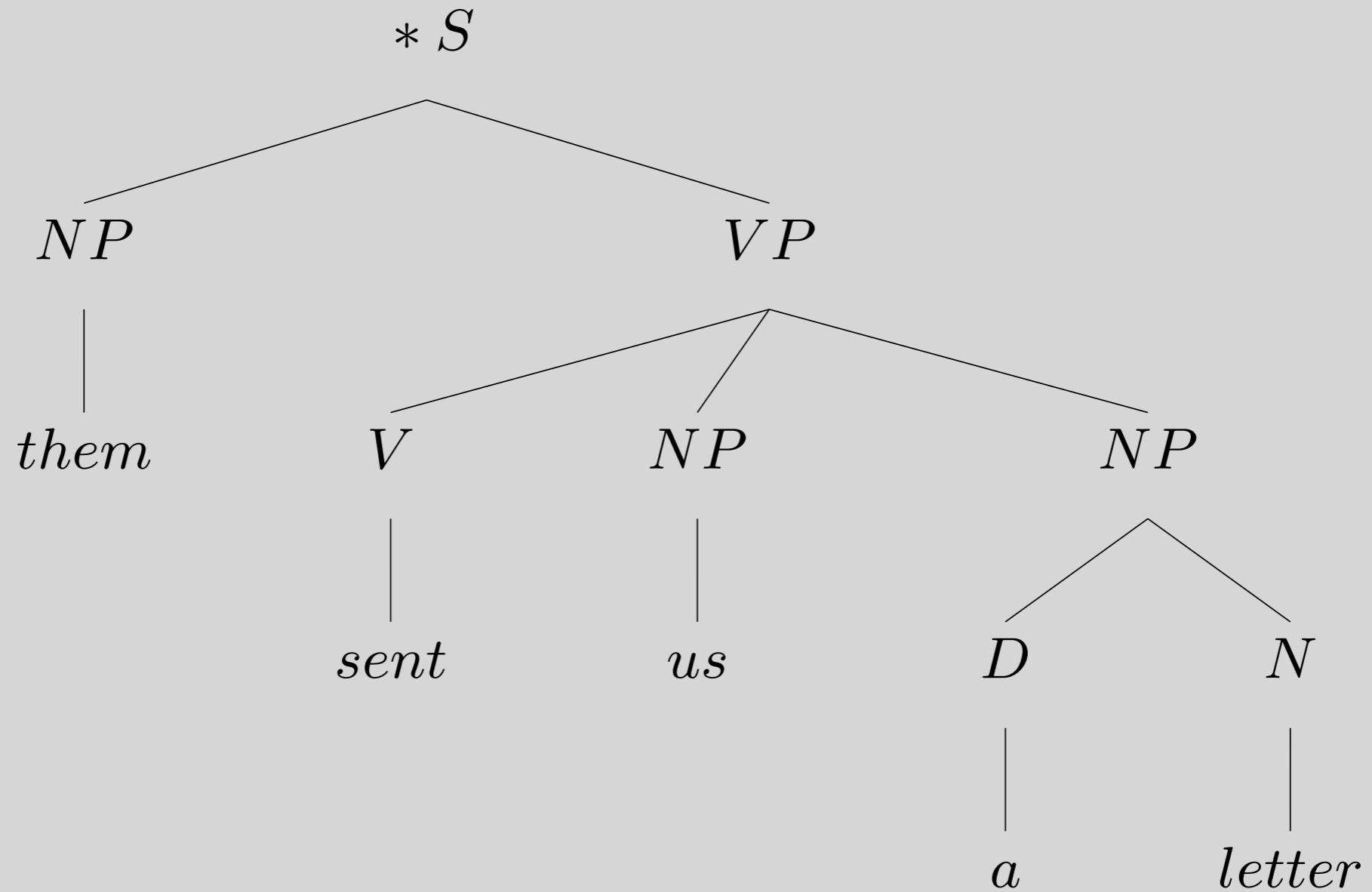
Two Semantic Features: the Lexicon & SIP



RESTR Values and the SCP

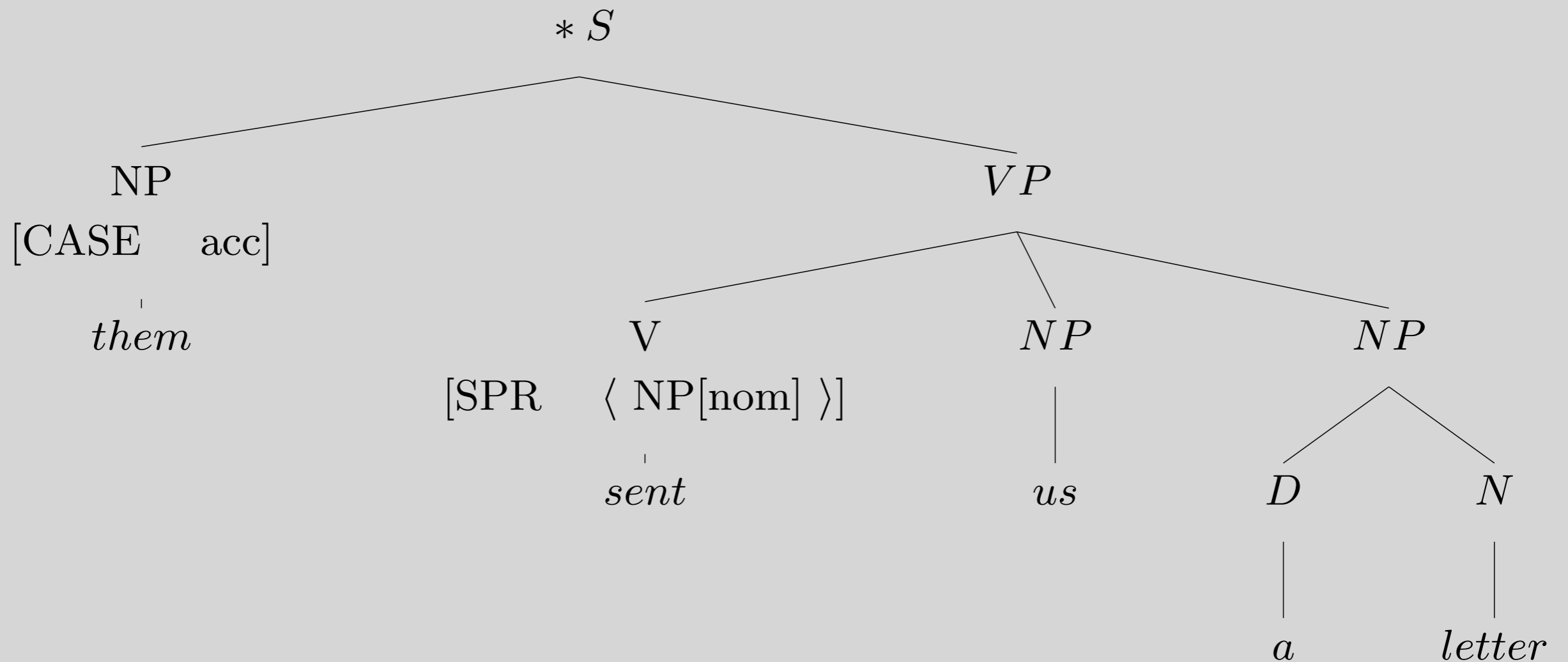


An Ungrammatical Example



What's wrong with this sentence?

An Ungrammatical Example

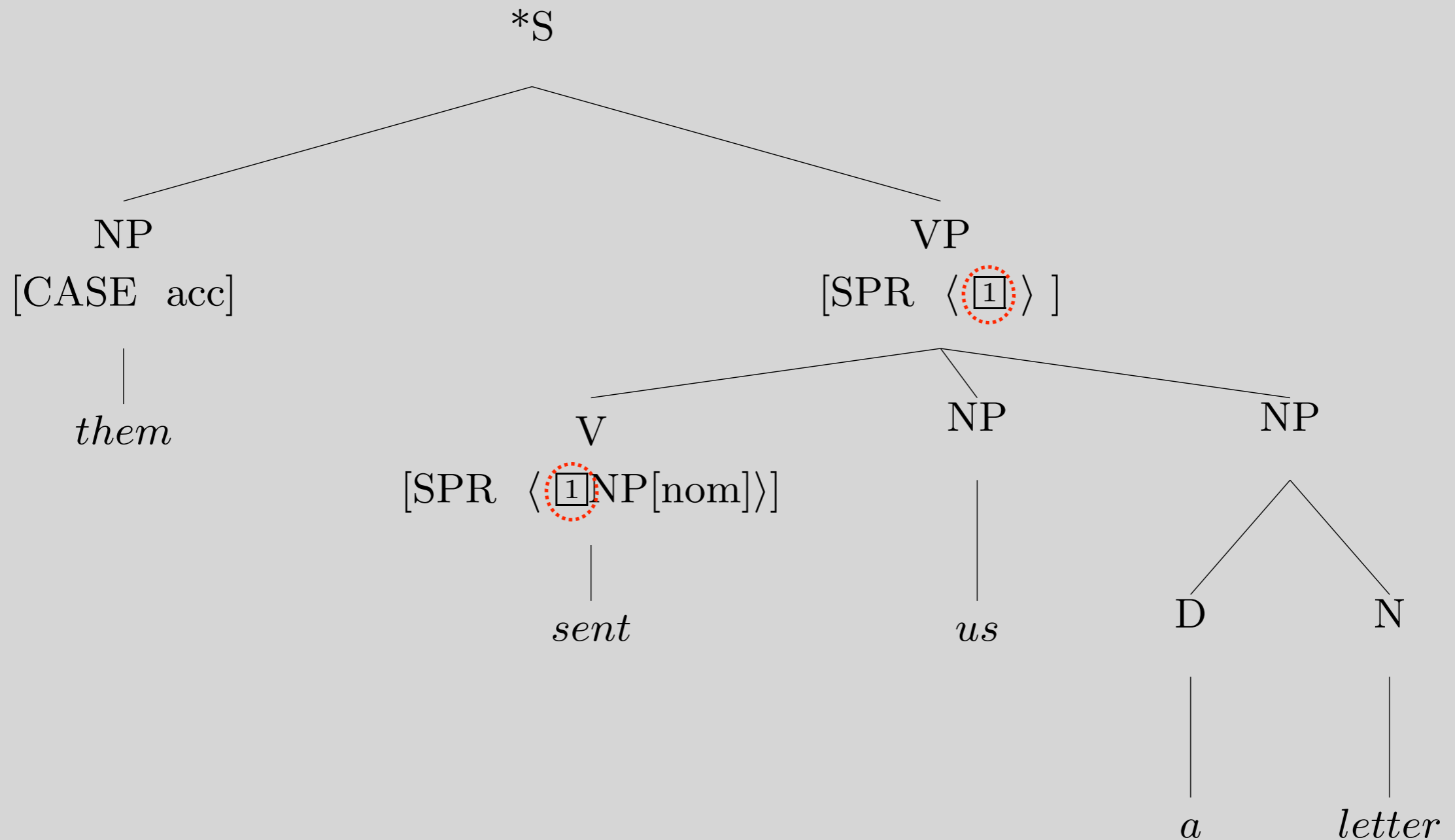


What's wrong with this sentence?

So what?

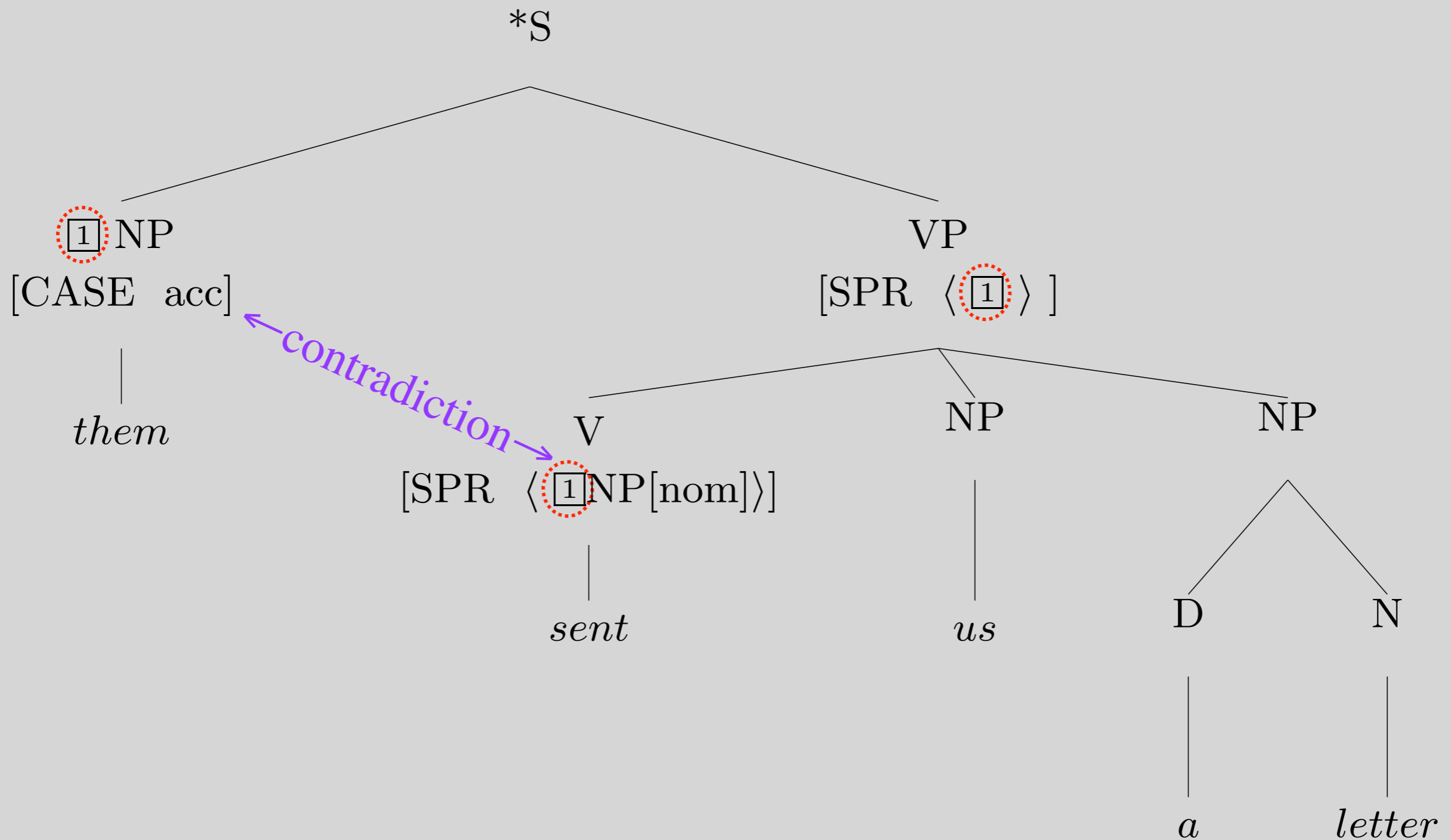
An Ungrammatical Example

The Valence Principle



An Ungrammatical Example

Head Specifier Rule



Exercise in Critical Thinking

- Our grammar has come a long way since Ch 2, as we've added ways of representing different kinds of information:
 - generalizations across categories
 - semantics
 - particular linguistic phenomena: valence, agreement, modification
- What else might we add? What facts about language are as yet unrepresented in our model?

Overview

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- Two extended examples
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- Reading questions

Reading Questions

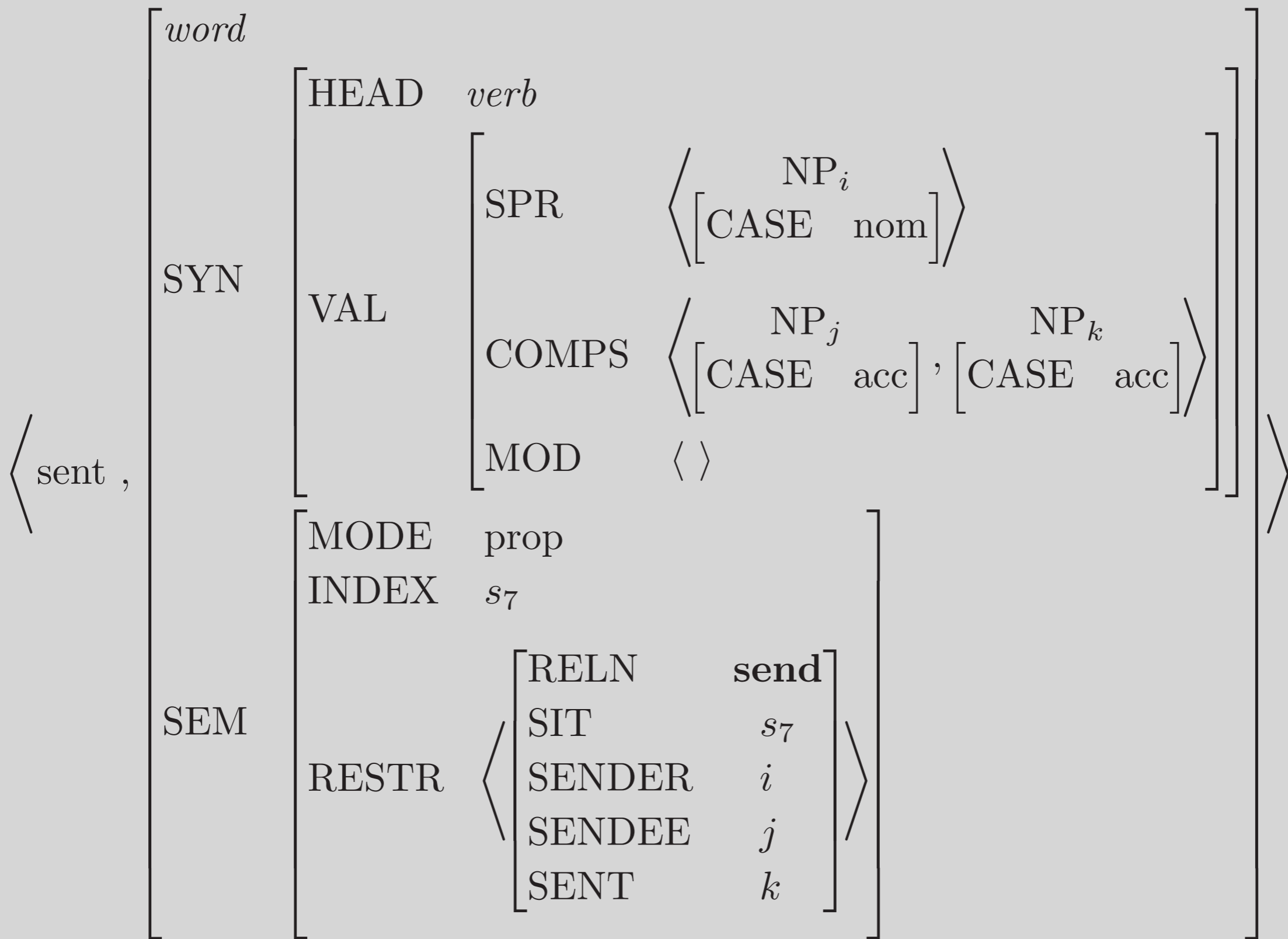
- What's the difference between Rules and Principles?
- Tags: it seems like sometimes they originate in the mothers and sometimes they originate in the daughters? For example, on pg 172, why is the [4] tag for AGR up in the mother?
- Tags: When do we use them, when do we show the whole feature structure?

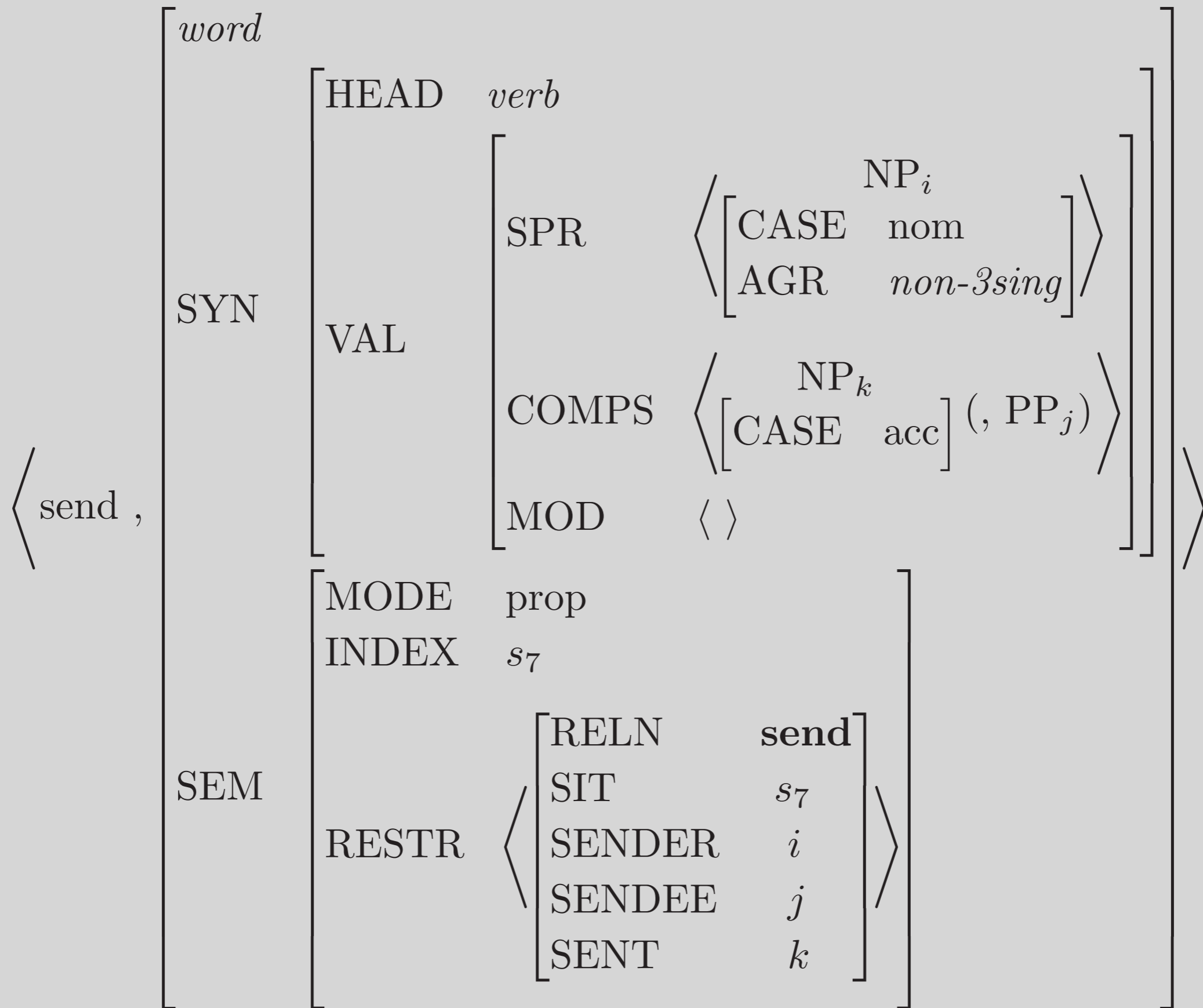
Reading Questions

- Does s7 in SIT stand for the seven predications listed on example 17? Does it mean that SIT account for the number of predications the sentence has?
- Is it true that a lexical entry can satisfy an infinite number of word structures if and only if its SPR or COMPS has selected one or more things on the list? How would this notion of infinity be useful?

Reading Questions

- When do we create multiple lexical entries for a given word? Can we use the same lexical entry to denote multiple semantic meanings if they are found in the same syntactic context? Or do we have to split them out for each one? Can we have multiple lexical entries for a word that maintains the same semantic meaning in multiple syntactic contexts?
- Can we write one entry for *send/sent* that gets both the NP NP and NP PP patterns?





Reading Questions

- Is it okay to leave semantic roles unlinked to other roles? (Like SENDEE in one of the structures for send two letter to Lee?)
- On page 171, immediately after (8), it says that there is no technical issue with having semantic roles that are not realized syntactically--in this case, there is no constituent that fills the ADDRESSEE role for letter. Is there any benefit to including such roles? Why would we include roles like this when they aren't relevant to the context we're looking at?
- P 171 - it's not a problem to have no constituent realizing the ADRESSEE role because we did not impose constraint requiring that semantic roles be realized syntactically. Will we impose such a constraint in other cases - do semantic roles have to be realized syntactically sometimes?

Reading Questions

- In page 179, do the predications with RELN group, speaker and member all belong to 'us'? How to interpret those predications?

$$\left[\begin{array}{ll} \text{RELN} & \text{group} \\ \text{INST} & i \end{array} \right], \left[\begin{array}{ll} \text{RELN} & \text{send} \\ \text{SIT} & s_7 \\ \text{SENDER} & i \\ \text{SENDEE} & j \\ \text{SENT} & k \end{array} \right], \left[\begin{array}{ll} \text{RELN} & \text{group} \\ \text{INST} & j \end{array} \right],$$

$$\left[\begin{array}{ll} \text{RELN} & \text{speaker} \\ \text{INST} & l \end{array} \right], \left[\begin{array}{ll} \text{RELN} & \text{member} \\ \text{SET} & j \\ \text{ELEMENT} & l \end{array} \right], \left[\begin{array}{ll} \text{RELN} & \text{exist} \\ \text{BV} & k \end{array} \right],$$

$$\left[\begin{array}{ll} \text{RELN} & \text{letter} \\ \text{INST} & k \\ \text{ADDRESSEE} & m \end{array} \right]$$

Reading Questions

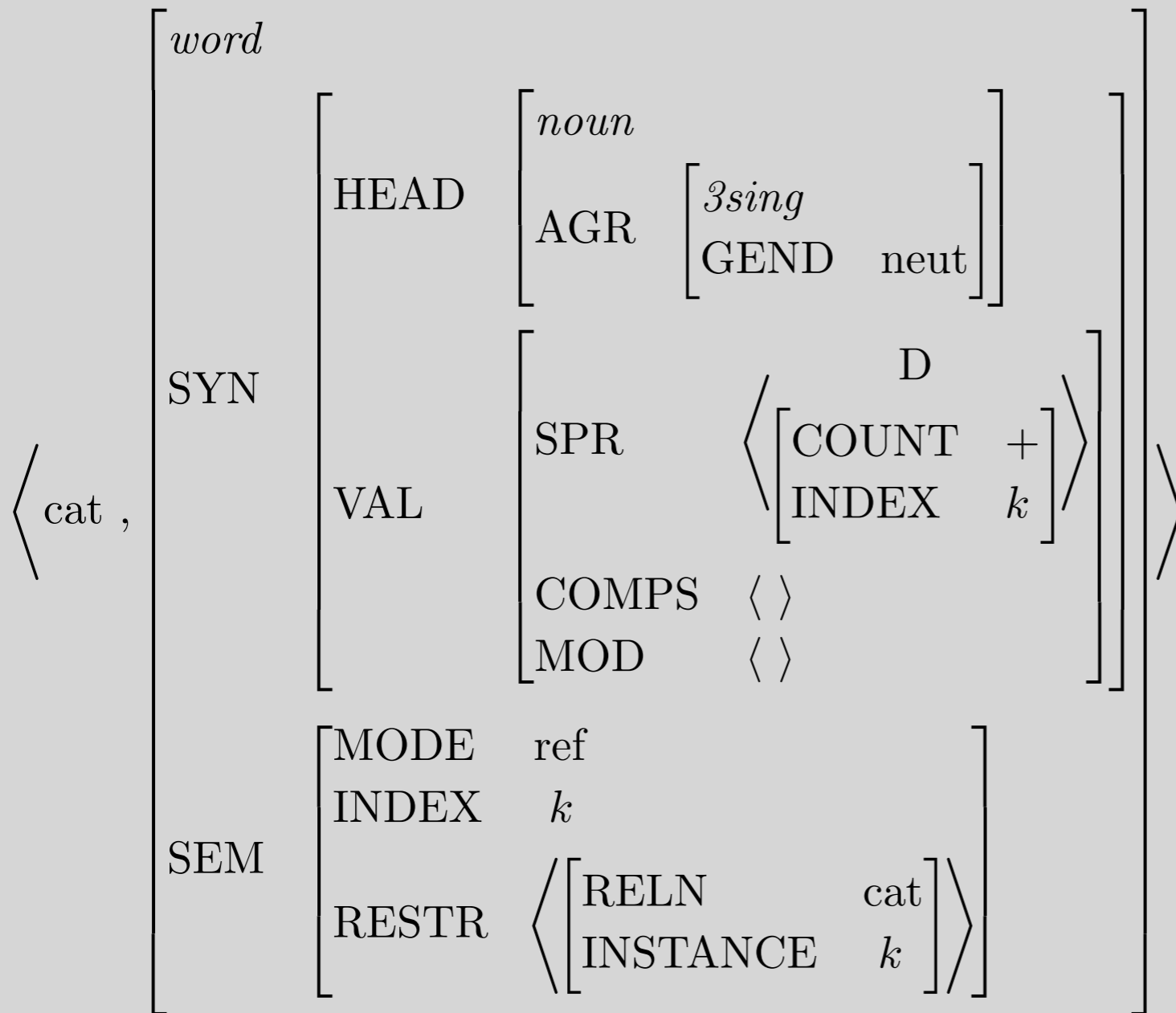
- How do BV & INST end up linked?

Lexical Entry for *a*

$\langle a, \rangle$	$\left[\begin{array}{l} \text{word} \\ \\ \text{SYN} \\ \\ \text{SEM} \end{array} \right.$	$\left[\begin{array}{l} \text{HEAD} \\ \\ \text{VAL} \\ \\ \text{MODE} \\ \text{INDEX} \\ \text{RESTR} \end{array} \right.$	$\left[\begin{array}{l} \text{det} \\ \text{AGR} \\ \text{COUNT} \\ \\ \text{COMPS} \\ \text{SPR} \\ \text{MOD} \\ \\ \text{none} \\ j \\ \left\langle \left[\begin{array}{l} \text{RELN} \\ \text{BV} \end{array} \right] \right\rangle \end{array} \right.$	$\left[\begin{array}{l} \\ 3sing \\ + \\ \\ \langle \rangle \\ \langle \rangle \\ \langle \rangle \\ \\ \\ a \\ j \end{array} \right.$	\rangle
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- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?

Lexical Entry for *cat*



- Which feature paths are abbreviated?
- Is this a fully specified description?
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Reading Questions

- Given the possibility of multiple well-formed parses of an ambiguous sentence, how does parse selection work with HPSG? What would make a parser choose one representation over the other? Is there a way to include a "weight" for parses to indicate preference within the context of a particular corpus?
- Has anyone actually built one of these in software?