

Ling 566

Oct 18, 2022

How the Grammar Works

Midterm feedback: Thank you!

- More examples (coming right up!)
- More time between chapter covered in lecture & homework due (getting better?)
- Reading takes a long time/hard to tell what's most important
- Talk slower/more time to formulate questions (will do my best)
- Not always clear what HW is asking for (please ask!)
- HW seems to stretch beyond the chapter (yes!)

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

Why does this matter to NLP?

- Understand how language works => better positioned to build technology that works with language
- For some applications, grammar engineering is a valuable component directly
- Grammar engineering can also support extremely detailed annotation

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?

🌐 When poll is active, respond at pollev.com/emb

📱 Text **EMB** to **22333** once to join



W Syntax (so far) helps me:

understand other classes

understand what I'm getting
the computer to do

understand how to evaluate
NLP systems

not very much/not at all

by being interesting

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W In the future, I think syntax will help me:

understand other classes

understand what I'm getting
the computer to do

understand how to evaluate
NLP systems

not very much/not at all

by being interesting

An Example

A cat slept.

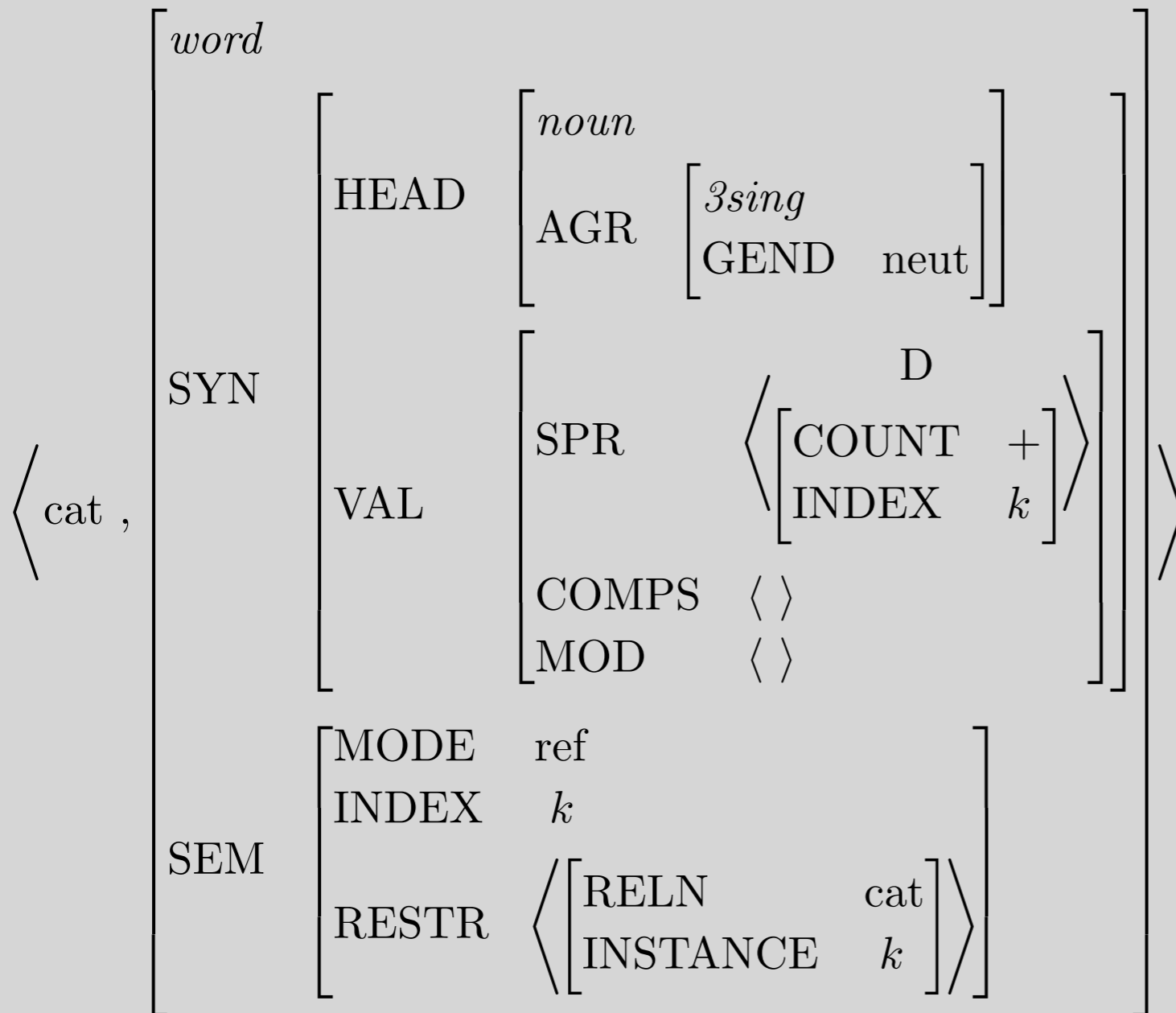
- Can we build this with our tools?
- Given the constraints our grammar puts on well-formed sentences, is this one?

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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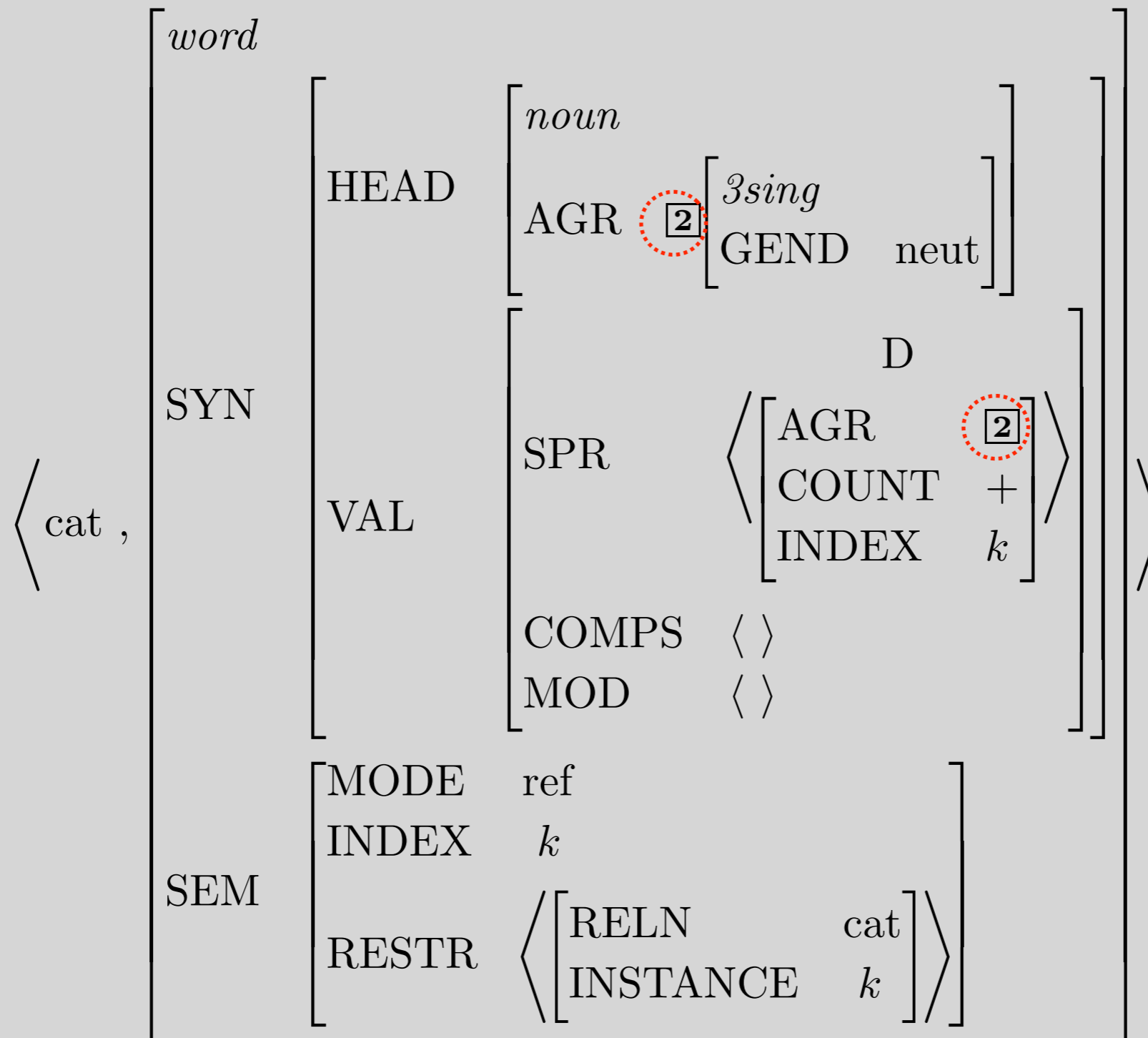
- Is this a fully specified (resolved) description?
- What features are unspecified?
- How many word structures can this entry license?

Lexical Entry for *cat*

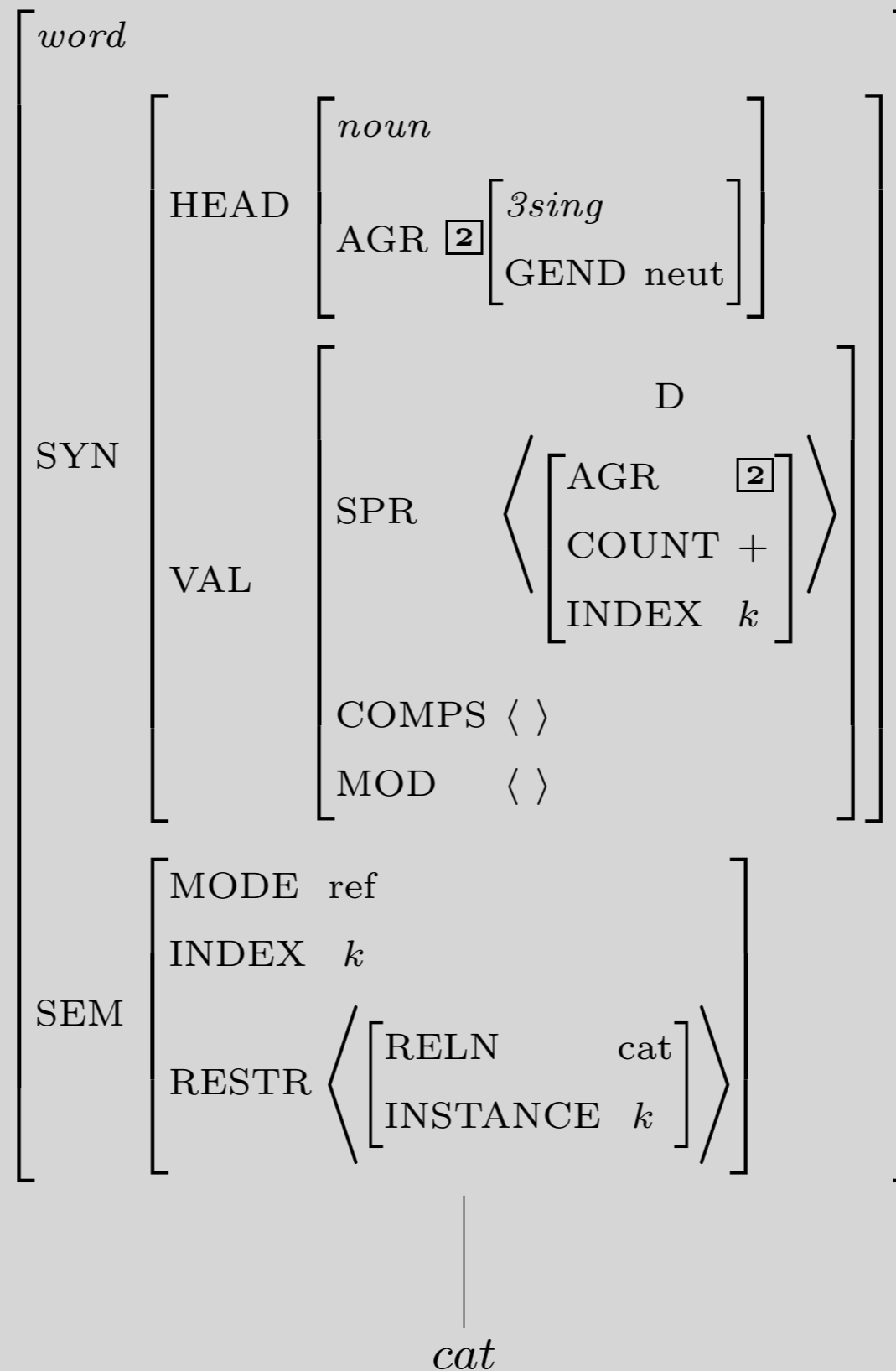


- Which feature paths are abbreviated?
- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?

Effect of Principles: the SHAC

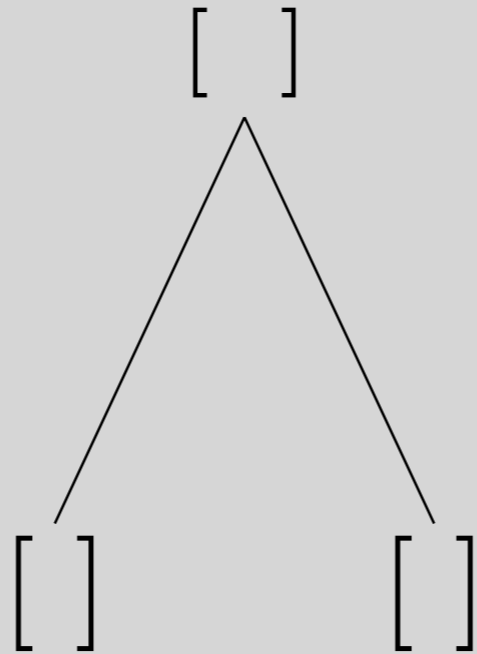


Description of Word Structures for *cat*

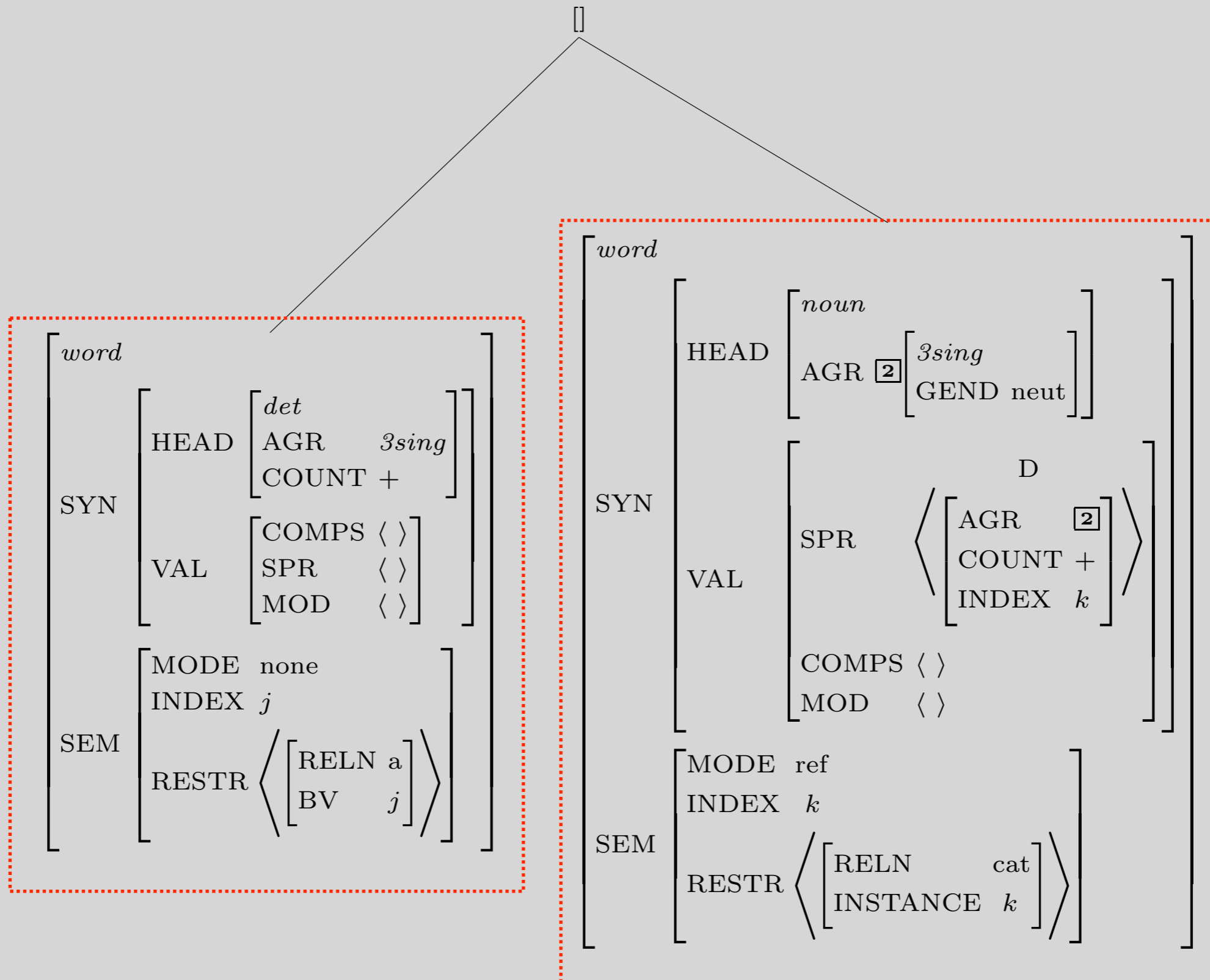


cat

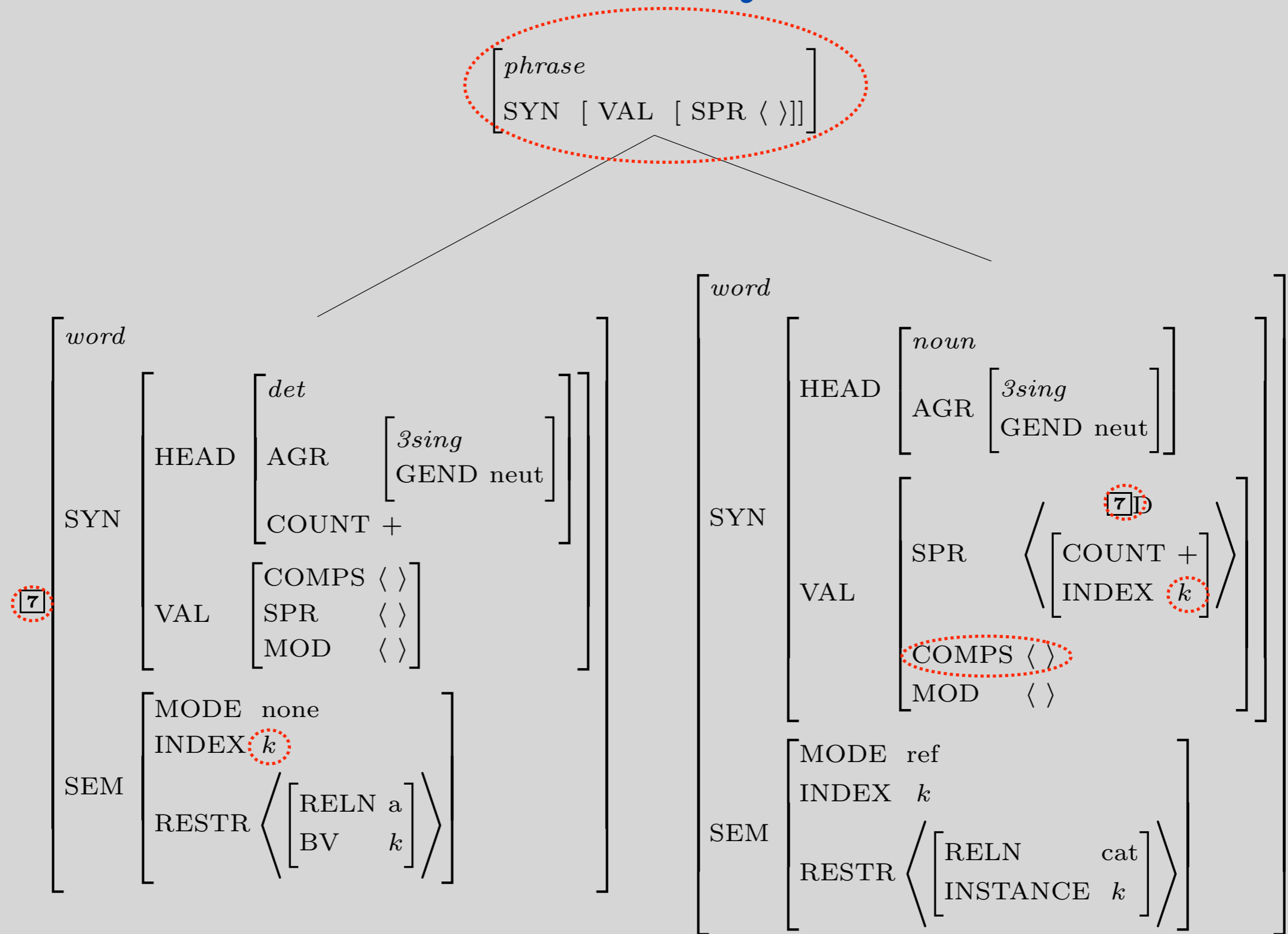
Building a Phrase



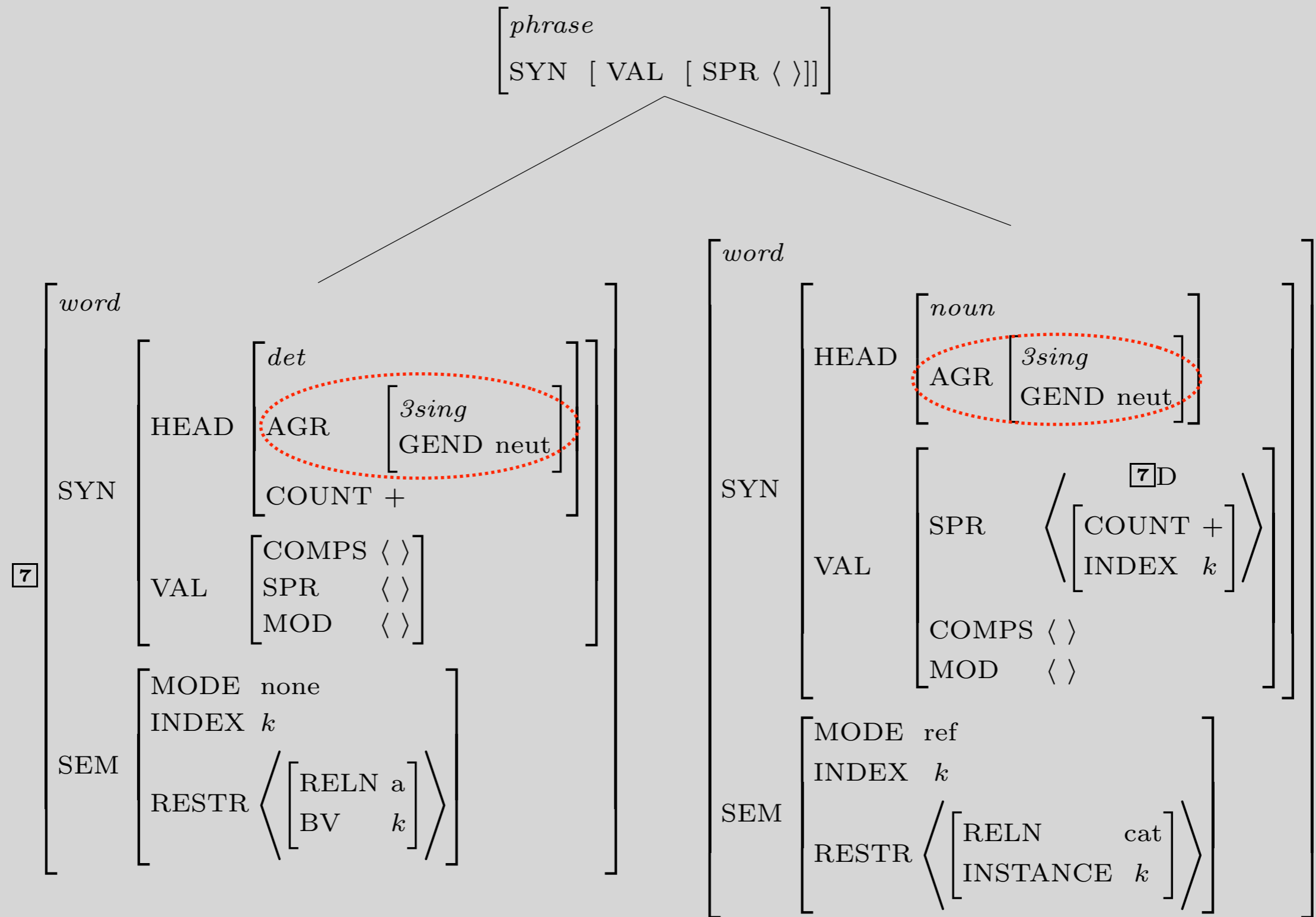
Constraints Contributed by Daughter Subtrees



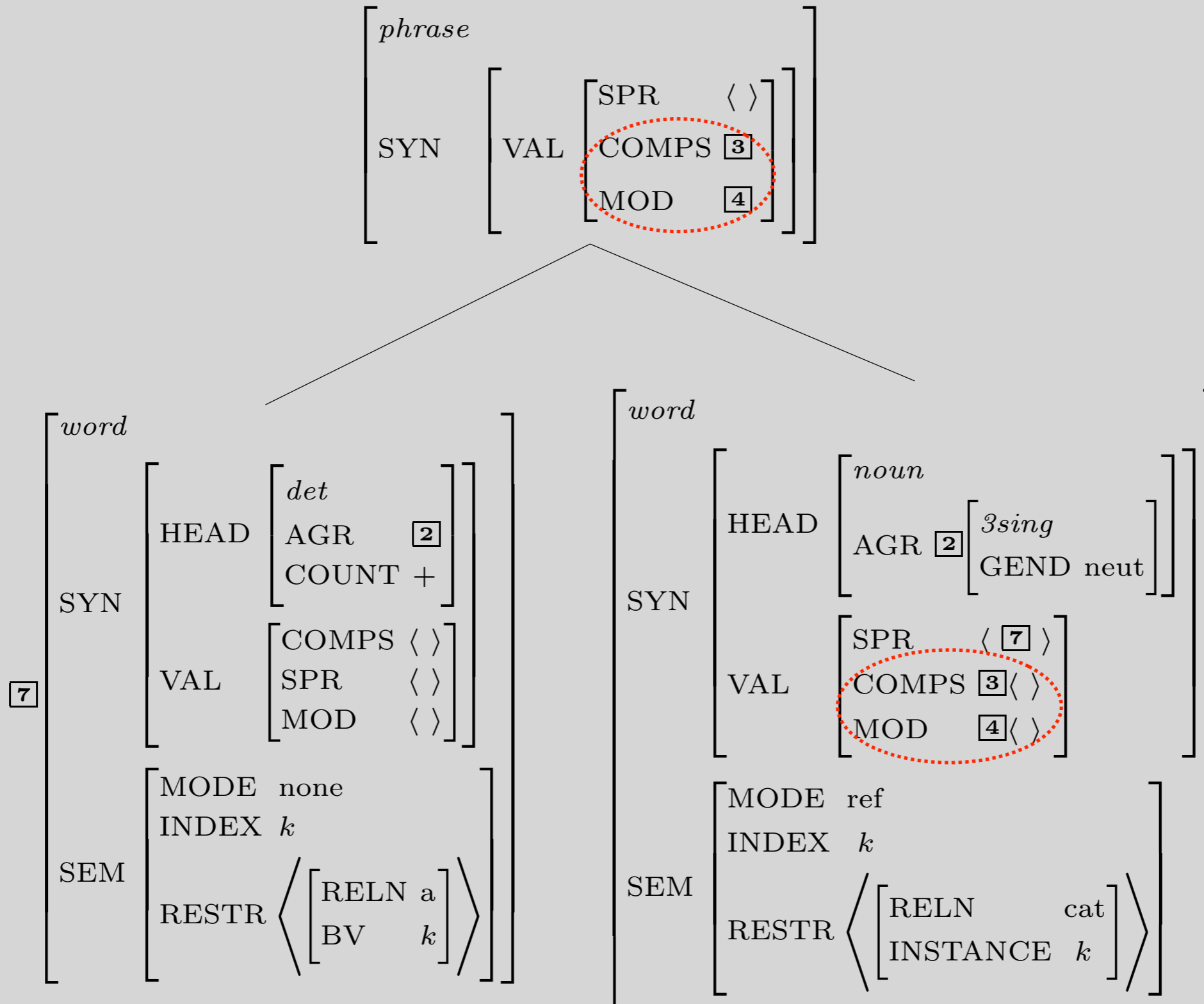
Constraints Contributed by the Grammar Rule



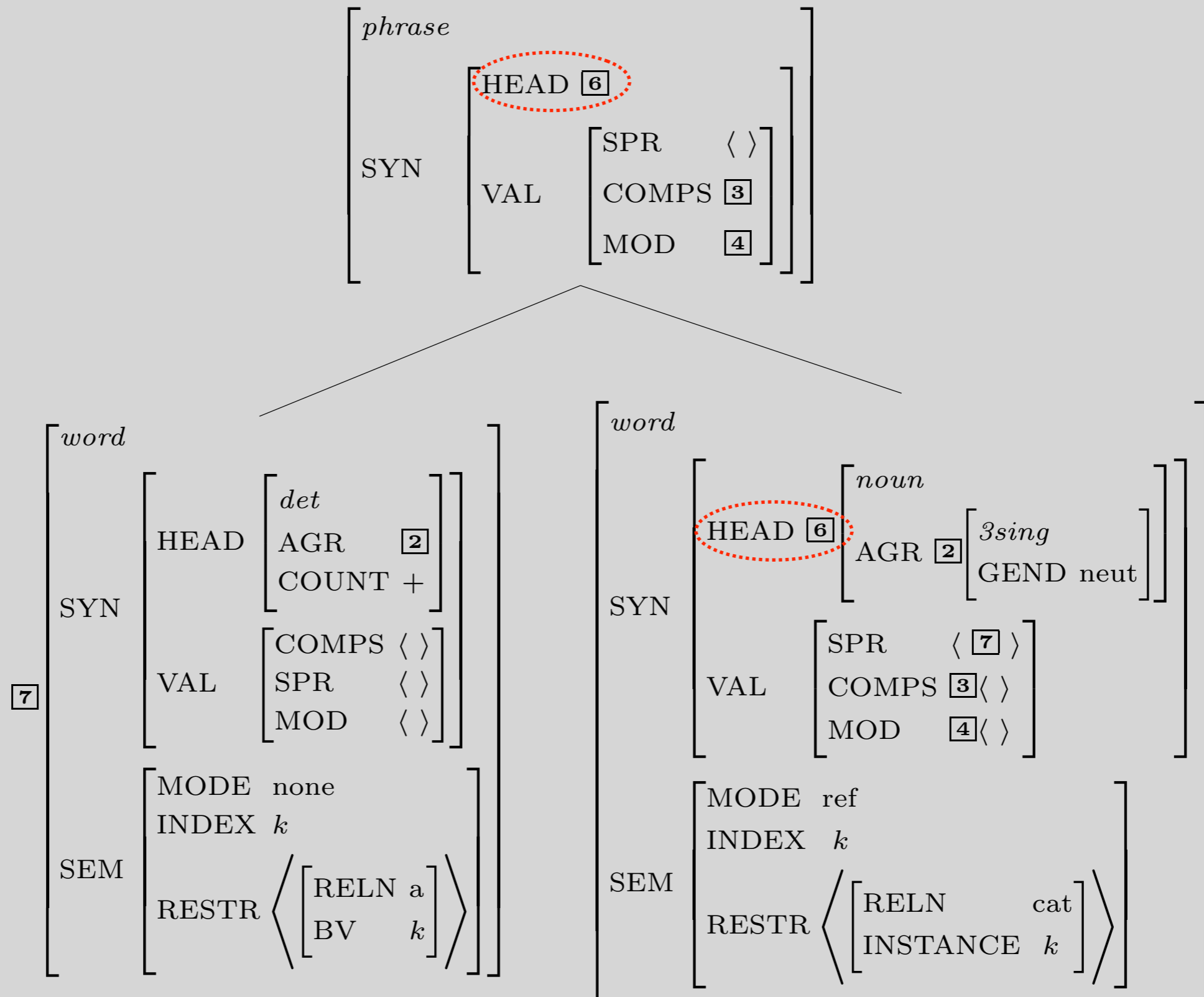
A Constraint Involving the SHAC



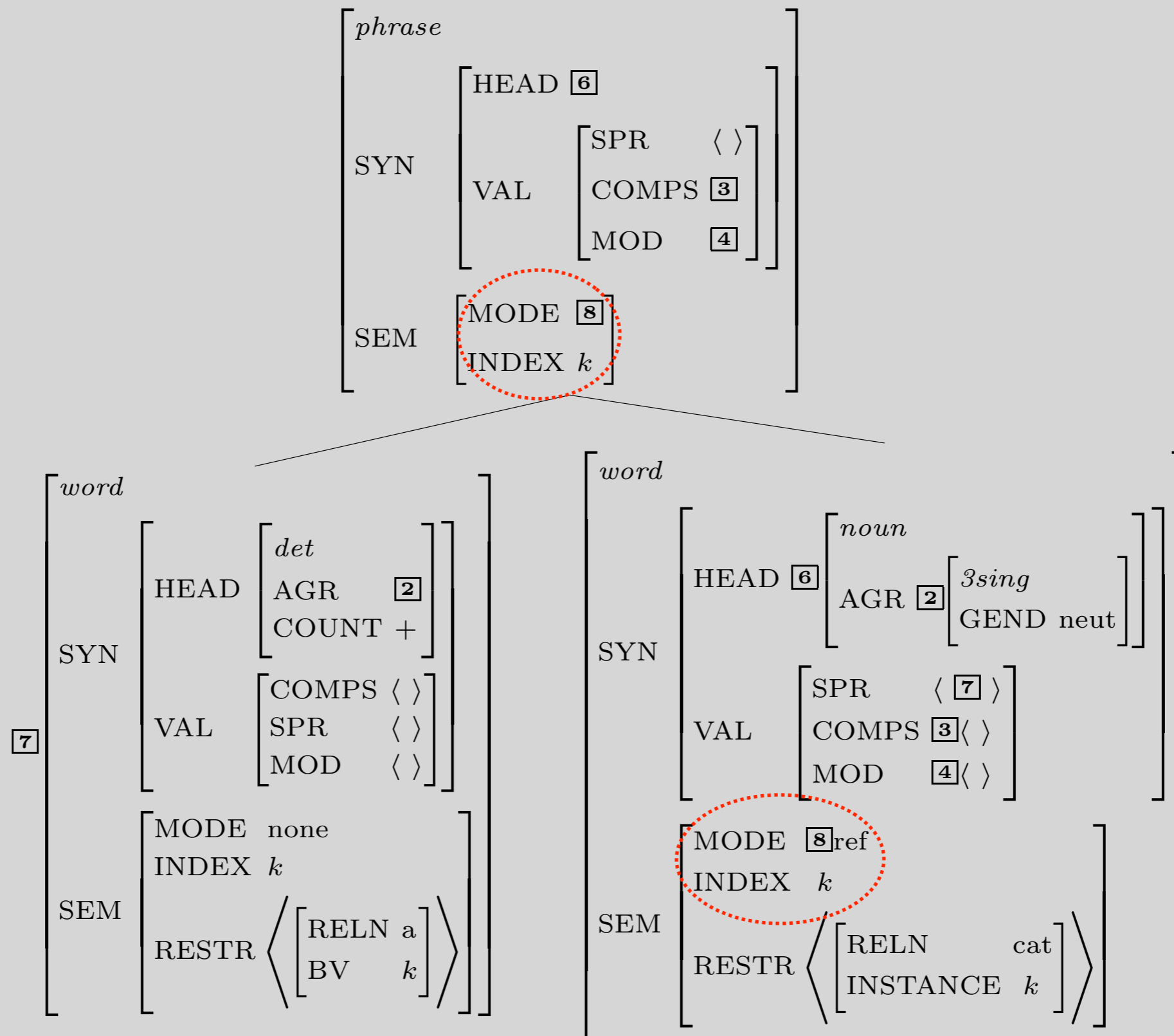
Effects of the Valence Principle



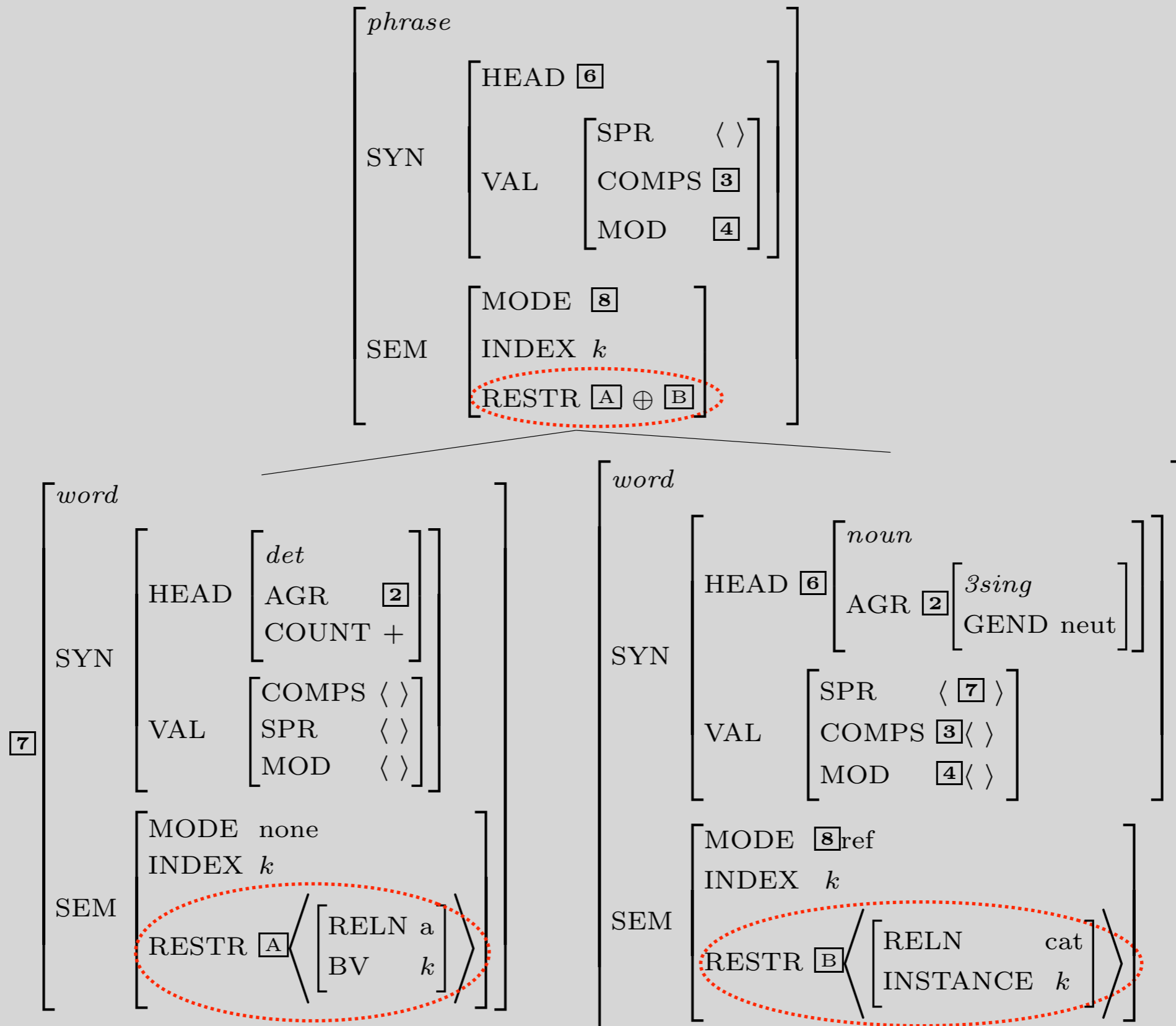
Effects of the Head Feature Principle



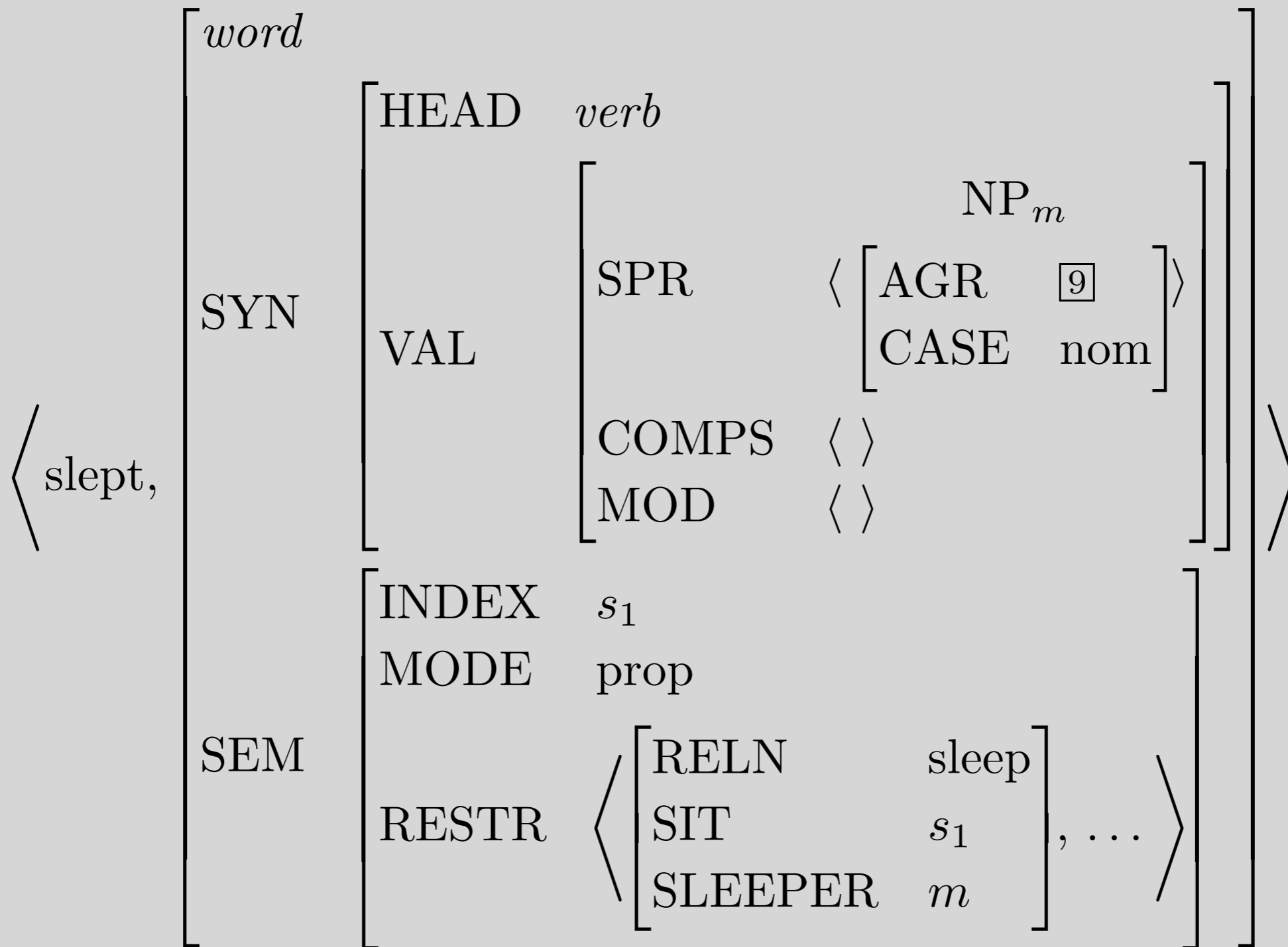
Effects of the Semantic Inheritance Principle



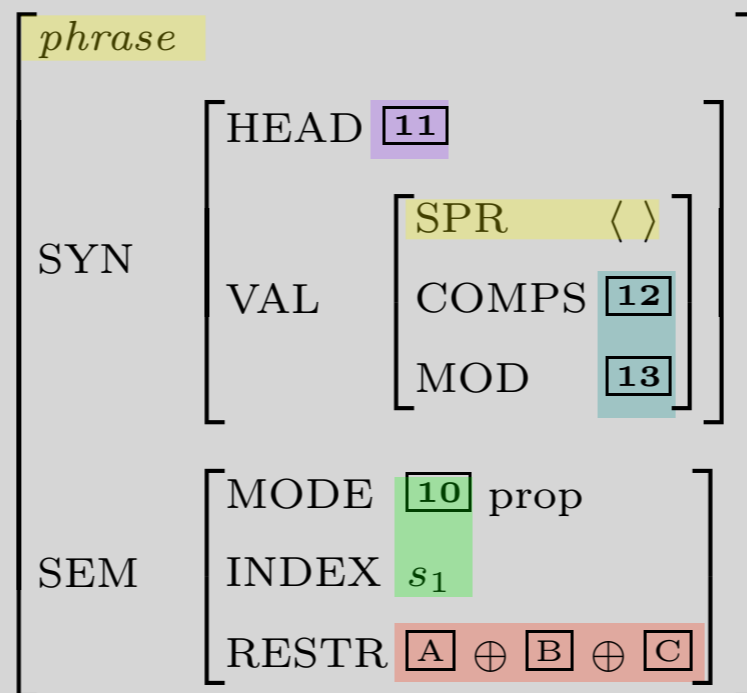
Effects of the Semantic Compositionality Principle



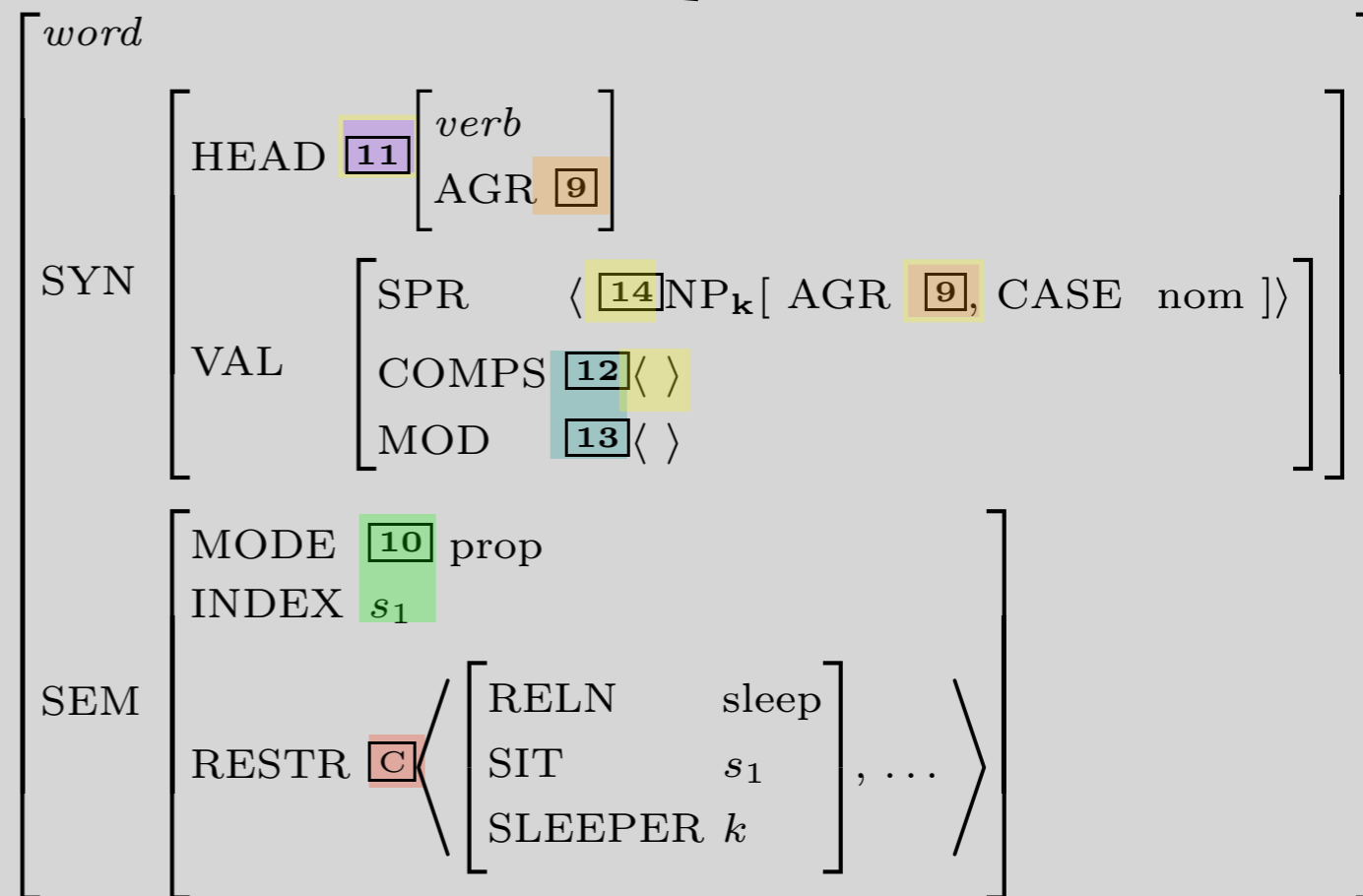
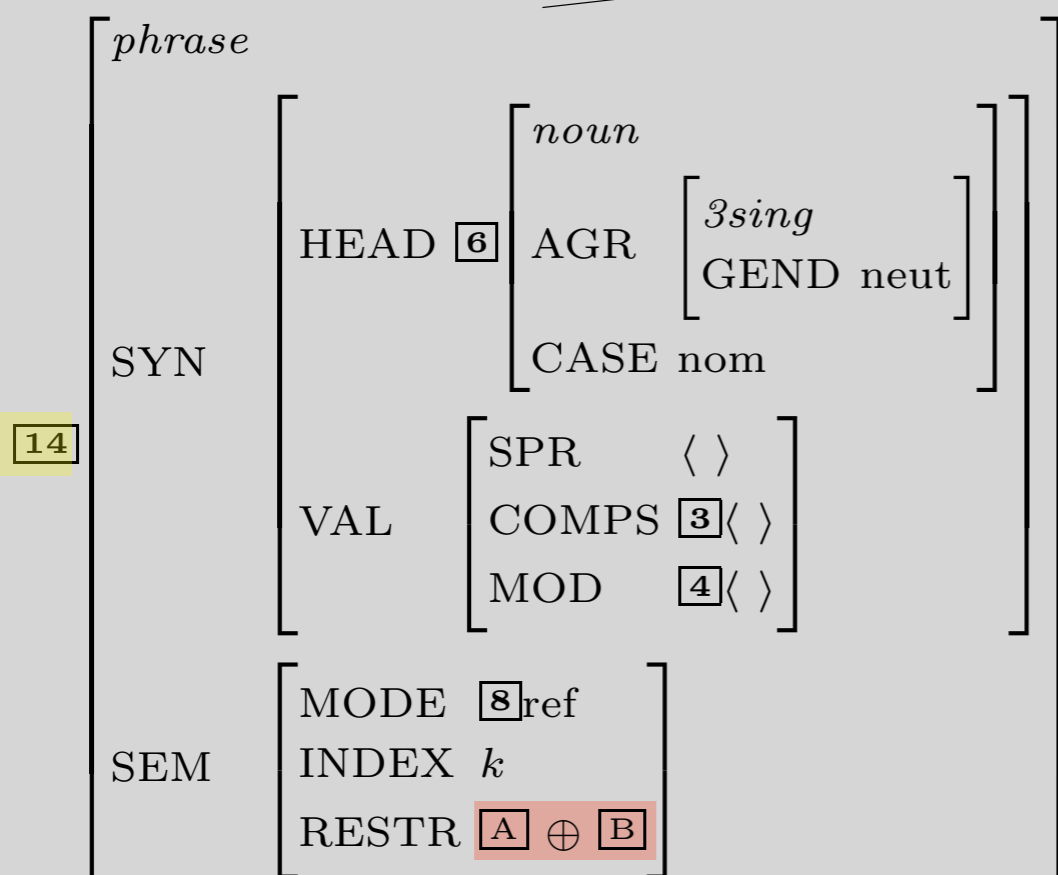
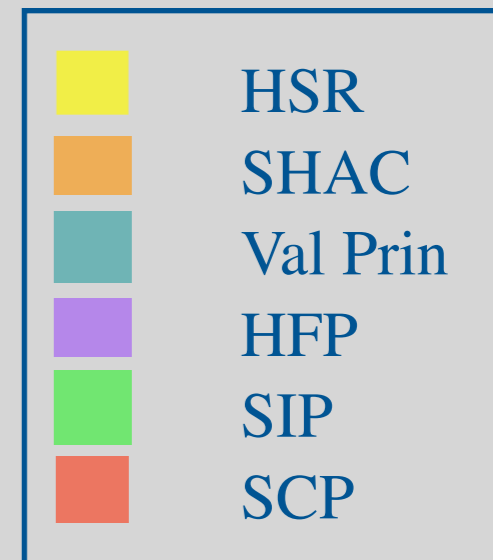
Lexical Entry for *slept*



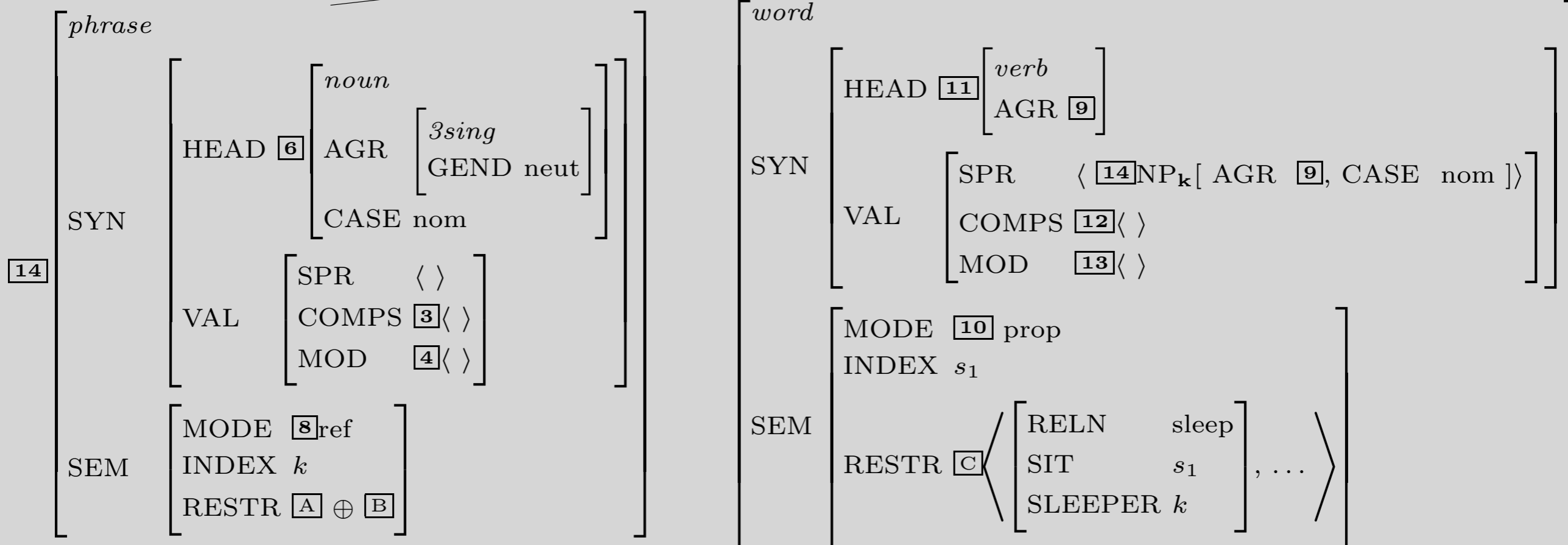
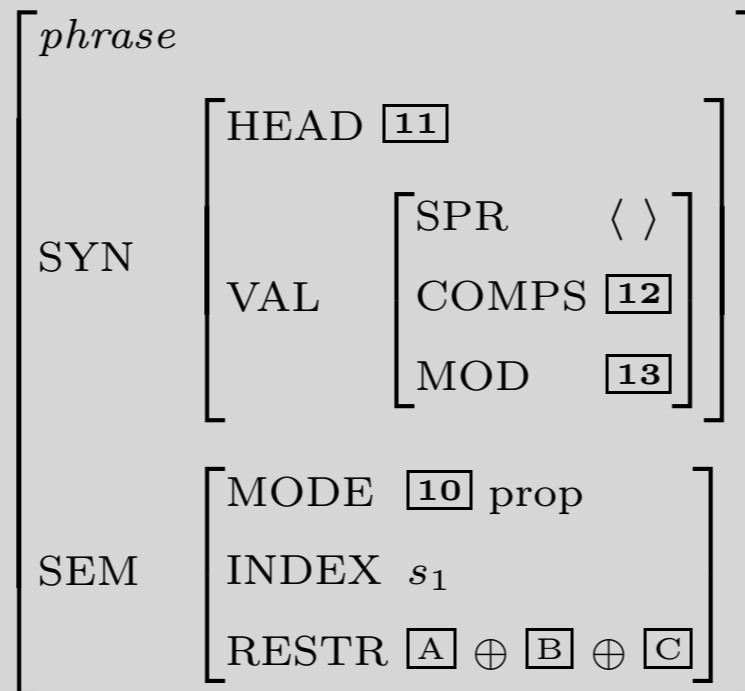
Another Head-Specifier Phrase



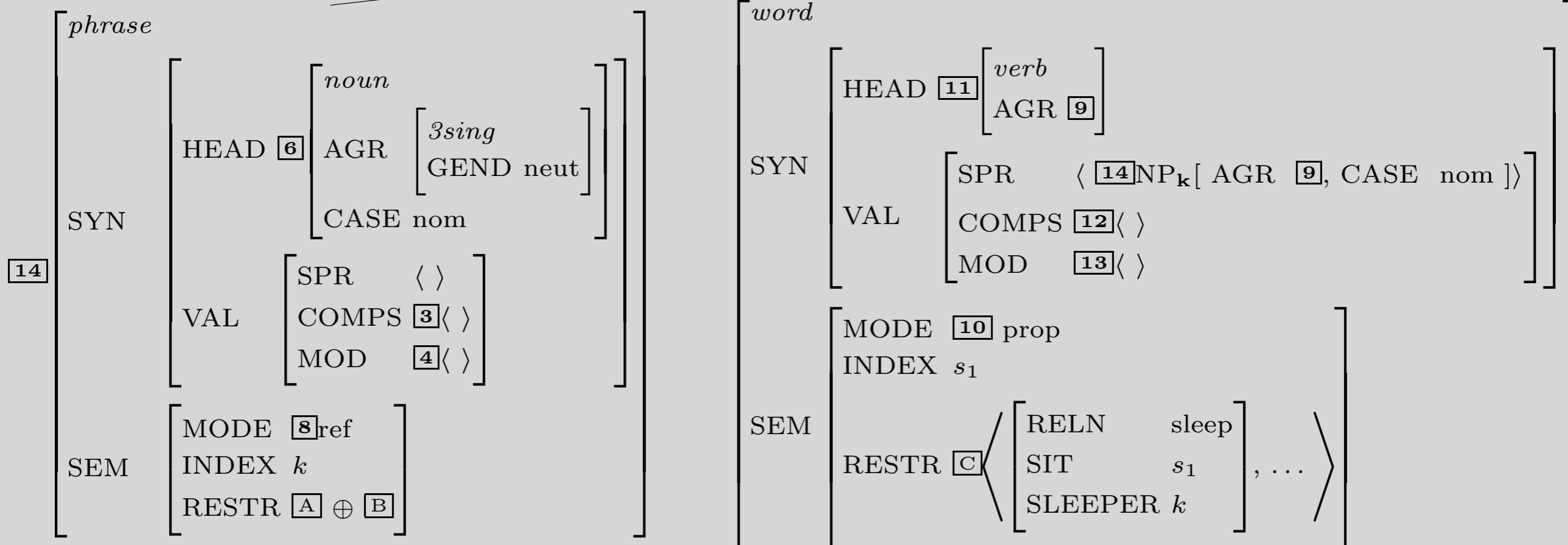
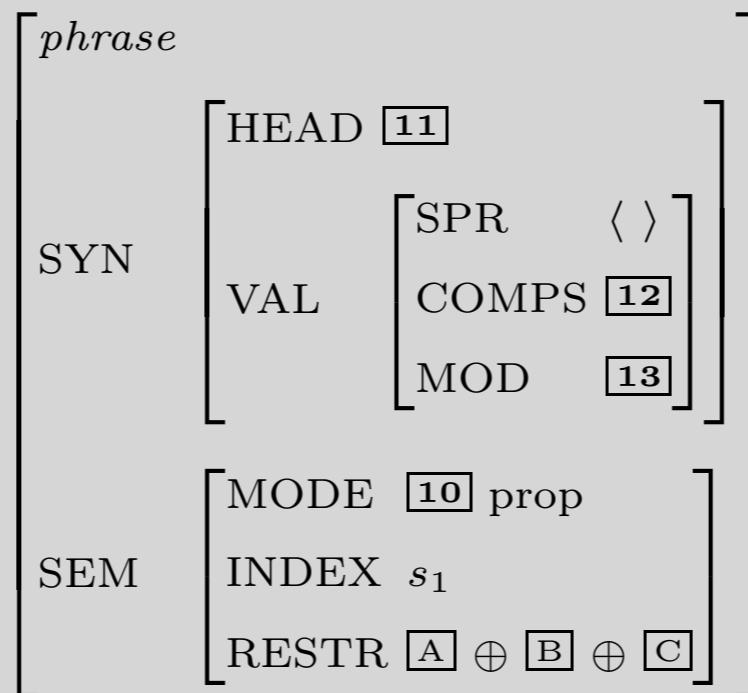
Key



Is this description fully specified?



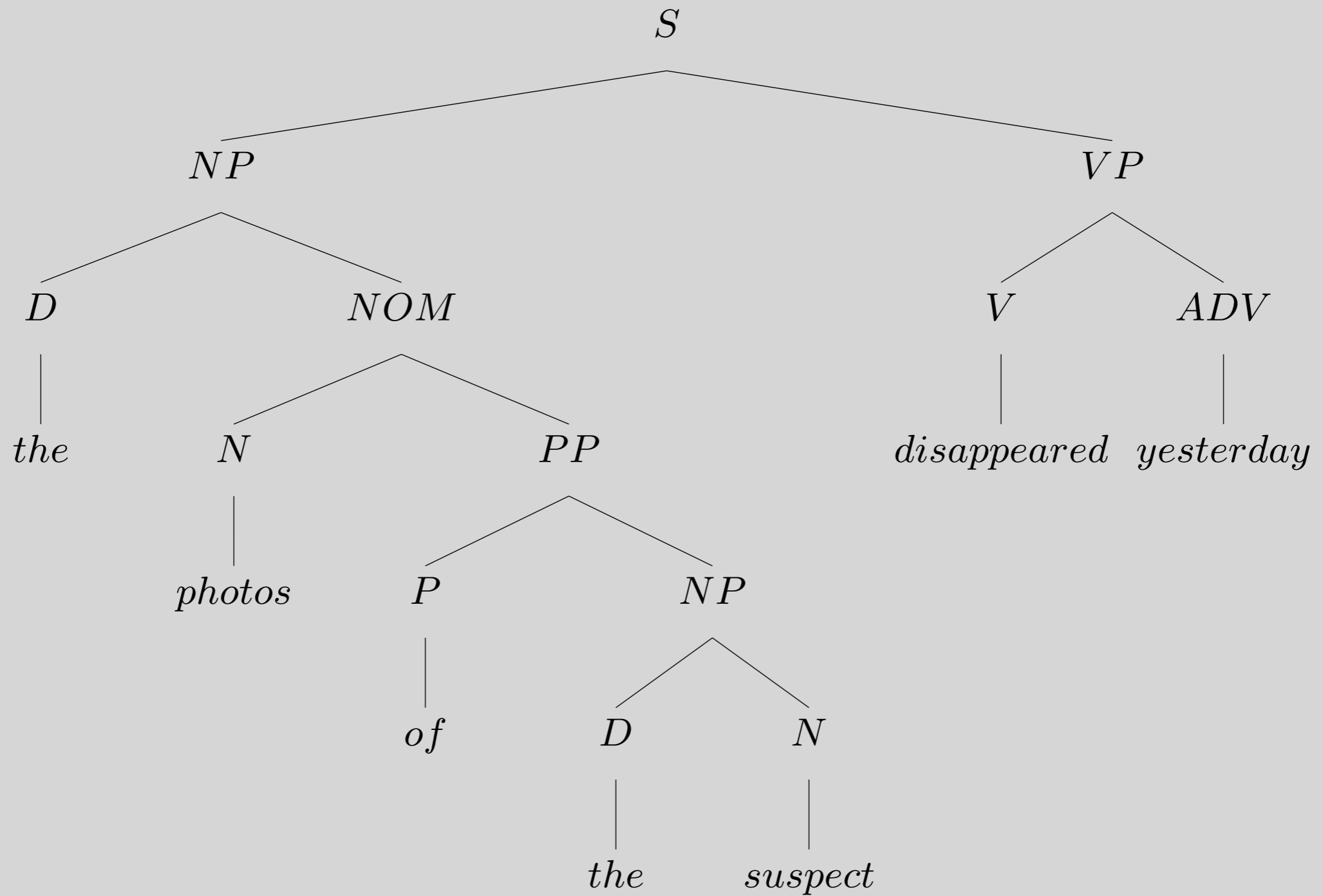
Does the top node satisfy the initial symbol?



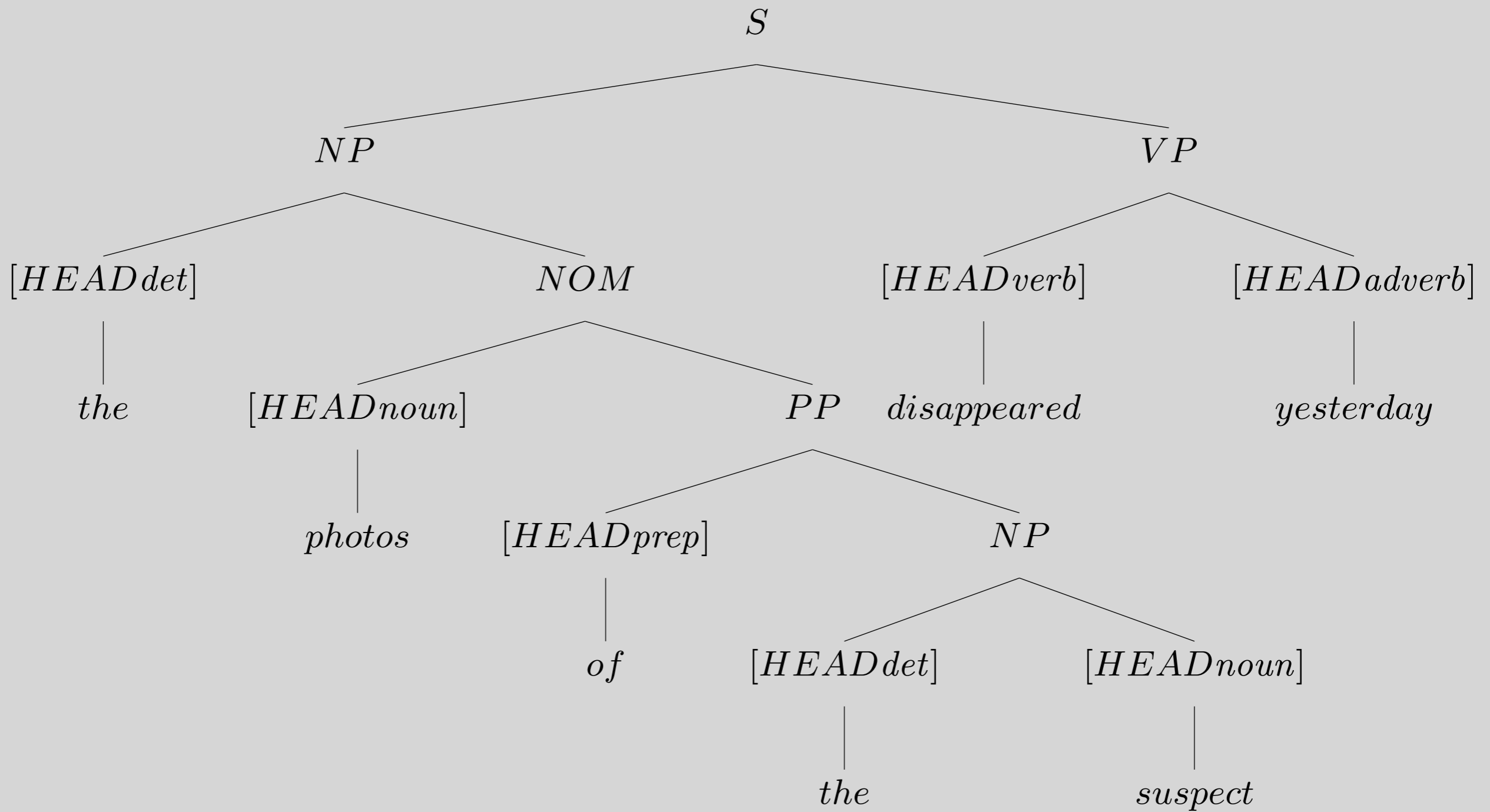
RESTR of the S node

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

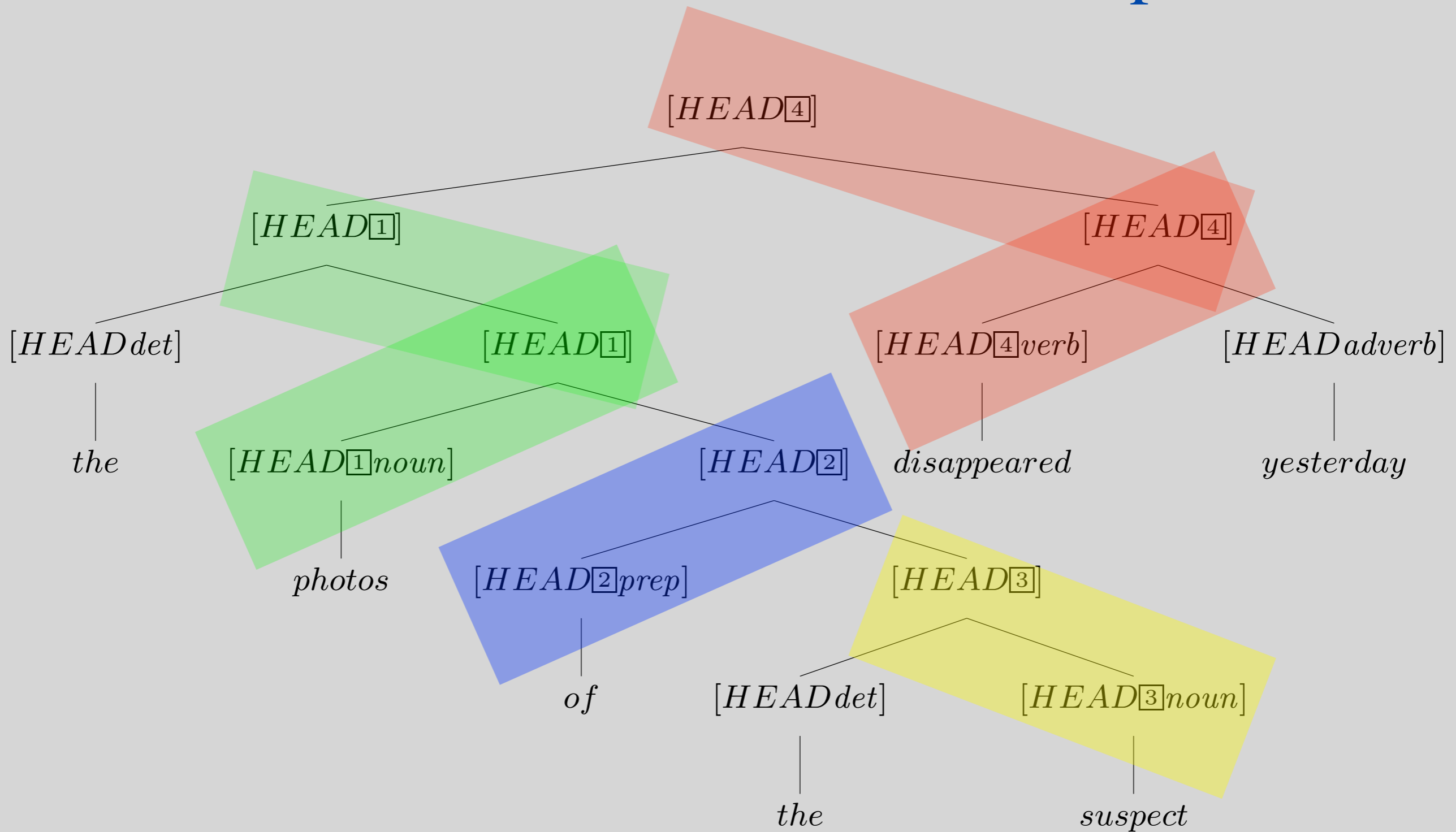
Another Example



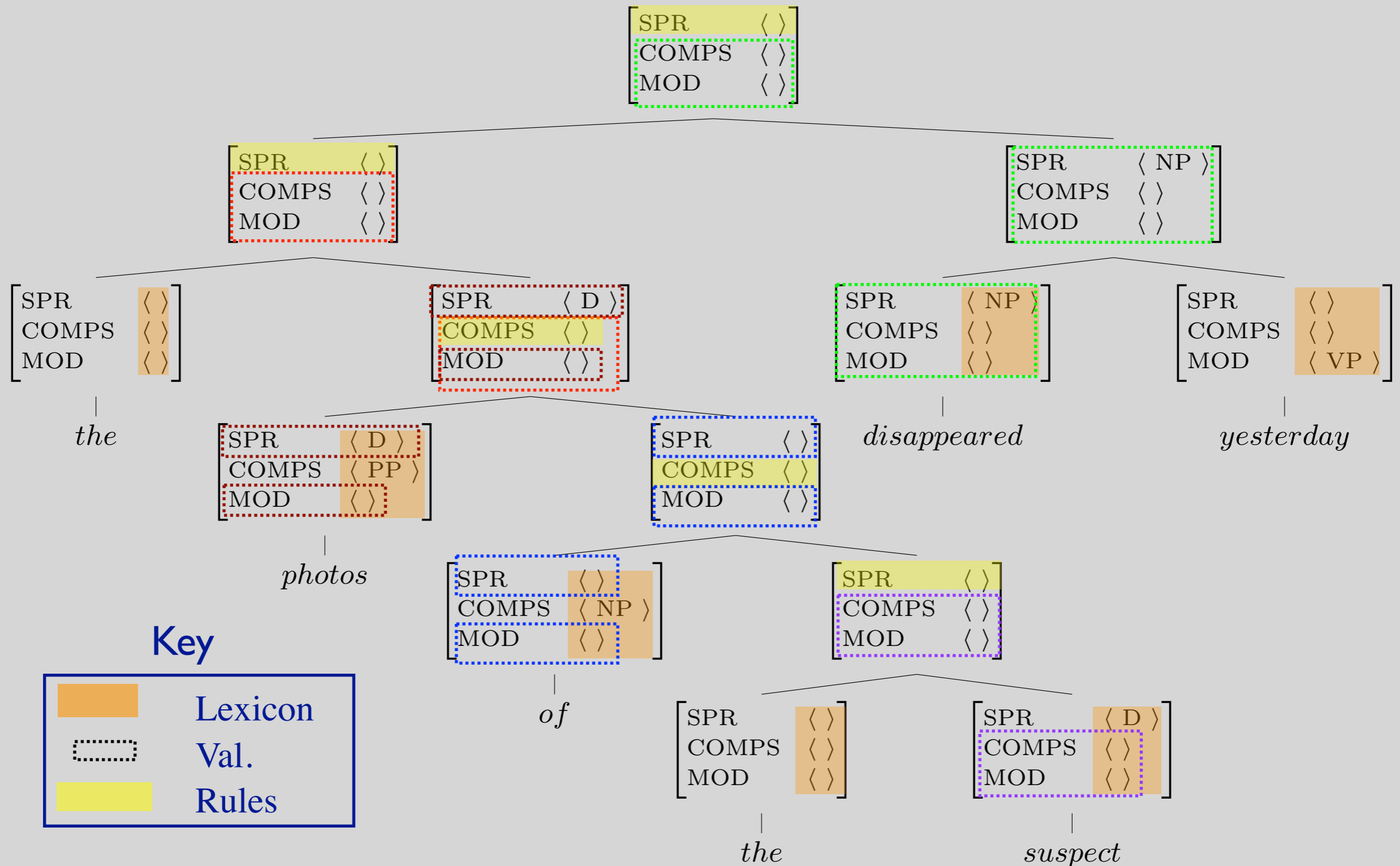
Head Features from Lexical Entries



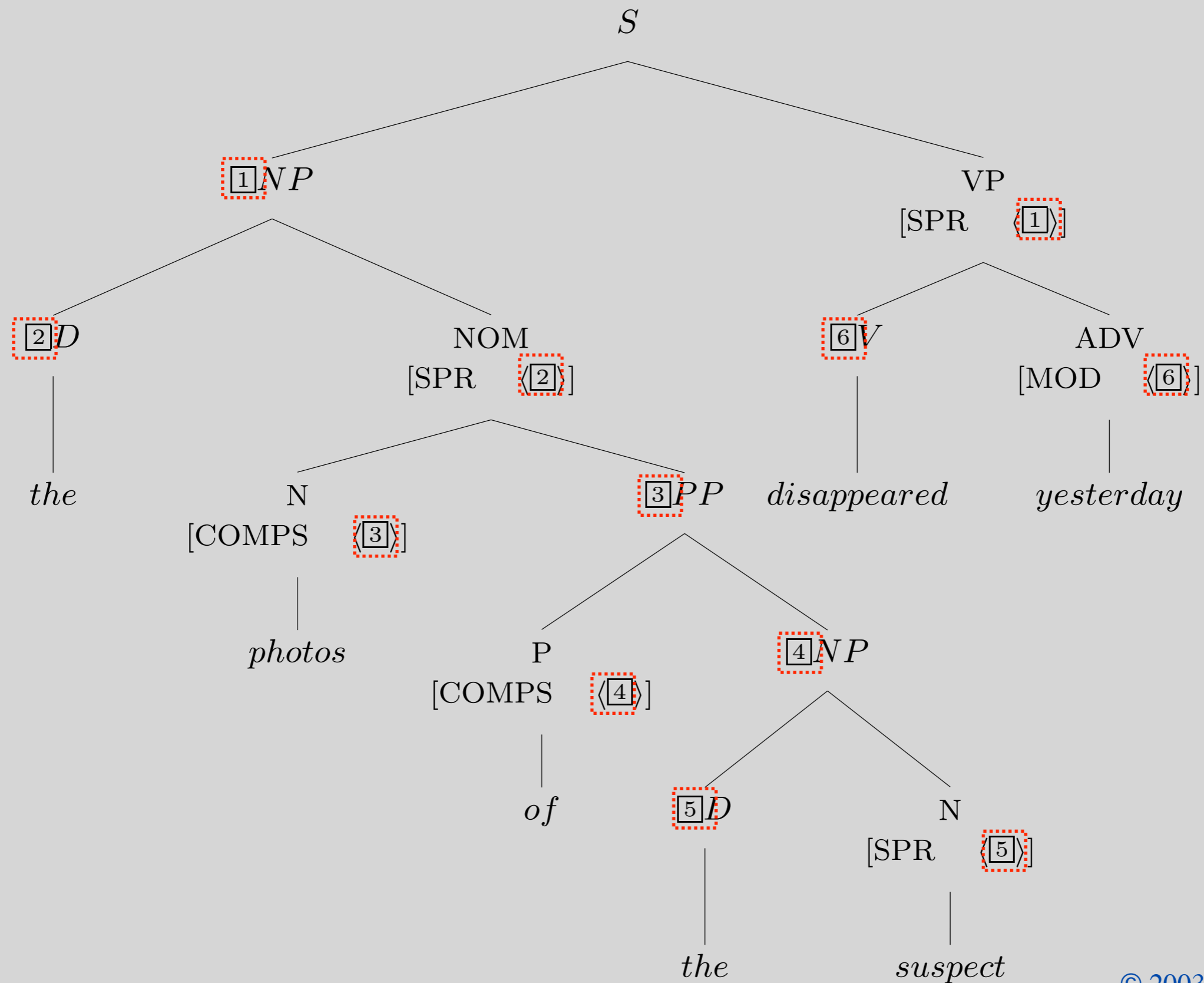
Head Features from Lexical Entries, plus HFP



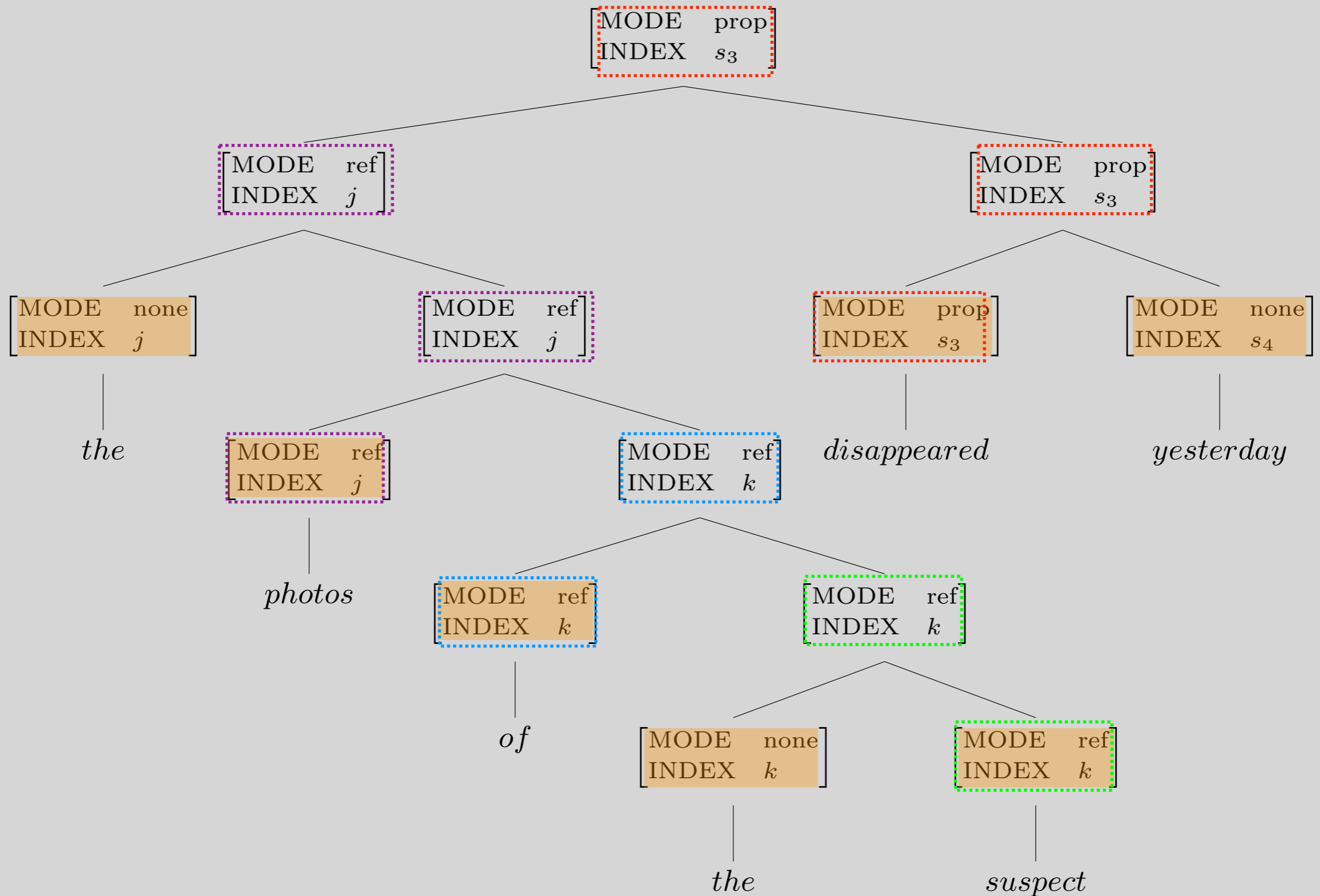
Valence Features: Lexicon, Rules, and the Valence Principle



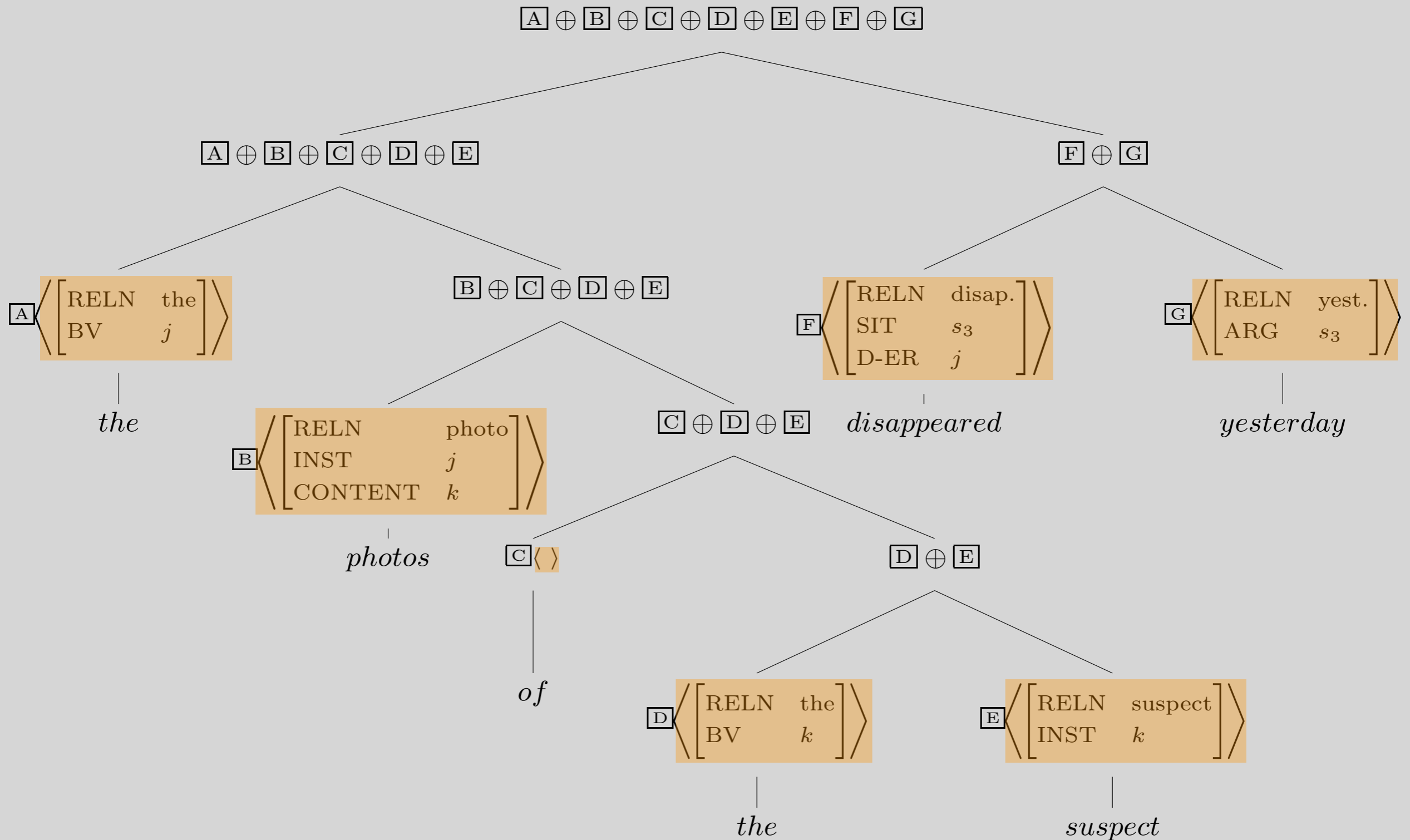
Required Identities: Grammar Rules



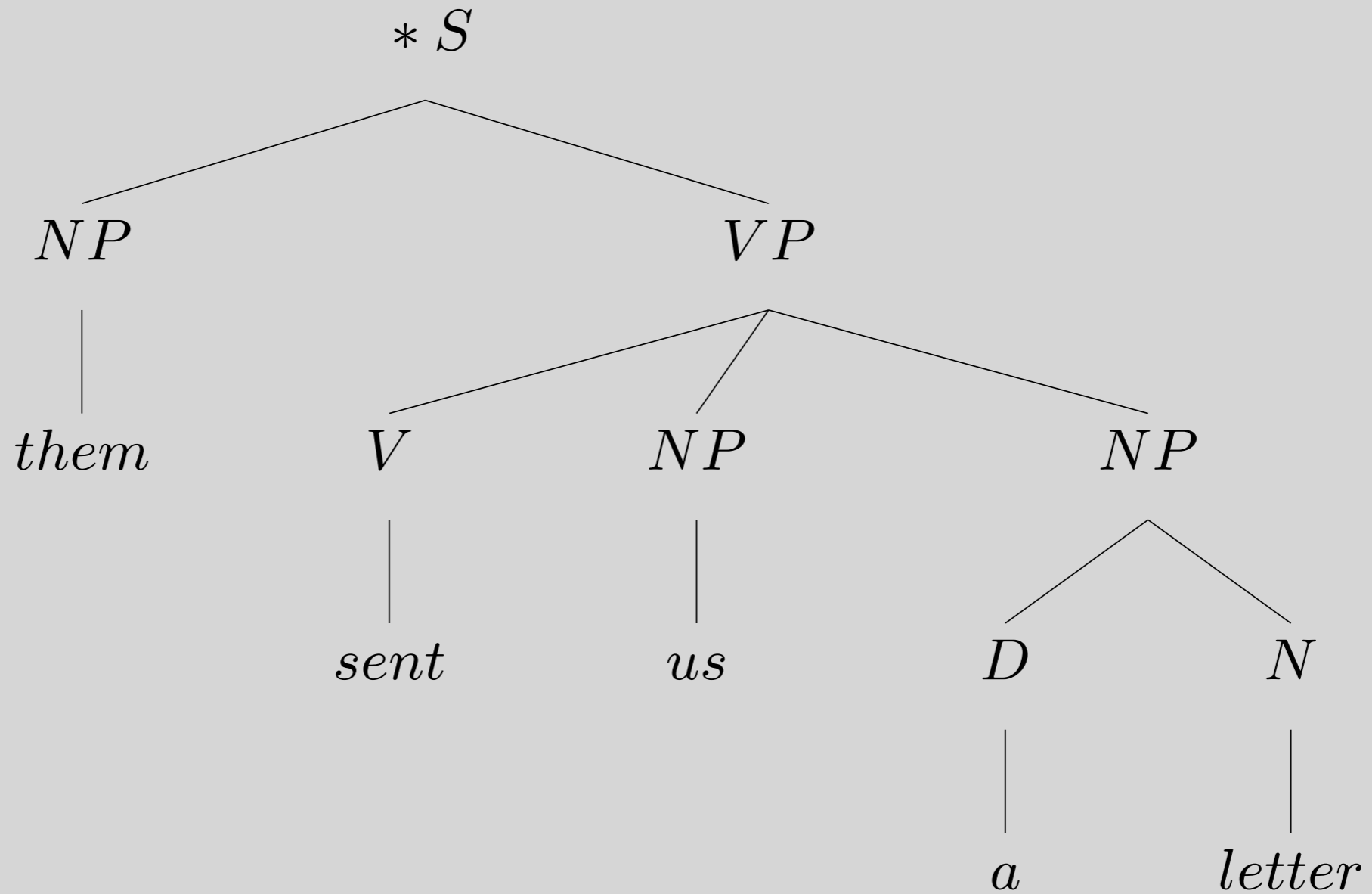
Two Semantic Features: the Lexicon & SIP



RESTR Values and the SCP

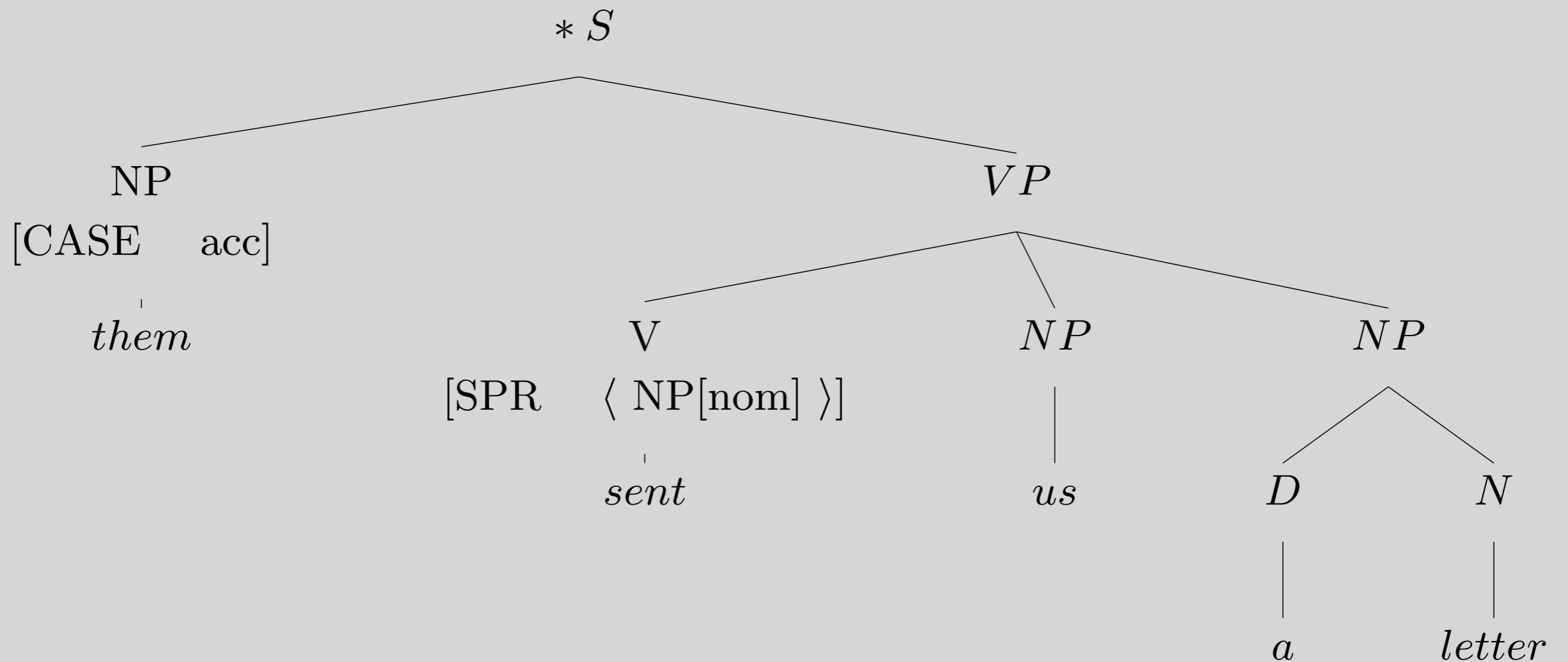


An Ungrammatical Example



What's wrong with this sentence?

An Ungrammatical Example

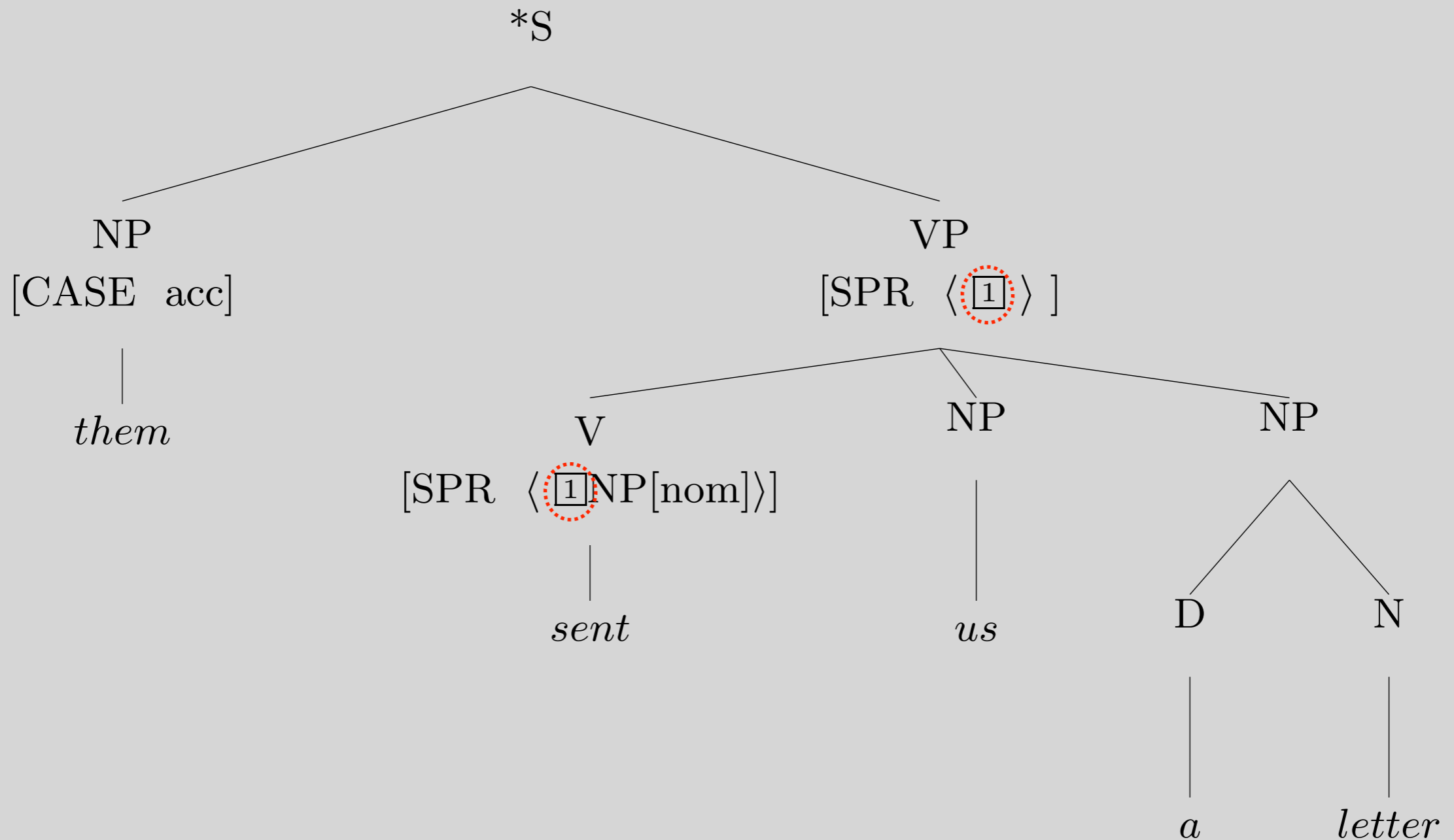


What's wrong with this sentence?

So what?

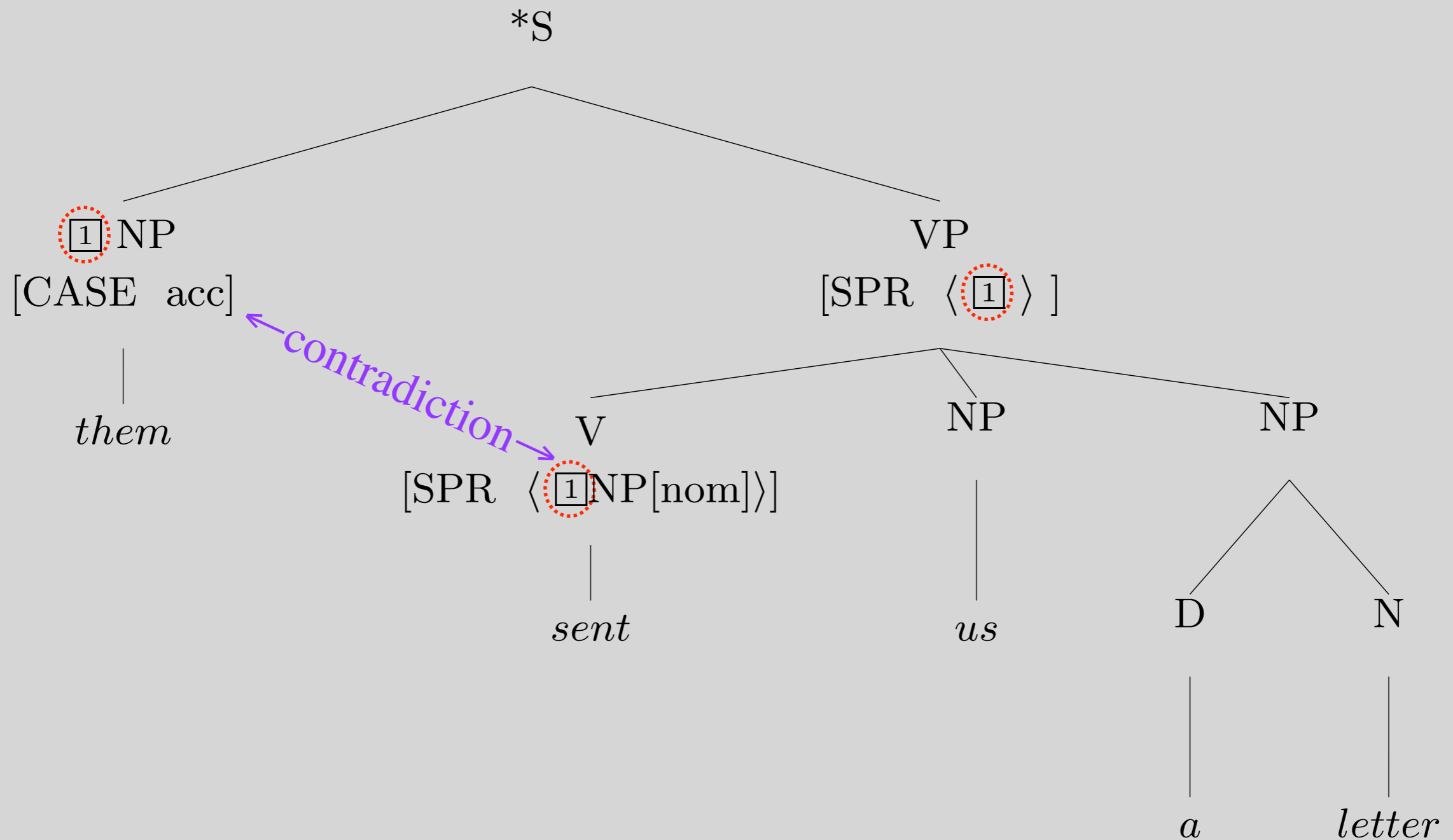
An Ungrammatical Example

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?

W What grammatical phenomena are we missing?

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

Reading Questions

- What is an "identity"? as used on page 172?
- When do we use [1] and when do we use [A]?

Reading Questions

- How does one know that a given phrase is "headed"? Can we get more examples of "headed phrases" (probably in the slides I would guess)
- In ex (14) (*VP sent us a letter*) on page 176 which node is the "head daughter"? (the left-most one because of the HCR?) Are there multiple head daughters in (14)?
- Why does CASE go just inside HEAD and not inside AGR?

Reading Questions

- I am confused by the difference between a modifier and an optional complement. For example, in 5 for the lexical entry of "letter", we see that letter takes an optional PP as a complement. Why is this PP not a modifier for letter that uses the Head Modifier Rule?

Reading Questions

- On page 154, the lexical entry to a includes an index value. By my current understanding of the role index values play, I'm not sure why it would be necessary. Assuming that whatever noun for which a acts as specifier must have index i , and the RESTR values follow compositionality (their union is passed up), then it seems unnecessary for a (and maybe all articles?) to have indices. Does a have an index on p. 154 simply because it is the lexical entry for a rather than what a would look like in an actual syntax tree?
- The same issue appears on the tree for a *letter* on p.172. Again, a has an index value. But is it necessary? Isn't it sufficient that it have a RESTR value that stipulates existence of some k ?

Reading Questions

- For (5) in the book, it seems like *letter* is referring to itself in its specifier (INDEX k is in the SPR list under D). Why does the noun have to refer to itself when its specifier is a determiner?

Reading Questions

- It seems that the RELN values we currently use for *a* and *the* might be almost interchangeable. Will we start refining our RELN predications to distinguish these?
- Is it always true that "RELN exist" can only take place if and only if the lexicon in question is of type determiner (e.g. a/an/the/all/any/these/those/this/that...); also, must its index always be the same as the nouny phrase/word it precedes?

Reading Questions

- Are there cases where we need to come up with multiple lexical entries for a single word? For example, the word novel. What happens when we want to express different semantic meanings through the same syntactic unit?

Reading Questions

- In the second parse of *We send two letters to Lee* the SENDEE role in the lexical entry for *send* doesn't have a corresponding constituent. Is this optional correspondence the default for semantic role's? For example, the lexical entry for the ditransitive verb *give* might have essentially the same semantic roles (giver, givee, gift) as *send* (sender, sendee, sent) but compliments $\langle \text{NP, PP} \rangle$ rather than $\langle \text{NP (PP)} \rangle$. Will we ever need to mandate that a semantic role has a corresponding syntactic constituent or do we rely only on valence features within the syntax in this way?

Reading Questions

- When defining the RESTR values, is up to the person writing the trees to define what they are? Does it happen that you put something in and then realize it serves no purpose? Or realize you're missing something?

Reading Questions

- In the first detailed example, where we analyze *They sent us a letter*, we get the word *letter* with the predication ADDRESSEE. Further on in the example we learn that this predication can go unspecified in certain sentences, e.g. *I brought the letter to the post office*. This has me thinking that there are plenty of other potential predications for the lexical entry for letter that are simply unspecified. Is the intention that we will update the lexical entries with these predications as we encounter them? If so, given how flexible the RESTR arguments appear to be, do we then run the risk of creating unmanageable lexical entries? (For instance, I can imagine specifying the letter writer, the letter sender, the recipient, the addressee, the material on which it was written, the style, etc.)

Reading Questions

- The three elements of RESTR for we/us (Ref. (11)) seem to correspond respectively to a set (RELN group), a belonging-to relation (RELN member), and an element (RELN speaker).
- Does it mean that we should most often decompose an relation into three parts?
- Consider the sentence: He is older than all his classmates. Is it acceptable to decompose older than into an element (RELN oldest), an older-than relation (RELN older), and a set (RELN younger_than)

Reading Questions

- In page 179, it mentioned top-down approach. I learned from 571 both top-down approach and bottom-up approach to parse a sentence. But in this book, I didn't quite understand the differences between top-down approach and bottom-up approach. They all seemed bottom-up to me.

Reading Questions

- In (28) the preposition *to* and its complement NP *Lee* have the same INDEX value, *j*. I'm a bit confused on how two sister nodes can have the same INDEX despite terminating in two different lexical items. Especially since according to the text's definition, "The value of INDEX is an index corresponding to the situation or individual referred to." What does this shared index imply about the relationship between the preposition and its complement? Are they seen as one situation/one individual?

Reading Questions

- How can we be sure that the principles/rules and the feature sets we're using actually do describe English well?
- Do people who do research in HPSG actually use any of the formal definitions?