

# Ling 566

## Oct 18, 2016

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*

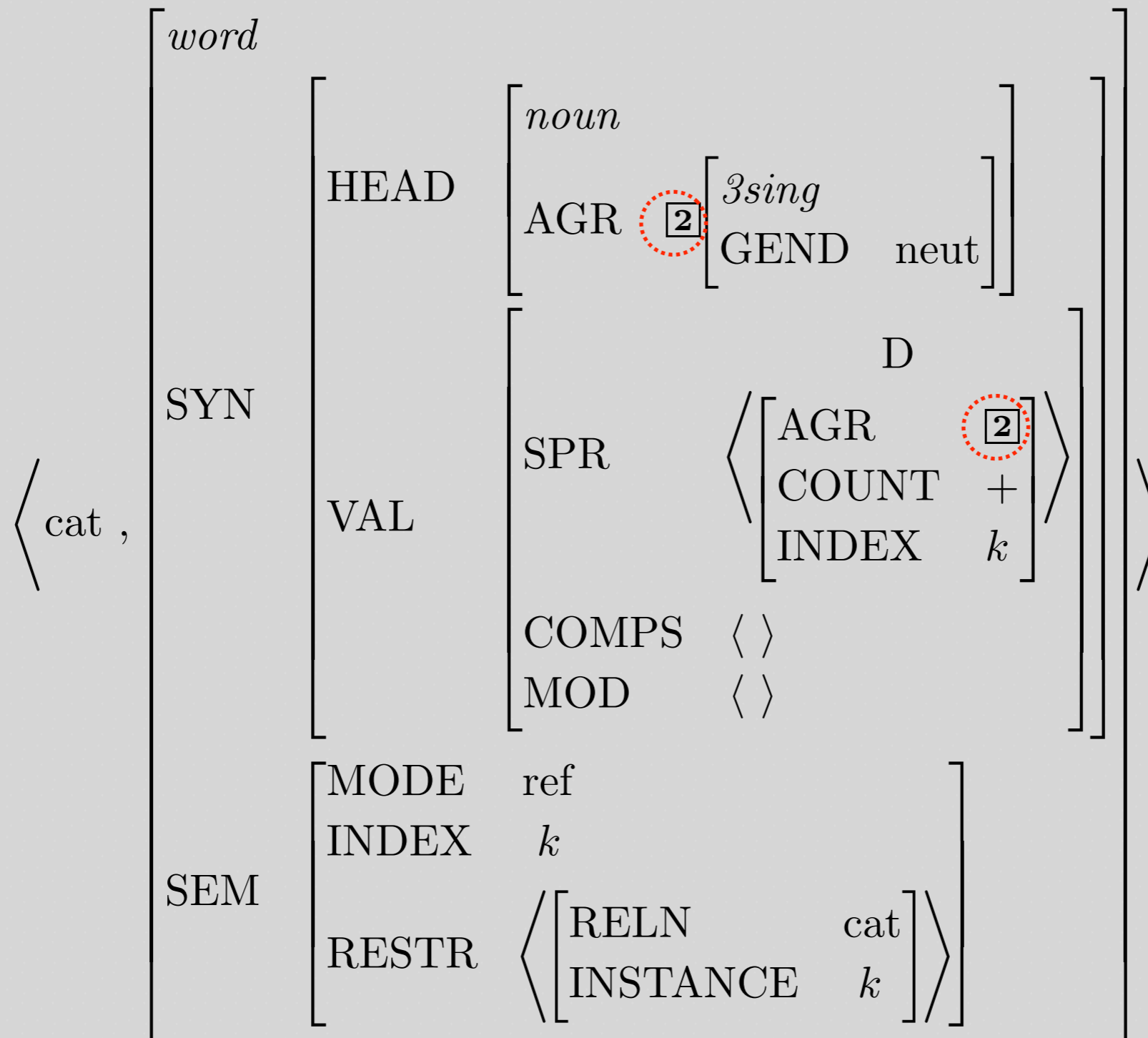
$\langle a, \rangle$	$\left[ \begin{array}{l} \text{word} \\ \\ \text{SYN} \\ \\ \text{SEM} \end{array} \right]$	$\left[ \begin{array}{l} \text{HEAD} \\ \\ \text{VAL} \\ \\ \text{MODE} \\ \text{INDEX} \\ \text{RESTR} \end{array} \right]$	$\left[ \begin{array}{l} \text{det} \\ \text{AGR} \quad 3sing \\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



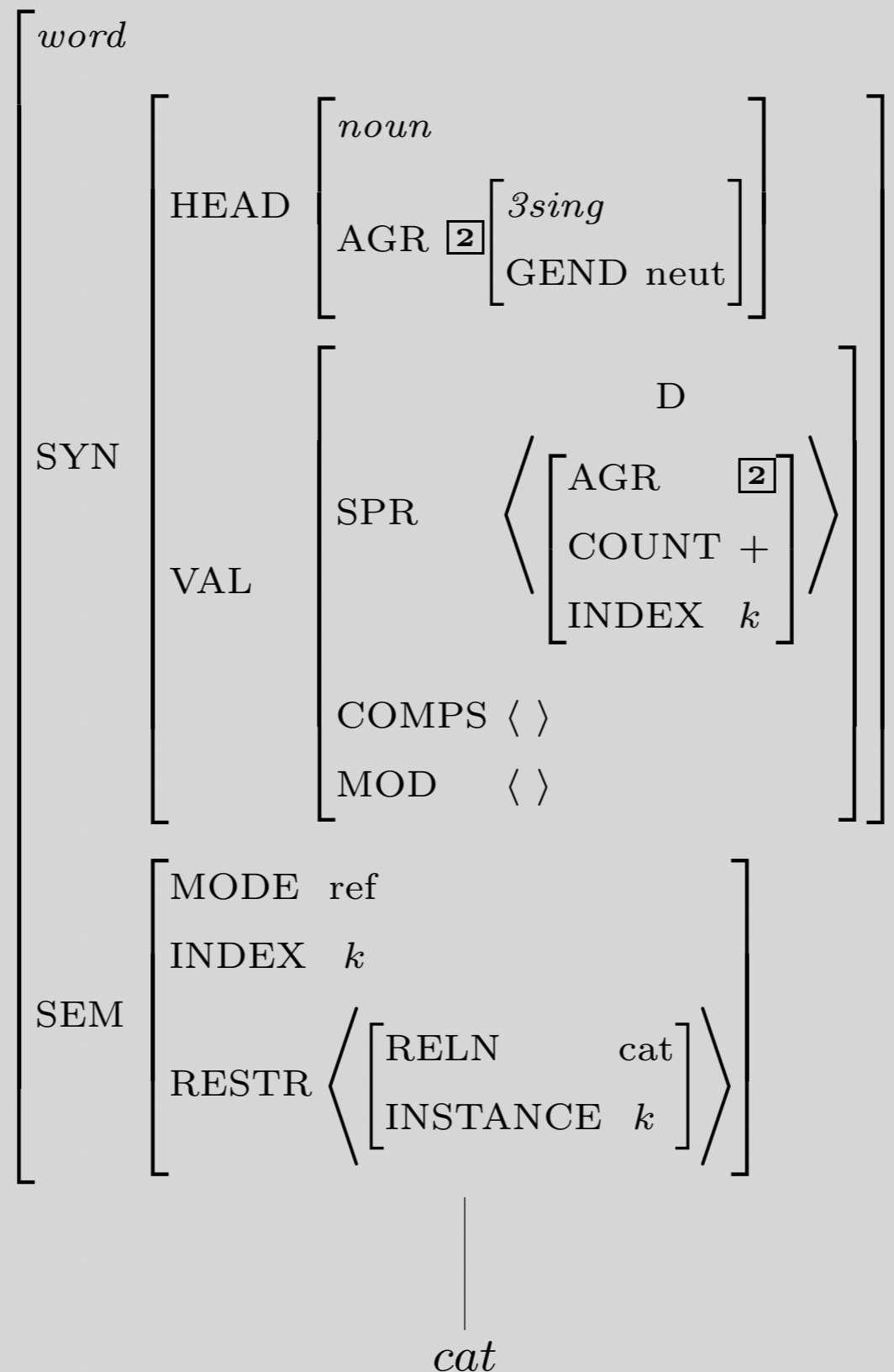


# Effect of Principles: the SHAC





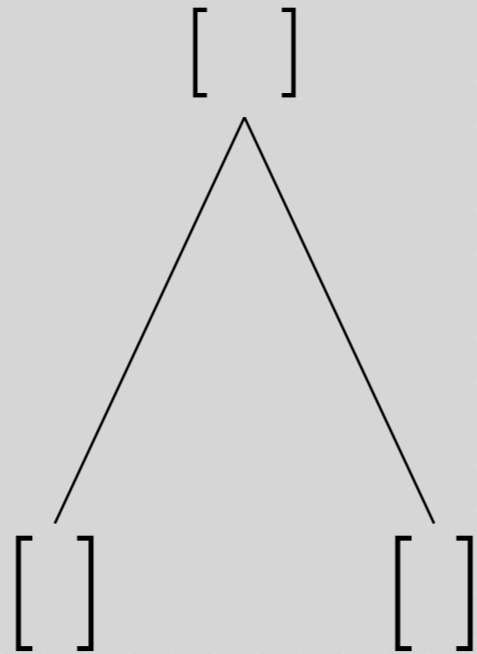
# Description of Word Structures for *cat*



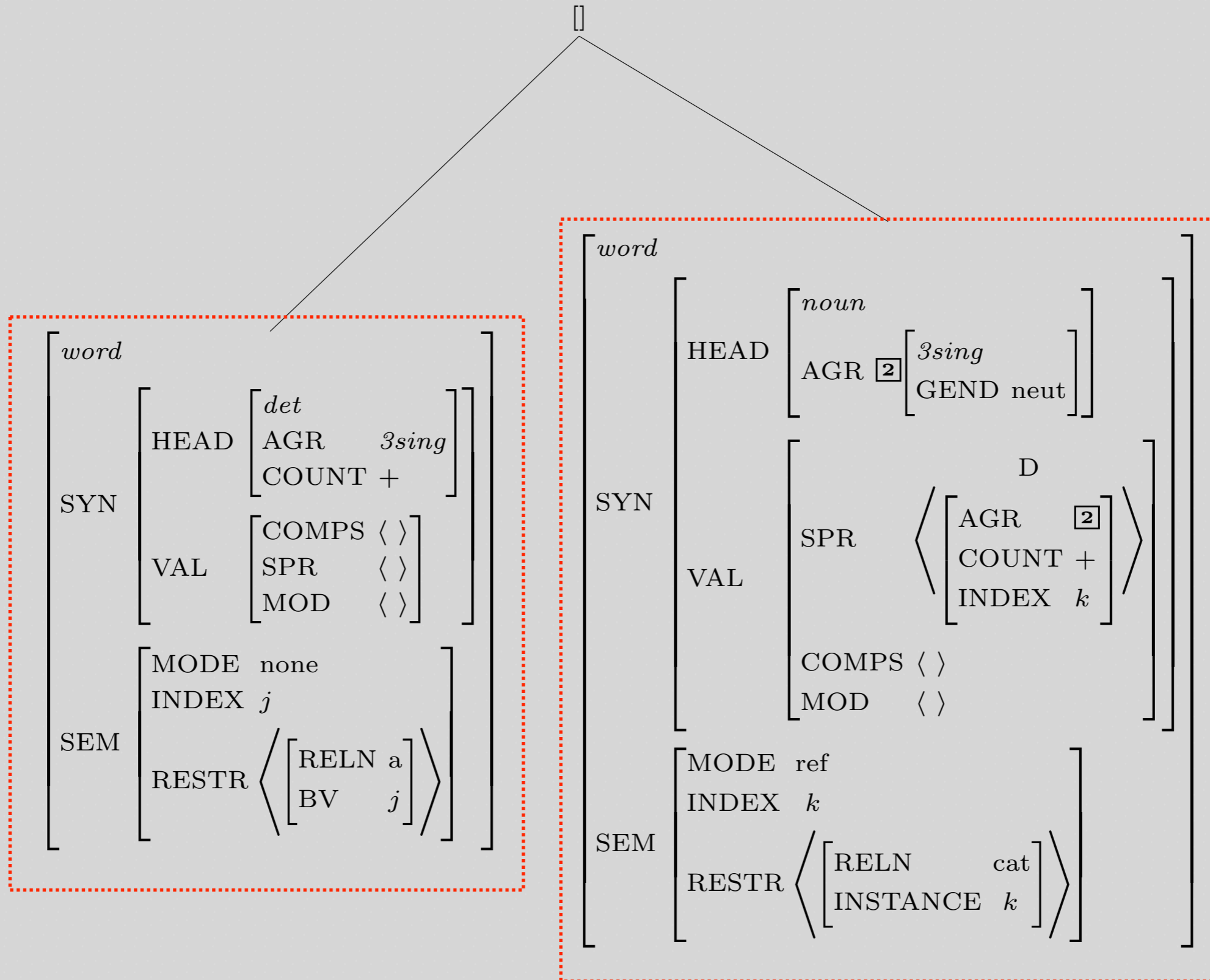
|  
*cat*



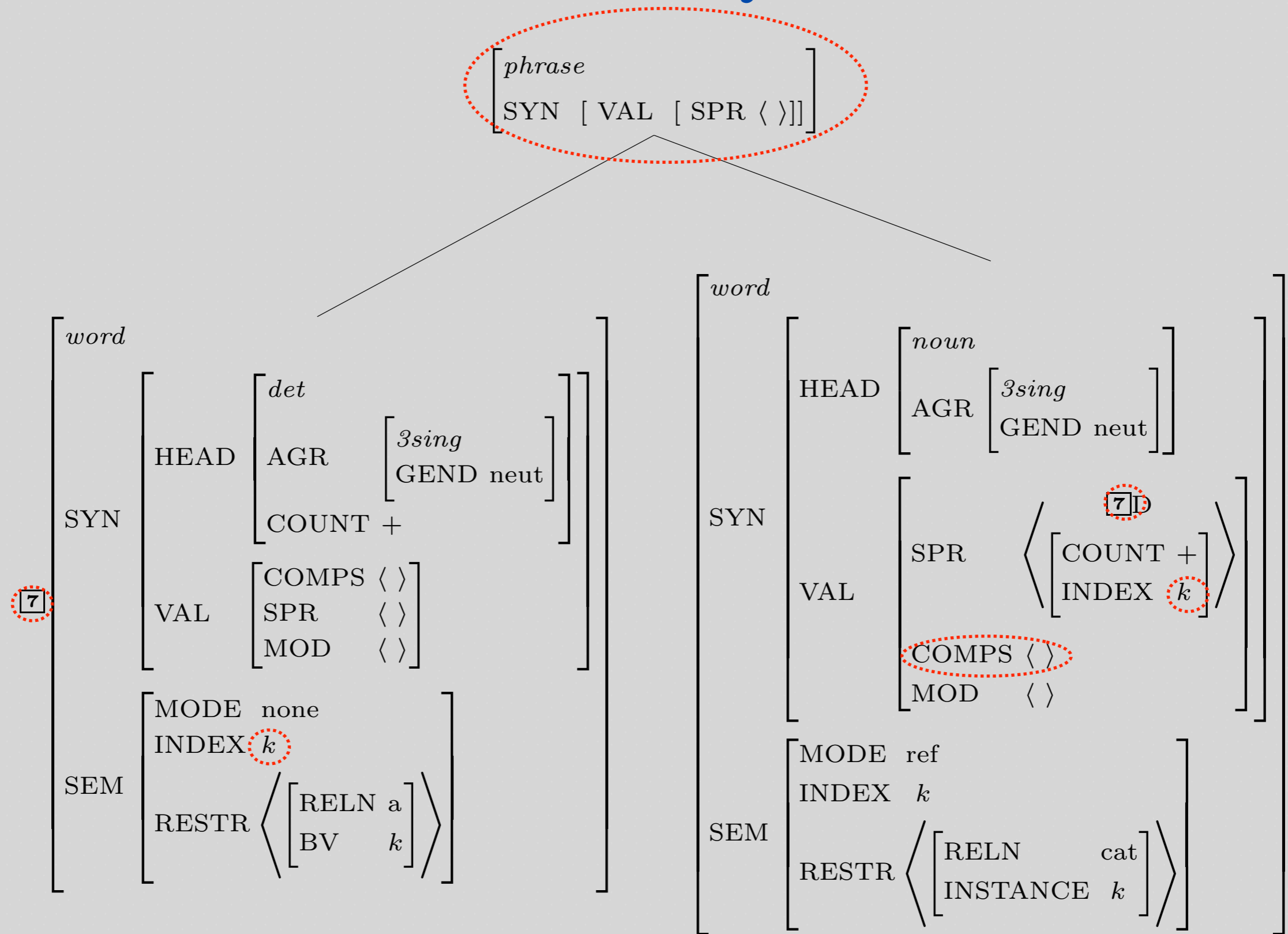
# Building a Phrase



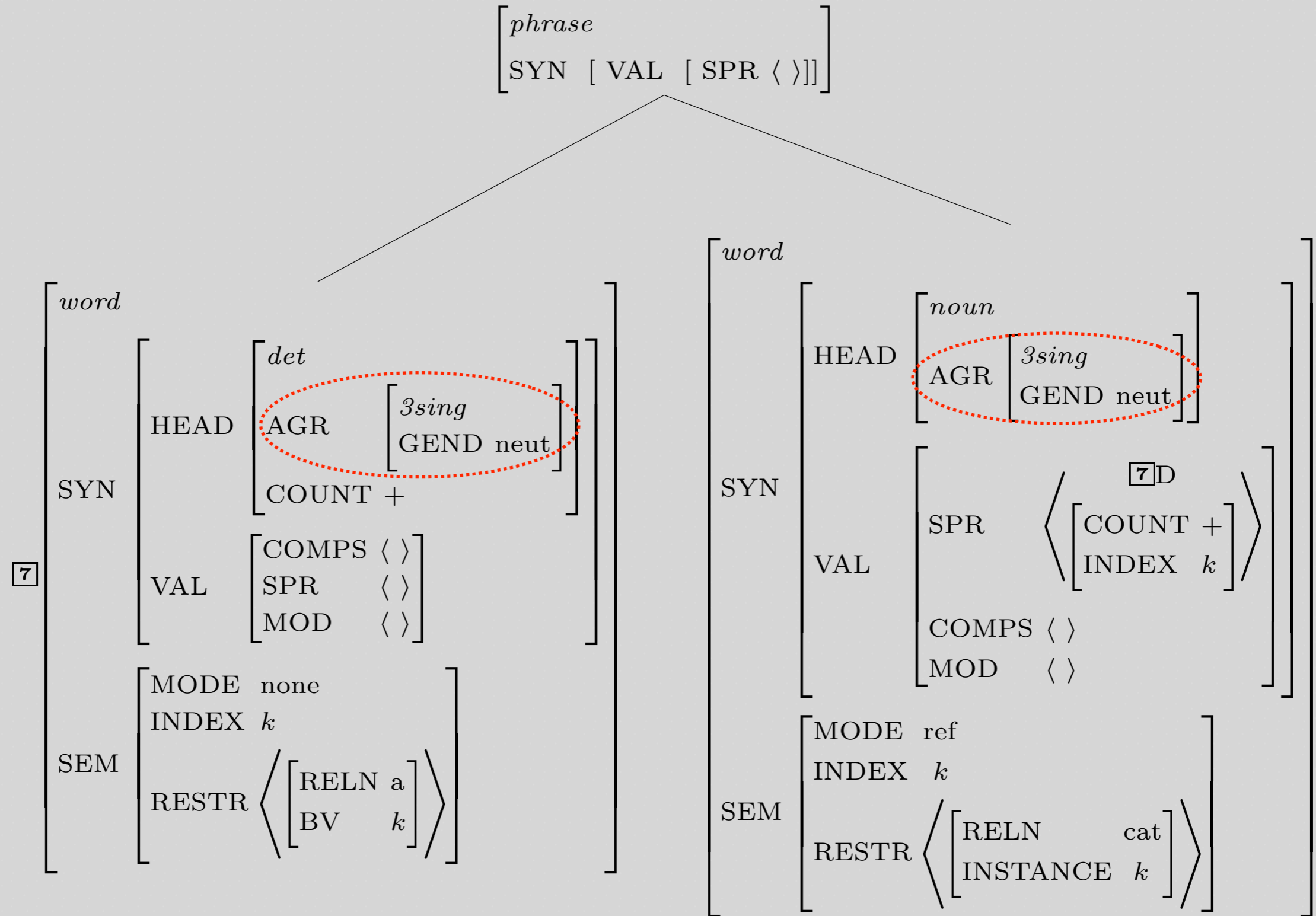
# Constraints Contributed by Daughter Subtrees



# Constraints Contributed by the Grammar Rule

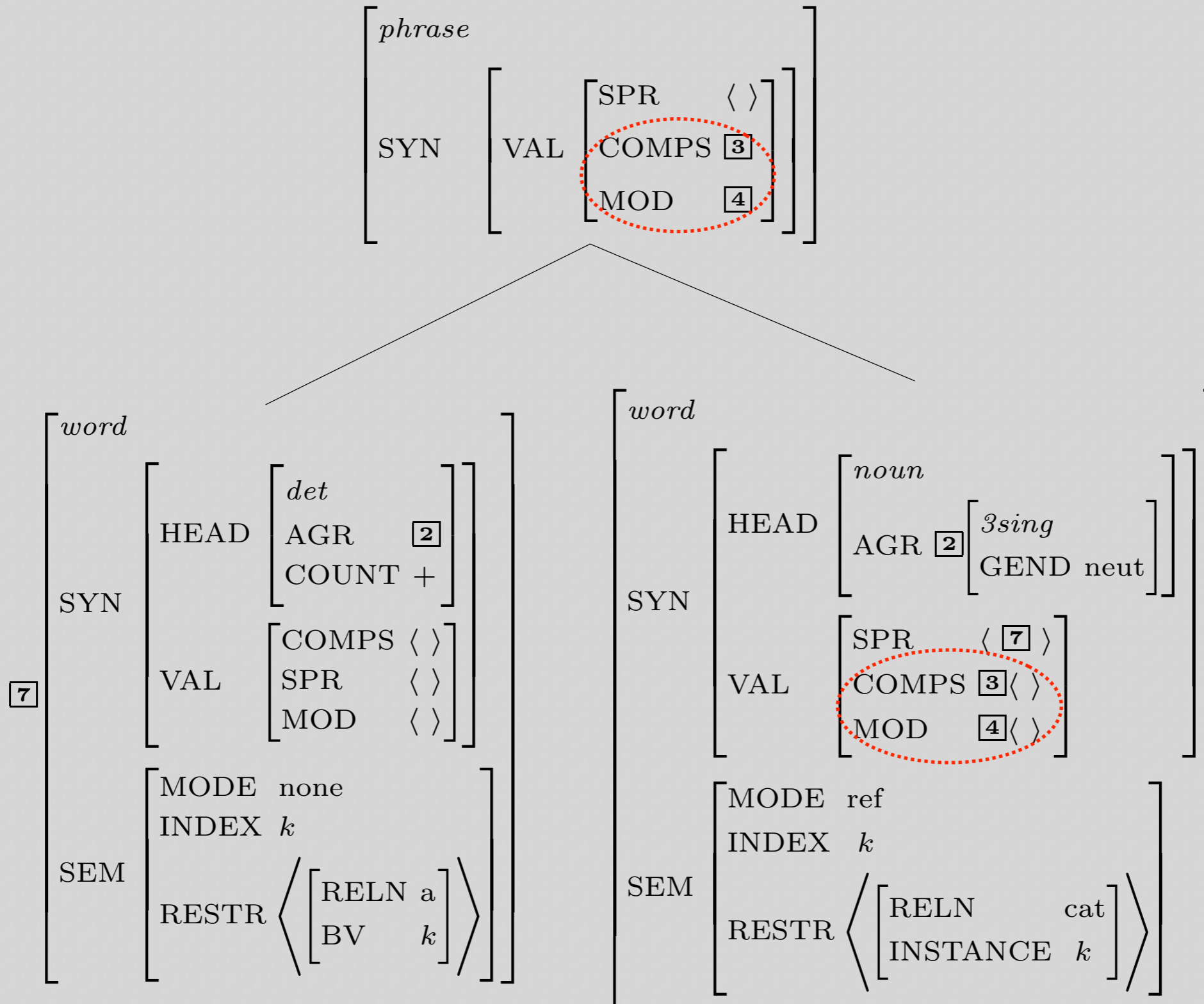


# A Constraint Involving the SHAC

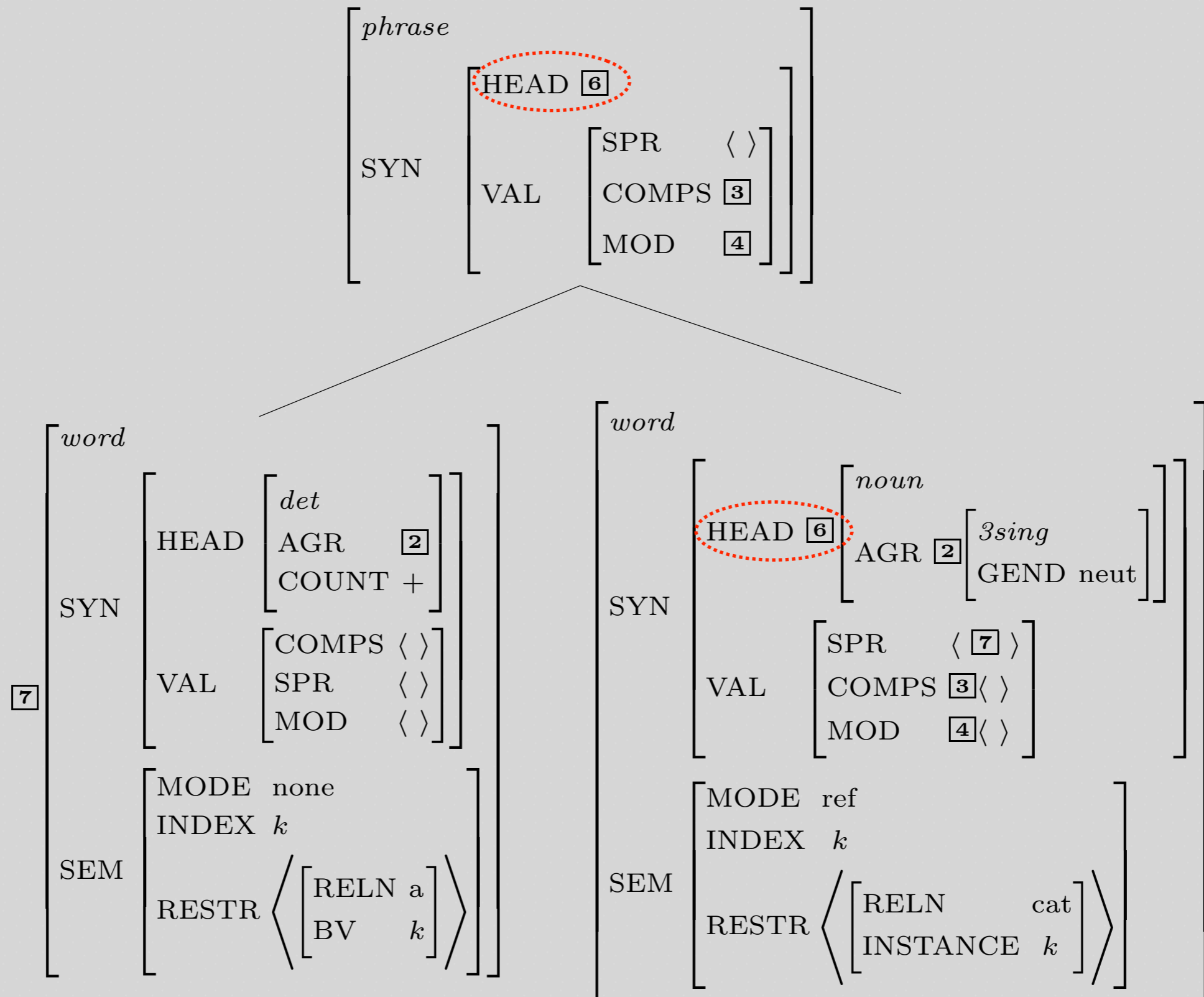




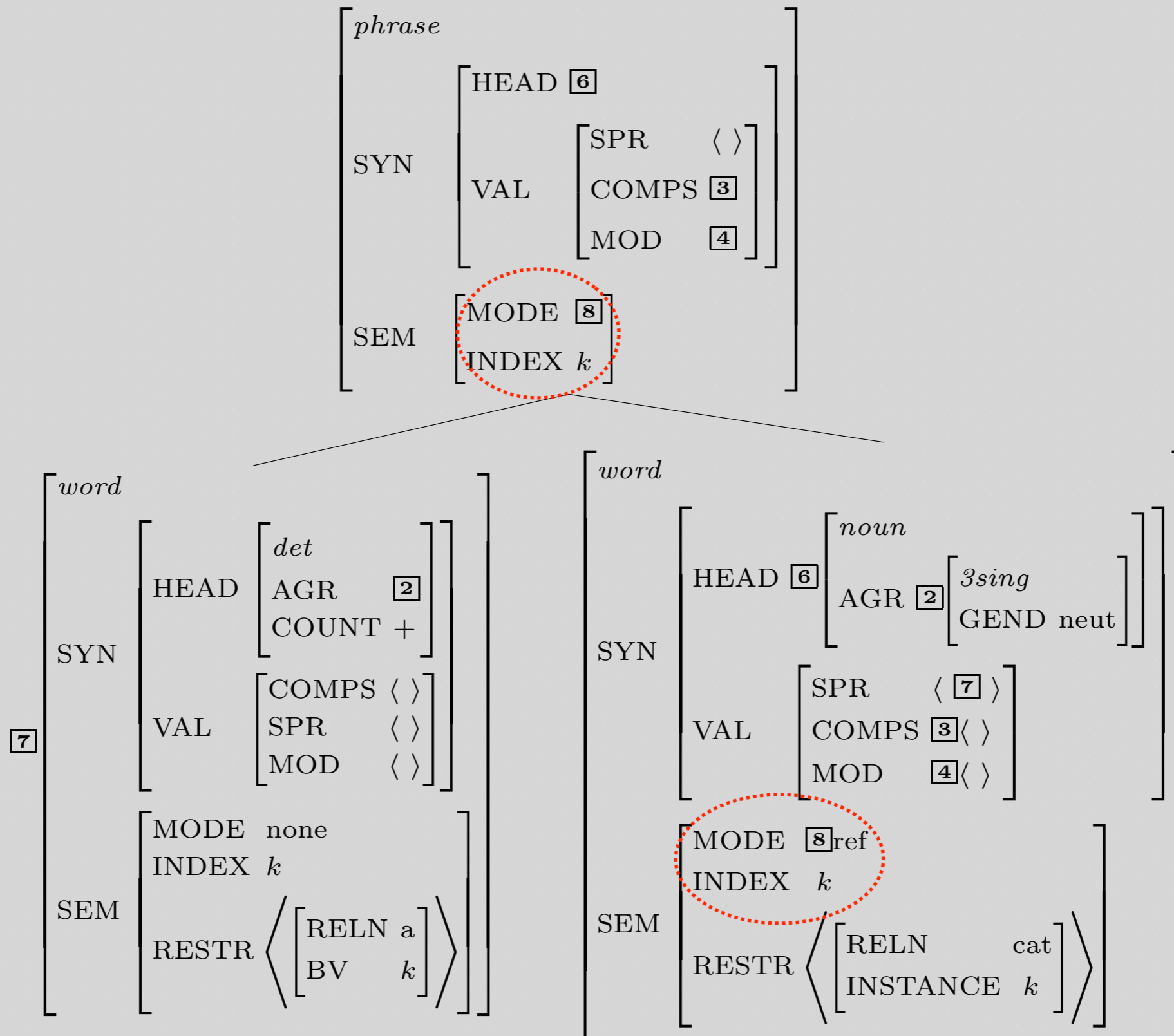
# Effects of the Valence Principle



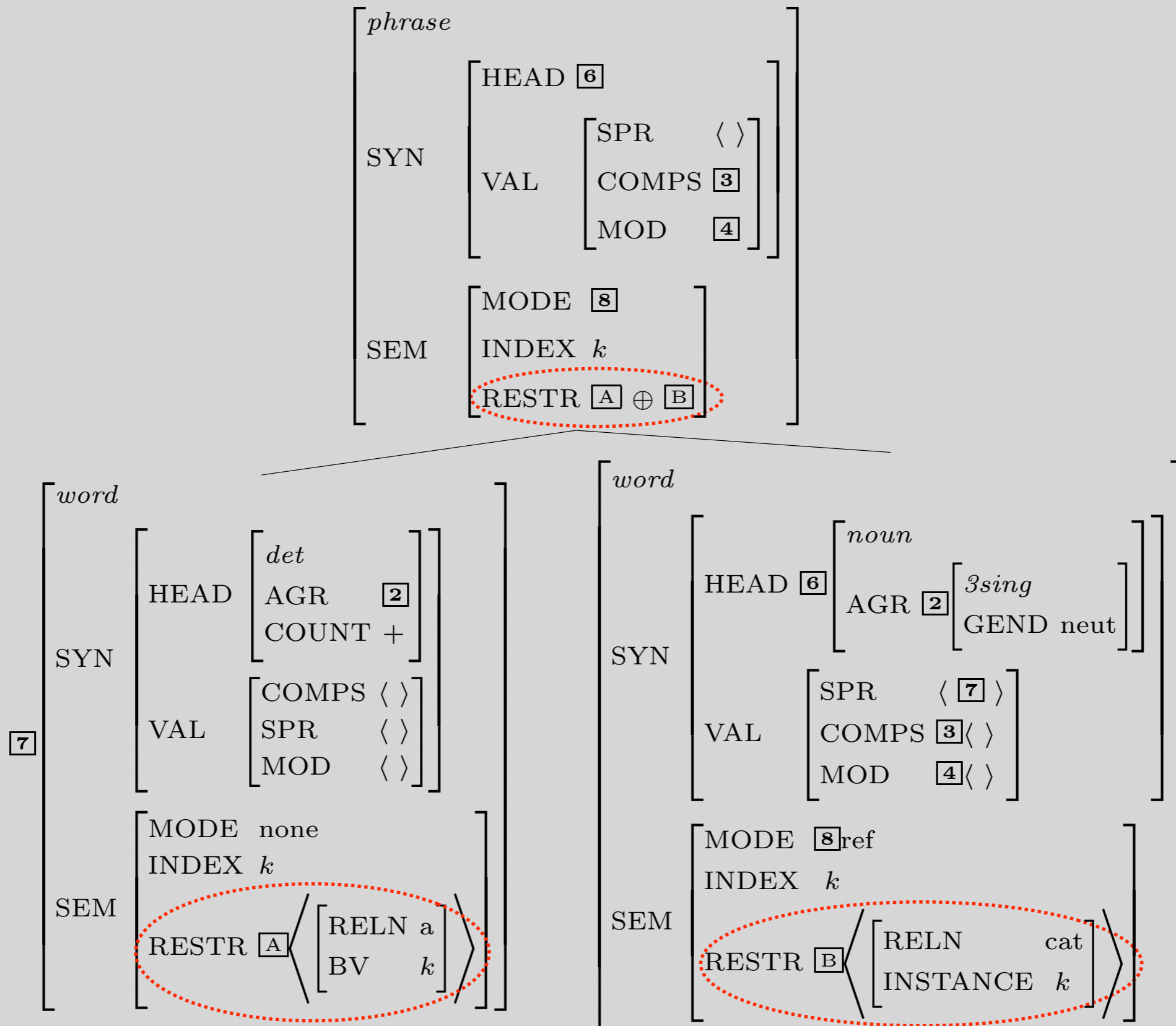
# Effects of the Head Feature Principle



# Effects of the Semantic Inheritance Principle

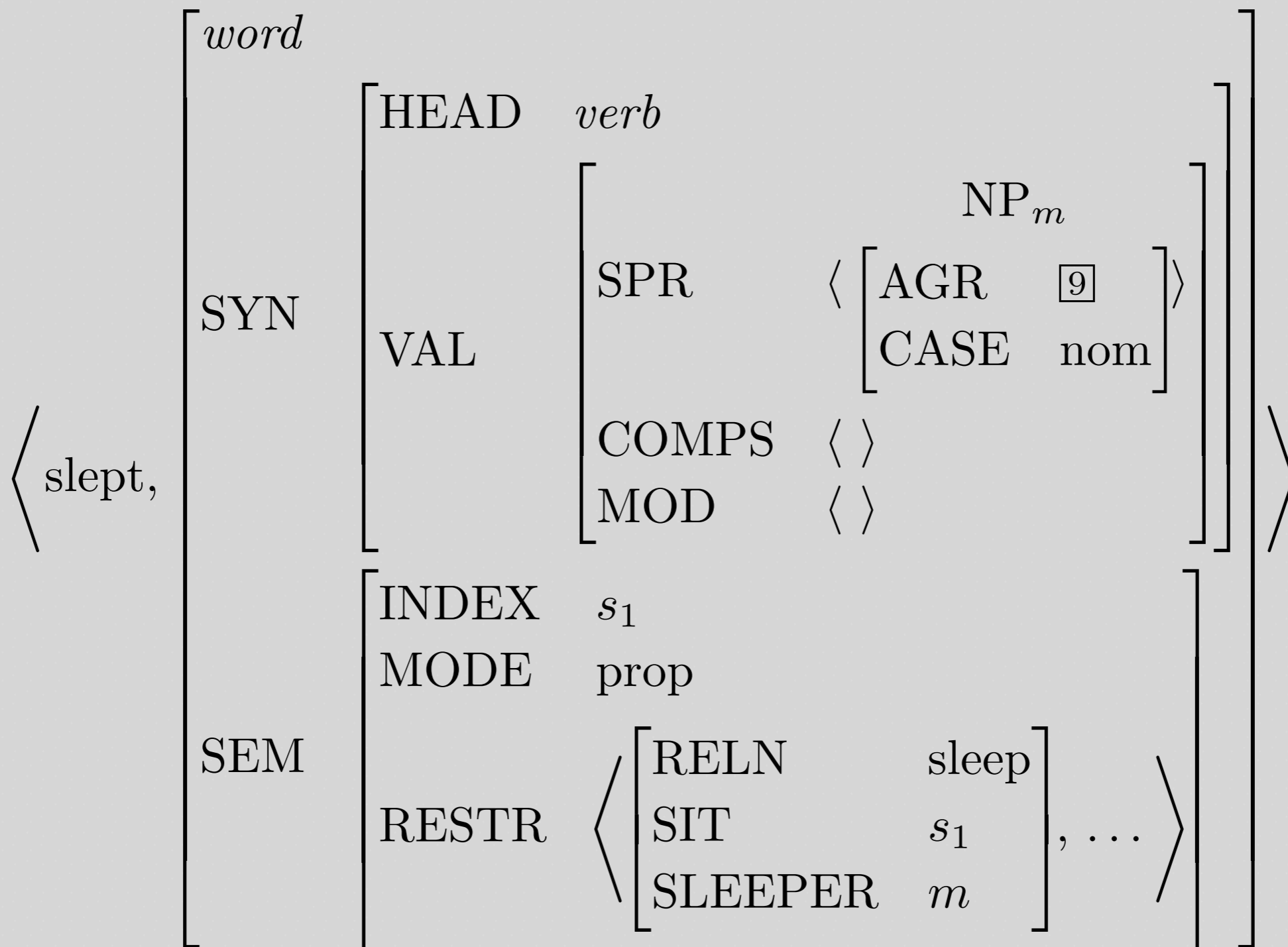


# Effects of the Semantic Compositionality Principle



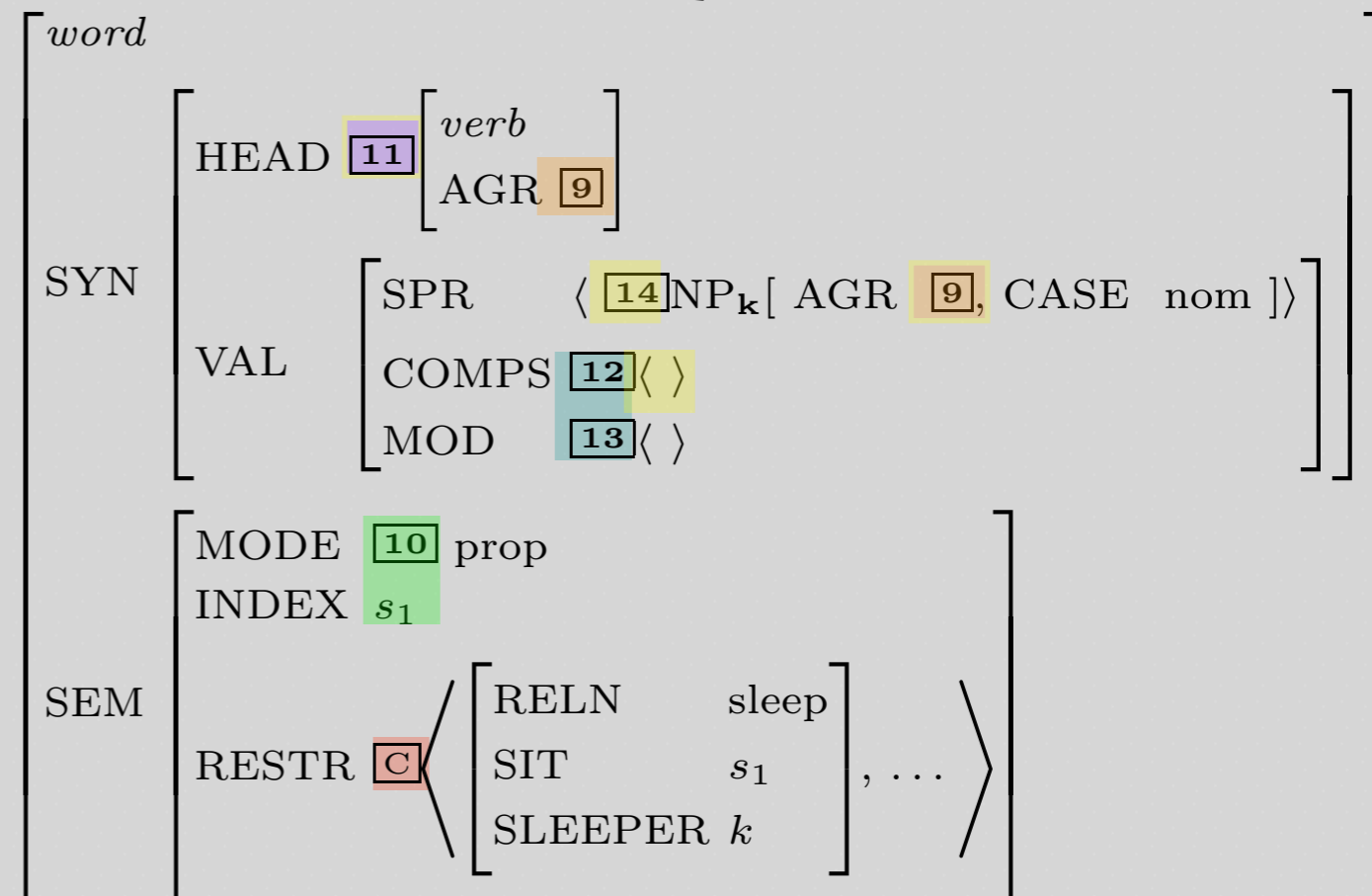
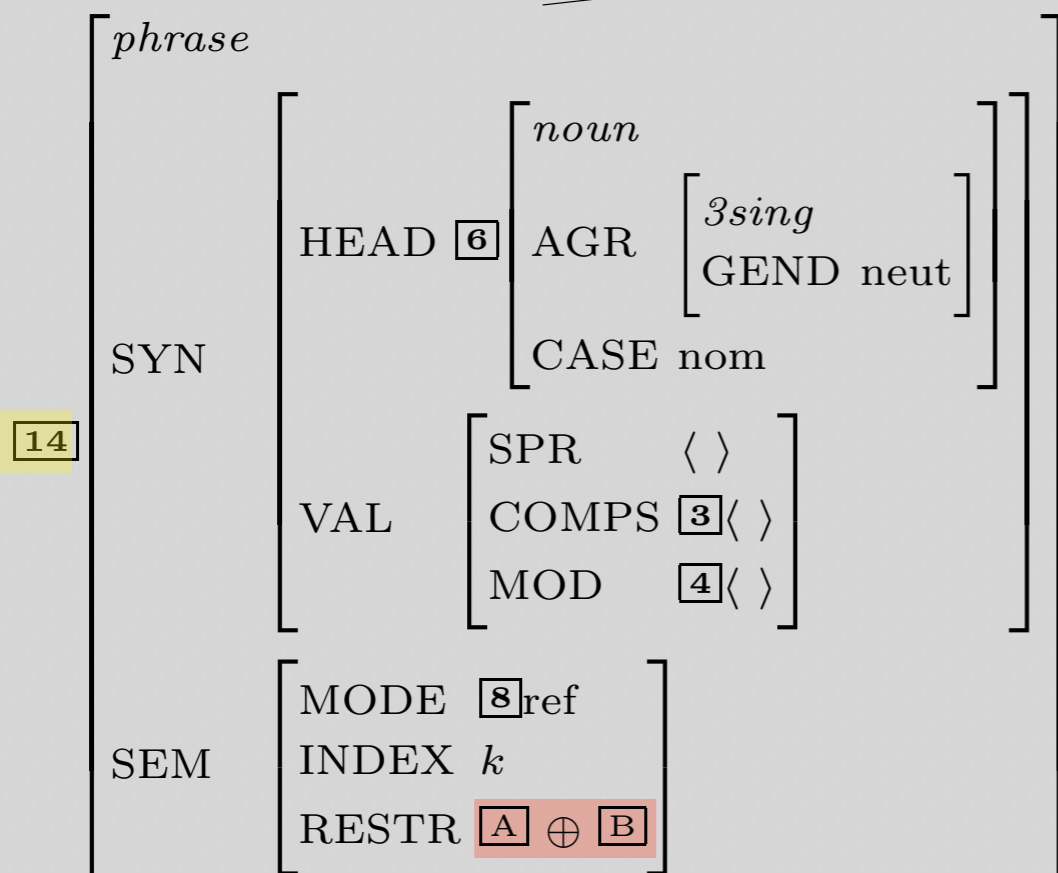
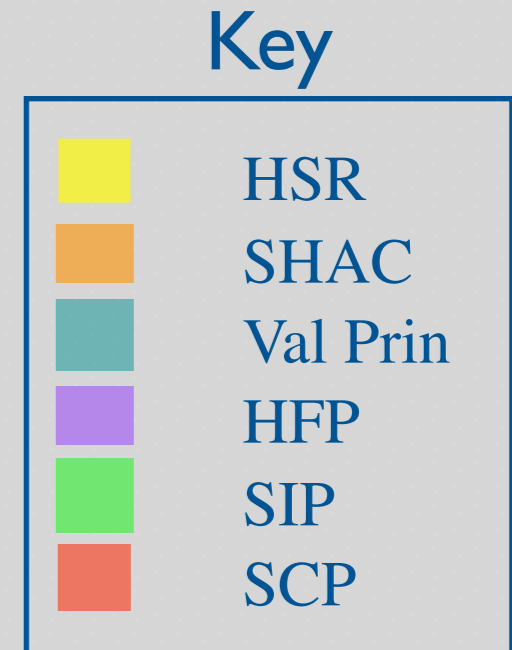
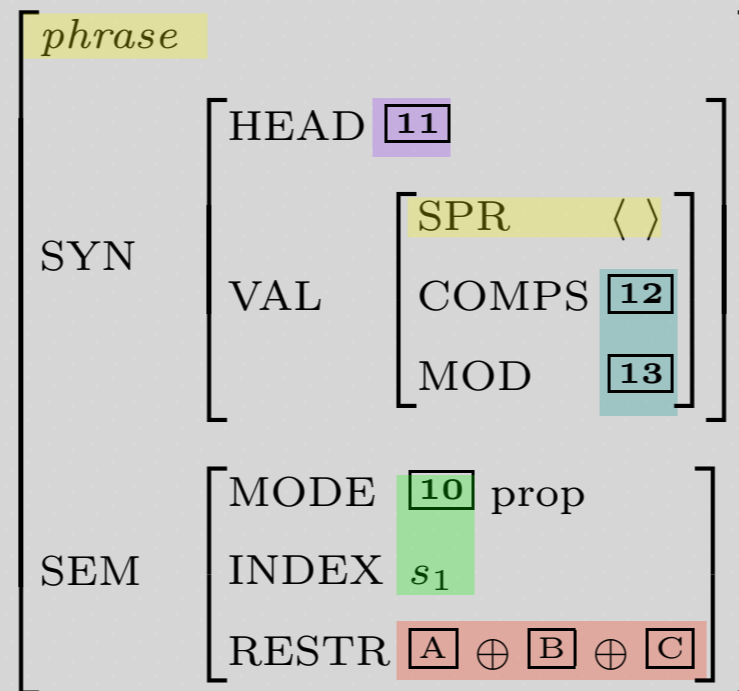


# Lexical Entry for *slept*

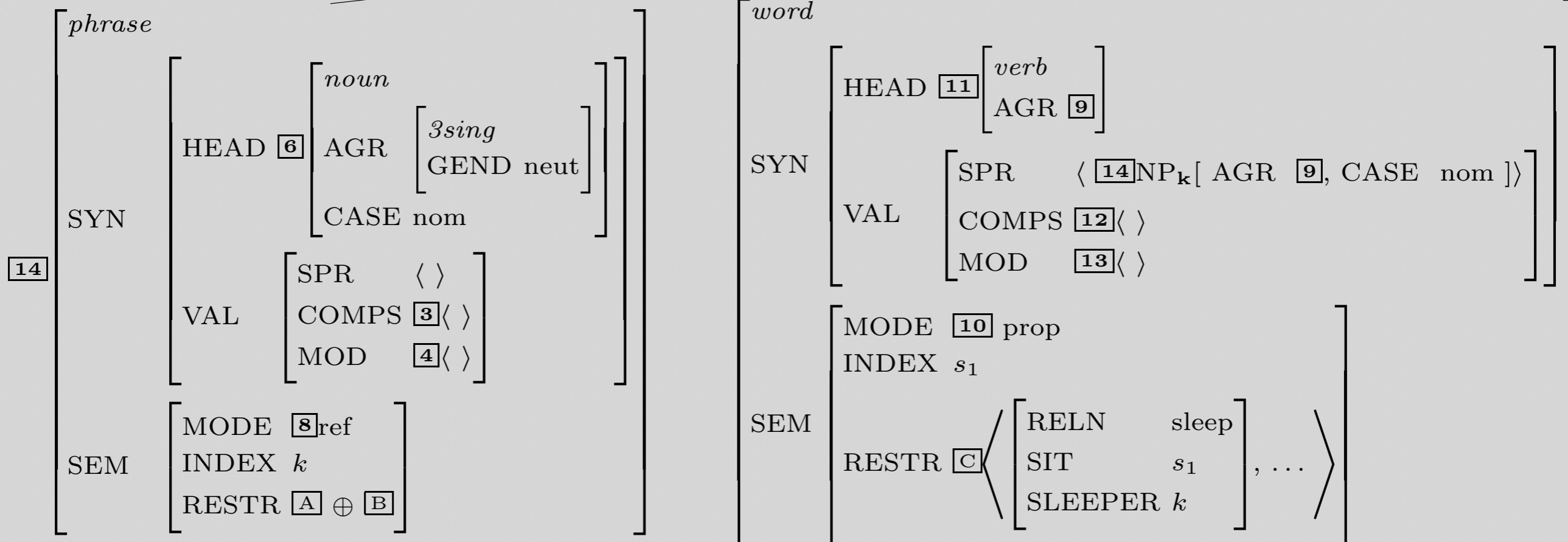
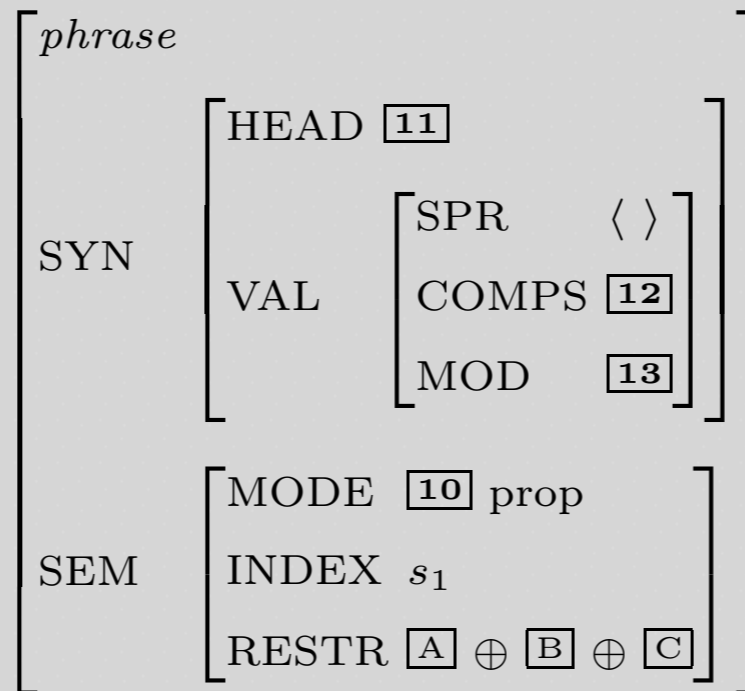




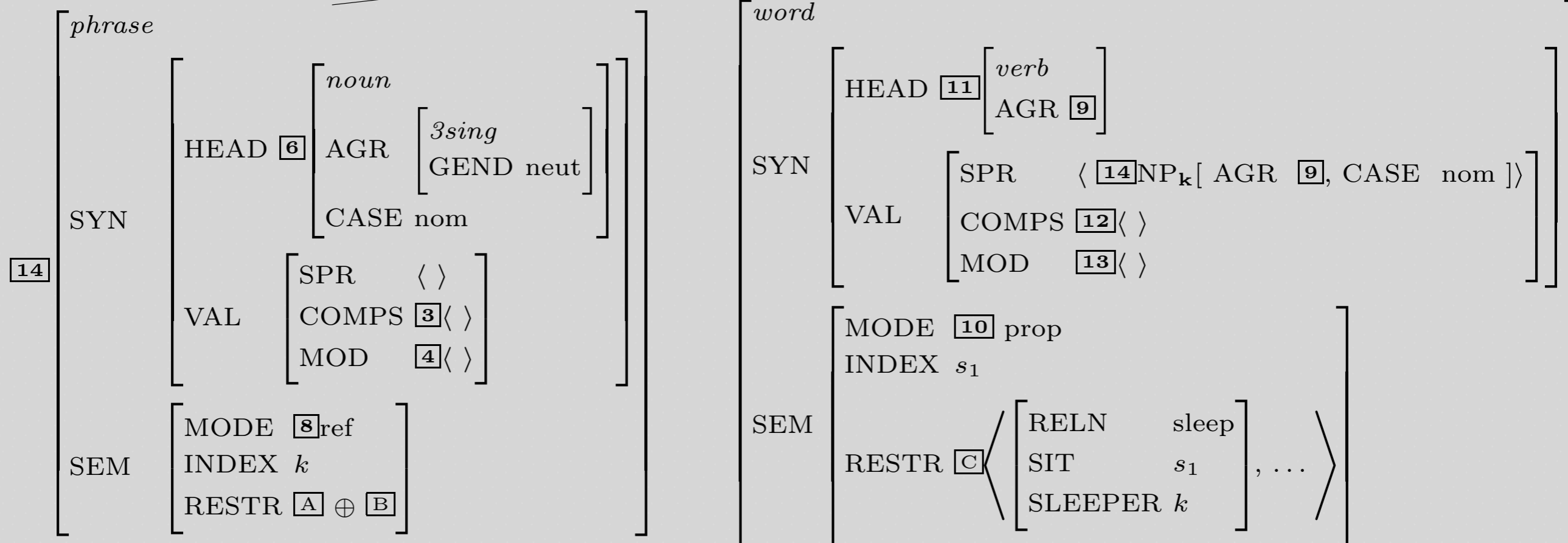
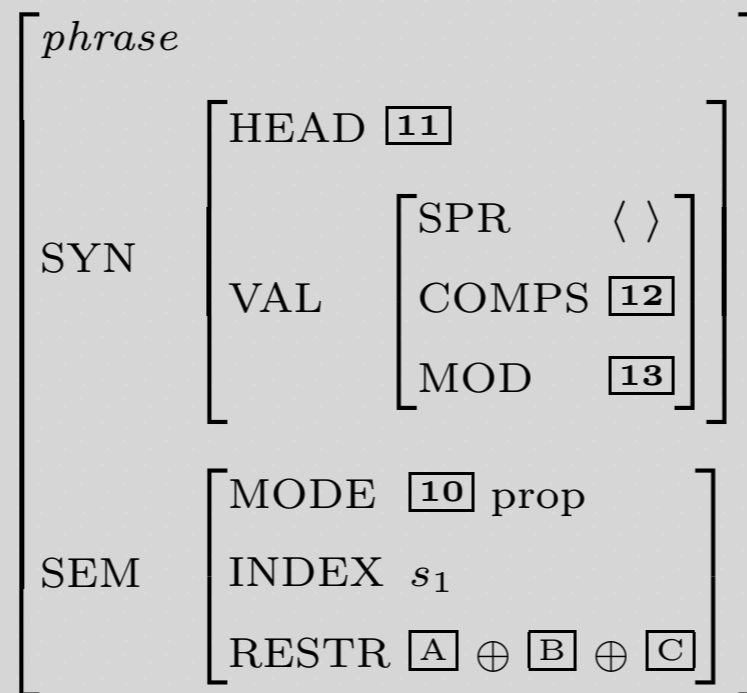
# Another Head-Specifier Phrase



# Is this description fully specified?



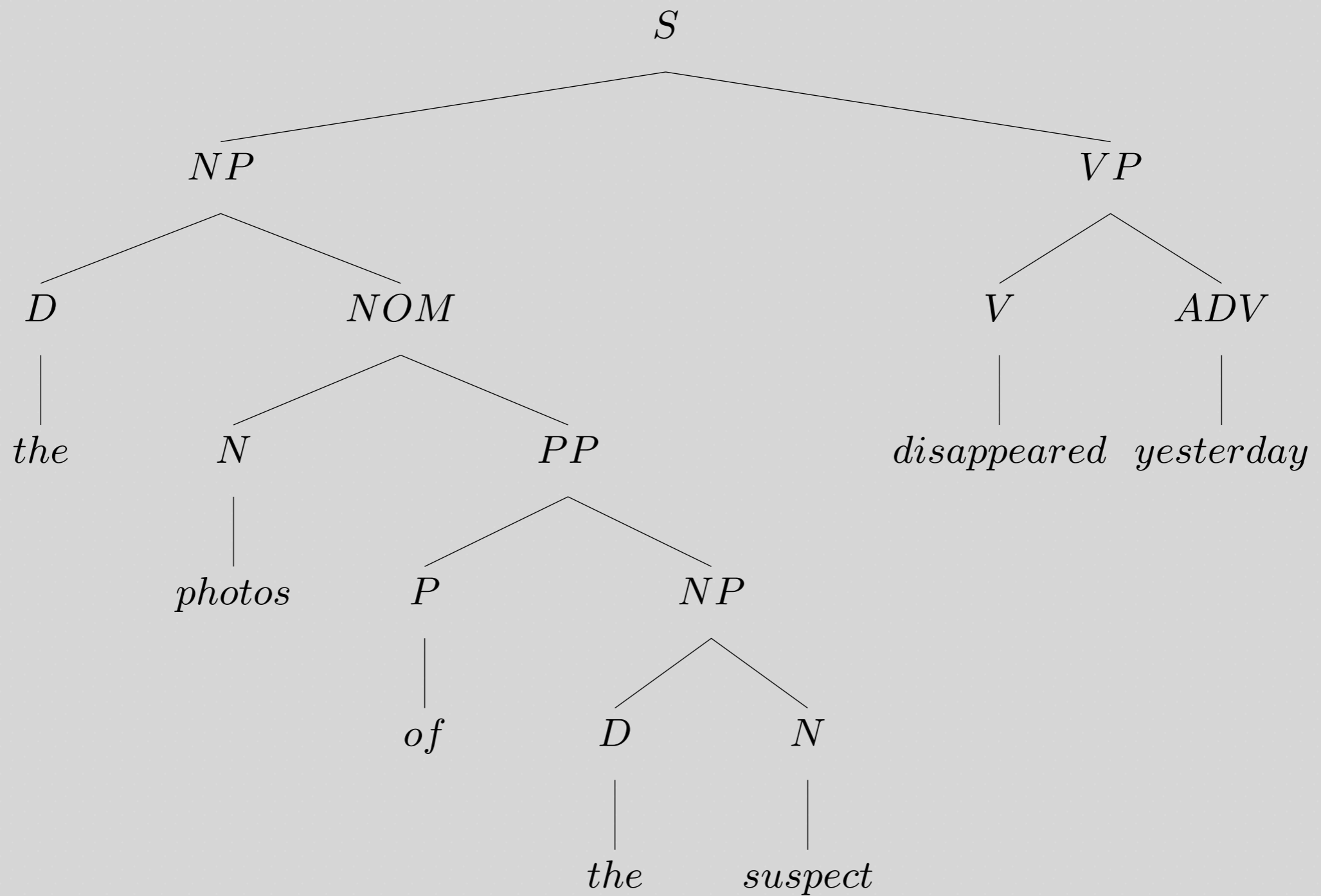
# Does the top node satisfy the initial symbol?



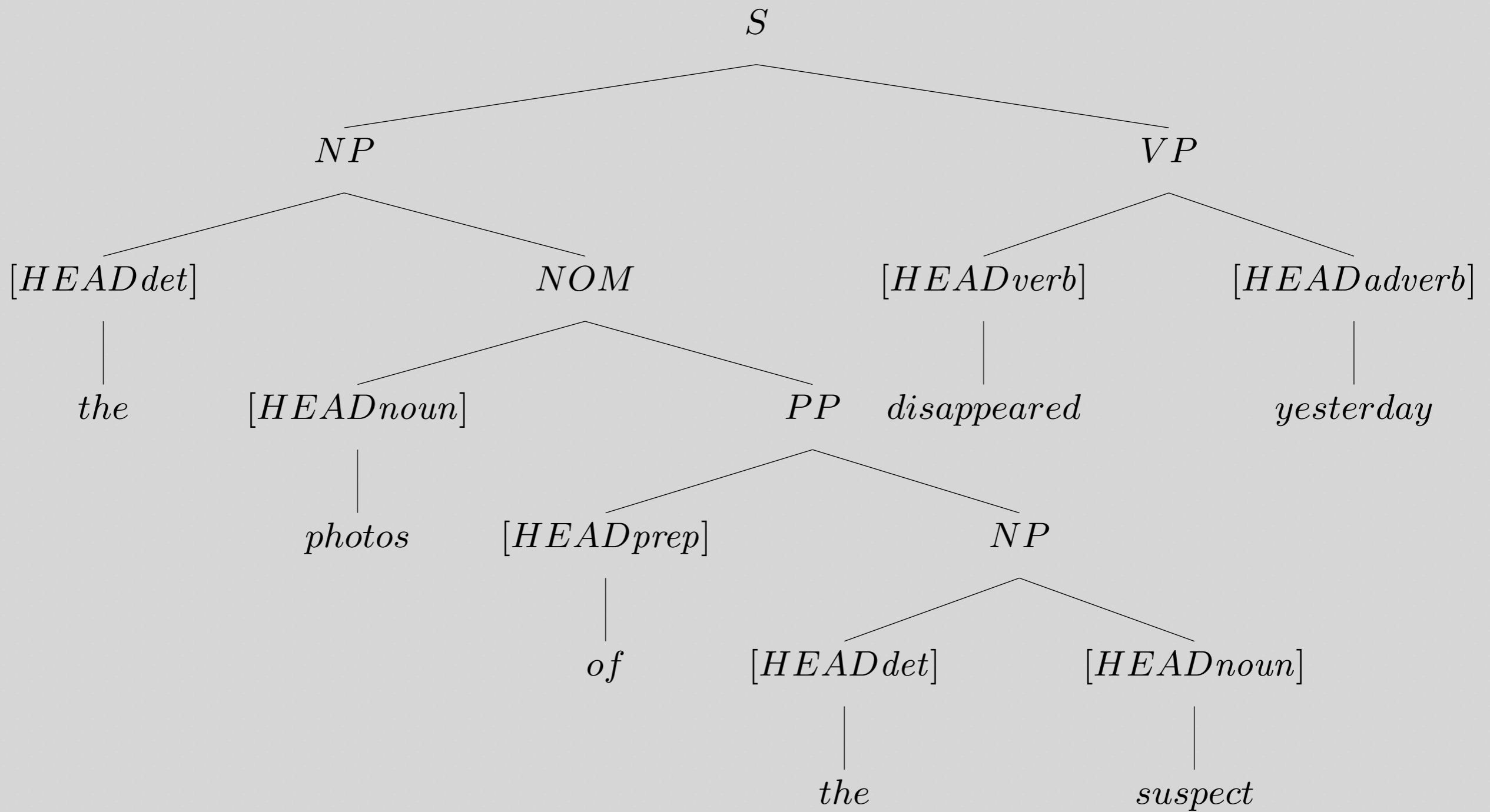
## RESTR of the S node

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

# Another Example

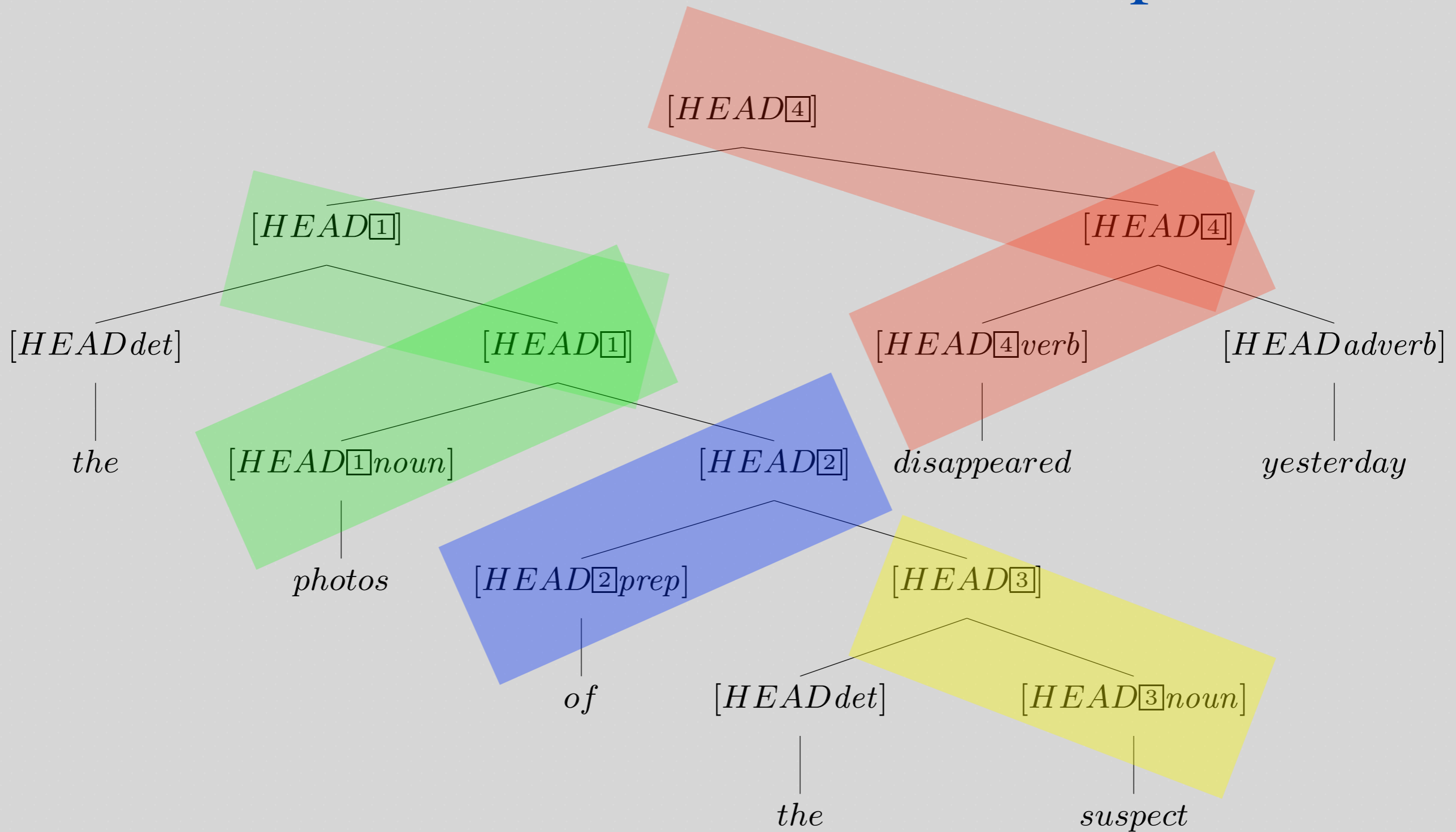


# Head Features from Lexical Entries



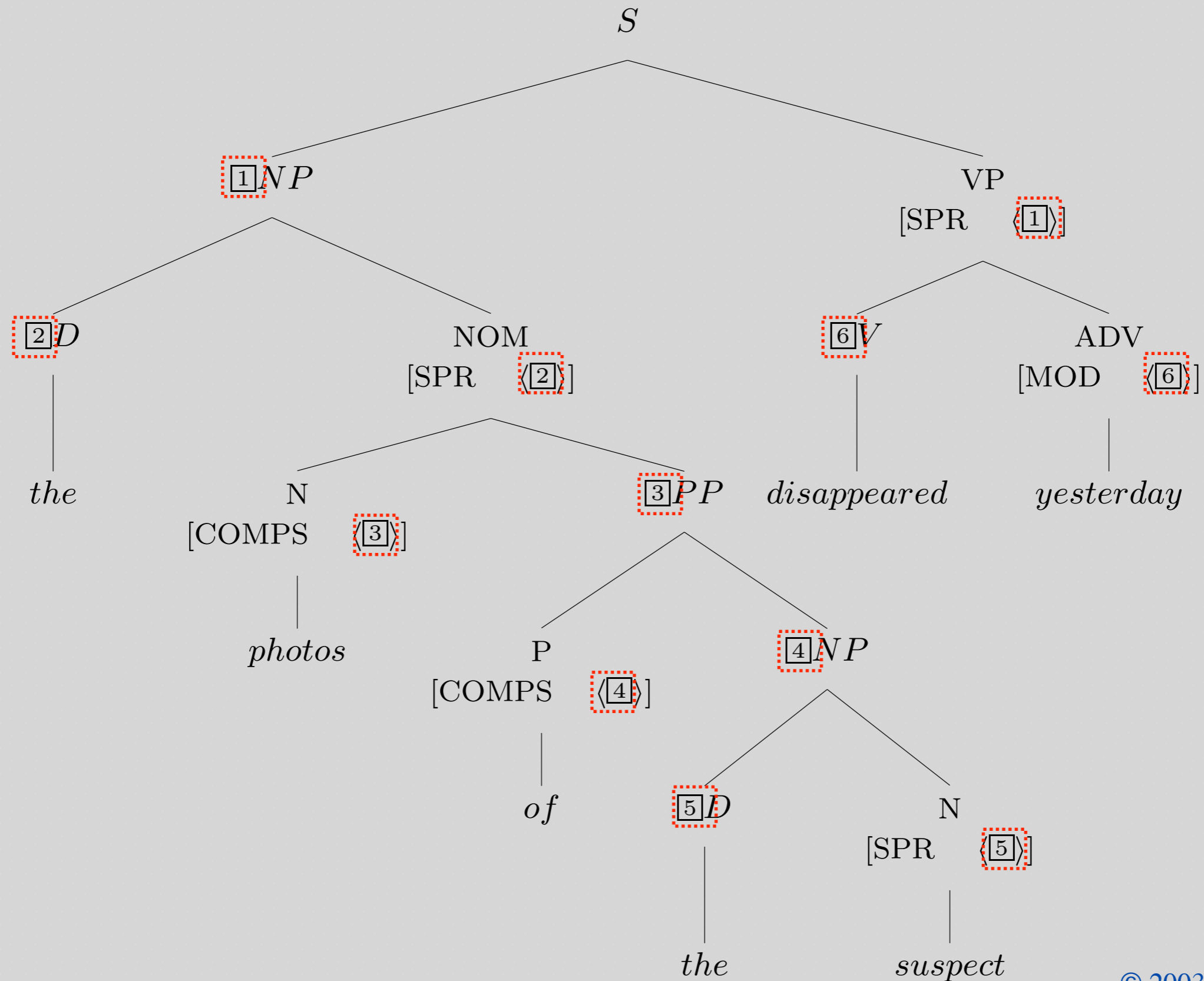


# Head Features from Lexical Entries, plus HFP

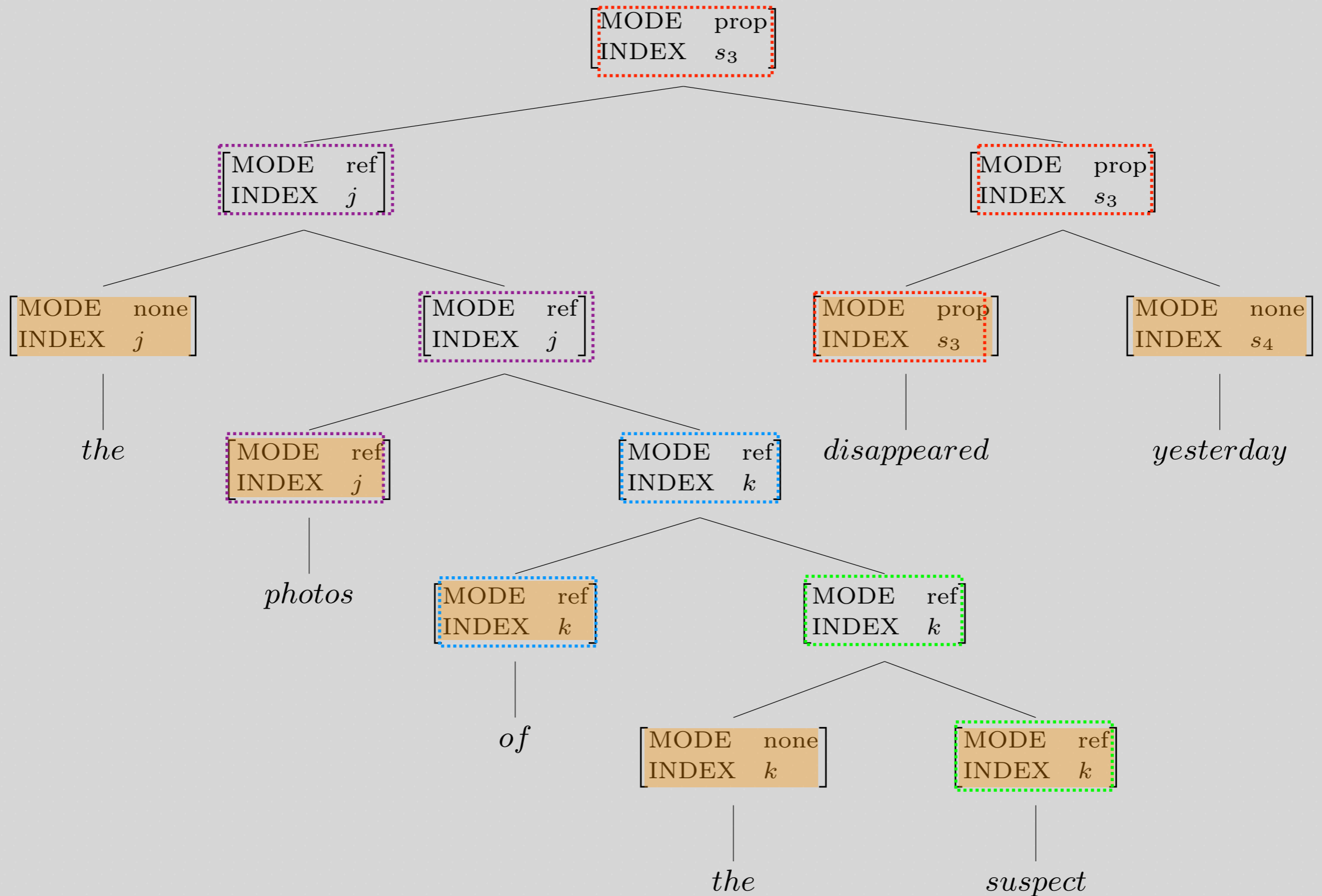




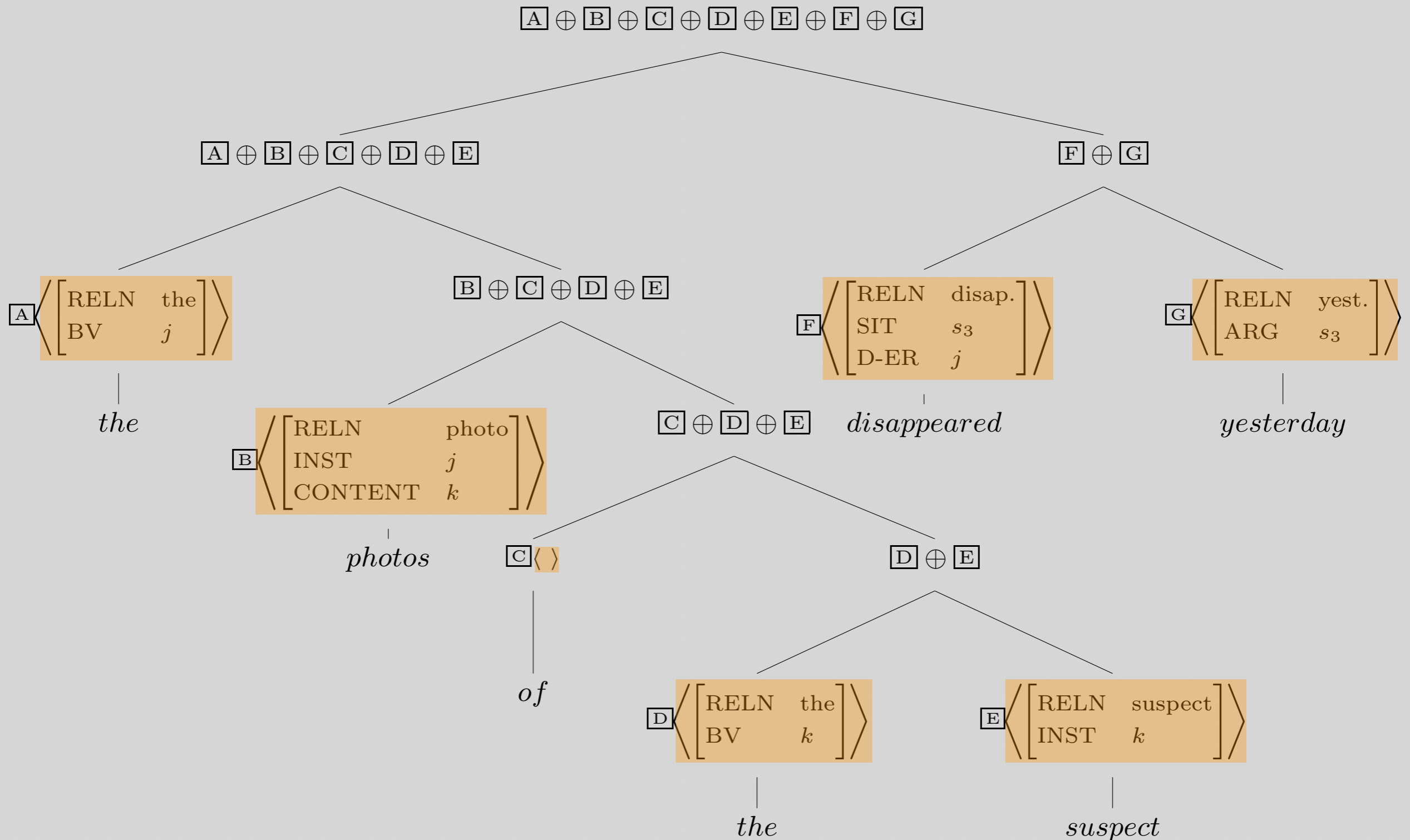
# Required Identities: Grammar Rules



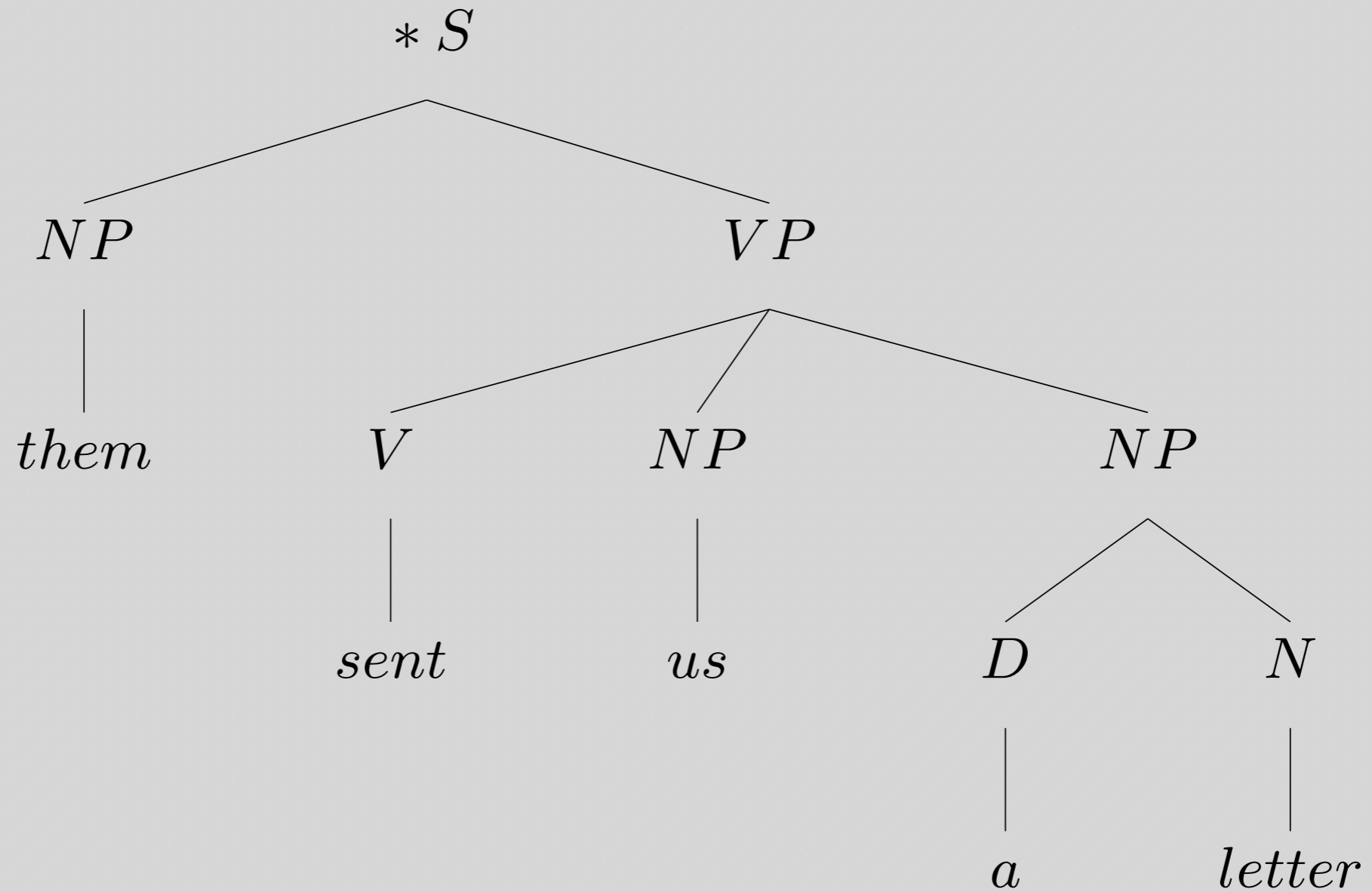
# Two Semantic Features: the Lexicon & SIP



# RESTR Values and the SCP



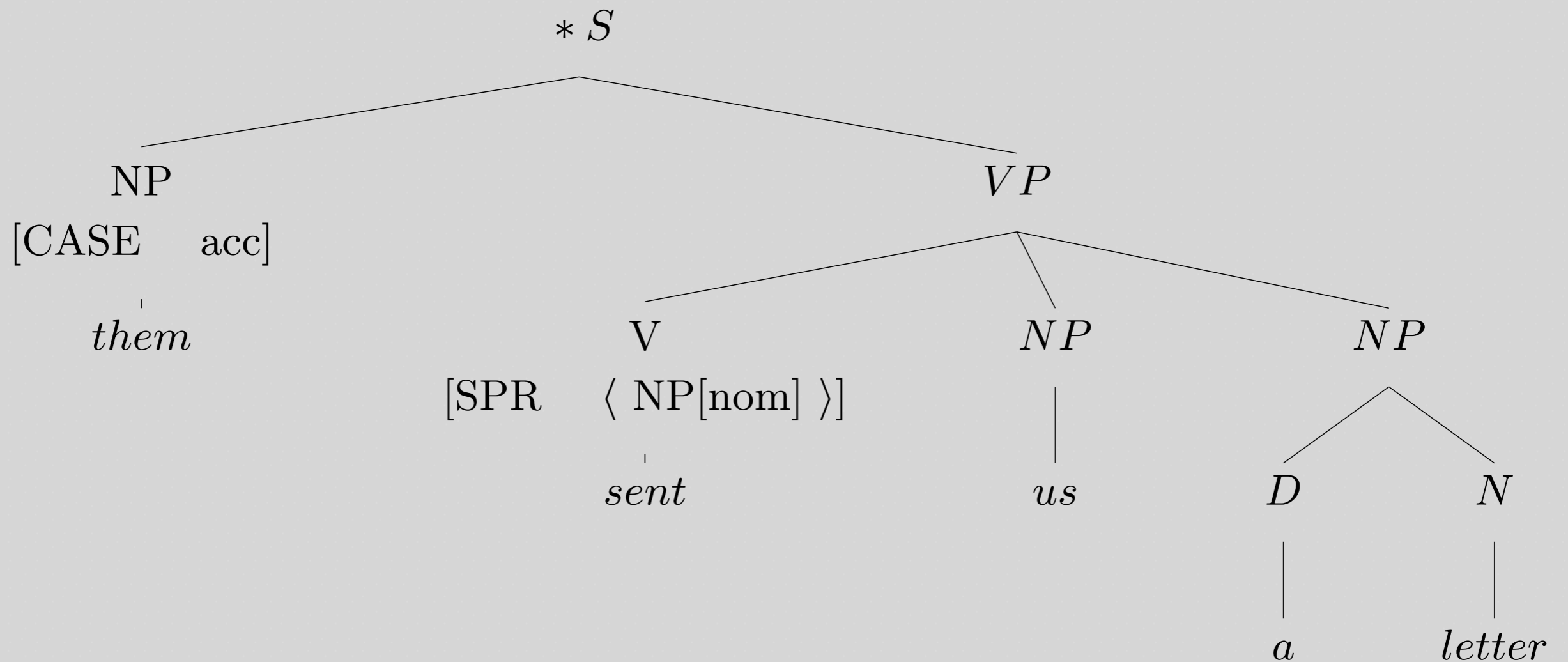
# An Ungrammatical Example



What's wrong with this sentence?



# An Ungrammatical Example

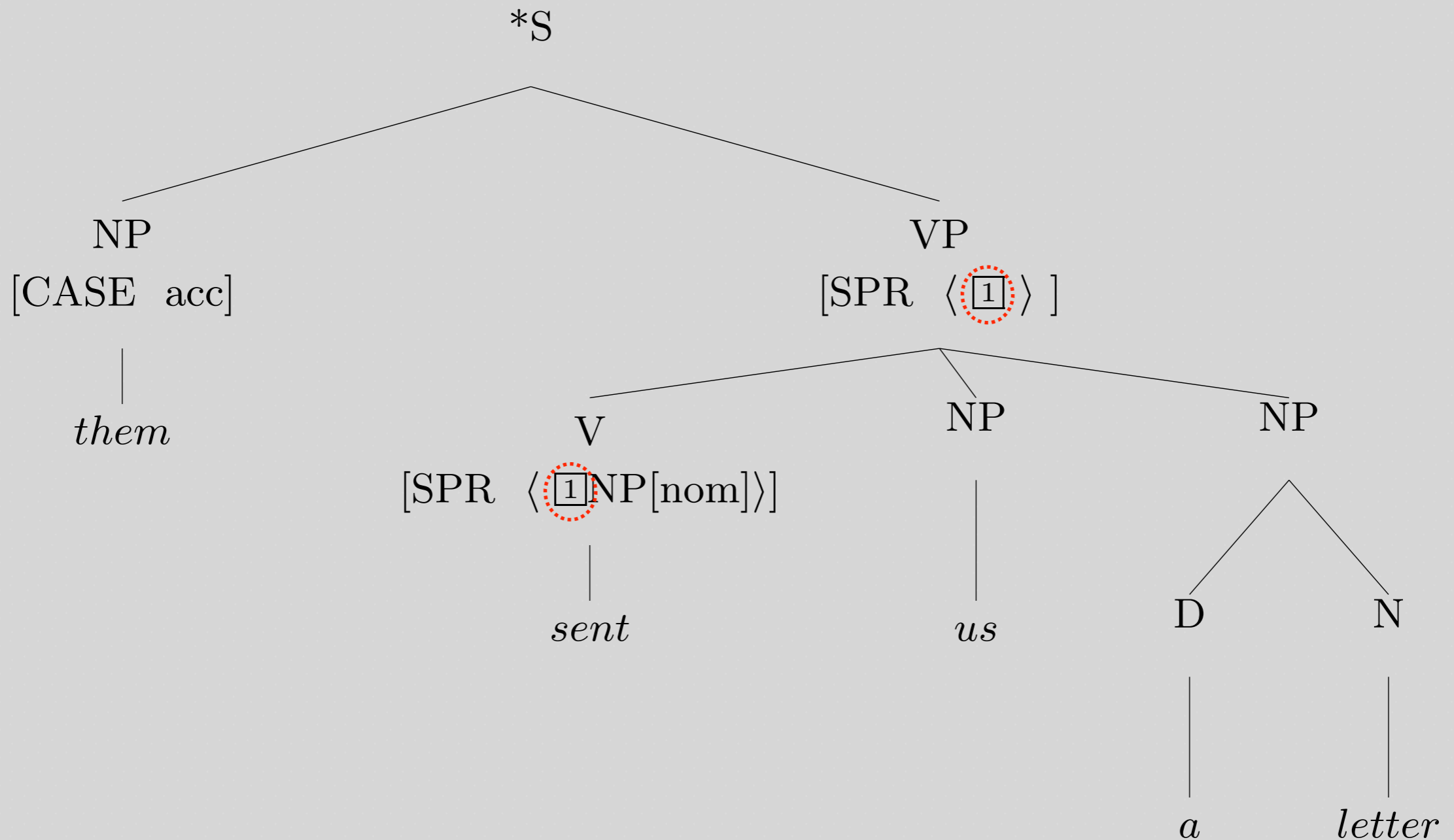


What's wrong with this sentence?

So what?

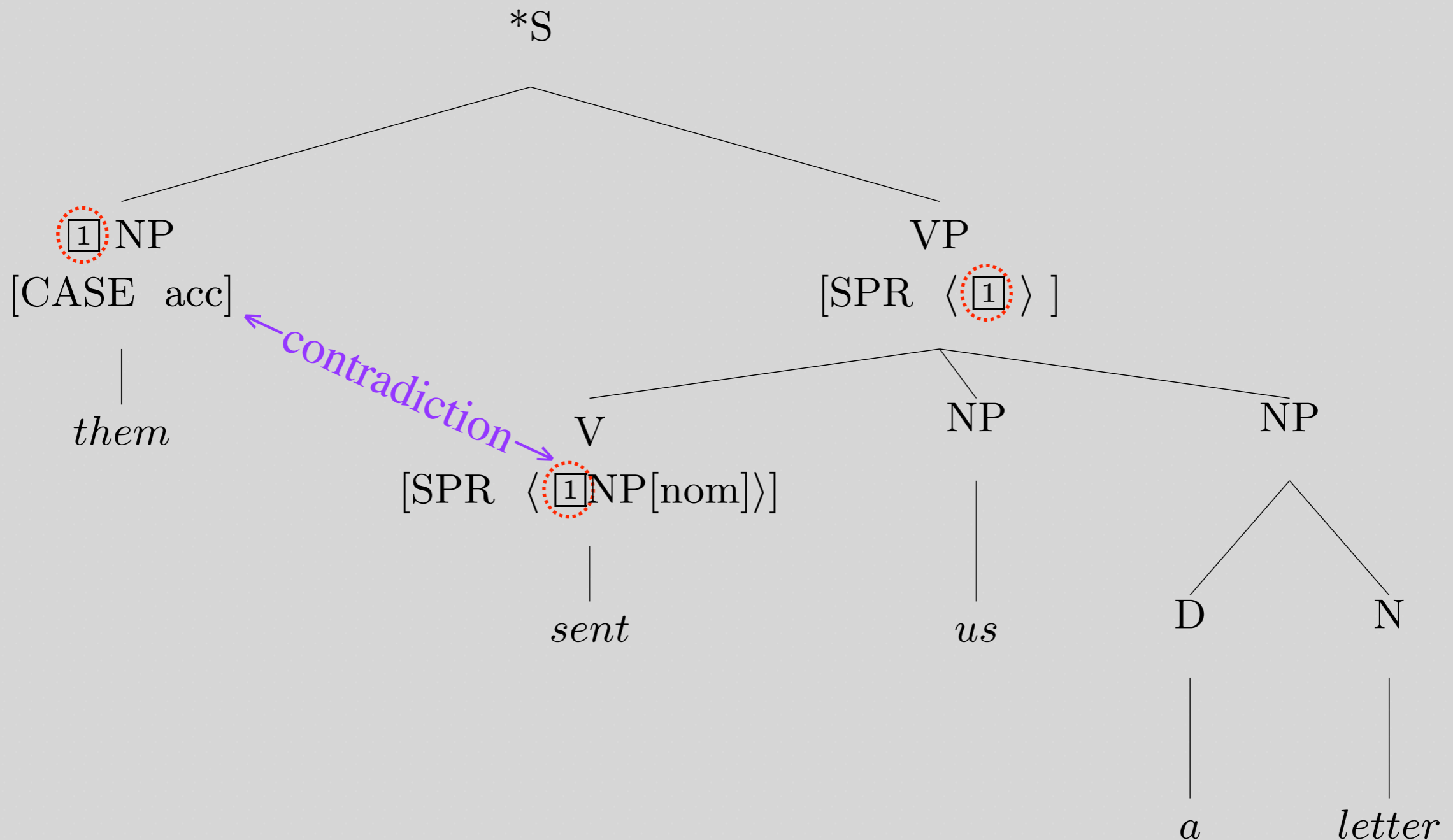
# An Ungrammatical Example

## 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?

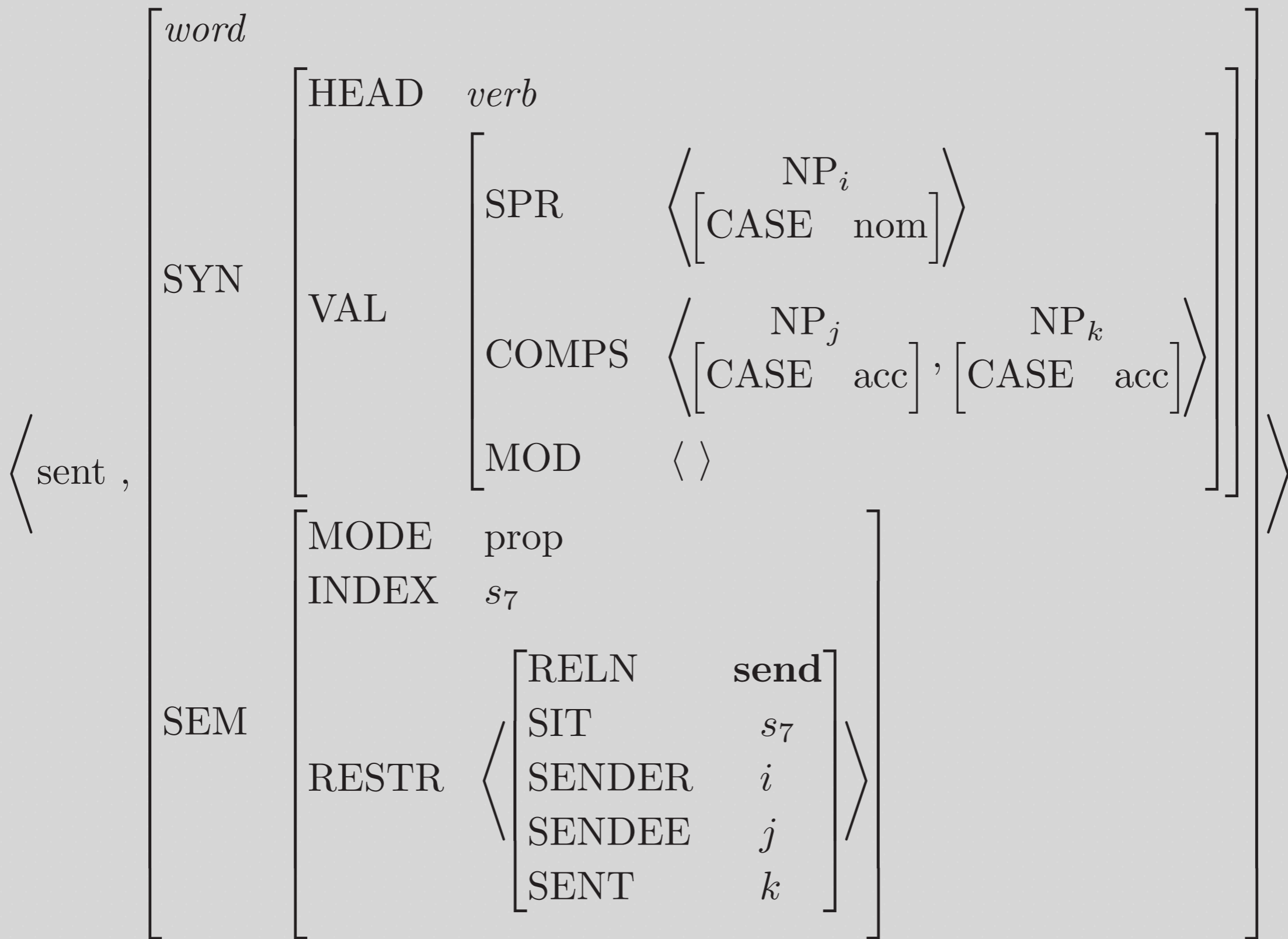
# Overview

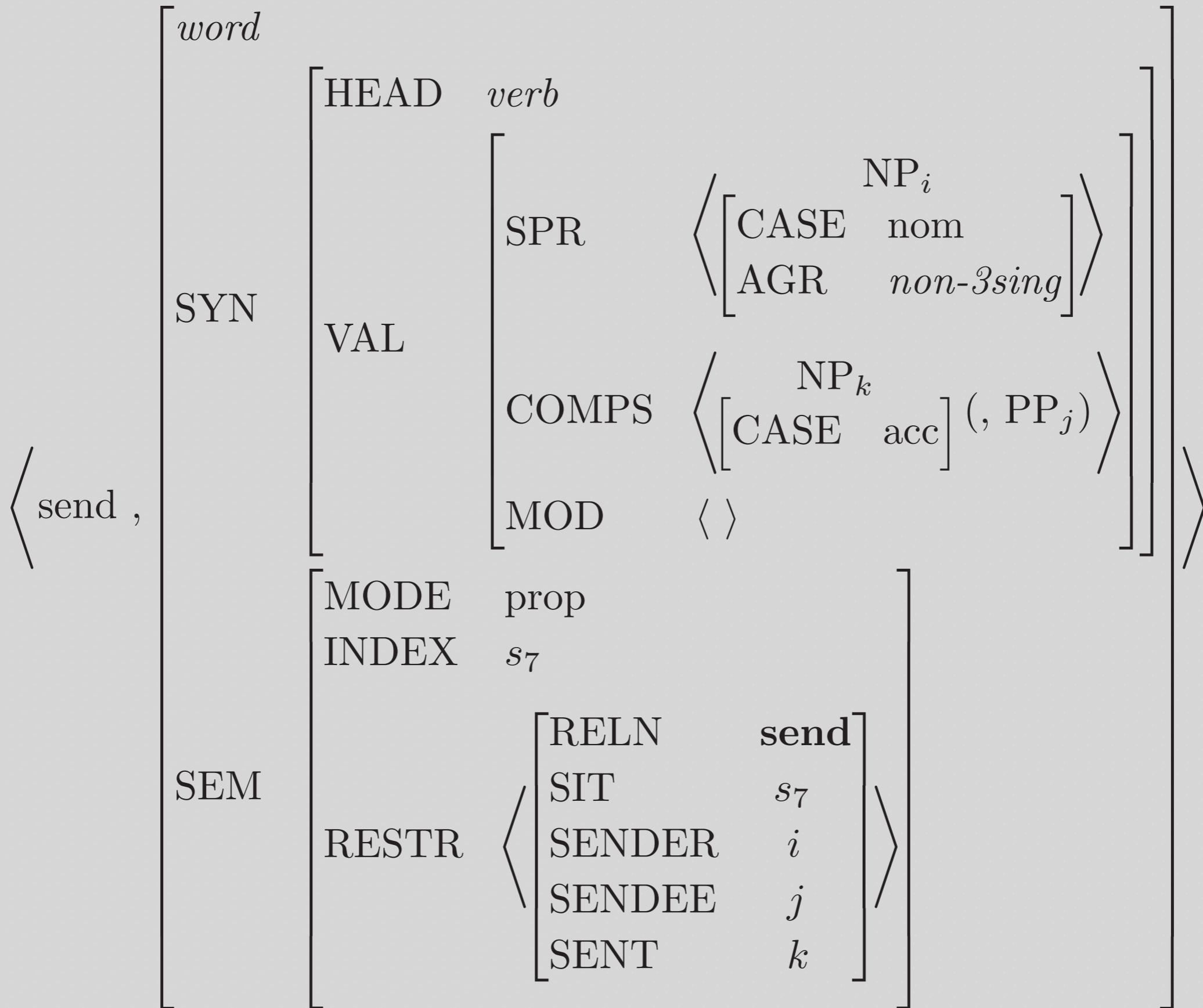
- What we're trying to do
- The pieces of our grammar
- Two extended examples
- Reflection on what we've done, what we still have to do
- Reading questions

# Reading Questions

- Why do send and sent have different COMPS lists? (see next slides)
- How many different lexical entries do we need?
- Does the tense of the verb in fact correlate with its COMPS value?







# Reading Questions

- The lexical entries in Chapter 6 seem almost absurdly long (taking up almost an entire page each). From a computational perspective, this doesn't seem feasible. Could you provide some examples of when it might make sense to encode all (or more than just the standard POS tags) of this information into a lexicon in practice?

# Reading Questions

- Also, could you explain the difference between saying "the subtree dominating the verb "send"" and "word-structure for send"?

# Reading Questions

- Does English have dative case?
- How do we know which NP has which semantic role?
- Why do we need separate SPR and COMPS lists?

# Reading Questions

- How is it that the lexical entry for a word like "a" and the lexical entry for a word like "letter" have the same index? They can't communicate with each other to ensure that they point to the same individual so I was just wondering how that comes about in their lexical entries.



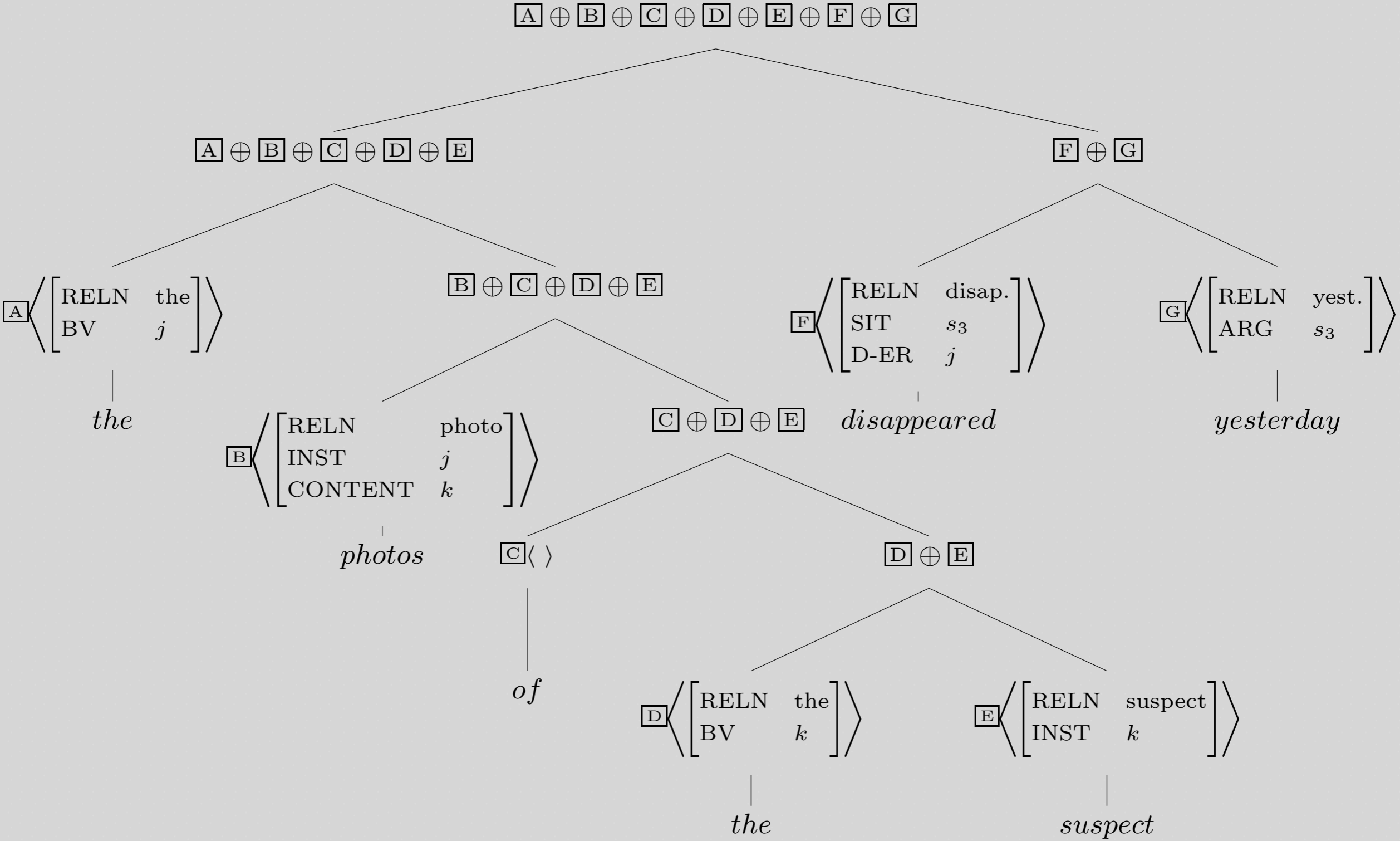
# Reading Questions

- Why do nouns and their specifiers share an INDEX value?
- Why do prepositions and their complements share an INDEX value?

# Reading Questions

- pp. 176 the RESTR of the VP "sent us a letter" is appears to denote a list of RESTR lists (look at RESTR D). Isn't it the case that by the principle of compositionality we create one RESTR list from the daughters? If this is the case, how should I read this RESTR list that looks to be composed of sub lists?
- Does it matter where in the feature structures of sentences we put just the tags (boxed numerals), and where we write out the details? How about for RESTR values?

# RESTR Values and the SCP



# Reading Questions

- Is there a list of possible RELN values & associated feature names somewhere?
- Does  $j$  in (14) refer to the whole group, and do the individuals within the group get their own letters?

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

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

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

# Reading Questions

- Are there any advantages to building trees bottom up/top down? Why do we need both to be possible?
- How is it that the nouns 'here' and 'there' can form PPs by themselves, as in the sentence "he sent it here"? PPs formed in this way have no P head daughter.