

Ling 566
Nov 18, 2008
Auxiliaries

Overview

- What are auxiliaries?
- General properties of auxiliaries
- Lexical type/lexical entries for auxiliaries
- NICE properties (lexical rules)

What Auxiliaries Are

- Sometimes called “helping verbs,” auxiliaries are little words that come before the main verb of a sentence, including forms of *be, have, do, can, could, may, might, must, shall, should, will, and would*
- They tend to be involved in the expression of time, necessity, possibility, permission, and obligation, as well as such things as negation, affirmation, and questioning

Some Basic Facts about Auxiliaries

- They are optional
Pat tapdanced. Pat can tapdance. Pat is tapdancing.
- They precede any non-auxiliary verbs
**Pat tapdance can. *Pat tapdancing is.*
- They determine the form of the following verb
**Pat can tapdancing. *Pat is tapdance.*
- When they co-occur, their order is fixed
*Pat must be tapdancing. *Pat is musting tapdance.*
- Auxiliaries of any given type cannot iterate
**Pat could should tapdance.*

A Little History

- Chomsky's first book, *Syntactic Structures* (1957), contained a detailed analysis of the English system of auxiliary verbs
- It showed how formal analysis could reveal subtle generalizations
- The power of Chomsky's analysis of auxiliaries was one of the early selling points for transformational grammar
 - Especially, his unified treatment of auxiliary *do*
- So it's a challenge to any theory of grammar to deal with the same phenomena

Two Approaches to Analyzing Auxiliaries

- Treat auxiliaries as a special category, and formulate specialized transformations sensitive to their presence
- Assimilate their properties to existing types as much as possible, and elaborate the lexicon to handle what is special about them
- We adopt the latter, treating auxiliaries as a subtype of *srv-lxm*

Consequences of Making *auxv-lxm* a Subtype of *srv-lxm*

- Auxiliaries should express one-place predicates
- Auxiliaries should allow non-referential subjects (dummy *there*, *it*, and idiom chunks)
- Passivization of the main verb (the auxiliary's complement) should preserve truth conditions
- Are these borne out?

Why call auxiliaries verbs?

- *be*, *have*, and *do* exhibit verbal inflections (tense, agreement)
- *be*, *have*, and *do* can all appear as main verbs (that is, as the only verb in a sentence)
 - Their inflections are the same in main and auxiliary uses
 - *be* exhibits auxiliary behavior, even in its main verb uses
- Modals (*can*, *might*, *will*, etc.) don't inflect, but they occur in environments requiring a finite verb with no (other) finite verb around.

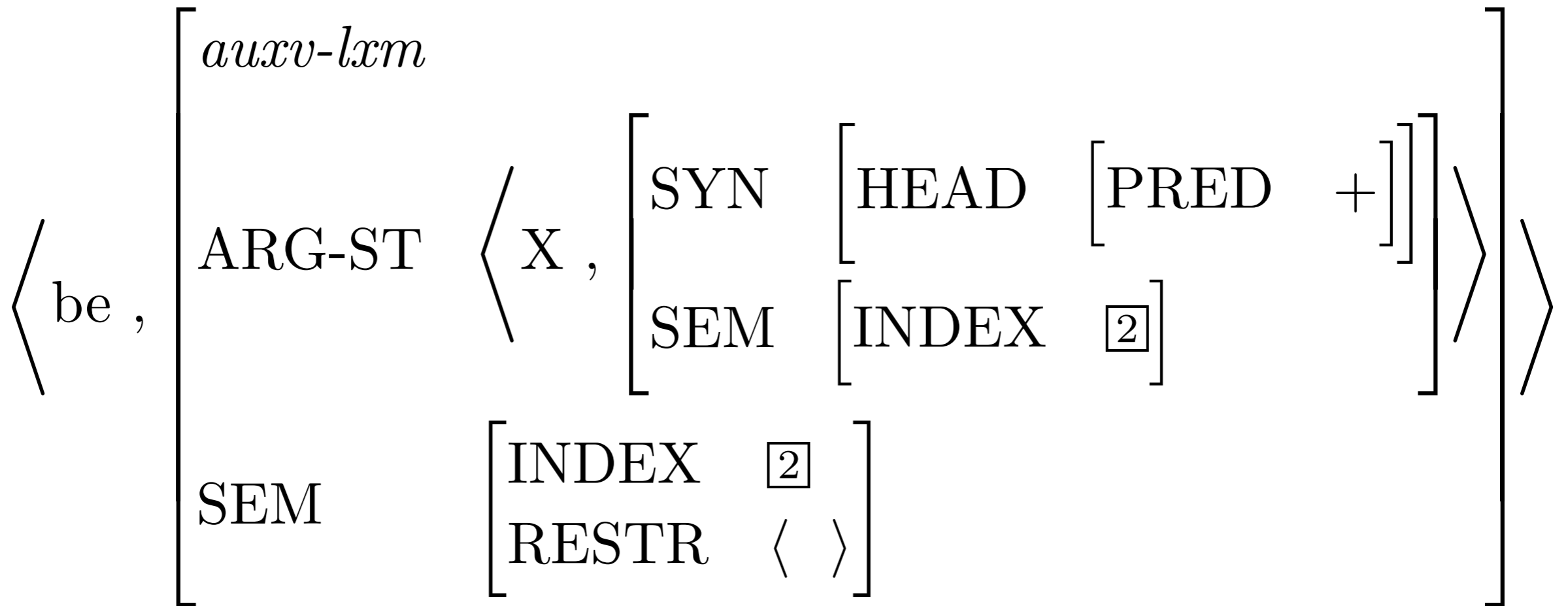
What's special about auxiliaries?

- Unlike other subject-raising verbs we have looked at, their complements aren't introduced by *to*
- The modals and *do* have defective paradigms
- There are restrictions on the ordering and iterability of auxiliaries
- They have a set of special characteristics known as the NICE properties.

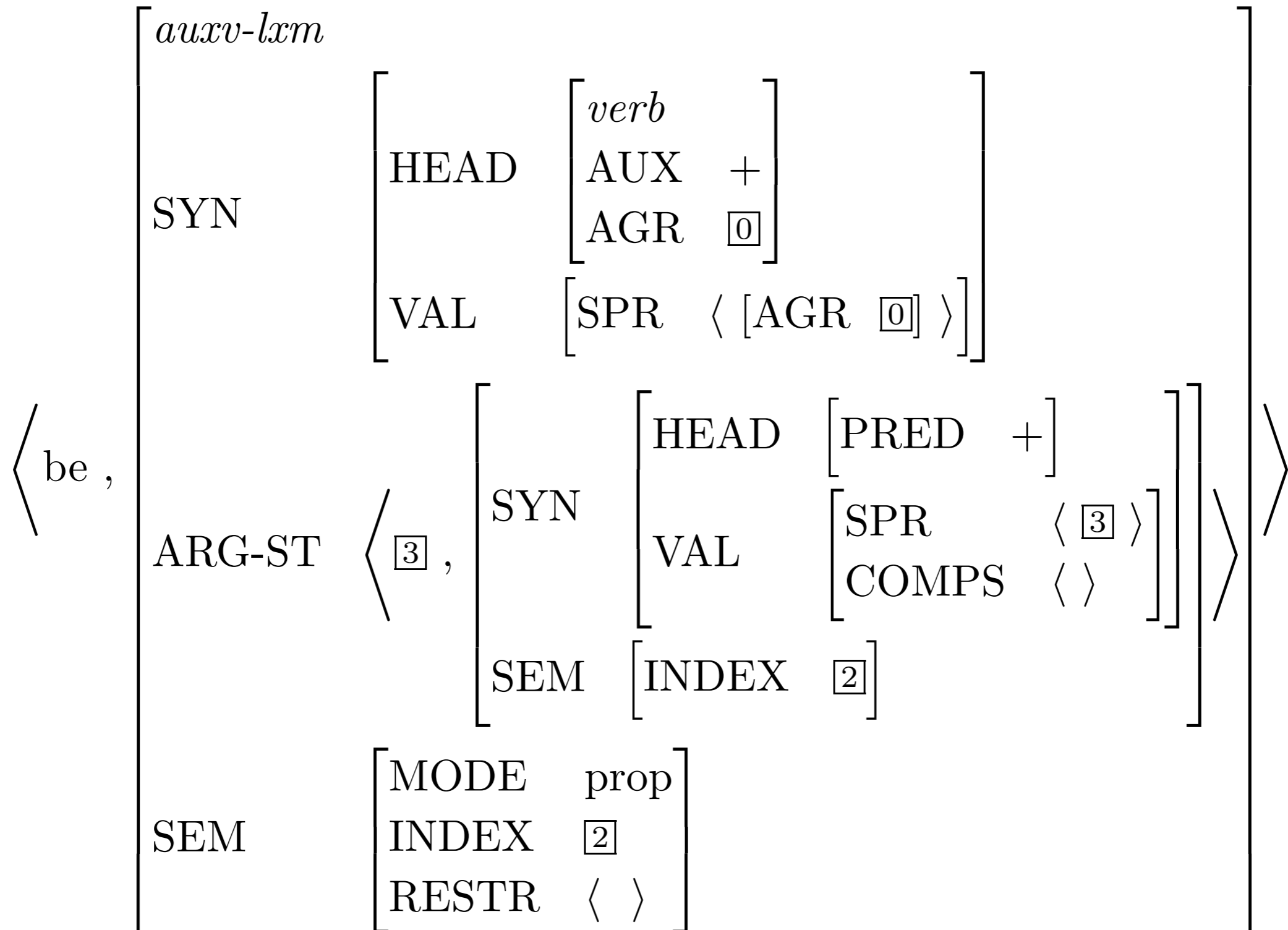
Some Type Constraints

TYPE	FEATURES/CONSTRAINTS	IST
<i>verb-lxm</i>	$\left[\begin{array}{l} \text{SYN} \quad \left[\text{HEAD} \quad \left[\begin{array}{l} \textit{verb} \\ \text{AUX} \quad / \quad - \end{array} \right] \right] \\ \text{ARG-ST} \quad \langle [\text{HEAD} \textit{nominal}], \dots \rangle \\ \text{SEM} \quad \left[\text{MODE} \quad \textit{prop} \right] \end{array} \right]$	<i>infl-lxm</i>
<i>srv-lxm</i>	$\left[\text{ARG-ST} \quad \left\langle \boxed{1}, \left[\begin{array}{l} \text{SPR} \quad \langle \boxed{1} \rangle \\ \text{COMPS} \quad \langle \rangle \end{array} \right] \right\rangle \right]$	<i>verb-lxm</i>
<i>ic-srv-lxm</i>	$\left[\begin{array}{l} \text{ARG-ST} \quad \left\langle \text{X}, \left[\begin{array}{l} \text{VP} \\ \text{INF} \quad + \\ \text{INDEX} \quad s \end{array} \right] \right\rangle \\ \text{SEM} \quad \left[\text{RESTR} \quad \left\langle [\text{ARG} \quad s] \right\rangle \right] \end{array} \right]$	<i>srv-lxm</i>
<i>auxv-lxm</i>	$\left[\text{SYN} \quad \left[\text{HEAD} \quad \left[\text{AUX} \quad + \right] \right] \right]$	<i>srv-lxm</i>

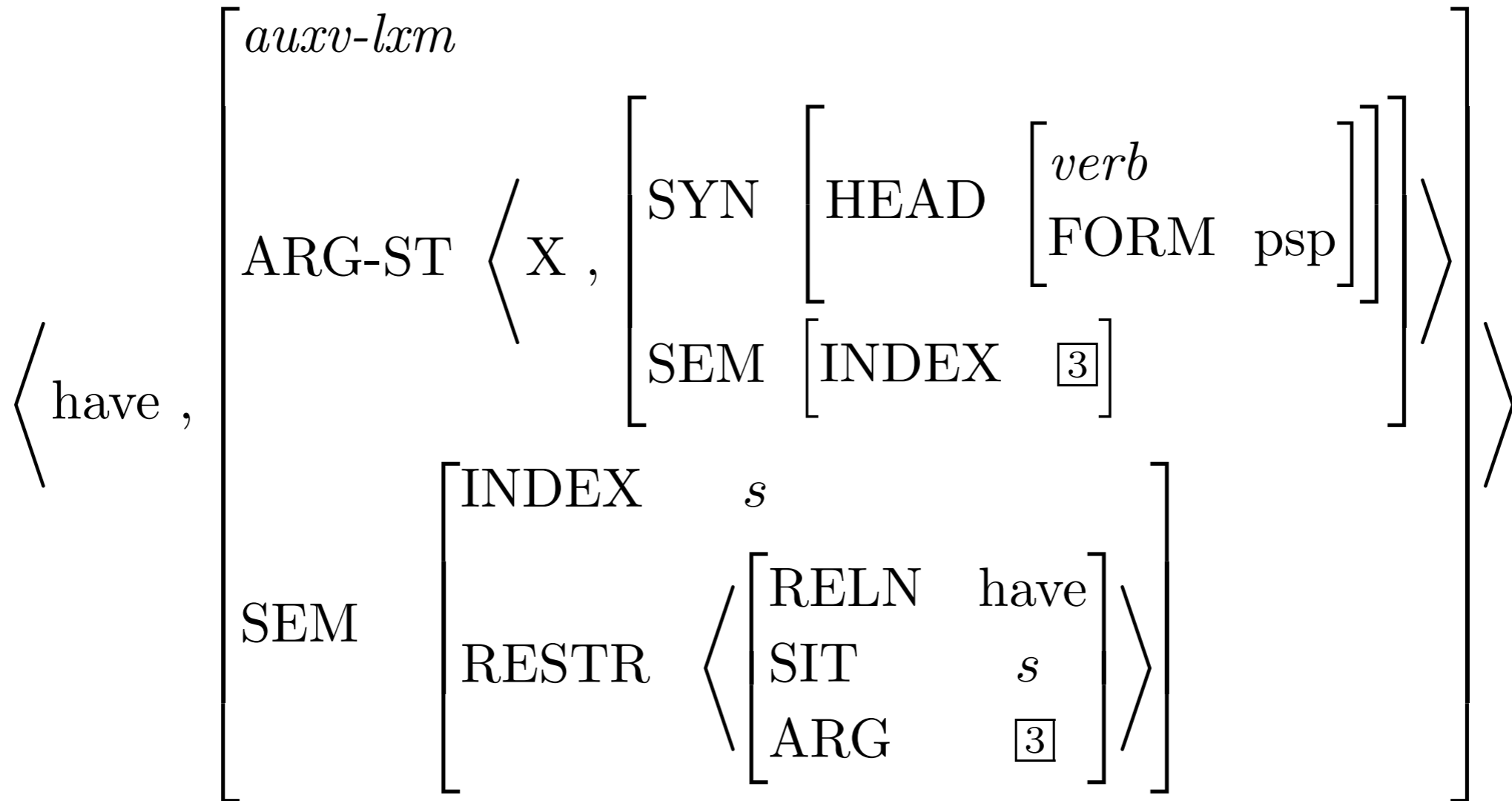
A Lexical Entry for *be*



The Entry for *be*, with Inherited Information

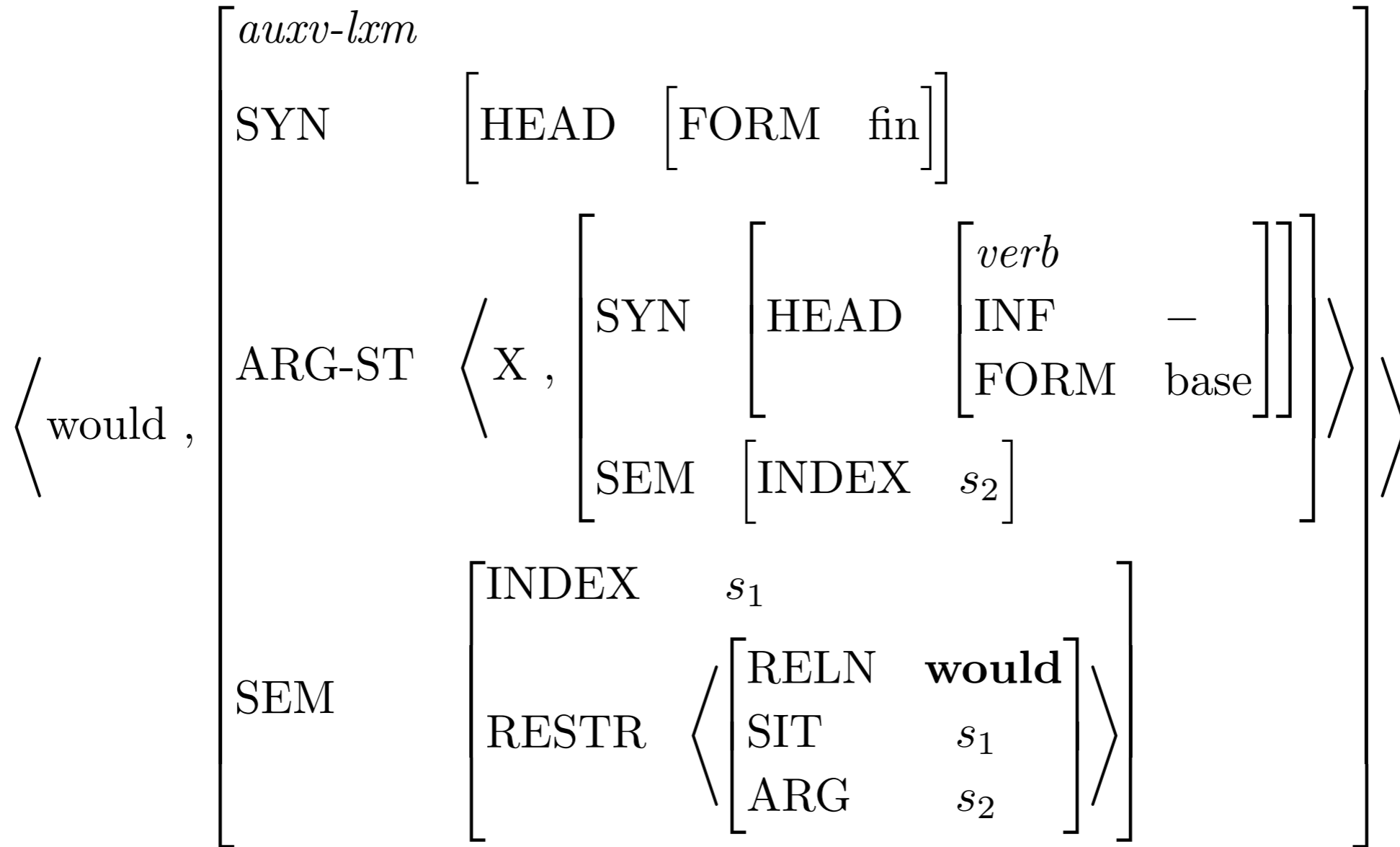


Entry for *have*



- Note the FORM restriction on the complement VP
- What accounts for the analogous FORM restriction on verbs following *be*?

Lexical Entry for a Modal



- What inflectional lexical rules apply to this lexeme?

Accounting for the Basic Facts Cited Earlier

- **Optionality of auxiliaries:**
As raising verbs, their subjects and complements go together.
- **Auxiliaries precede non-auxiliary verbs:**
Auxiliaries are heads, and complements follow heads in English.
- **Auxiliaries determine the form of the following verb:**
This is built into their lexical entries.
- **When auxiliaries co-occur, their order is fixed:**
Different explanations for different combinations; see next slide.
- **Non-iterability of auxiliaries:**
Ditto.

Accounting for Restrictions on Order and Iterability

- **Order**

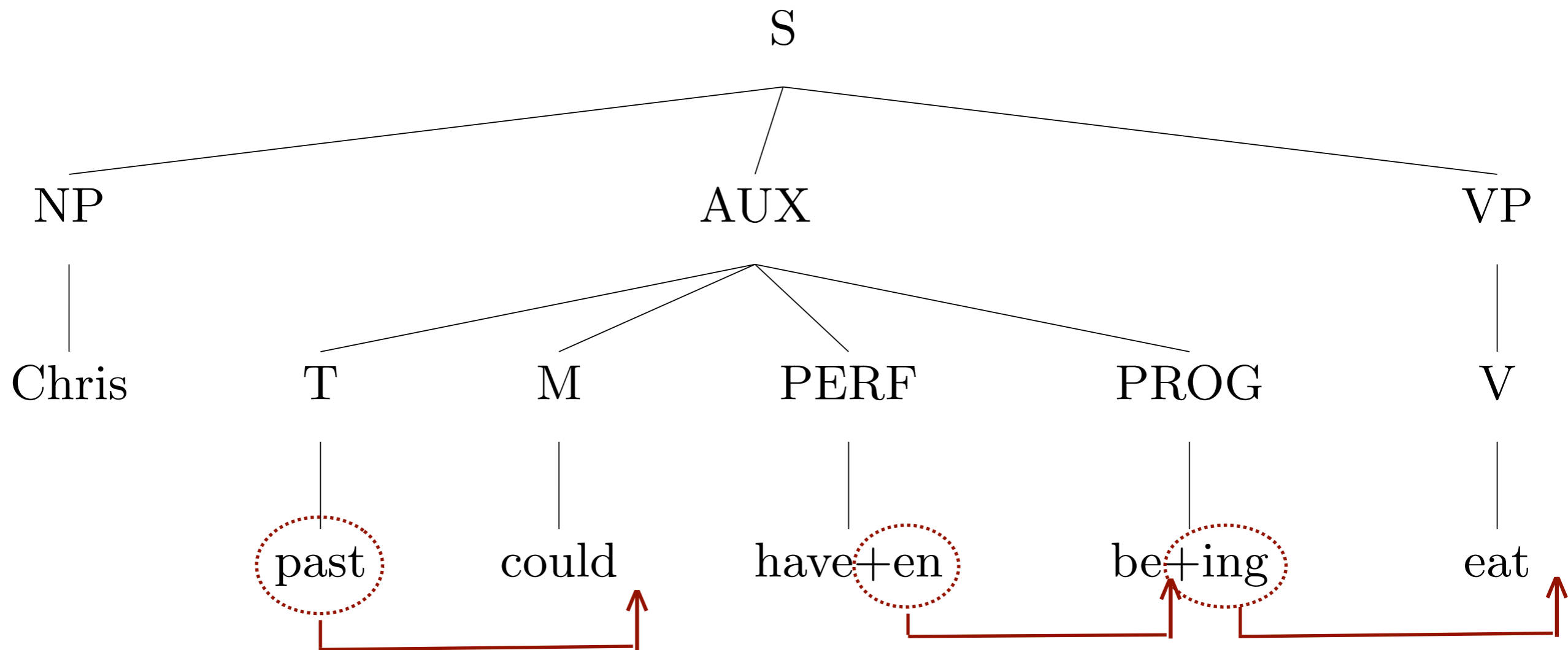
- Modals are finite, and all auxiliaries take non-finite complements. Hence, modals must come first.
- Stative verbs (like *own*) don't have present participles, and auxiliary *have* is stative. Hence, **Pat is having tapdanced*.

- **Iterability**

- Auxiliary *be* is also stative, so **Pat is being tapdancing*.
- Modals must be finite, and their complements must be base, so **Pat can should tapdance*.
- **Pat has had tapdanced* can be ruled out in various ways, e.g. stipulating that auxiliary *have* has no past participle.

Sketch of Chomsky's Old Analysis

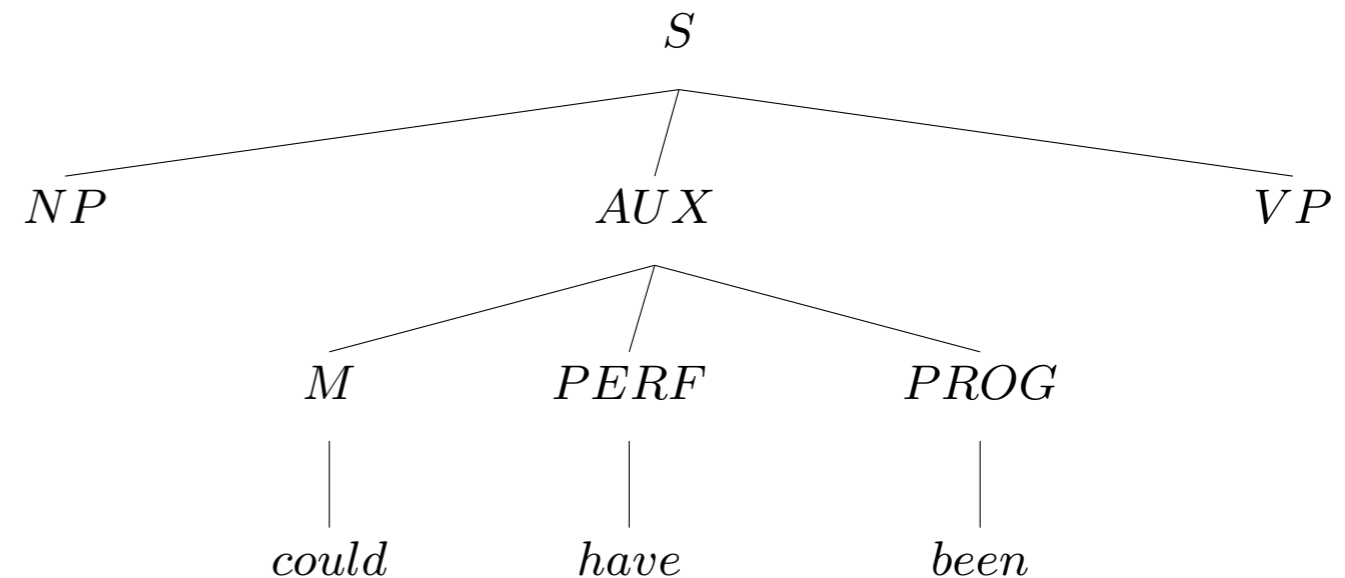
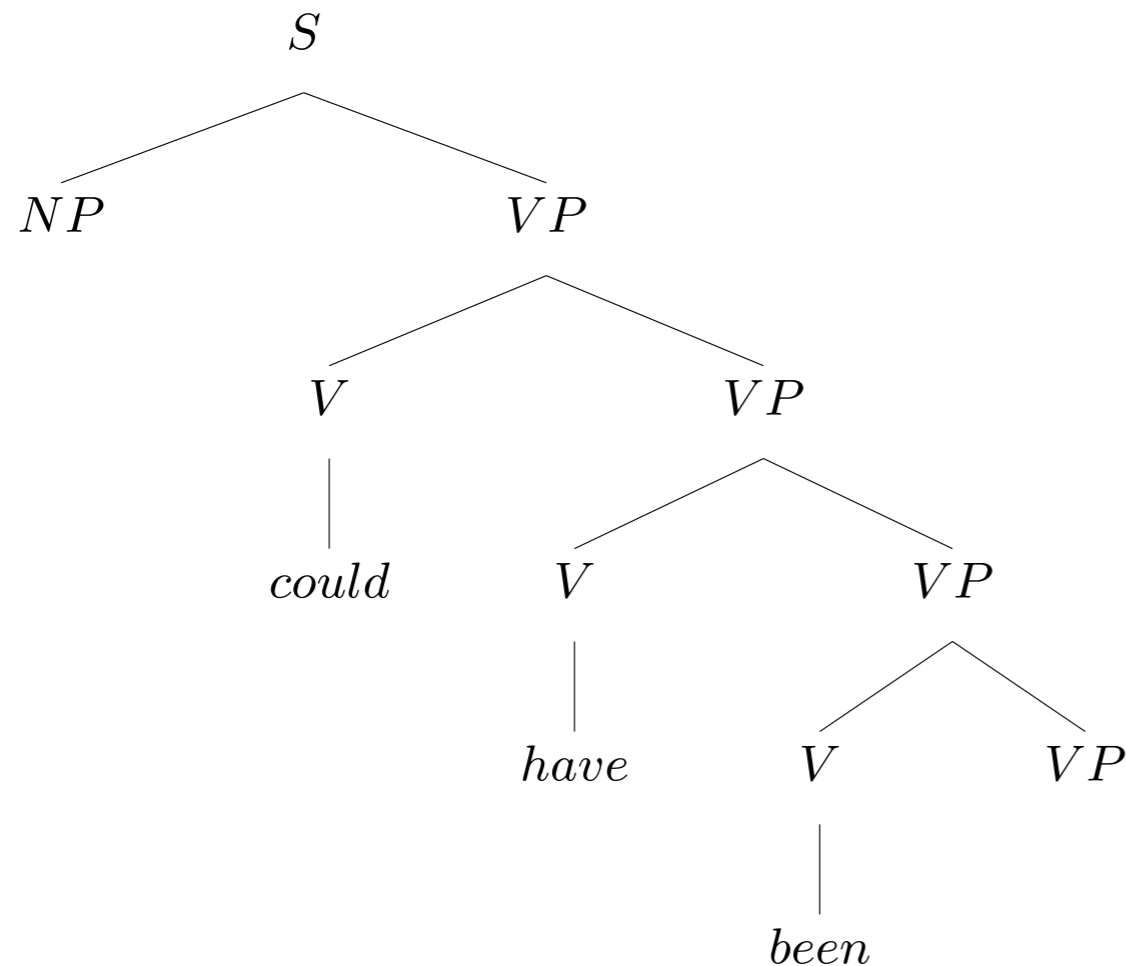
$S \rightarrow NP \text{ AUX } VP$
 $AUX \rightarrow T(M)(PERF)(PROG)$



How this Analysis Handles the Basic Facts

- **Optionality of auxiliaries:**
Stipulated in the phrase structure rule (with parentheses)
- **Auxiliaries precede non-auxiliary verbs:**
Built into the phrase structure rule, with AUX before VP
- **Auxiliaries determine the form of the following verb:**
Inflections are inserted with the auxiliaries and moved onto the following verb transformationally.
- **When auxiliaries co-occur, their order is fixed:**
Stipulated in the phrase structure rule for AUX
- **Non-iterability of auxiliaries:**
Ditto.

The two analyses assign very different trees



- *could have been* VP, *have been* VP, and *been* VP are all constituents
- *could have been* is not a constituent

- *could have been* VP, *have been* VP, and *been* VP are not constituents
- *could have been* is a constituent

Ellipsis and Constituency

- Consider:

Pat couldn't have been eating garlic, but Chris could have been

Pat couldn't have been eating garlic, but Chris could have

Pat couldn't have been eating garlic, but Chris could

- On the nested analysis, the missing material is a (VP) constituent in each case
- On the flat analysis, the missing material is never a constituent
- This argues for our analysis over the old transformational one.

Our Analysis of Auxiliaries So Far

- Auxiliaries are subject-raising verbs
- Most basic distributional facts about them can be handled through selectional restrictions between auxiliaries and their complements (that is, as ARG-ST constraints)
- Auxiliaries are identified via a HEAD feature AUX, which we have not yet put to use

Descriptive Summary of the NICE Properties

Negation

Sentences are negated by putting *not* after the first auxiliary verb; they can be reaffirmed by putting *too* or *so* in the same position

Inversion

Questions are formed by putting an auxiliary verb before the subject NP

Contraction

Auxiliary verbs take negated forms, with *n't* affixed

Ellipsis

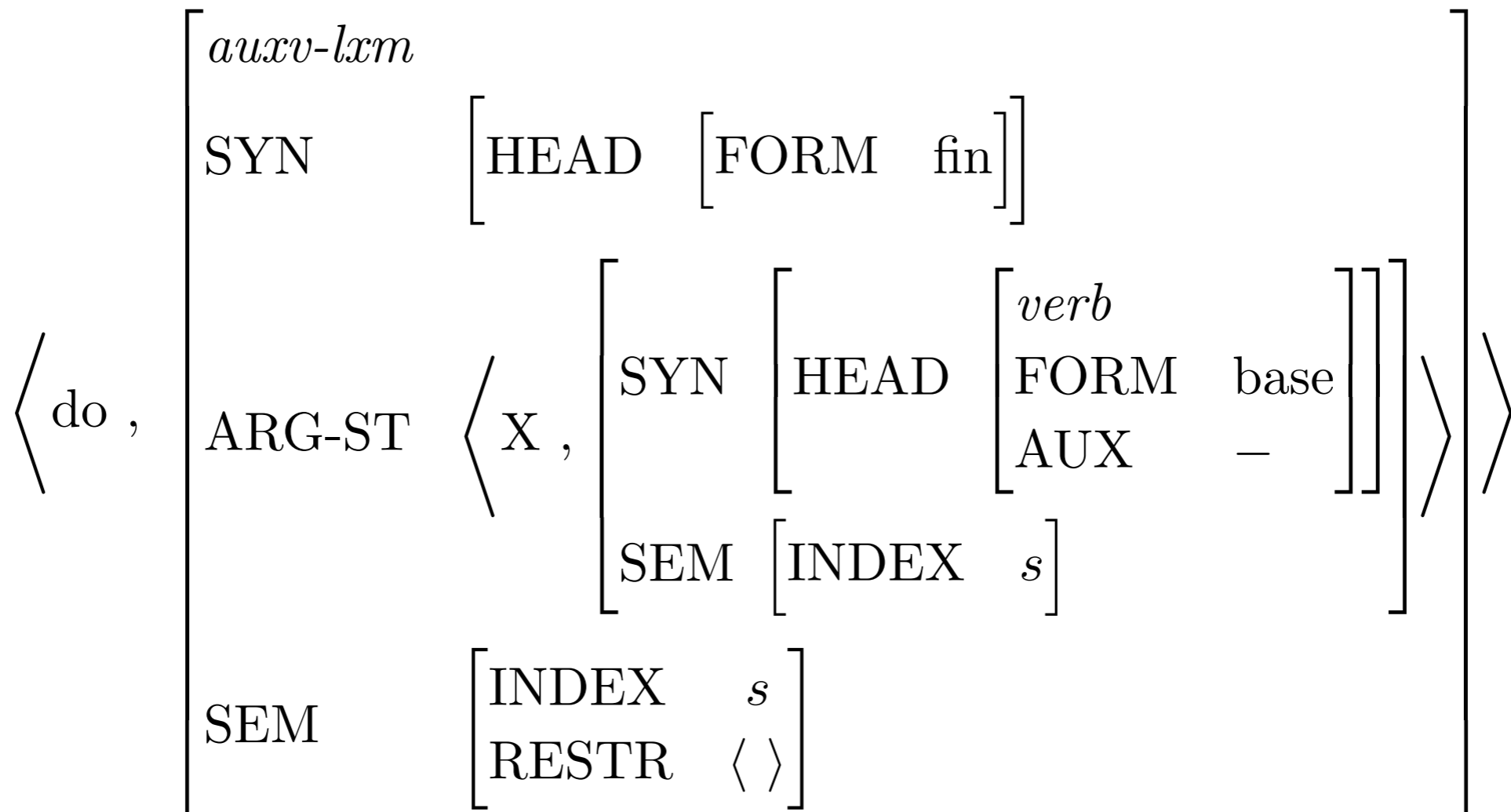
Verb phrases immediately following an auxiliary verb can be omitted

Negation (and Reaffirmation)

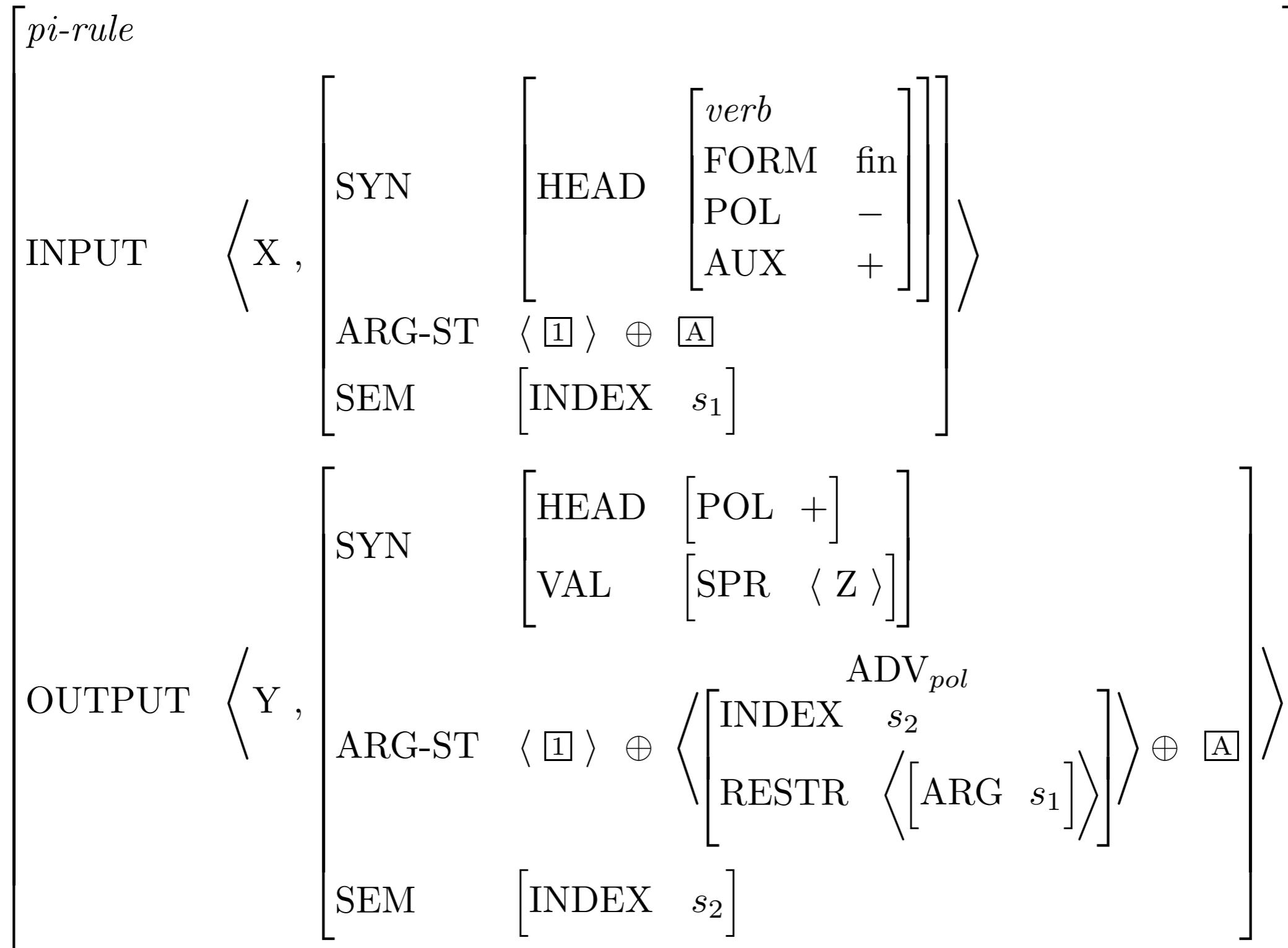
- Polar adverbs (sentential *not*, *so*, and *too*) appear immediately following an auxiliary
 - Pat will not leave*
 - Pat will SO leave*
 - Pat will TOO leave*
- What about examples like *Not many people left*?
- What happens when you want to deny or reaffirm a sentence with no auxiliary?
 - Pat left*
 - Pat did not leave*
 - Pat did TOO leave*

The Auxiliary *do*

- Like modals, *do* only occurs in finite contexts:
**Pat continued to do not leave*
- Unlike modals, *do* cannot be followed by other auxiliaries:
**Pat did not have left*

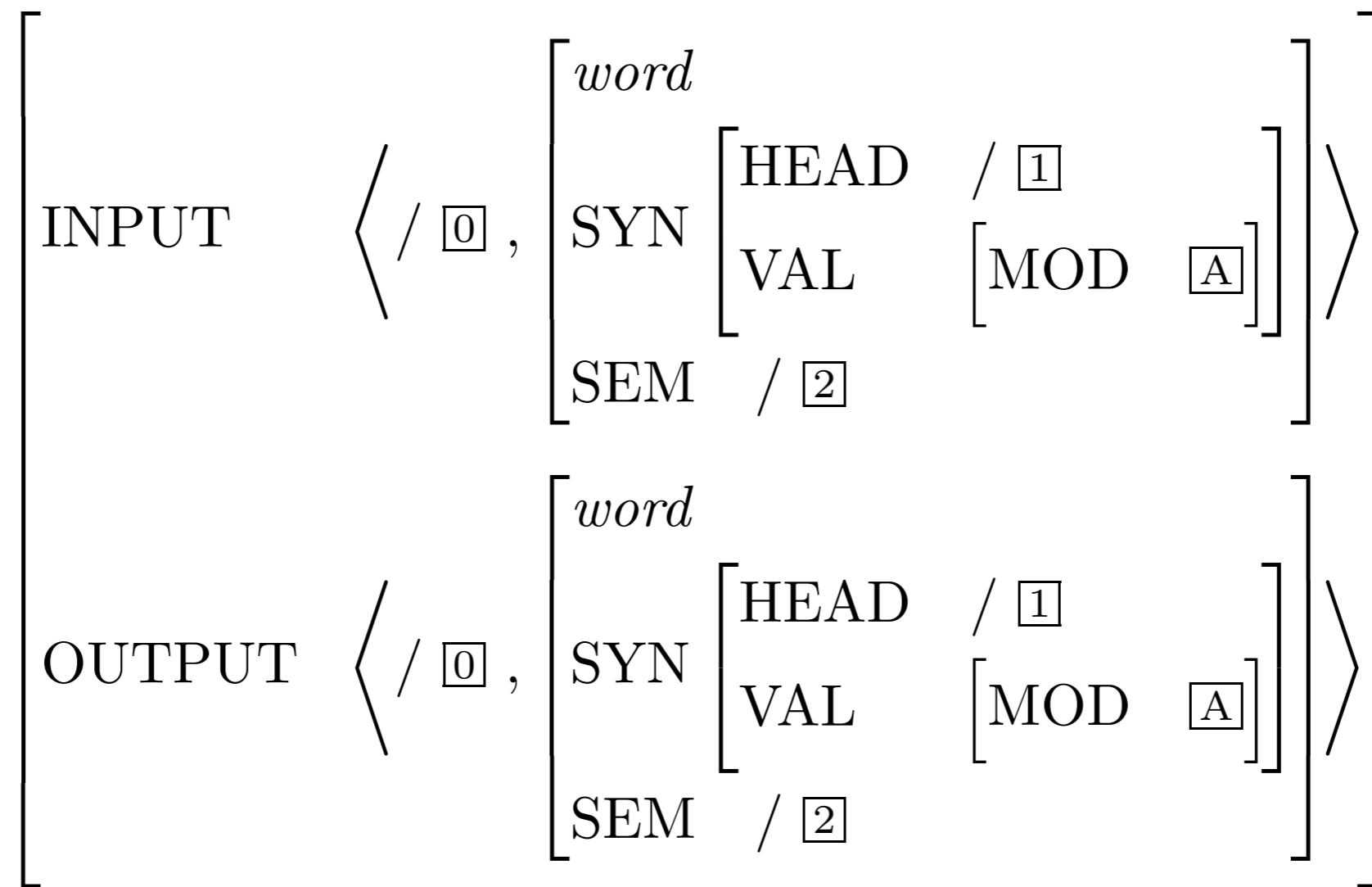


The ADV_{pol} -Addition Lexical Rule

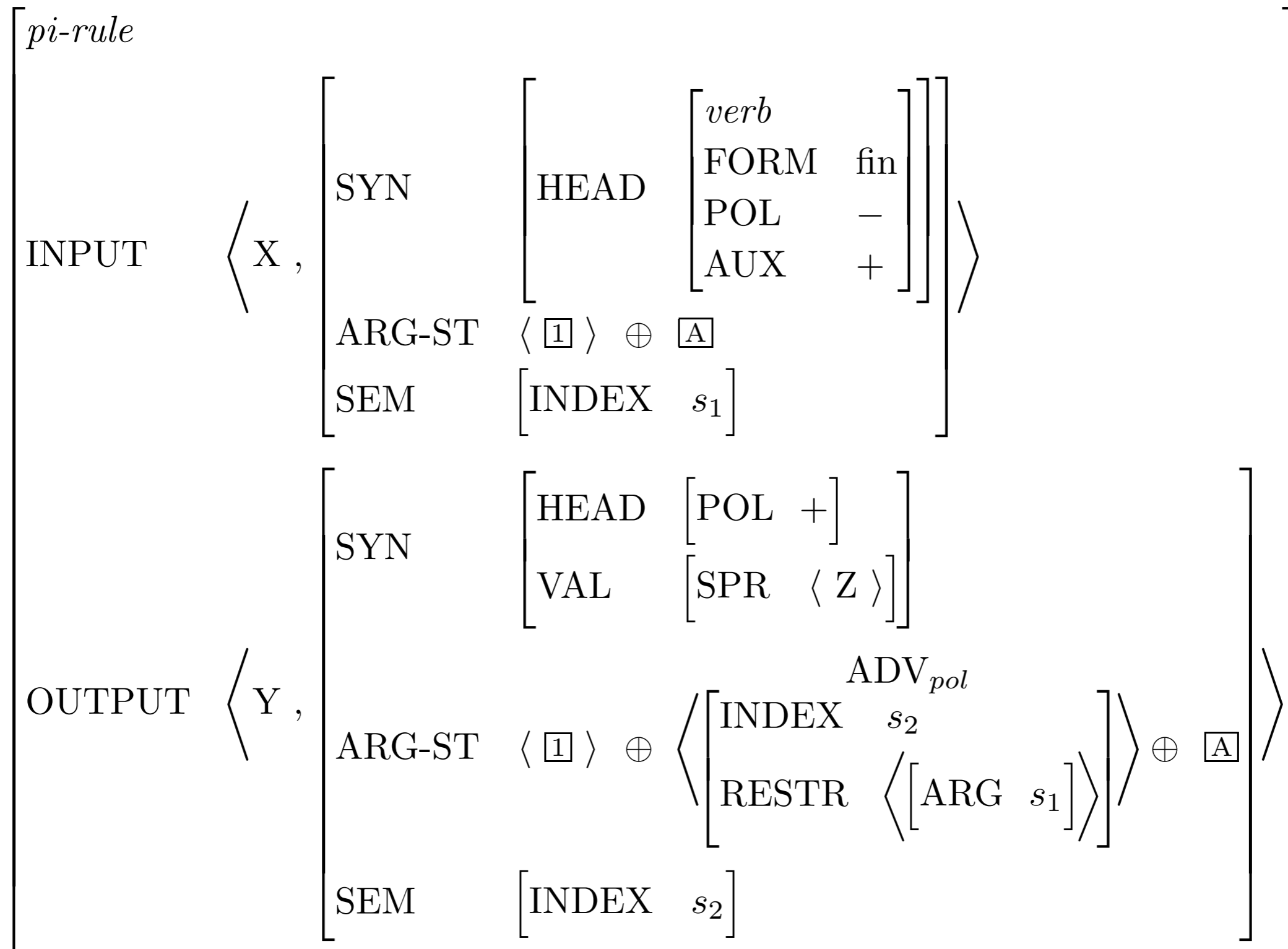


What does the type *pi-rule* mean?

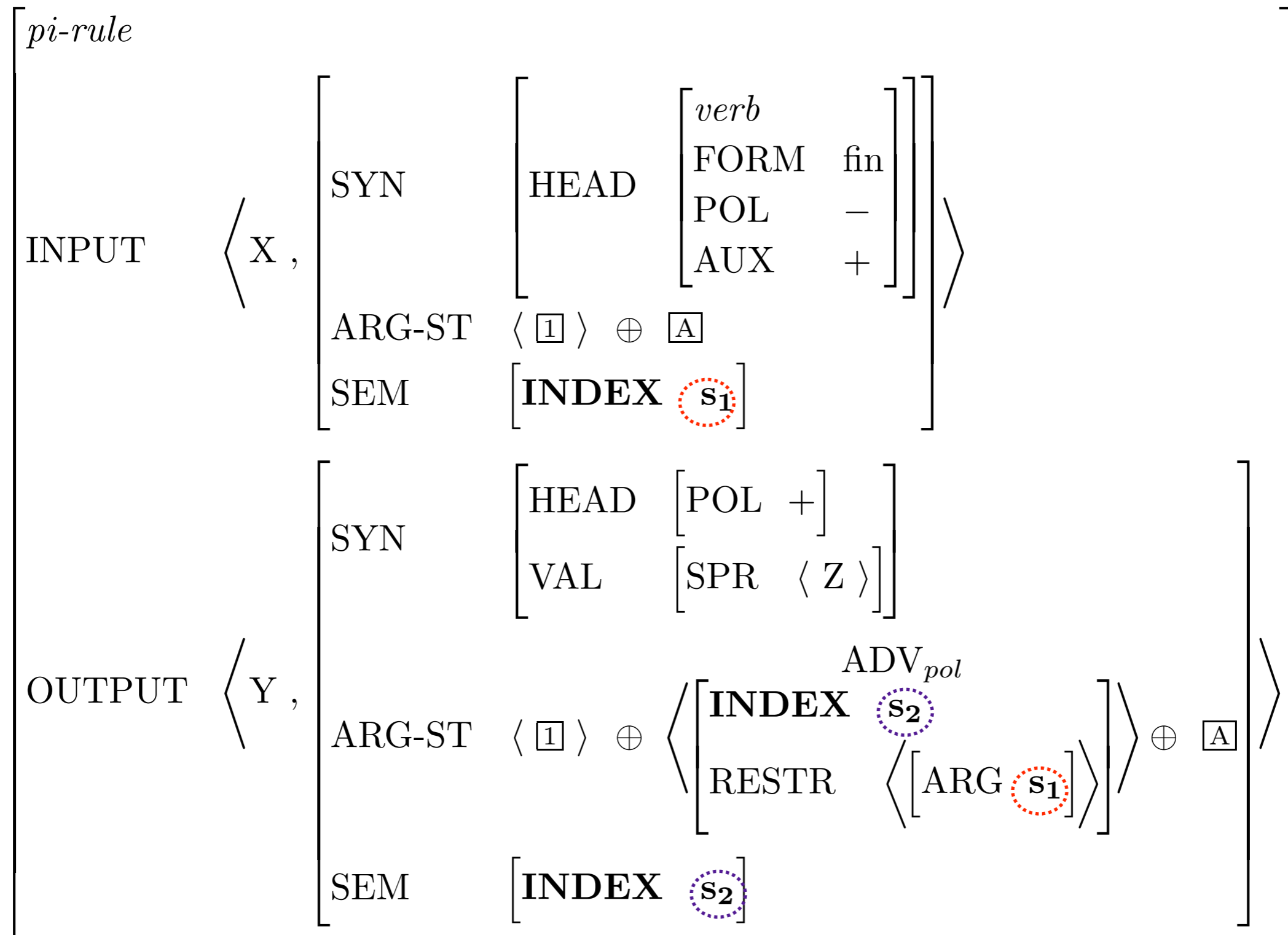
- It maps words to words (hence, “post-inflectional”)
- It preserves MOD values, HEAD values as a default, and (like other lexical rule types) SEM values as a default



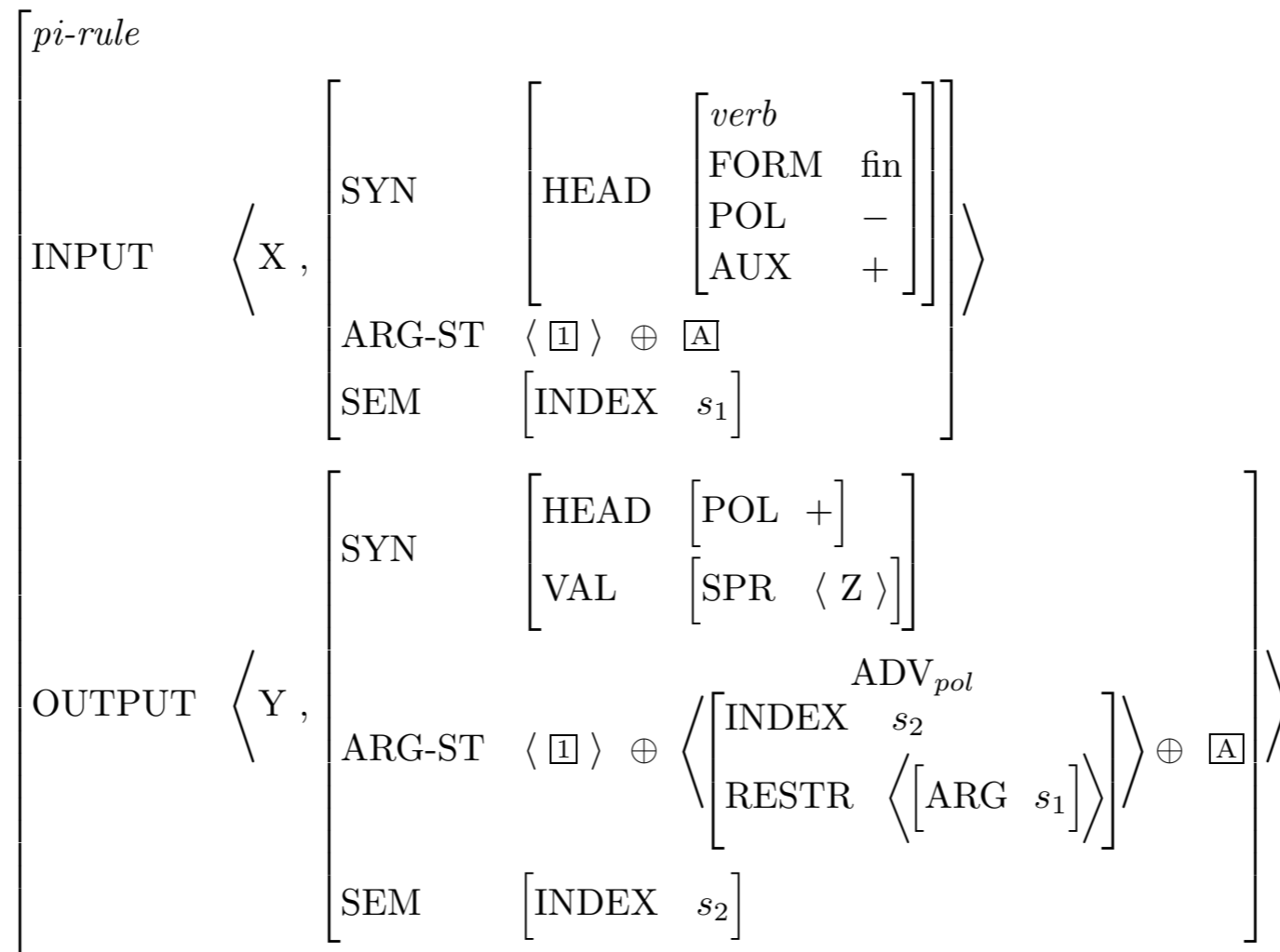
Why doesn't ADV_{pol} -Addition LR mention VAL?



What is the role of these indices?



Which *nots* does the rule license?



Andy must not have been sleeping?

✓

Andy must have not been sleeping?

✗

Andy must have been not sleeping?

✗

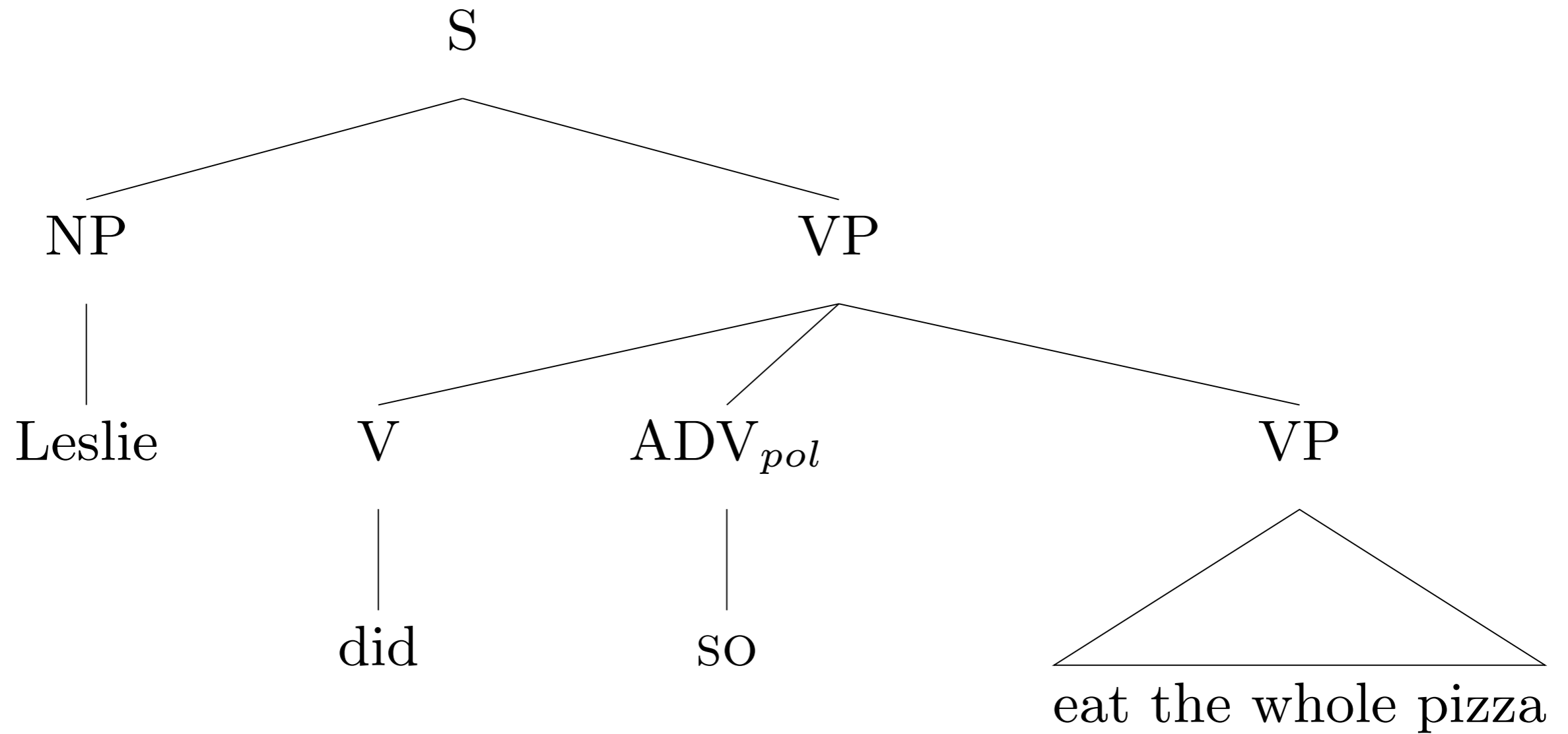
Kleptomaniacs cannot not steal.

✓

Kleptomaniacs cannot not steal.

✗

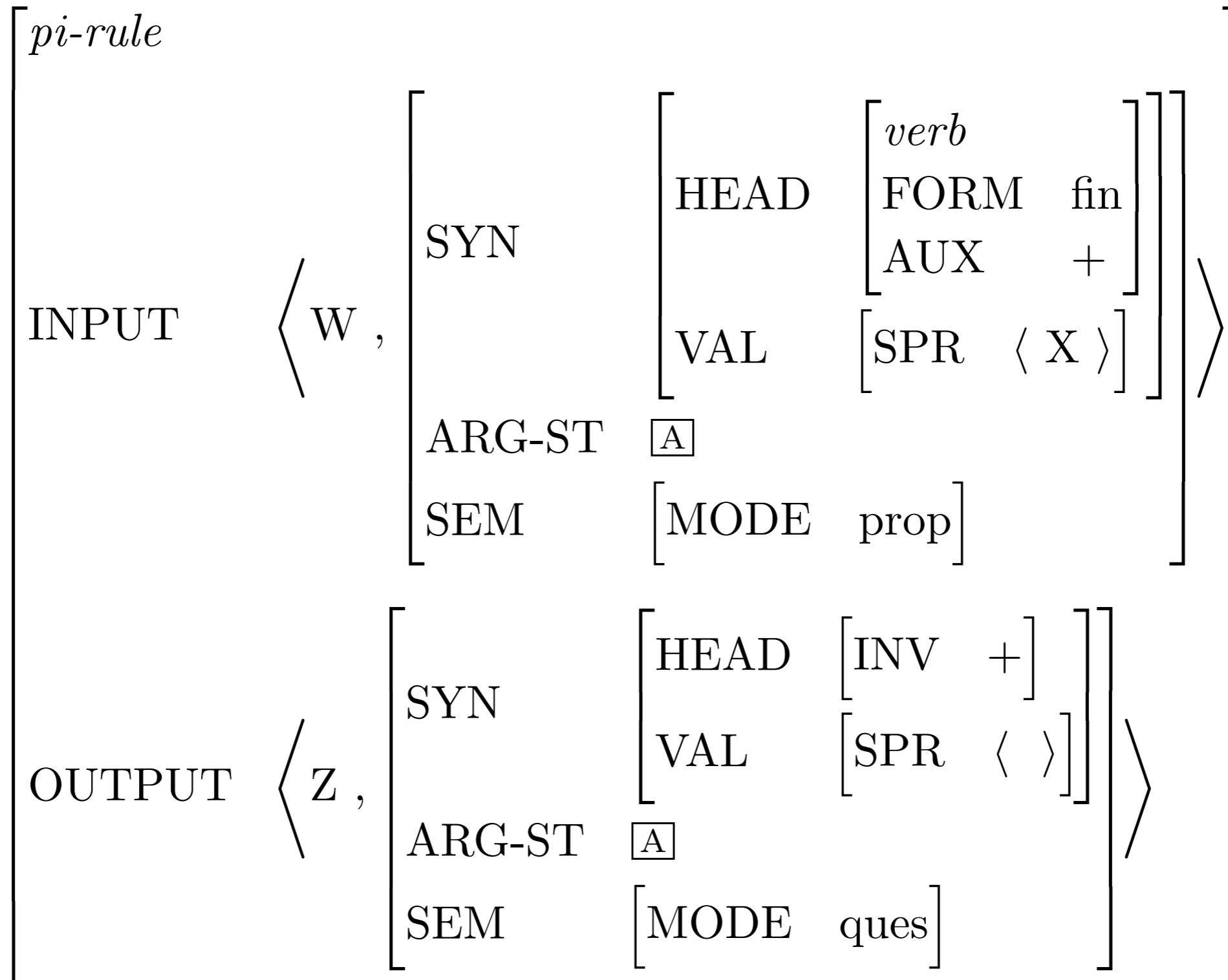
Negation and Reaffirmation: A Sample Tree



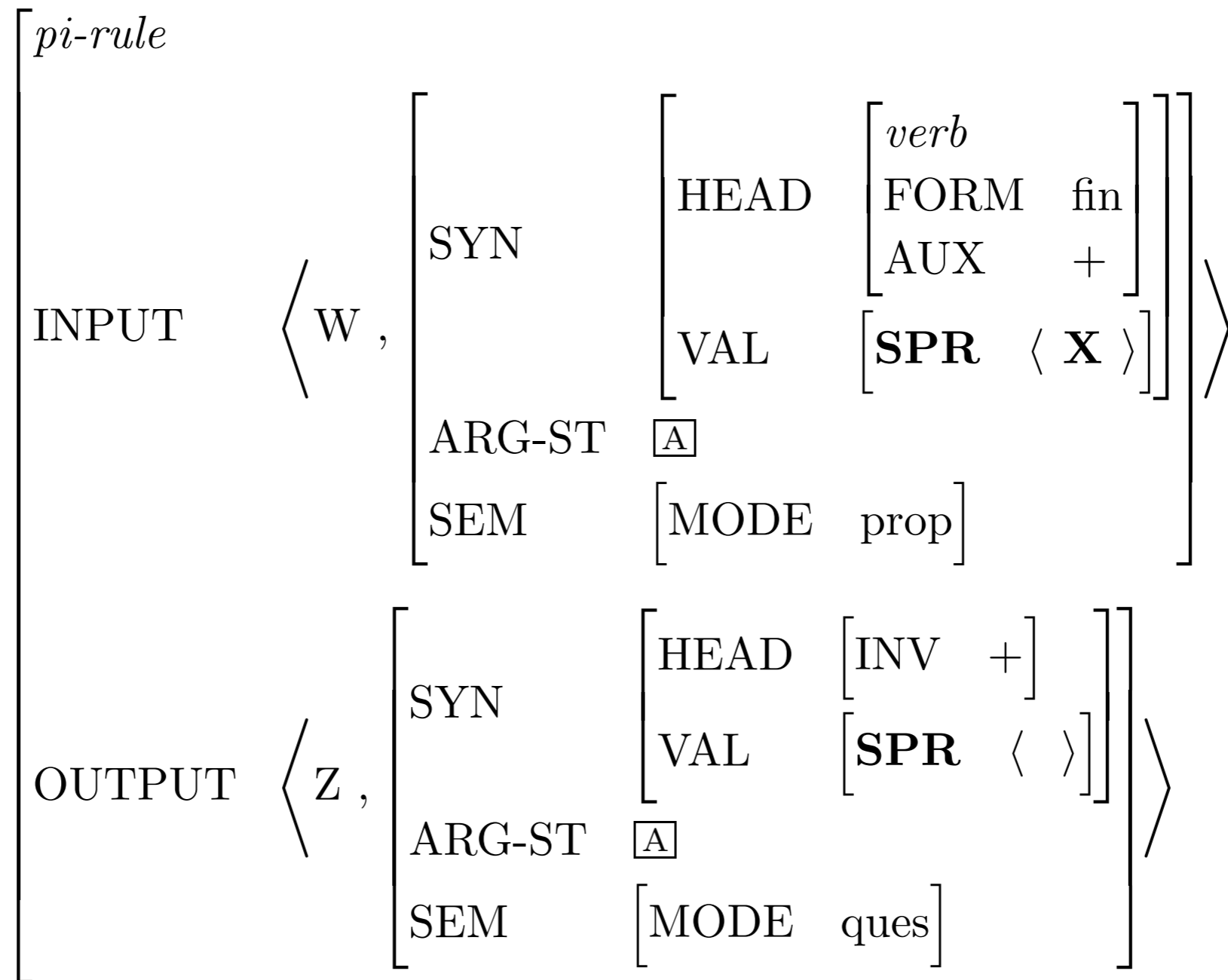
Inversion

- Yes-no questions begin with an auxiliary:
Will Robin win?
- The NP after the auxiliary has all the properties of a subject
 - Agreement: *Have they left?* vs. **Has they left?*
 - Case: **Have them left?*
 - Raising: *Will there continue to be food at the meetings?*
- What happens if you make a question out of a sentence without an auxiliary?
Robin won
Did Robin win?

The Inversion Lexical Rule



How the Rule Yields Inverted Order



...plus the ARP

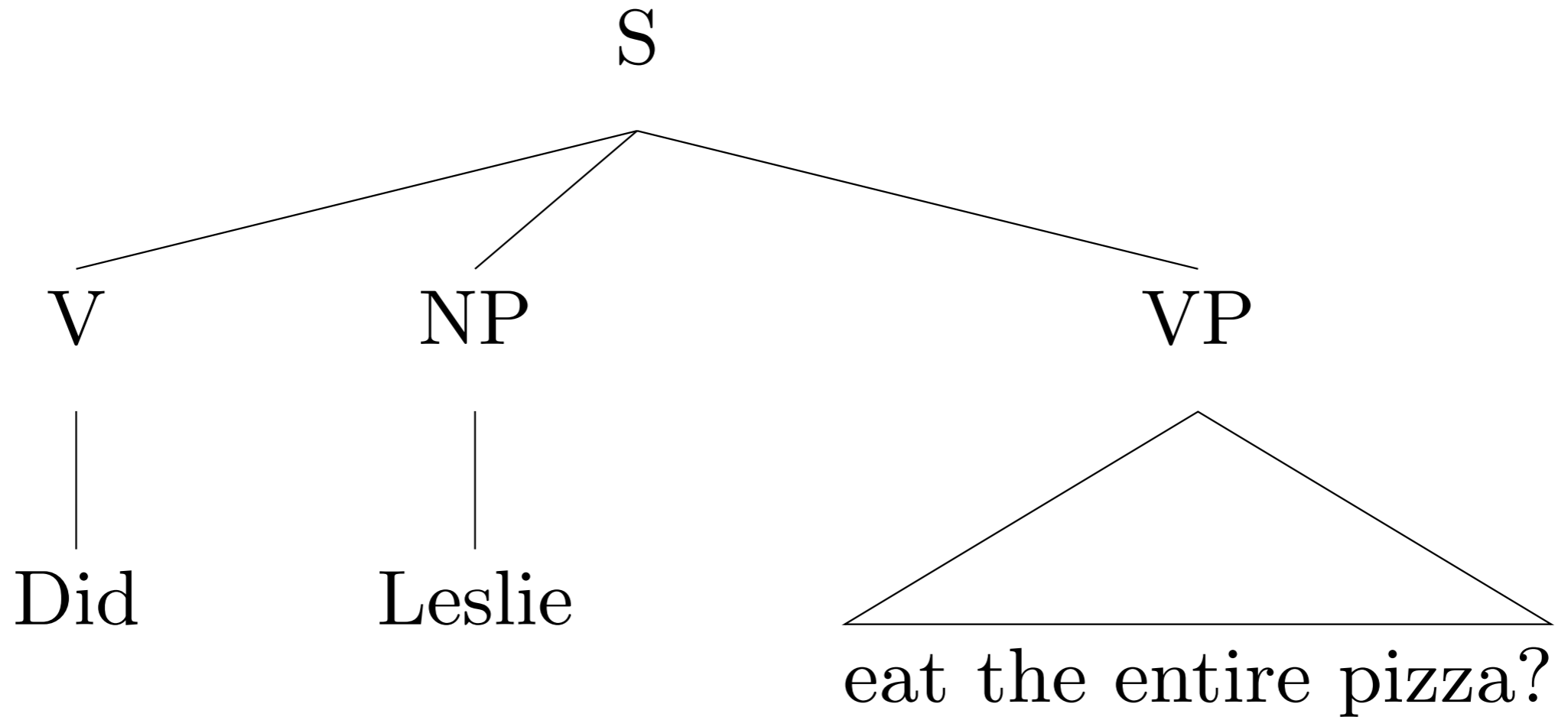
The Feature INV

- What is the INV value of inputs to the Inversion LR?
 - Perhaps surprisingly, the input is [INV +]
 - Word-to-word rules (*pi-rules*) have default identity of HEAD features, and no INV value is given on the input
- Then what work is the feature doing?
 - It's used to mark auxiliaries that can't or must be inverted
You better watch out vs. **Better you watch out*
I shall go (*shall* ~ 'will') vs. *Shall I go?* (*shall* ~ 'should')

Other Cases of Inversion

- Inversion is not limited to questions
 - Preposed negatives: *Never have I been so upset!*
 - Conditionals: *Had we known, we would have left.*
 - Exclamations: *May your teeth fall out!*
- Does our rule account for these?
 - No. Our rule's output says [MODE ques]. And each construction has slightly different idiosyncrasies.
- How might we extend our analysis to cover them?
 - Define a type of inversion lexical rules, sharing certain properties, but with some differences.

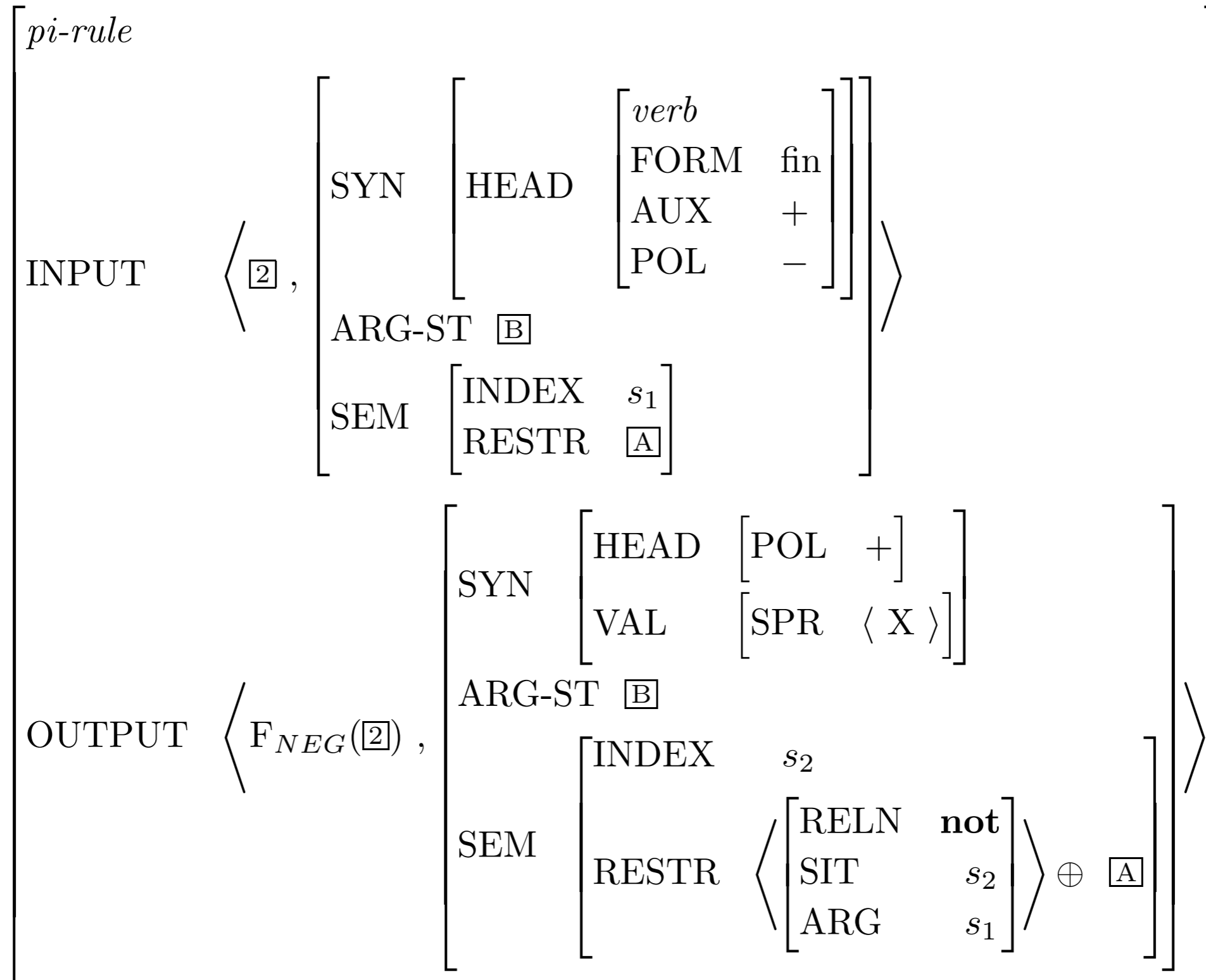
Inversion: A Sample Tree



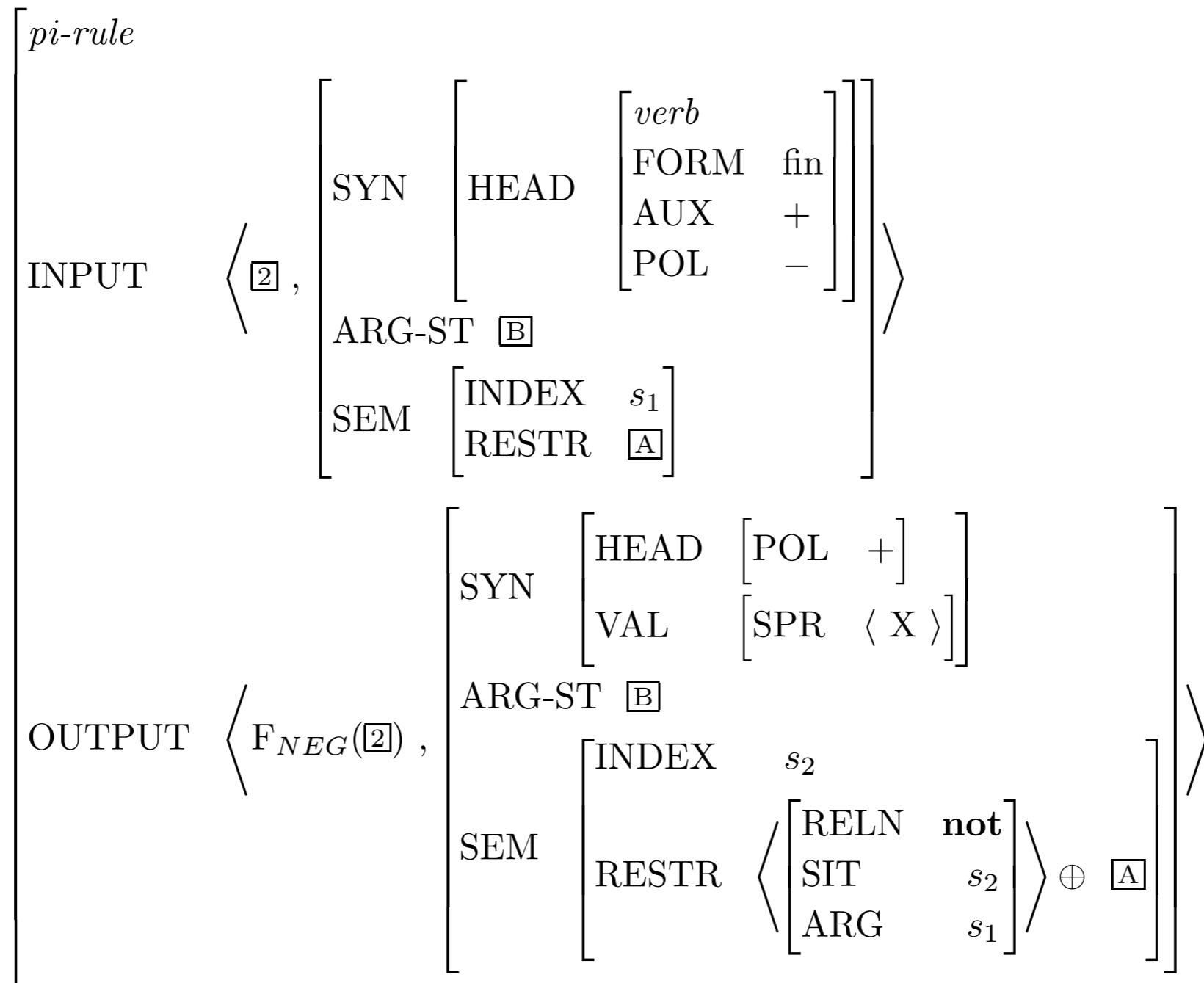
Contraction

- There are several types of contraction in English, but we're only talking about words ending in *n't*
- It may seem like just *not* said fast, but there's more to it
 - Only finite verbs can take *n't*:
**Terry must haven't seen us*
 - There are morphological irregularities:
won't, not **willn't* *%shan't*, not **shalln't*
mustn't pronounced *mussn't*
don't pronounced *doen't*, not *dewn't*
**amn't*

The Contraction Lexical Rule

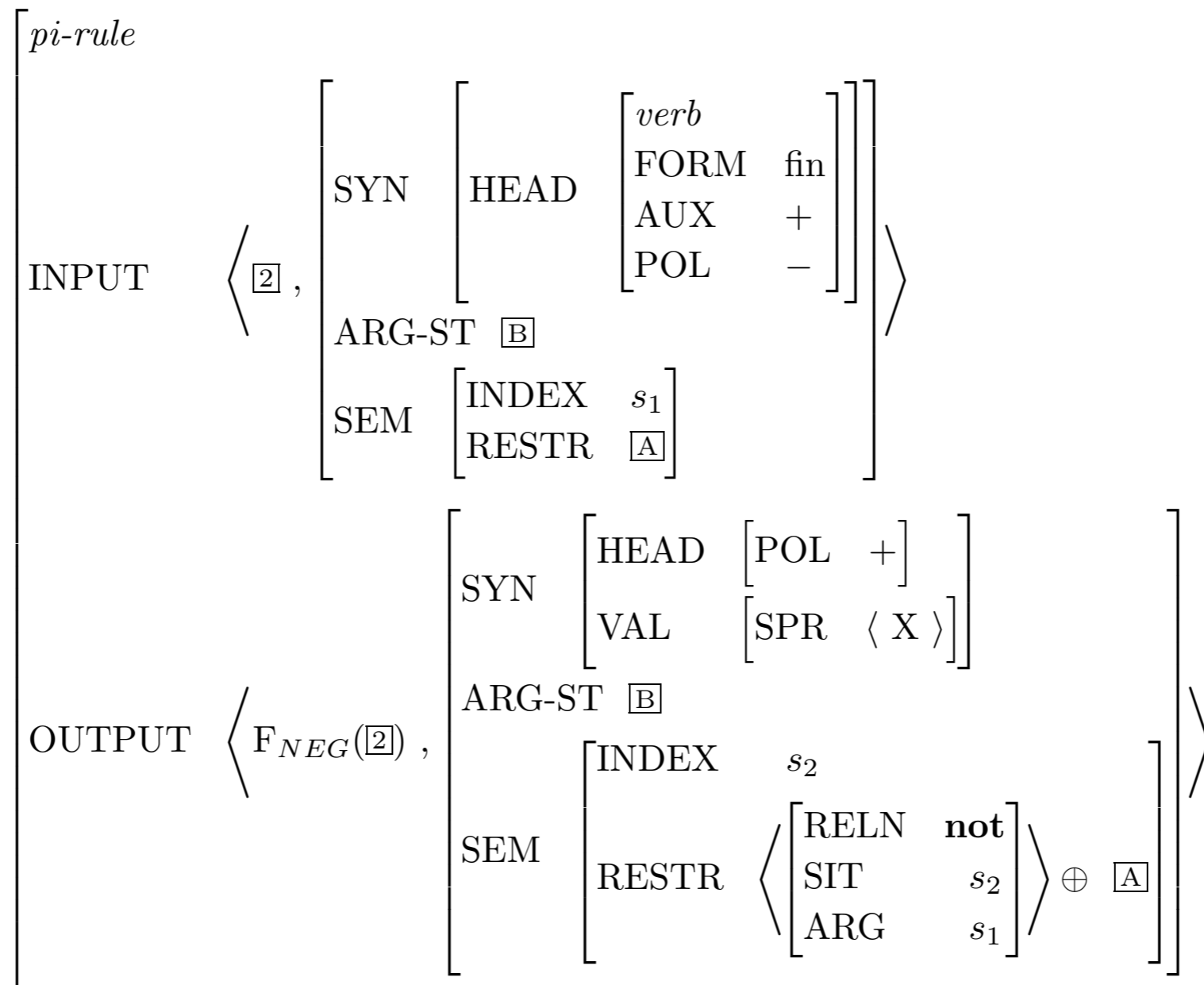


Most of the work is in the semantics



Why?

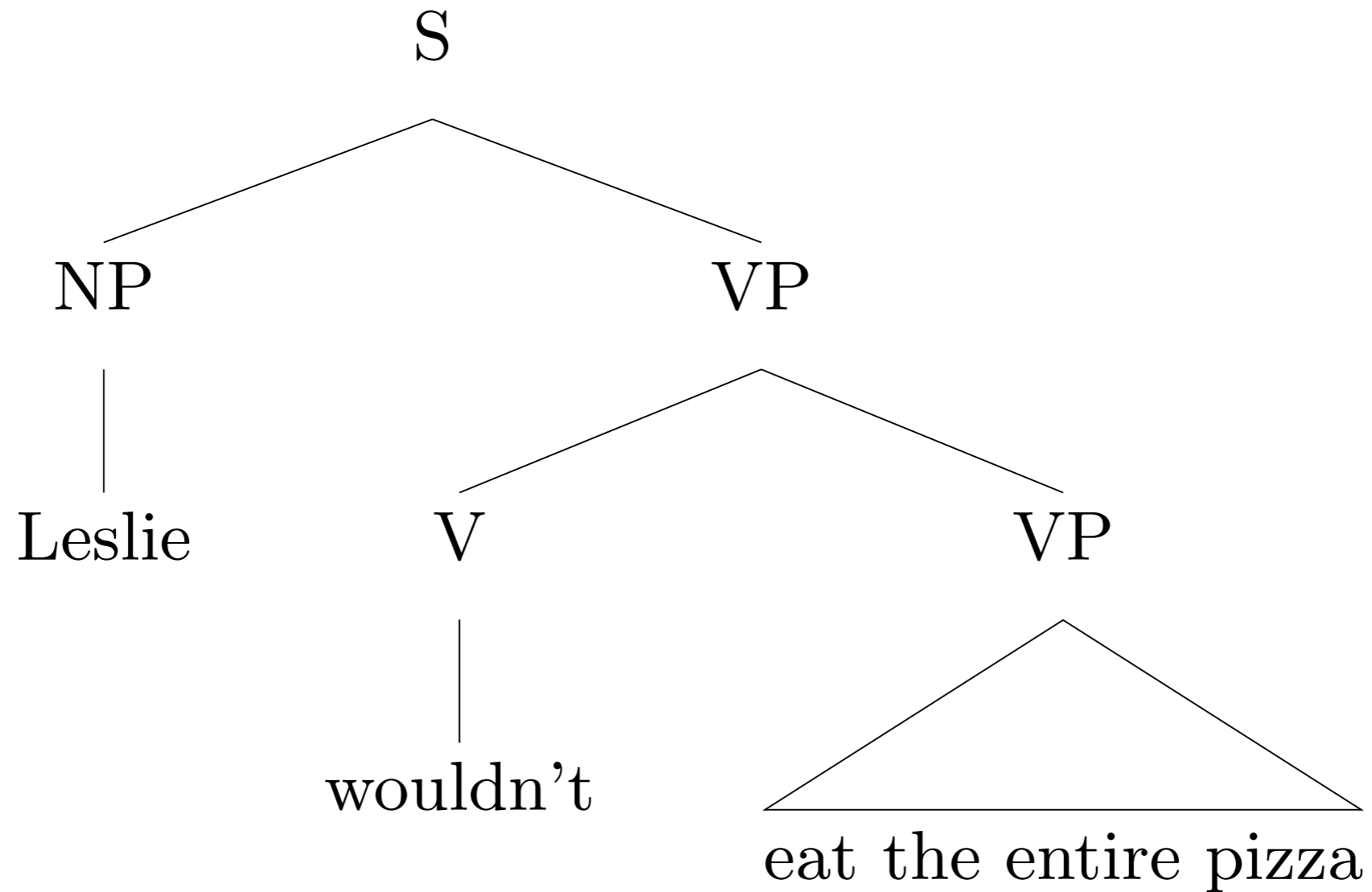
What does POL do?



**We can't stop*

**They won't TOO mind*

Contraction: Sample Tree



Ellipsis

- Ellipsis allows VPs to be omitted, so long as they would have been preceded by an auxiliary

*Pat couldn't have been watching us, but
Chris could have been watching us.*

- Unlike the other NICE properties, this holds of all auxiliaries, not just finite ones.
- What is the elliptical counterpart to a sentence with no auxiliary?

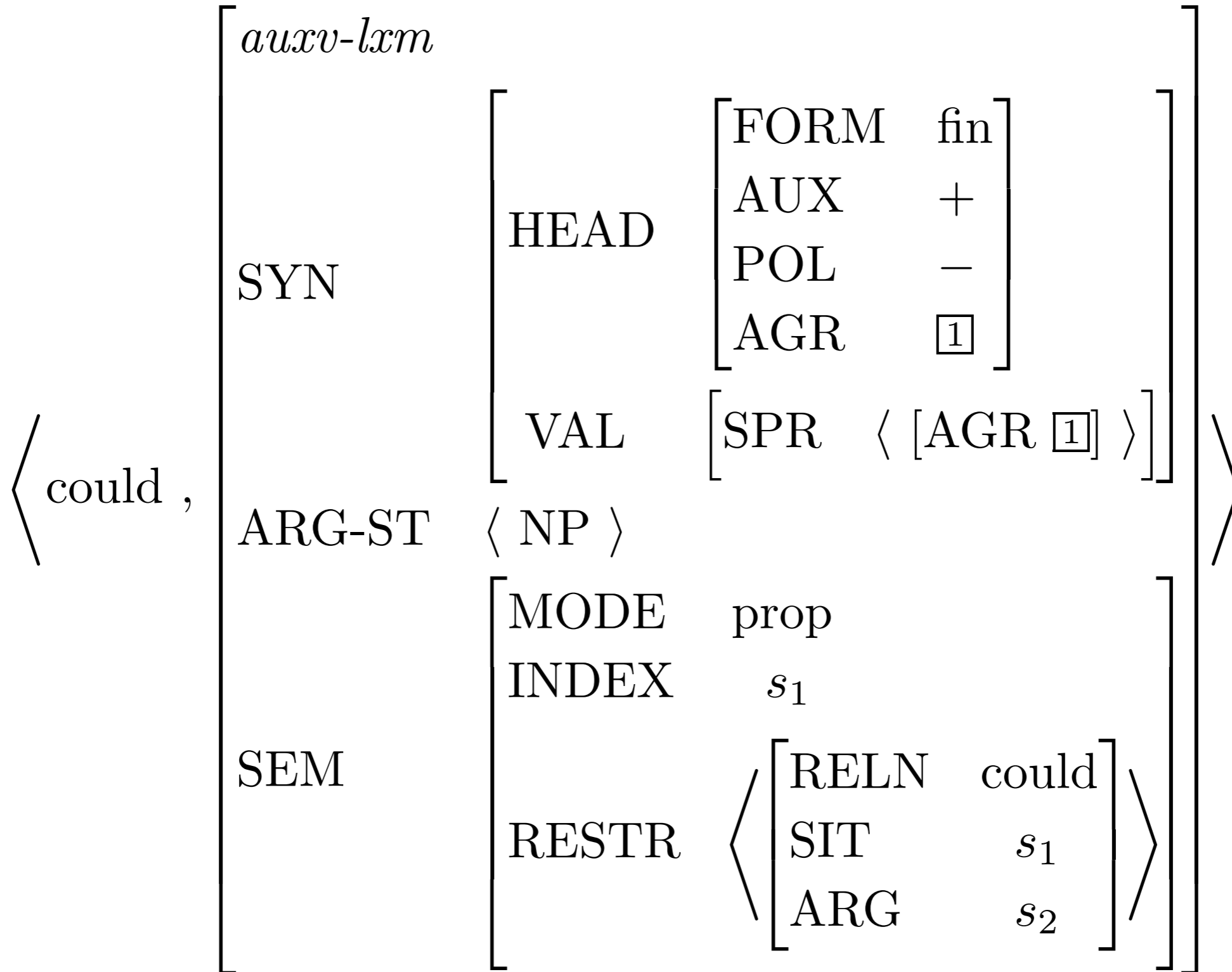
*Whenever Pat watches TV, Chris watches TV
Whenever Pat watches TV, Chris does*

The Ellipsis Lexical Rule

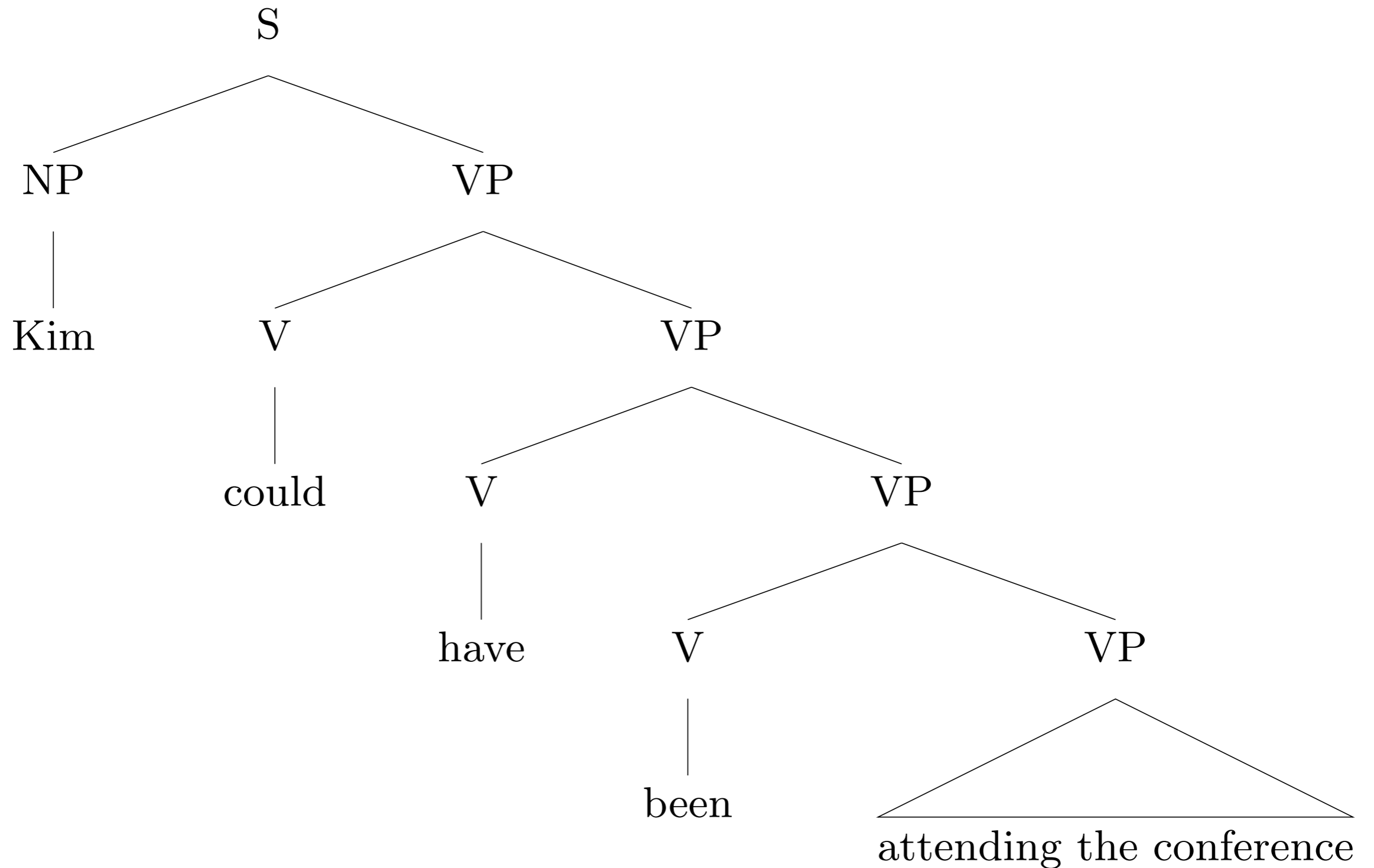
$$\left[\begin{array}{l} d\text{-rule} \\ \text{INPUT} \left\langle \boxed{1}, \left[\begin{array}{l} auxv\text{-}lxm \\ \text{ARG-ST} \langle \boxed{2} \rangle \oplus \boxed{A} \end{array} \right] \right\rangle \\ \text{OUTPUT} \left\langle \boxed{1}, \left[\begin{array}{l} derivv\text{-}lxm \\ \text{ARG-ST} \langle \boxed{2} \rangle \end{array} \right] \right\rangle \end{array} \right]$$

- Note that this is a derivational LR (*d-rule*) -- that is, lexeme-to-lexeme
- This means that SYN and SEM are unchanged, by default

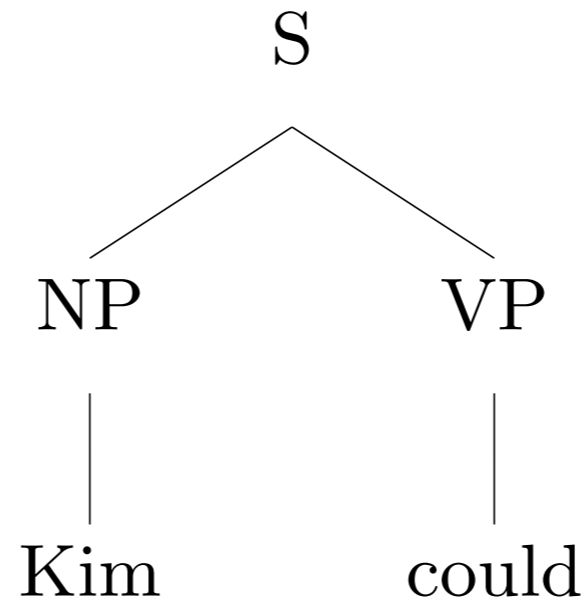
Ellipsis: A Sample Output



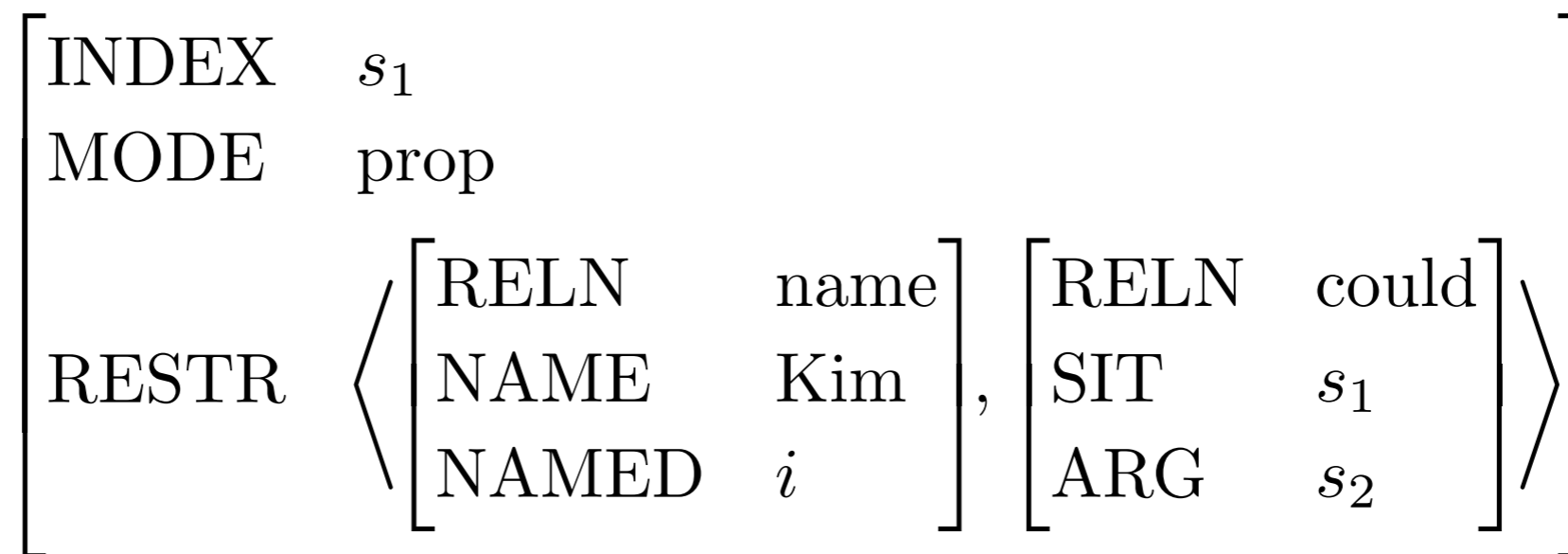
Ellipsis: A Sample Tree



Semantics of Ellipsis



What is the SEM value of the S node of this tree?



Note: s_2 has to be filled in by context.

Infinitival *to* Revisited

- VP Ellipsis can occur after *to*:

We didn't find the solution, but we tried to.

- This is covered by our Ellipsis LR if we say *to* is [AUX +].
- Since AUX is declared on type *verb*, it follows that *to* is a verb.

do Revisited

- Chomsky's old analysis: in sentences w/o auxiliaries...
 - Tense can get separated from the verb in various ways
 - Negation/Reaffirmation inserts something between Tense and the following verb
 - Inversion moves Tense to the left of the subject NP
 - Ellipsis deletes what follows Tense
 - When this happens, *do* is inserted to support Tense
- Our counterpart:
 - NICE properties hold only of auxiliaries
 - *do* is a semantically empty auxiliary, so negated, reaffirmed, inverted, and elliptical sentences that are the semantic counterparts to sentences w/o auxiliaries are ones with *do*.

Summary

- Our analysis employs straightforward mechanisms
 - Lexical entries for auxiliaries
 - 3 new features (AUX, POL, INV)
 - 4 lexical rules
- We handle a complex array of facts
 - co-occurrence restrictions (ordering & iteration)
 - the NICE properties
 - auxiliary *do*
 - combinations of NICE constructions