Ling 566
Dec 4, 2014

Sign-Based Construction Grammar

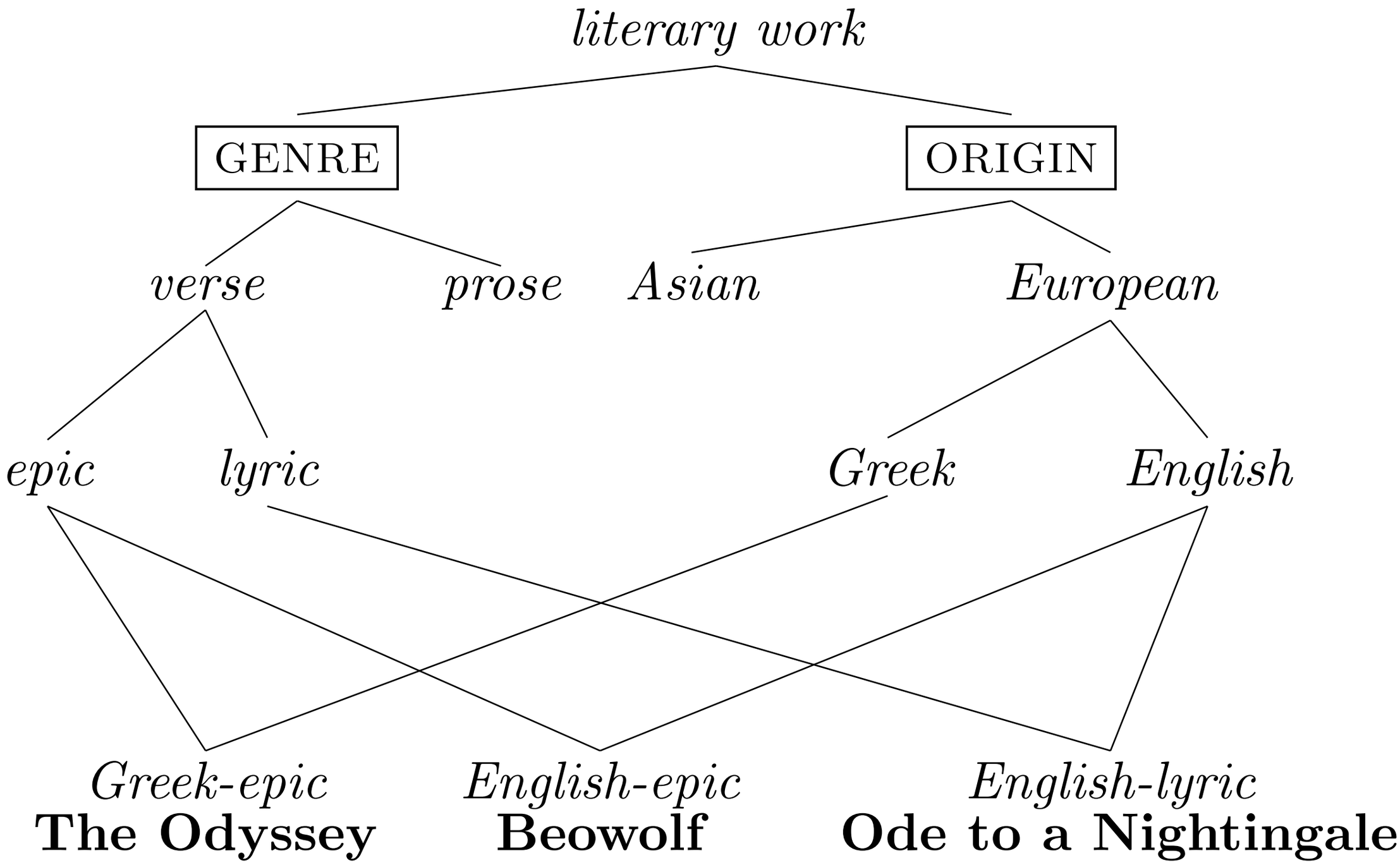
Overview

- Chapter 16 framework (same analyses, different underlying system)
- Reading questions
- Untangle this
- General wrap up

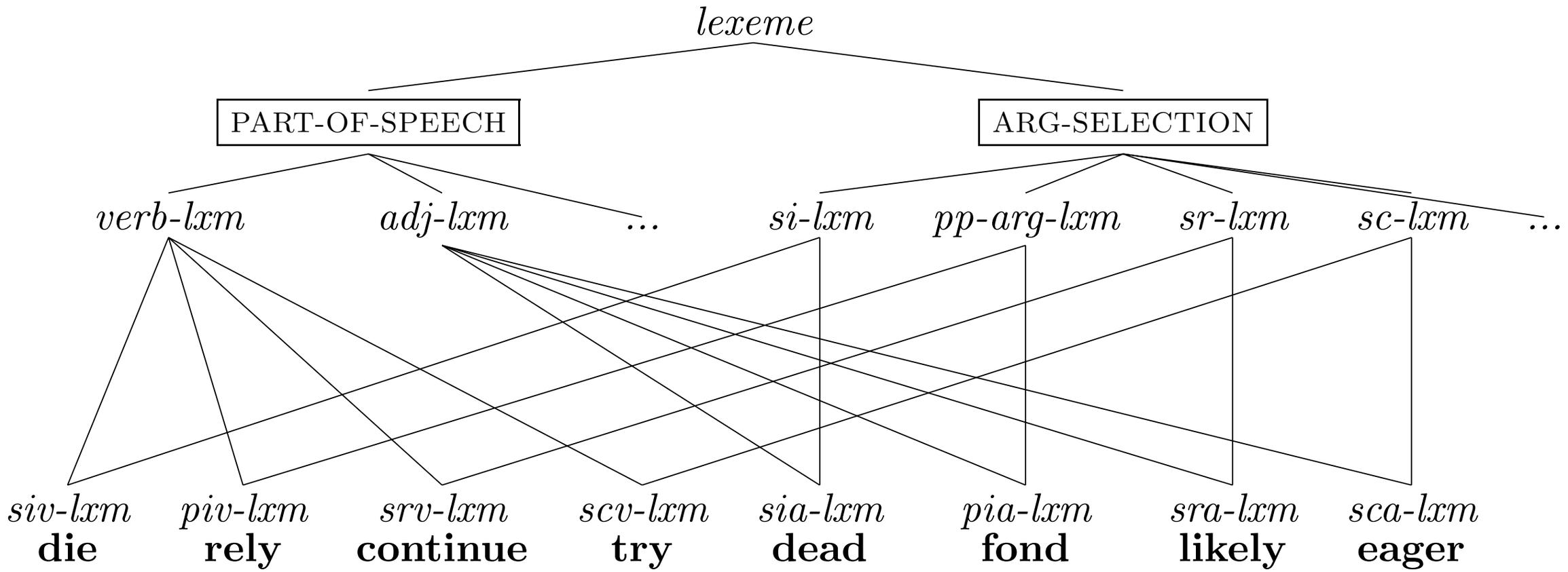
Overview of Differences

- Multiple Inheritance
- Signs
- Grammar rules form a hierarchy
- Every tree node has its own phonology
- Many principles become constraints on grammar rules
- The definition of well-formedness is simplified

Multiple Inheritance Hierarchies



Lexeme Hierarchy



Lexeme Abbreviations

- *si-lxm* : *strict-intransitive-lexeme*
- *pp-arg-lxm* : *PP-argument-lexeme*
- *sr-lxm* : *subject-raising-lexeme*
- *sc-lxm* : *subject-control-lexeme*
- *siv-lxm* : *strict-intransitive-verb-lexeme*
- *piv-lxm* : *PP-intransitive-verb-lexeme*
- *srv-lxm* : *subject-raising-verb-lexeme*
- *scv-lxm* : *subject-control-verb-lexeme*
- *sia-lxm* : *strict-intransitive-adjective-lexeme*
- *pia-lxm* : *PP-intransitive-adjective-lexeme*
- *sra-lxm* : *subject-raising-adjective-lexeme*
- *sca-lxm* : *subject-control-adjective-lexeme*

Lexeme Constraints

- *si-lxm* : $\left[\text{ARG-ST} \quad \langle\ \text{X}\ \rangle\right]$
- *pp-arg-lxm* : $\left[\text{ARG-ST} \quad \langle\ \text{X}\ ,\ \text{PP}\ \rangle\right]$
- *sr-lxm* : $\left[\text{ARG-ST} \quad \left\langle\ \boxed{1}\ ,\ \left[\text{SPR} \quad \langle\ \boxed{1}\ \rangle\right]\right\rangle\right]$
- *sc-lxm* : $\left[\text{ARG-ST} \quad \left\langle\ \text{NP}_i\ ,\ \left[\text{SPR} \quad \langle\ \text{NP}_i\ \rangle\right]\right\rangle\right]$

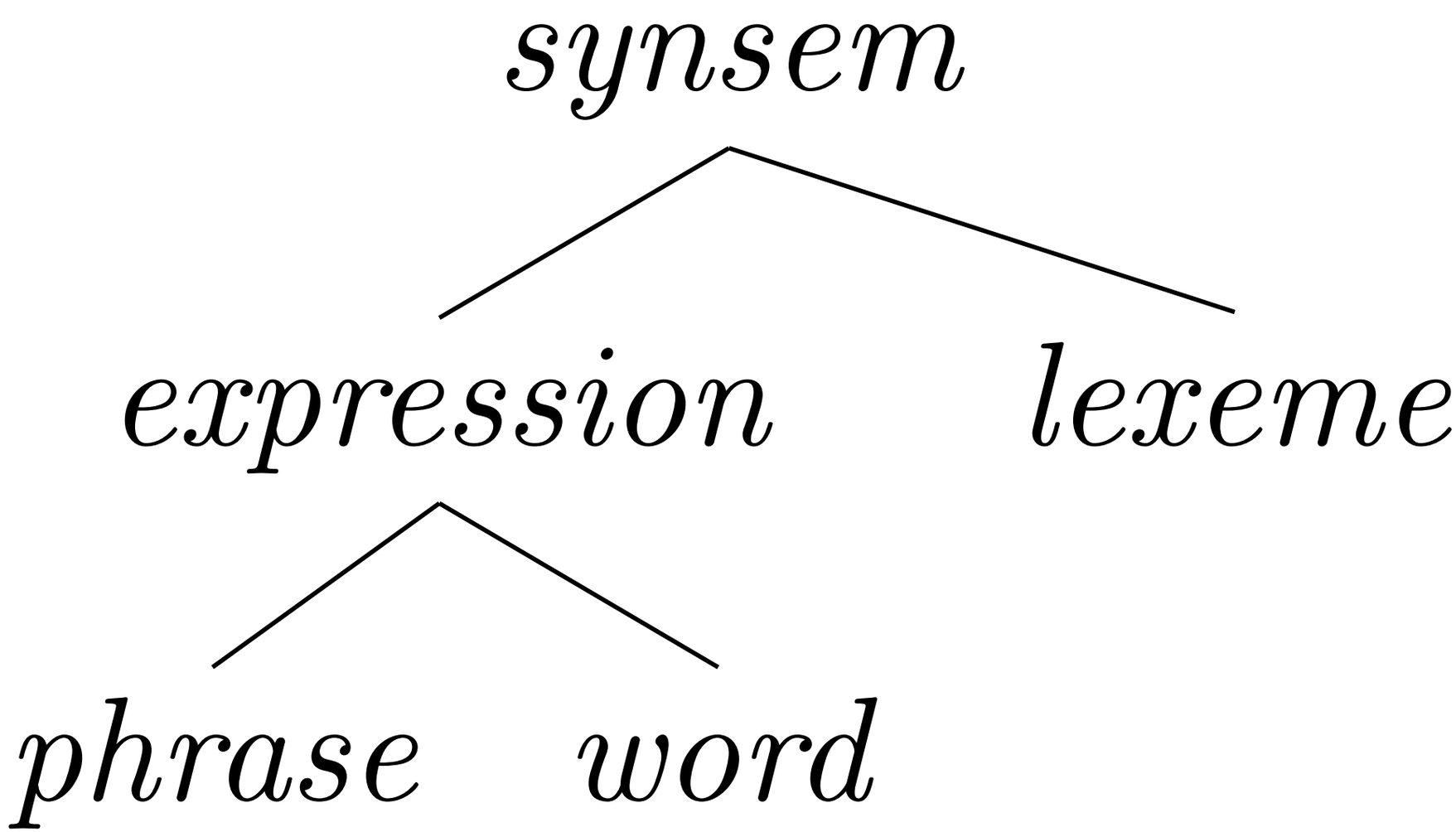
Another Lexeme Constraint

$$
\textit{verb-lxm}: \left[\begin{array}{ll}
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \left[\begin{array}{ll}
\textit{verb} & \\
\text{PRED} & - \\
\text{INF} & / - \\
\text{AUX} & / - \\
\text{POL} & -
\end{array}\right] \\
\text{ARG-ST} & \left\langle \left[\begin{array}{ll}
\text{HEAD} & \textit{nominal} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\,\rangle \\
\text{COMPS} & \langle\,\rangle
\end{array}\right]
\end{array}\right], \ldots \right\rangle \\
\text{SEM} & \left[\text{MODE} \quad \text{prop}\right]
\end{array}\right]
\end{array}\right]
$$

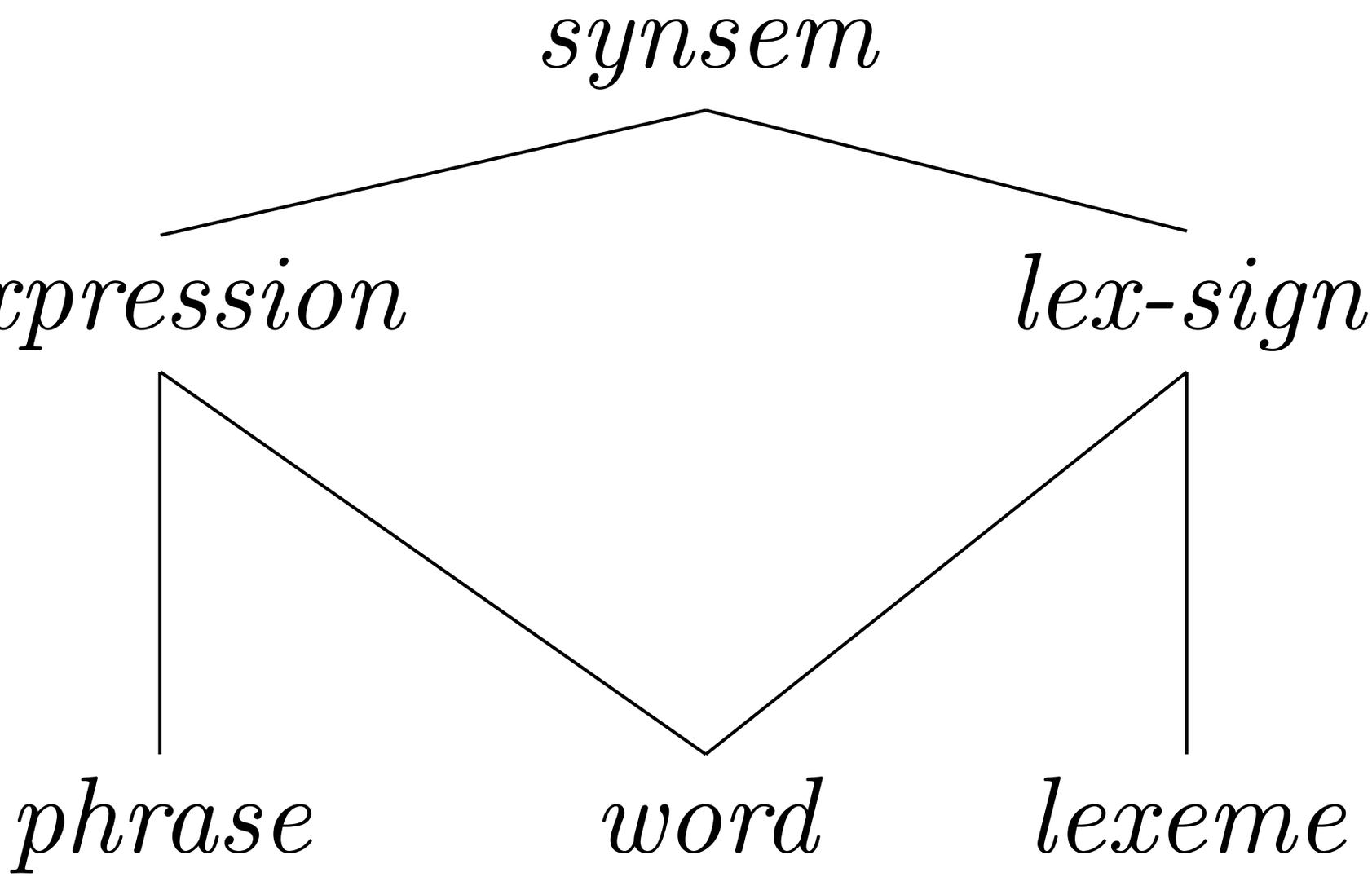
And Another

$$
\textit{adj-lxm} : \left[\begin{array}{ll}
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & adj \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \text{X}\ \rangle \\
\text{MOD} & \langle\ [\text{HEAD}\ \ noun]\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{ARG-ST} & \left\langle \left[\begin{array}{ll}
\text{HEAD} & nominal \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right]
\end{array}\right], \ldots \right\rangle \\
\text{SEM} & \left[\text{MODE}\ \ \text{prop}\right]
\end{array}\right]
$$

Synsem Types



Give ARG-ST a Unique Home



Words and Phrases as Saussurean Signs

$$\begin{bmatrix} \textit{word} & & \\ \text{PHON} & \langle\ \text{Kim}\ \rangle & \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

Augmented Signs

$$\begin{bmatrix} word & & \\ \text{PHON} & \langle\ \text{Kim}\ \rangle & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} noun & \\ \text{AGR} & 3sing \end{bmatrix} \end{bmatrix} & \\ \text{ARG-ST} & \langle\ \ \rangle & \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} & \\ \text{INDEX} & i & \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle & \end{bmatrix} & \end{bmatrix}$$

Phrases as Signs

$$\begin{bmatrix} \textit{phrase} & & \\ \text{PHON} & \langle\ \text{Kim}\ ,\ \text{walks}\ \rangle & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \ \rangle \\ \text{COMPS} & \langle\ \ \rangle \end{bmatrix} & \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} & \\ \text{INDEX} & s & \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{name} \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \textbf{walk} \\ \text{SIT} & s \\ \text{WALKER} & i \end{bmatrix}, \ldots \right\rangle & \end{bmatrix} & \end{bmatrix}$$

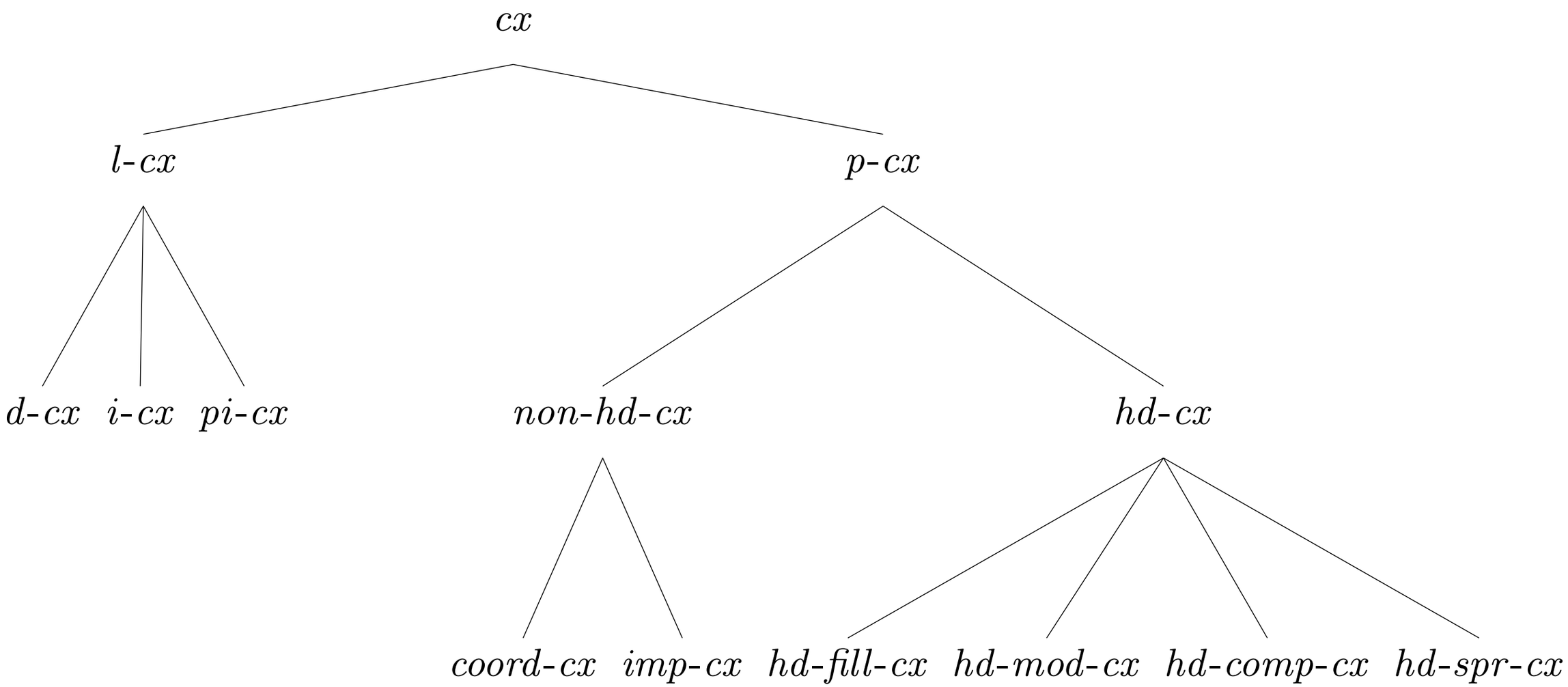
Types and Constraints

TYPE	FEATURES/VALUE TYPES	IST
sign	$\begin{bmatrix} \text{PHON} & \textit{list}(\textit{form}) \\ \text{SYN} & \textit{syn-cat} \\ \text{SEM} & \textit{sem-cat} \end{bmatrix}$	*feat-struc*
expression		*sign*
lex-sign	$[\text{ARG-ST} \quad \textit{list}(\textit{expression})]$	*sign*
phrase		*expression*
word		*expression* & *lex-sign*
lexeme		*lex-sign*

Constructions: Some Abbreviations

cx	*construction*
l-cx	*lexical-construction*
d-cx	*derivational-construction*
i-cx	*inflectional-construction*
pi-cx	*postinflectional-construction*
p-cx	*phrasal-construction*
non-hd-cx	*non-headed-construction*
hd-cx	*headed-construction*
coord-cx	*coordinate-construction*
imp-cx	*imperative-construction*
hd-fill-cx	*head-filler-construction*
hd-comp-cx	*head-complement-construction*
hd-spr-cx	*head-specifier-construction*
hd-mod-cx	*head-modifier-construction*

The World of Constructions



Properties of Constructions

TYPE	FEATURES/VALUE TYPES	IST
cx	$\begin{bmatrix} \text{MOTHER} & \textit{sign} \\ \text{DTRS} & \textit{list}(\textit{sign}) \end{bmatrix}$	*feat-struc*
l-cx	$\begin{bmatrix} \text{MOTHER} & \textit{lex-sign} \\ \text{DTRS} & \langle\ \textit{lex-sign}\ \rangle \end{bmatrix}$	*cx*
p-cx	$\begin{bmatrix} \text{MOTHER} & \textit{phrase} \\ \text{DTRS} & \textit{list}(\textit{expression}) \end{bmatrix}$	*cx*

Well-Formed Tree Structure

Φ is a Well-Formed Structure according to a grammar G if and only if

1. there is some construction C in G, such that
2. there is a feature structure I that is an instantiation of C, such that Φ is the value of the MOTHER feature of I.

A Well-Formed Feature Structure

The grammar licenses a feature structure of type *phrase* whose PHON value is < *ate* , *a* , *pizza* > because there is a feature structure instantiating the head-complement construction that has that feature structure as its MOTHER value. This phrasal construct satisfies the following description:

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON} \quad \langle\, \text{ate} \,,\, \text{a} \,,\, \text{pizza} \,\rangle \\ \text{SYN} \quad \begin{bmatrix} \text{HEAD} \quad \begin{bmatrix} \textit{verb} \\ \text{FORM} \quad \text{fin} \end{bmatrix} \\ \text{VAL} \quad \begin{bmatrix} \text{SPR} \quad \langle\, \text{NP} \,\rangle \\ \text{COMPS} \quad \langle\, \rangle \\ \text{MOD} \quad \langle\, \rangle \end{bmatrix} \\ \text{GAP} \quad \langle\, \rangle \end{bmatrix} \\ \text{SEM} \quad \begin{bmatrix} \text{MODE} \quad \text{prop} \\ \text{INDEX} \quad s \\ \text{RESTR} \quad \left\langle \begin{bmatrix} \text{RELN} \quad \mathbf{eat} \\ \text{SIT} \quad s \\ \text{EATER} \quad i \\ \text{EATEN} \quad j \end{bmatrix}, \begin{bmatrix} \text{RELN} \quad \mathbf{a} \\ \text{BV} \quad j \end{bmatrix}, \begin{bmatrix} \text{RELN} \quad \mathbf{pizza} \\ \text{INST} \quad j \end{bmatrix}, \right\rangle \end{bmatrix} \end{bmatrix}$$

Another Well-Formed Feature Structure

$$\begin{bmatrix} \textit{lexeme} & & \\ \text{PHON} & \langle\ \text{driver}\ \rangle & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & [\text{PER} \quad \text{3rd}] \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \text{DP}\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{MOD} & \langle\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \textbf{drive} \\ \text{SIT} & s \\ \text{DRIVER} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

Two Constraints

Root Constraint:

$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{FORM} \quad \text{fin} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{COMPS} \quad \langle\ \rangle \\ \text{SPR} \quad \langle\ \rangle \end{bmatrix} \\ \text{GAP} \quad \langle\ \rangle \end{bmatrix} \end{bmatrix}$$

Principle of Order:

$$cx: \begin{bmatrix} \text{MOTHER} & [\text{PHON} \ \boxed{\text{A1}} \oplus \ldots \oplus \boxed{\text{An}}\ ] \\ \text{DTRS} & \langle\ [\text{PHON}\ \boxed{\text{A1}}]\ ,\ \ldots\ ,\ [\text{PHON}\ \boxed{\text{An}}]\ \rangle \end{bmatrix}$$

Semantic Compositionality Principle

$$cx: \begin{bmatrix} \text{MOTHER} & [\text{SEM } [\text{RESTR } \boxed{\text{A1}} \oplus ... \oplus \boxed{\text{An}} \,]] \\ \text{DTRS} & \langle\, [\text{SEM } [\text{RESTR } \boxed{\text{A1}}]] \;,\; ... \;,\; [\text{SEM } [\text{RESTR } \boxed{\text{An}}]] \,\rangle \end{bmatrix}$$

Alternative Version:

$$cx: \begin{bmatrix} \text{MOTHER} & [\text{SEM } [\text{RESTR } \boxed{\text{A0}} \oplus \boxed{\text{A1}} \oplus ... \oplus \boxed{\text{An}} \,]] \\ \text{DTRS} & \langle\, [\text{SEM } [\text{RESTR } \boxed{\text{A1}}]] \;,\; ... \;,\; [\text{SEM } [\text{RESTR } \boxed{\text{An}}]] \,\rangle \\ \text{CX-SEM} & \boxed{\text{A0}} \end{bmatrix}$$

Headed Constructions

TYPE	FEATURES/VALUE TYPES	IST
hd-cx	[HD-DTR *sign*]	*cx*

Head Feature Principle:

$$hd\text{-}cx : \begin{bmatrix} \text{MOTHER} & [\text{SYN} & [\text{HEAD} & \boxed{1}]] \\ \text{HD-DTR} & [\text{SYN} & [\text{HEAD} & \boxed{1}]] \end{bmatrix}$$

Two More Principles

Semantic Inheritance Principle:

$$hd\text{-}cx: \begin{bmatrix} \text{MOTHER} & \begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{MODE} & \boxed{1} \\ \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{MODE} & \boxed{1} \\ \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Valence Principle:

$$hd\text{-}cx: \begin{bmatrix} \text{MOTHER} & [\text{SYN} & [\text{VAL} & / \boxed{1}]] \\ \text{HD-DTR} & [\text{SYN} & [\text{VAL} & / \boxed{1}]] \end{bmatrix}$$

The GAP Principle

hd-cx:

$$\begin{bmatrix} \text{MOTHER} & [\text{SYN}\ [\text{GAP}\ \ (\ \boxed{\text{A1}} \oplus \ldots \oplus \boxed{\text{An}}\ )\ \ominus\ \boxed{\text{A0}}\ ]\ ] \\ \text{HD-DTR} & [\text{SYN}\ [\text{STOP-GAP}\ \ \boxed{\text{A0}}\ ]] \\ \text{DTRS} & \langle\ [\text{SYN}\ [\text{GAP}\ \boxed{\text{A1}}\ ]]\ ,\ \ \ldots\ \ ,\ [\text{SYN}\ [\text{GAP}\ \boxed{\text{An}}\ ]]\ \rangle \end{bmatrix}$$

The Head-Complement Construction

$$hd\text{-}comp\text{-}cx : \begin{bmatrix} \text{MOTHER} & [\text{SYN} \; [\text{VAL} \; [\text{COMPS} \; \langle \; \rangle \;]\;]] \\ \text{HD-DTR} & \boxed{0}\begin{bmatrix} word \\ \text{SYN} \; [\text{VAL} \; [\text{COMPS} \; \boxed{A} \;]] \end{bmatrix} \\ \text{DTRS} & \langle \; \boxed{0} \; \rangle \; \oplus \; \boxed{A}nelist \end{bmatrix}$$

And with inherited constraints....

$$\left[\begin{array}{ll}
\text{MOTHER} & \left[\begin{array}{ll}
\text{PHON} & \boxed{\text{A1}} \oplus \ldots \oplus \boxed{\text{An}} \\
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \boxed{1} \\
\text{VAL} & \left[\begin{array}{ll}
\text{COMPS} & \langle\ \rangle \\
\text{SPR} & \boxed{\text{D}} \\
\text{MOD} & \boxed{\text{E}}
\end{array}\right]
\end{array}\right] \\
\text{SEM} & \left[\begin{array}{ll}
\text{MODE} & \boxed{2} \\
\text{INDEX} & \boxed{3} \\
\text{RESTR} & \boxed{\text{C1}} \oplus \ldots \oplus \boxed{\text{Cn}}
\end{array}\right]
\end{array}\right] \\
\text{HD-DTR} & \boxed{4}\left[\begin{array}{ll}
\textit{word} & \\
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \boxed{1} \\
\text{VAL} & \left[\begin{array}{ll}
\text{COMPS} & \langle\ \boxed{5}\ ,\ \ldots\ ,\ \boxed{\text{m}}\ \rangle \\
\text{SPR} & \boxed{\text{D}} \\
\text{MOD} & \boxed{\text{E}}
\end{array}\right]
\end{array}\right] \\
\text{SEM} & \left[\begin{array}{ll}
\text{MODE} & \boxed{2} \\
\text{INDEX} & \boxed{3}
\end{array}\right]
\end{array}\right] \\
\text{DTRS} & \left\langle \boxed{4}\left[\begin{array}{ll}\text{PHON} & \boxed{\text{A1}} \\ \text{RESTR} & \boxed{\text{C1}}\end{array}\right], \boxed{5}\left[\begin{array}{ll}\text{PHON} & \boxed{\text{A2}} \\ \text{RESTR} & \boxed{\text{C2}}\end{array}\right], \ldots, \boxed{\text{m}}\left[\begin{array}{ll}\text{PHON} & \boxed{\text{An}} \\ \text{RESTR} & \boxed{\text{Cn}}\end{array}\right] \right\rangle
\end{array}\right]$$

An Instance of the HCC

$$\left[\begin{array}{l} \textit{hd-comp-cx} \\ \text{MOTHER} \left[\begin{array}{l} \textit{phrase} \\ \text{PHON} \langle \text{ talked , to , Kim } \rangle \\ \text{SYN} \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \boxed{\text{A}}\langle \text{ NP } \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \end{array}\right] \\ \text{SEM} \left[\text{ ... } \right] \end{array}\right] \\ \text{HD-DTR} \ \boxed{0} \\ \text{DTRS} \left\langle \boxed{0}\left[\begin{array}{l} \textit{word} \\ \text{PHON} \ \langle \text{ talked } \rangle \\ \text{SYN} \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \boxed{\text{A}} \\ \text{COMPS} & \langle\ \boxed{1}\ \rangle \end{array}\right] \end{array}\right] \\ \text{SEM} \left[\text{ ... } \right] \end{array}\right] , \boxed{1}\left[\begin{array}{l} \textit{phrase} \\ \text{PHON} \ \langle \text{ to , Kim } \rangle \\ \text{SYN} \left[\begin{array}{ll} \text{HEAD} & \textit{prep} \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \end{array}\right] \\ \text{SEM} \left[\text{ ... } \right] \end{array}\right] \right\rangle \end{array}\right]$$

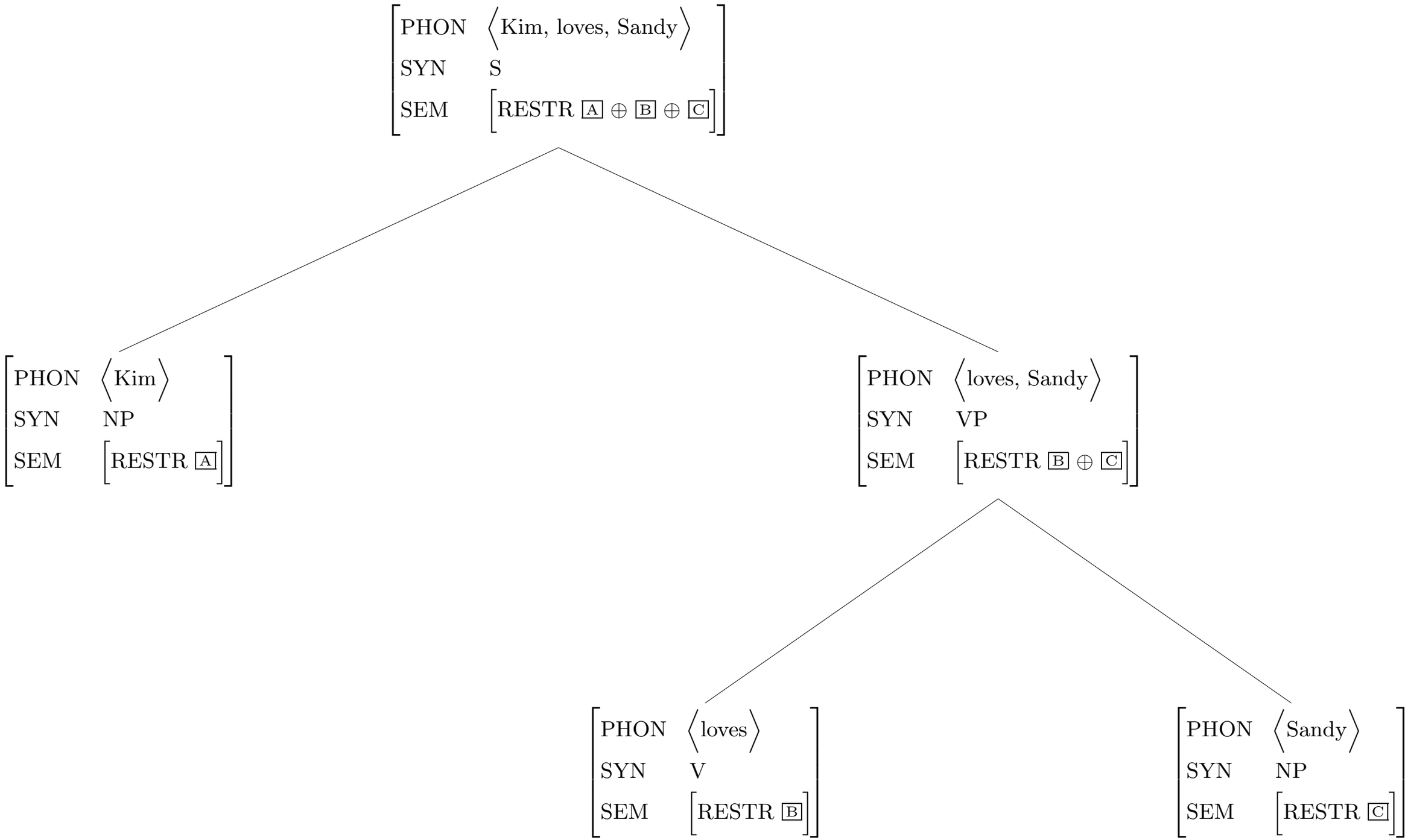
$$\left[\begin{array}{l}
\textit{hd-comp-cx} \\
\text{MOTHER} \left[\begin{array}{l}
\textit{phrase} \\
\text{PHON} \quad \langle\ \text{in}\ ,\ \text{Seattle}\ \rangle \\
\text{SYN} \left[\begin{array}{ll}
\text{HEAD} & \textit{prep} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \boxed{\text{A}} \\
\text{COMPS} & \langle\ \rangle \\
\text{MOD} & \boxed{\text{B}}
\end{array}\right]
\end{array}\right] \\
\text{SEM}\ [\ \ldots\ ]
\end{array}\right] \\
\text{HD-DTR}\ \ \boxed{0} \\
\text{DTRS} \left\langle \boxed{0} \left[\begin{array}{l}
\textit{word} \\
\text{PHON}\ \langle\ \text{in}\ \rangle \\
\text{SYN} \left[\begin{array}{ll}
\text{HEAD} & \textit{prep} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \boxed{\text{A}} \\
\text{COMPS} & \langle\ \boxed{1}\ \rangle \\
\text{MOD} & \boxed{\text{B}}
\end{array}\right]
\end{array}\right] \\
\text{SEM}\ [\ \ldots\ ]
\end{array}\right] , \boxed{1} \left[\begin{array}{l}
\textit{word} \\
\text{PHON}\ \langle\ \text{Seattle}\ \rangle \\
\text{SYN} \left[\begin{array}{ll}
\text{HEAD} & \textit{noun} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{SEM}\ [\ \ldots\ ]
\end{array}\right] \right\rangle
\end{array}\right]$$

Two More Constructions

$$\textit{hd-spr-cx}: \begin{bmatrix} \text{MOTHER} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \langle\,\rangle \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \boxed{0}\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \langle\,\boxed{1}\,\rangle \\ \text{COMPS} & \langle\,\rangle \\ \text{STOP-GAP} & \langle\,\rangle \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \langle\,\boxed{1}\,,\,\boxed{0}\,\rangle \end{bmatrix}$$

$$\textit{hd-mod-cx}: \begin{bmatrix} \text{HD-DTR} & \boxed{1}\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{COMPS} & \langle\,\rangle \end{bmatrix} \\ \text{STOP-GAP} & \langle\,\rangle \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \left\langle\,\boxed{1}\,,\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{COMPS} & \langle\,\rangle \\ \text{MOD} & \langle\,\boxed{1}\,\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}\right\rangle \end{bmatrix}$$

A Tree



The Head-Filler Construction

$$
\textit{hd-fill-cx}: \left[\begin{array}{ll}
\text{HD-DTR} & \boxed{0}\left[\begin{array}{ll}
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \left[\begin{array}{ll} \textit{verb} & \\ \text{FORM} & \text{fin} \end{array}\right] \\
\text{VAL} & \left[\begin{array}{ll} \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \\
\text{GAP} & \langle\ \boxed{1}\ \rangle \\
\text{STOP-GAP} & \langle\ \boxed{1}\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{DTRS} & \langle\ \boxed{1}[\text{GAP}\ \langle\ \rangle]\ ,\ \boxed{0}\ \rangle
\end{array}\right]
$$

$$\left[\begin{array}{l} \textit{hd-fill-cx} \\ \\ \text{MOTHER} \left[\begin{array}{ll} \text{PHON} & \langle\ \text{Bagels , I , think , she , likes}\ \rangle \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \boxed{2}\left[\begin{array}{ll} \textit{verb} & \\ \text{FORM} & \text{fin} \end{array}\right] \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \\ \text{GAP} & \langle\ \rangle \end{array}\right] \\ \text{SEM} & [\ \ldots\ ] \end{array}\right] \\ \\ \text{HD-DTR}\ \boxed{0} \\ \\ \text{DTRS}\ \left\langle \boxed{1}\left[\begin{array}{ll} \text{PHON} & \langle\ \text{Bagels}\ \rangle \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \textit{noun} \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \end{array}\right] \\ \text{SEM} & [\ \ldots\ ] \end{array}\right] , \boxed{0}\left[\begin{array}{ll} \text{PHON} & \langle\ \text{I, think, she, likes}\rangle \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \boxed{2} \\ \text{VAL} & \left[\begin{array}{ll} \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \\ \text{GAP} & \langle\ \boxed{1}\ \rangle \\ \text{STOP-GAP} & \langle\ \boxed{1}\ \rangle \end{array}\right] \\ \text{SEM} & [\ \ldots\ ] \end{array}\right] \right\rangle \end{array}\right]$$

The Imperative Construction

$$
\textit{imp-cx}: \left[\begin{array}{l}
\text{MOTHER} \left[\begin{array}{ll}
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \textit{verb} \\
\text{VAL} & \left[\text{SPR} \quad \langle\ \rangle\right] \\
\text{GAP} & \boxed{\text{A}}
\end{array}\right] \\
\text{SEM} & \left[\begin{array}{ll}
\text{MODE} & \text{dir} \\
\text{INDEX} & s
\end{array}\right]
\end{array}\right] \\
\text{DTRS} \left\langle \left[\begin{array}{ll}
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \left[\begin{array}{ll}
\textit{verb} & \\
\text{INF} & - \\
\text{FORM} & \text{base}
\end{array}\right] \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \text{NP[PER 2nd]}\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right] \\
\text{GAP} & \boxed{\text{A}}
\end{array}\right] \\
\text{SEM} & [\text{INDEX} \quad s\ ]
\end{array}\right] \right\rangle
\end{array}\right]
$$

Coordination Construction

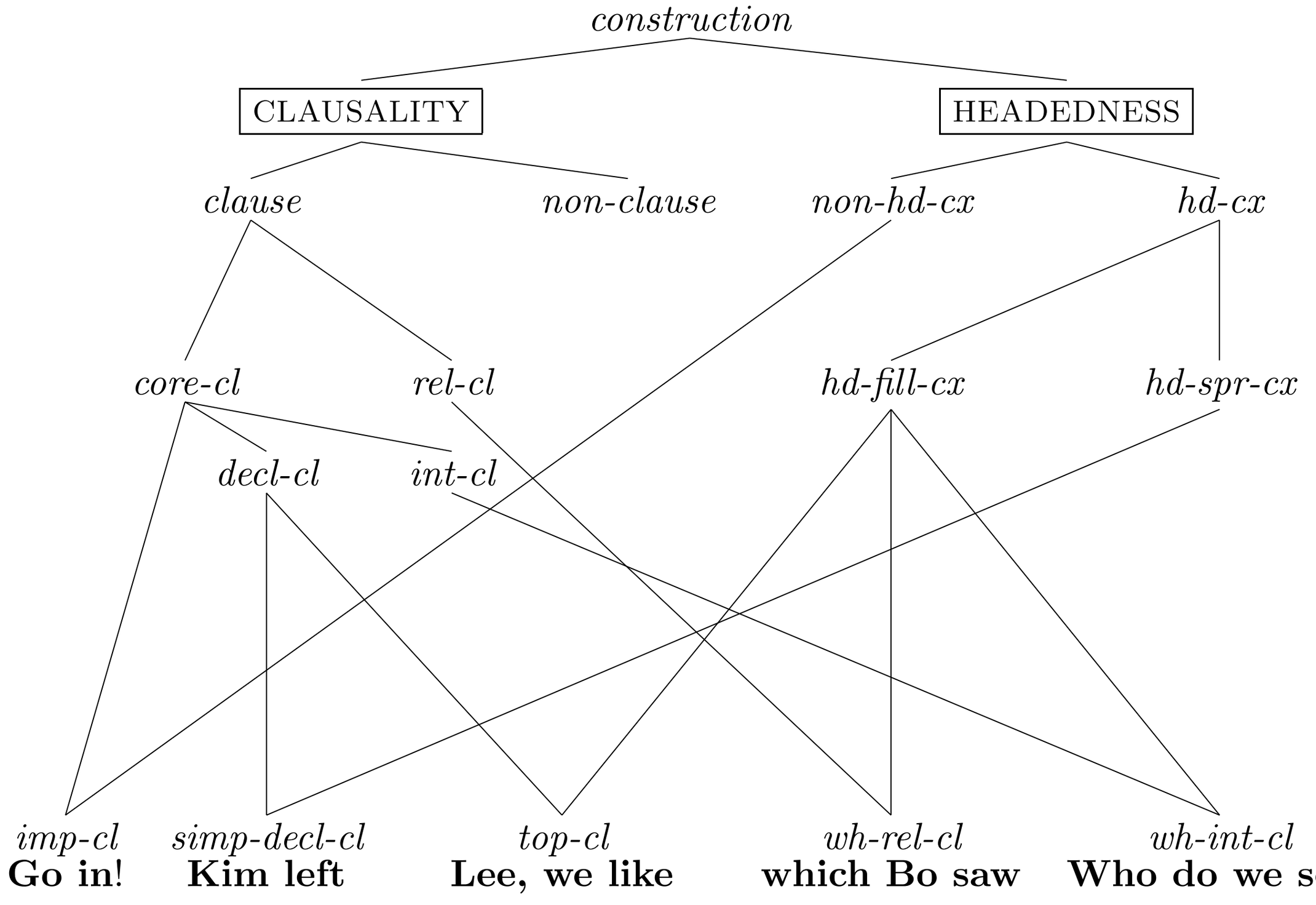
$$\left[\begin{array}{l}
\text{MOTHER} \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & [\text{FORM } \boxed{1}] \\ \text{VAL} & \boxed{2} \\ \text{GAP} & \boxed{A} \end{array}\right] \\ \text{SEM} & [\text{IND} \quad s_0] \end{array}\right] \\
\text{DTRS} \left\langle \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & [\text{FORM } \boxed{1}] \\ \text{VAL} & \boxed{2} \\ \text{GAP} & \boxed{A} \end{array}\right] \\ \text{SEM} & [\text{IND} \quad s_1] \end{array}\right], \ldots, \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & [\text{FORM } \boxed{1}] \\ \text{VAL} & \boxed{2} \\ \text{GAP} & \boxed{A} \end{array}\right] \\ \text{SEM} & [\text{IND} \quad s_{n-1}] \end{array}\right], \right. \\
\left. \left[\begin{array}{l} \text{HEAD } \textit{conj} \\ \text{IND} \quad s_0 \\ \text{RESTR} \left\langle [\text{ARGS } \langle s_1 \ldots s_n \rangle] \right\rangle \end{array}\right], \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & [\text{FORM } \boxed{1}] \\ \text{VAL} & \boxed{2} \\ \text{GAP} & \boxed{A} \end{array}\right] \\ \text{SEM} & [\text{IND} \quad s_n] \end{array}\right] \right\rangle
\end{array}\right]$$

$$\left[\begin{array}{ll}
\text{MOTHER} & \left[\begin{array}{ll}
\text{PHON} & \langle\ \text{Kim , sleeps , and , Pat , works}\ \rangle \\
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \textit{verb} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{SEM} & [\ \ldots\ ]
\end{array}\right] \\
\text{DTRS} \langle & \left[\begin{array}{ll}
\text{PHON} & \langle\ \text{Kim , sleeps}\ \rangle \\
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \textit{verb} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{SEM} & [\ \ldots\ ]
\end{array}\right], \left[\begin{array}{ll}
\text{PHON} & \langle\ \text{and}\ \rangle \\
\text{SYN} & \left[\text{HEAD}\ \textit{conj}\right] \\
\text{SEM} & [\ \ldots\ ]
\end{array}\right], \\
& \left[\begin{array}{ll}
\text{PHON} & \langle\ \text{Pat , works}\ \rangle \\
\text{SYN} & \left[\begin{array}{ll}
\text{HEAD} & \textit{verb} \\
\text{VAL} & \left[\begin{array}{ll}
\text{SPR} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{array}\right]
\end{array}\right] \\
\text{SEM} & [\ \ldots\ ]
\end{array}\right] \rangle
\end{array}\right]$$

Some More Abbreviations

imp-cl	*imperative-clause*
decl-cl	*declarative-clause*
simp-decl-cl	*simple-declarative-clause*
top-cl	*topicalized-clause*
wh-rel-cl	*wh-relative-clause*
wh-int-cl	*wh-interrogative-clause*
core-cl	*core-clause*

A Construction Hierarchy



Locality

- Like CFG rules, constructions involve only mothers and daughters.
- A lexical head can place constraints on its sisters or on an appropriate maternal dependent.
- Unbounded dependencies are localized.

  Sandy is hard ((for us) to continue) to please___

  Getting it done is hard for us to imagine them considering___
- Our principles provide a theory of what information (reflected in terms of HEAD,VAL, GAP, etc.) is passed up within the domain projected by a lexical head (including subjects and modifiers) and hence a theory of what information is locally accessible at any given point in a tree.

Reading Questions

- Why wait until Ch 16 to do this?
- Is Ch 16 the final version of the grammar, or is Appendix A?
- Which one do the implemented grammars look like?
- Other kinds of computational syntax?
- What is a sign and why are words and phrases both signs?

Reading Questions

- Why is PHON list-valued? Why are the PHON values of phrases lists of words?
- How does PHON relate to the morphological functions in lexical rules?
- Why are the things on those lists orthographic rather than phonetic (or both)?
- What is the value of having PHON on phrases? Isn't that redundant to what's in the yield of the tree?

Reading Questions

- Are there still trees in this version of the theory?
- What's the gain of making everything feature structures?
- What are examples of semantically contentful constructions?
- Doesn't a multiple inheritance hierarchy lead to more types? How is that more convenient?

Untangle This

- What phenomena are illustrated by this sentence?
- What rules or interesting lexical types are involved in our analysis of it?
- What tree structure does our grammar assign?

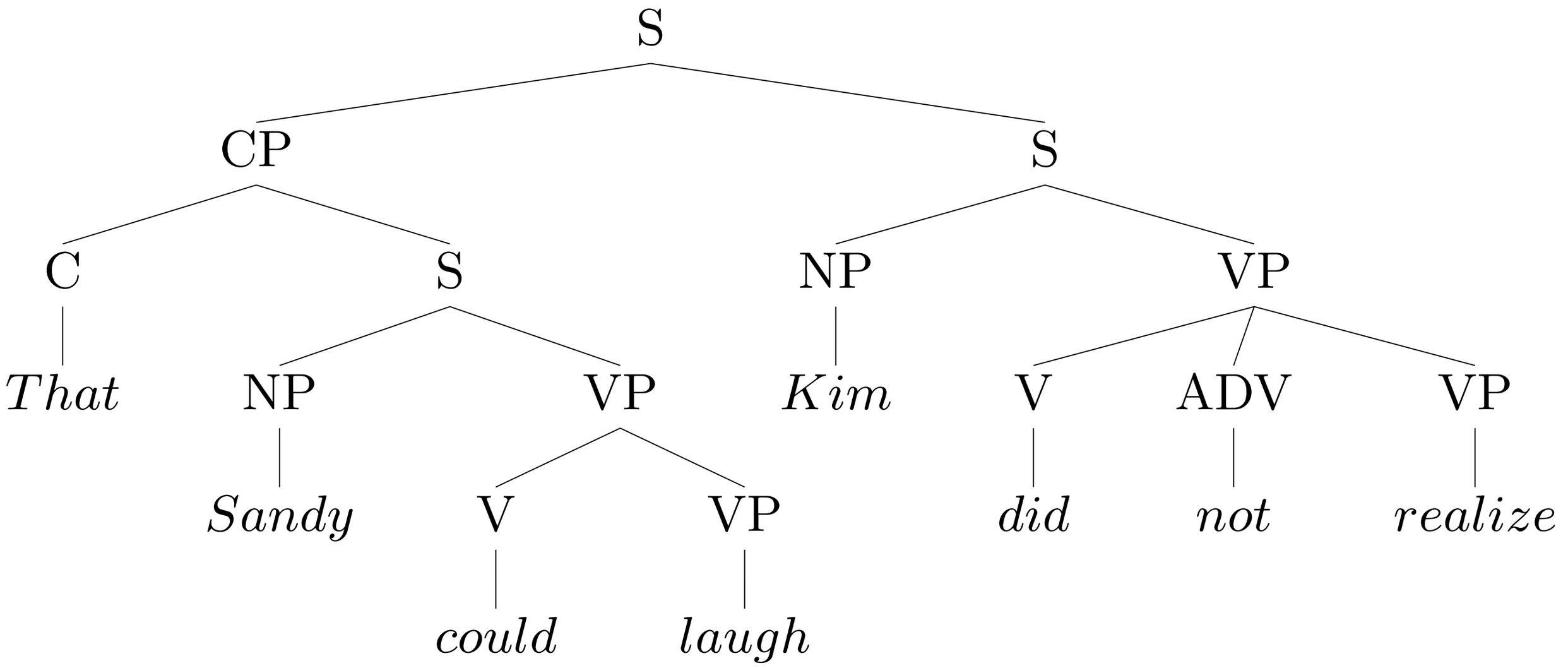
Complicated example #5

That Sandy could laugh so hard, Kim did not realize.

**That Sandy could laugh so hard, Kim realized not.*

**Sandy could laugh so hard, Kim did not realize.*

**That Sandy could laugh so hard, Kim did not realize it.*



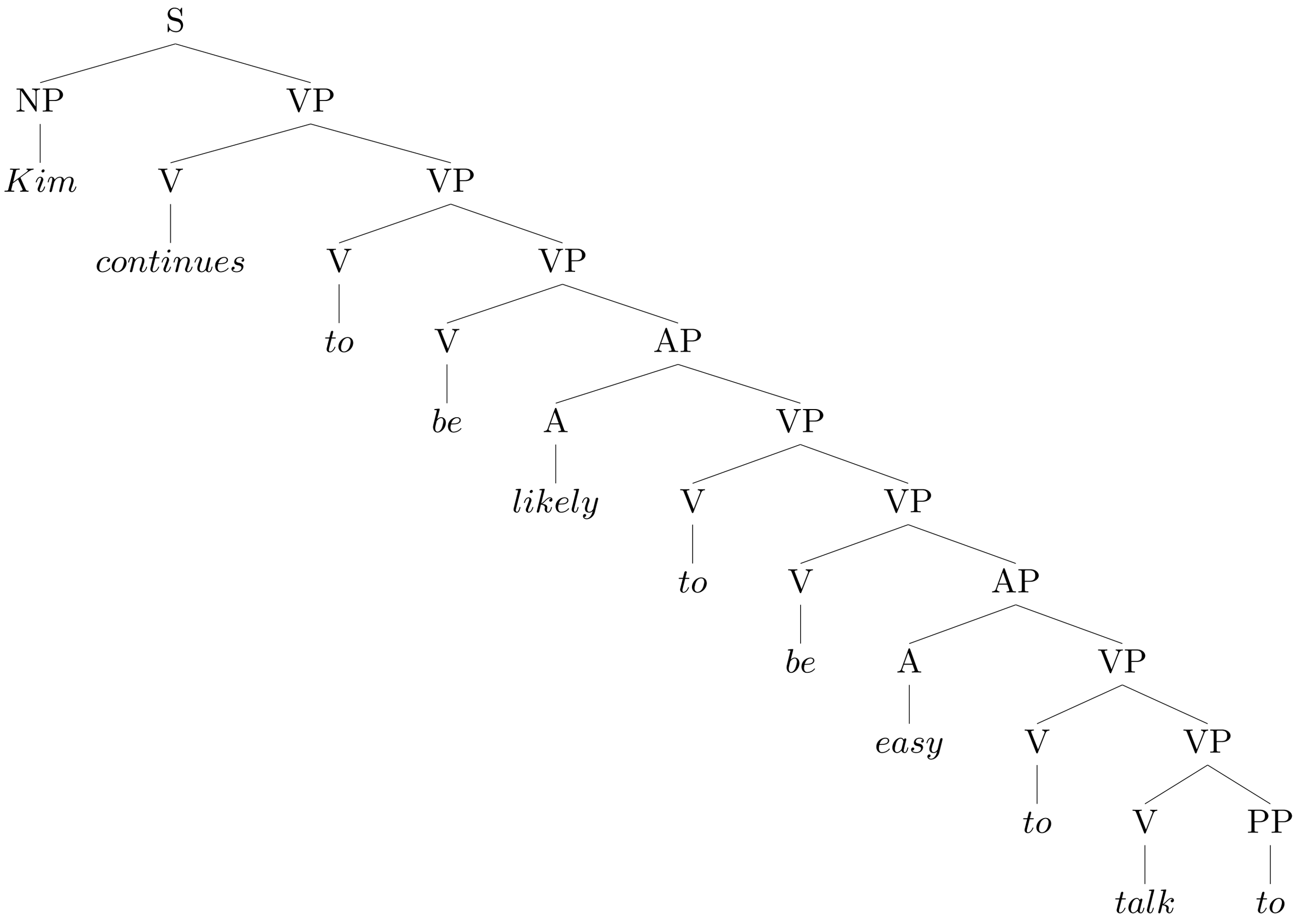
Complicated example #6

Kim continues to be likely to be easy to talk to.

**Kim continue to be likely to be easy to talk to.*

**Kim continues to be likely to is easy to talk to.*

**Kim continues to Kim be likely to be easy to talk to.*



Complicated example #7

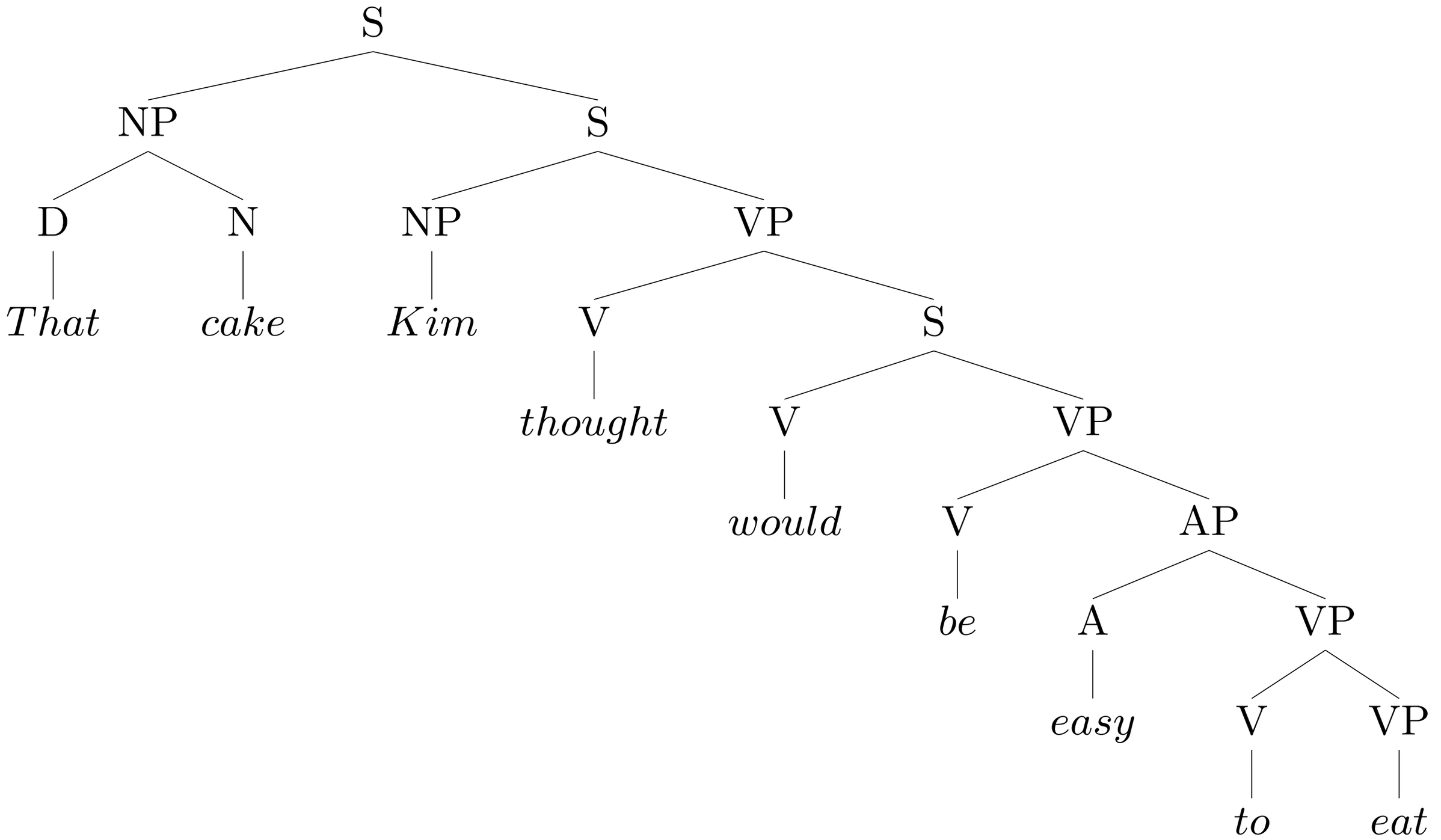
That cake, Kim thought would be easy to eat.

**That cake, Kim thought would be easy to eat pie.*

**That cake, Kim thought would be easy to eaten.*

**Cupcake, Kim thought would be easy to eat.*

**That cake, Kim thought that would be easy to eat.*



Course overview

- Survey of some phenomena central to syntactic theory
- Introduction to the HPSG framework
- Process over product: How to build a grammar fragment
- Value of precise formulation (and of getting a computer to do the tedious part for you!)

Reflection

- What was the most surprising thing in this class?
- What do you think is most likely wrong?
- What do you think is the coolest result?
- What do you think you're most likely to remember?
- How do you think this course will influence your work as a computational linguist?

Overview

- Chapter 16 framework (same analyses, different underlying system)
- Reading questions
- Untangle this
- General wrap up