Quantifier Retrieval à la Przepiórkowski

Jonathan Khoo
jkhoo@sfs.uni-tuebingen.de

Introduction to HPSG
Winter Semester 2005/2006

Agenda

1. **Introduction**
2. **Background**
   - Theory review
   - Pollard and Yoo
3. **Przepiórkowski's Account**
   - Foundations
   - Theory in Action: Examples
   - Problems

Benefits

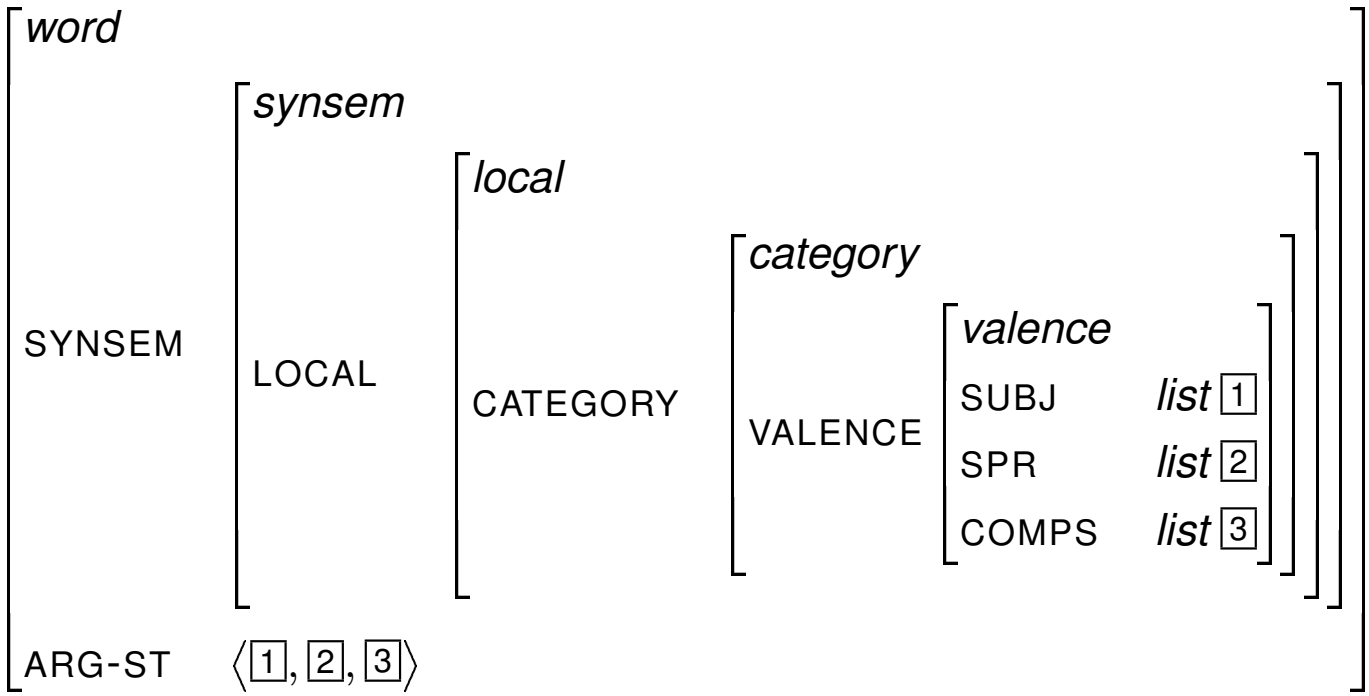
- Retrieval only at certain sites $\rightarrow$ no spurious ambiguities
- Simpler analysis: completely lexical
  - No complex constraints
  - Semantics completely in CONTENT
- Works with traceless extractions

Outline

RIP SUBCAT

$$\begin{bmatrix} \textit{word} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOCAL} \begin{bmatrix} \textit{local} \\ \text{CATEGORY} \begin{bmatrix} \textit{category} \\ \text{SUBCAT} \langle \boxed{1}, \boxed{2}, \boxed{3} \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

VALENCE and ARG-ST



- ARG-ST is a list of SYNSEMs.

Semantics Principle (paraphrased)

In a headed phrase...

- RETRIEVED = subset list of union of daughters' QSTOREs, and QSTORE is relative complement of that set
- If semantic head's CONTENT is *psoa* then...
  - NUCLEUS is identical to NUCLEUS of semantic head
  - QUANTS is QUANTS of semantic head + RETRIEVED

  else...
  - RETRIEVED = $\langle\rangle$
  - CONTENT is token-identical to CONTENT of semantic head

Outline

Pollard and Yoo's *sign*

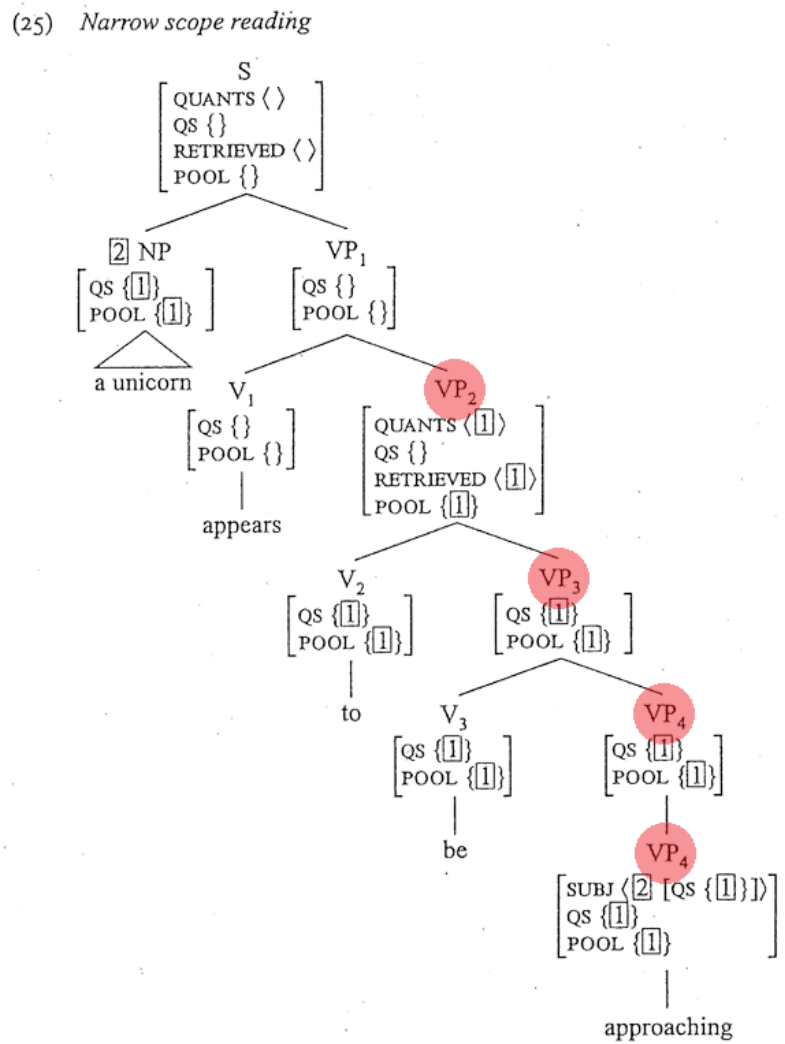
$$\left[\begin{array}{ll} \textit{sign} & \\ \text{PHONOLOGY} & \langle \text{phonstring} \rangle \\ \text{SYSNSEM} & \left[\text{LOCAL} \left[\begin{array}{ll} \text{CATEGORY} & \textit{category} \\ \text{CONTENT}|\text{NUCLEUS} & \textit{qfpsoa} \\ \text{QSTORE} & \{\textit{quantifier}^*\} \\ \text{POOL} & \{\textit{quantifier}^*\} \end{array}\right]\right] \\ \text{RETRIEVED} & \langle \textit{quantifier}^* \rangle \end{array}\right]$$

POOL = union of QSTOREs of *selected arguments* ($\rightarrow$VALENCE)

POOL = QSTORE $\cup$ set of elements of RETRIEVED

Spurious Ambiguities in PY

- Retrievals at VP_2, VP_3, VP_4, and V_4 yield the same reading



Outline

Overview

(1.2a)
$$\begin{bmatrix} \textit{content} \\ \text{QSTORE} \quad \{\textit{quant}^*\} \end{bmatrix}$$

psoa *nom-obj* *quant*

(1.2b)
$$\begin{bmatrix} \textit{word} \\ \ldots \\ \text{NEW-QUANTIFIERS} \quad \{\textit{quant}^*\} \end{bmatrix}$$

(1.3) $\textit{word} \rightarrow \text{Desc}_1 \vee \text{Desc}_2$

(1.4)
$$\text{Desc}_1 = \begin{bmatrix} \text{SS|LOC|CONT} & \begin{bmatrix} \textit{nom-obj} \vee \textit{quant} \\ \text{QSTORE} \quad \boxed{1} \end{bmatrix} \vee \begin{bmatrix} \textit{psoa} \\ \text{QSTORE} \quad \boxed{2} \\ \text{QUANTS} \quad \boxed{3} \end{bmatrix} \\ \text{NEW-QUANTIFIERS} \quad \boxed{5} \end{bmatrix}$$

where
- $\boxed{1} = \boxed{5} \uplus$ union QSTOREs of selected arguments
- $\boxed{4} =$ set of elements of $\boxed{3}$
- $\boxed{1} = \boxed{2} \uplus \boxed{4}$

(1.5)
$$\text{Desc}_2 = \begin{bmatrix} \text{SS|LOC|CONT} \quad \boxed{1} \\ \text{ARG-ST} \quad \left\langle \ldots, \begin{bmatrix} \text{SS|LOC|CONT} \quad \boxed{1} \end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

Selected Arguments

- **Pollard and Yoo**
  - POOL is union of quantifiers from QSTOREs of selected arguments:
    - thematic elements from SUBJ or COMPS feature,
    - elements selected via SPR feature, or
    - elements selected via MOD feature
  - **NOTE:** reliance on VALENCE!
- **Przepiórkowski**
  - QSTORE accumulates quantifiers from QSTOREs of those members of ARG-ST ***not*** raised from other arguments

Outline

A unicorn appears to be approaching.

A unicorn appears to be approaching  **.**

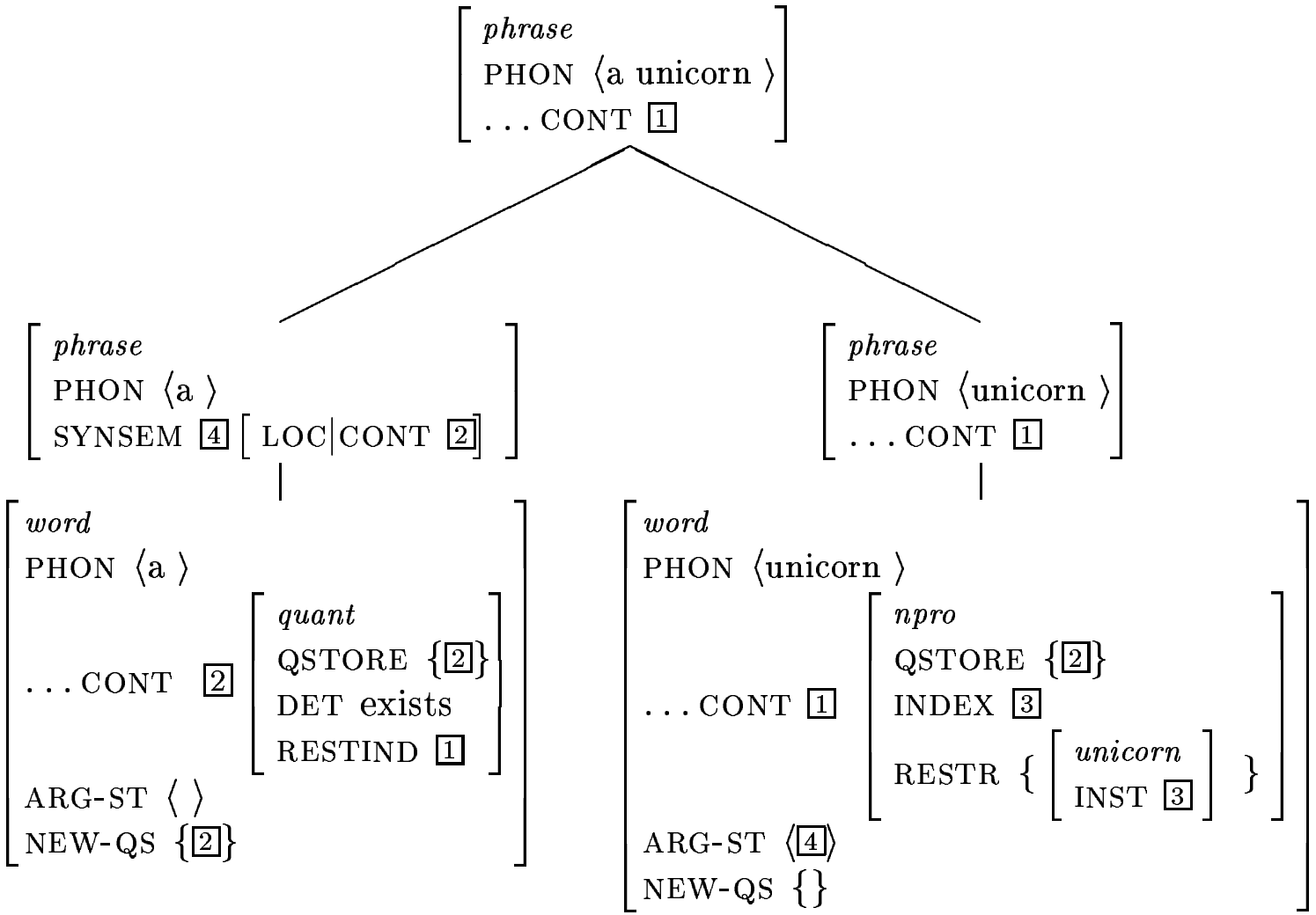
exists (1) *may not exist* (2)

1. Something appears to be approaching, and it is a unicorn.
2. Something appears to be approaching, and it appears to be a unicorn.

(But then again, it could just be a dog wearing a party hat  .)

A unicorn appears to be approaching.

(1.6)



A unicorn appears to be approaching. (bottom)

NP

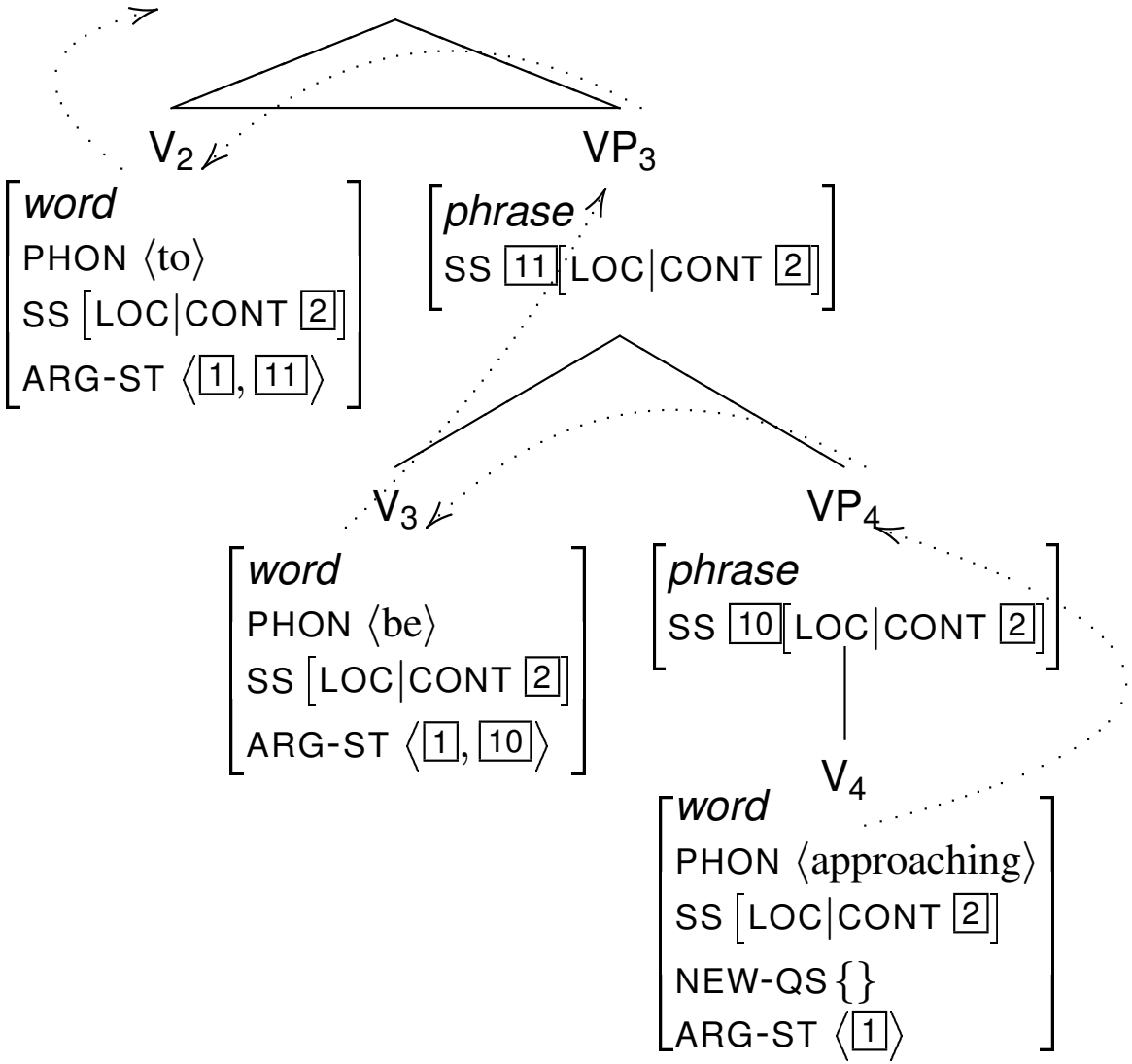
$$\begin{bmatrix} \textit{phrase} \\ \text{PHON} \ \langle \text{a unicorn} \rangle \\ \text{SS} \ \boxed{1}\begin{bmatrix} \text{LOC}|\text{CONT}|\text{QS} \ \{\boxed{4}\} \end{bmatrix} \end{bmatrix}$$

narrow $\boxed{2}$:

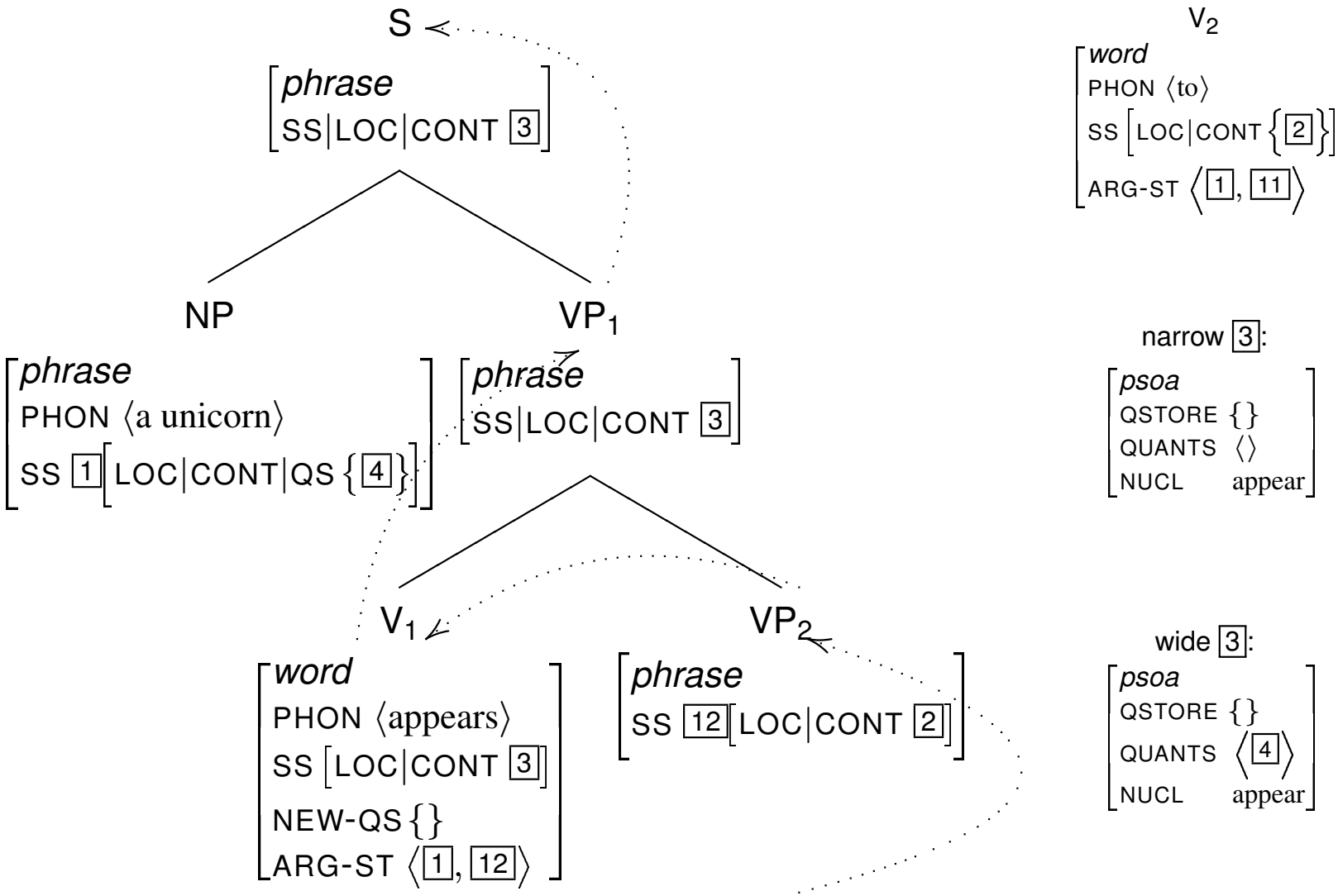
$$\begin{bmatrix} \textit{psoa} \\ \text{QSTORE} \ \{\} \\ \text{QUANTS} \ \langle \boxed{4} \rangle \\ \text{NUCL} \ \ \text{approach} \end{bmatrix}$$

wide $\boxed{2}$:

$$\begin{bmatrix} \textit{psoa} \\ \text{QSTORE} \ \{\boxed{4}\} \\ \text{QUANTS} \ \langle\rangle \\ \text{NUCL} \ \ \text{approach} \end{bmatrix}$$



A unicorn appears to be approaching. (top)



Traceless Extraction

- "A book, I know 1you gave 2Kim." (But *a car*, I didn't know!)

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON} \quad \langle \text{a book} \rangle \\ \text{SS} \quad \boxed{3}\begin{bmatrix}\text{LOC}\ \boxed{4}\end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \textit{word} \\ \text{PHON}\ \langle \text{gave} \rangle \\ \text{SS} \quad \begin{bmatrix} \text{LOCAL}|\text{CATEGORY}|\text{VALENCE} & \begin{bmatrix}\text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2} \rangle\end{bmatrix} \\ \text{NONLOC}|\text{INHER}|\text{SLASH} & \{\boxed{4}\} \end{bmatrix} \\ \text{ARG-ST}\ \langle \boxed{1}, \boxed{3}, \boxed{2} \rangle \end{bmatrix}$$

- PY fail because trace for "a book" does not appear in VALENCE
  - A trace would appear on COMPS
  - Traceless: COMPS $\left\langle \boxed{4}', \boxed{2} \right\rangle \rightarrow$COMPS $\langle \boxed{2} \rangle$, SLASH $\{\boxed{4}\}$ via lexical rule ($\boxed{4}' = \boxed{3}$)
- Przepiórkowski works because "a book" appears in ARG-ST, thus quantifier available via Desc_1

Wh- Retrieval Constraints (Paraphrased)

- At a filler-head node, if the **filler**'s QUE is nonempty, then the member in its QUE is retrieved in that node's QUANTS.
  You must retrieve a filler wh- as soon as possible.

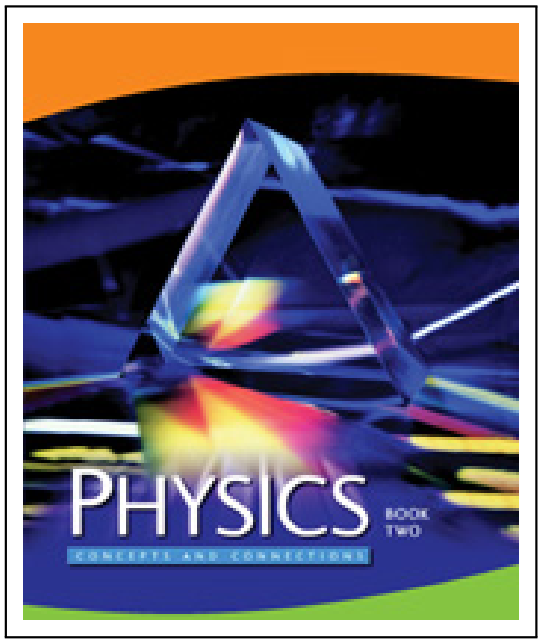
  "...a fronted wh-phrase has exactly the scope indicated by the surface realization of the phrase."

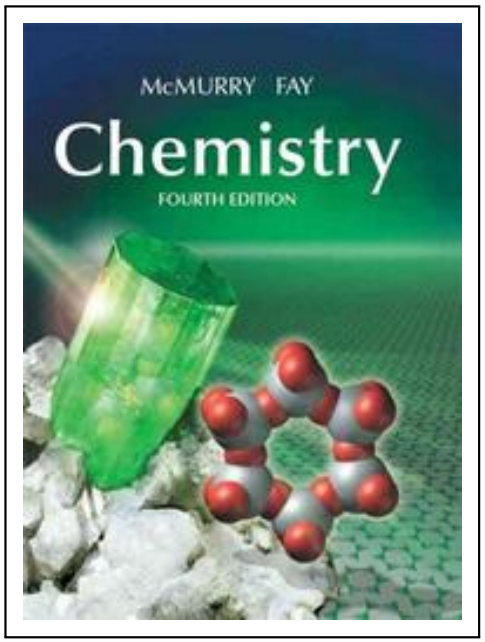
Wh- Retrieval Constraints (Paraphrased)

- If the QUANTS of a *psoa* contains a wh- quantifier (i.e., a wh- quantifier is retrieved), you must also retrieve the QUE member of a left-peripheral daughter of a semantic projection.
  You may retrieve a stored wh- quantifier **if and only if** you also retrieve a wh- quantifier from a left-hand node.
  "...the quantifier corresponding to an in situ wh- phrase...can be retrieved only when there is a left periphery...wh- phrase."

  Non-local: Must dig around the sentence to get the QUE

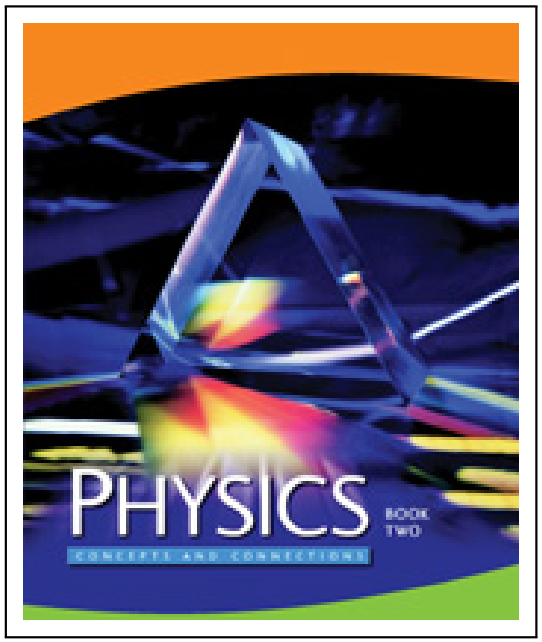
Wh- Retrieval Example 1

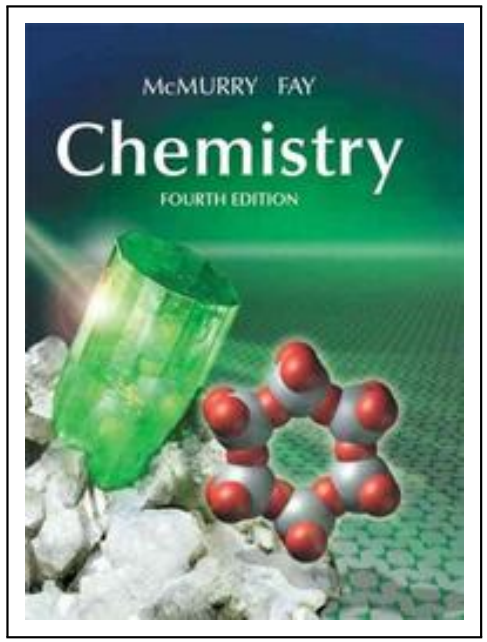




- "Who remembers where$_{filler}$ we bought which book?"
  - For each book, who remembers where we bought it?
    "John remembers where we bought the physics book and Jill remembers where we bought the chemistry book."
  - Who remembers, for each book, where we bought it?
    "John and Jill remember (where we bought which book)."

Wh- Retrieval Example 1





- "Who remembers where$_{filler}$ we bought which book?"
  - For each book, who remembers where we bought it?
    "John remembers where we bought the physics book and Jill remembers where we bought the chemistry book."
  - Who remembers, for each book, where we bought it?
    "John and Jill remember (where we bought which book)."

Wh- Retrieval Example 2

- "Who remembers which vegetables$_{filler}$ Bill bought?"
  - *For each vegetable Bill bought, who remembers it?
    "Glen remembers Bill bought carrots, and Carla remembers Bill bought broccoli." (NOT an appropriate answer!)
  - Who remembers the vegetables Bill bought?
    "Judy remembers (which vegetables Bill bought)."

Wh- Retrieval Example 2

- "Who remembers which vegetables$_{filler}$ Bill bought?"
  - *For each vegetable Bill bought, who remembers it?
    "Glen remembers Bill bought carrots, and Carla remembers Bill bought broccoli." (NOT an appropriate answer!)
  - Who remembers the vegetables Bill bought?
    "Judy remembers (which vegetables Bill bought)."

Wh- Retrieval Example 3

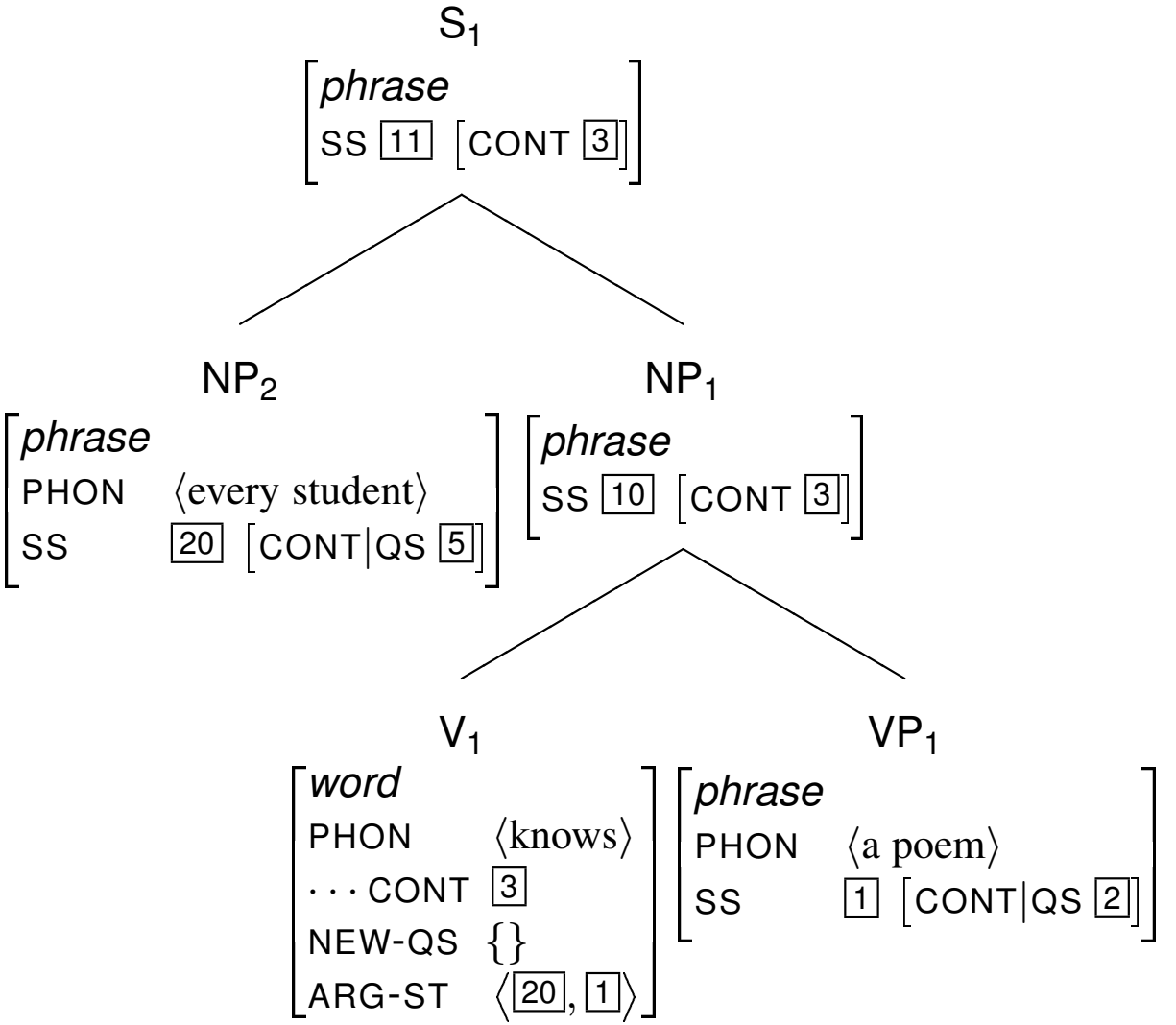
- "Who predicted who would win?"
  - For each team, who predicted they would win?
    "Marcie predicted Northwestern would win, and Tony predicted Miami of Ohio would win." (Naturally, Tony was wrong.)
  - Who predicted the winning team?
    "Rick did."

Wh- Retrieval Example 3

- "Who predicted who would win?"
  - For each team, who predicted they would win?
    "Marcie predicted Northwestern would win, and Tony predicted Miami of Ohio would win." (Naturally, Tony was wrong.)
  - Who predicted the winning team?
    "Rick did."

Outline

"Every student knows a poem."



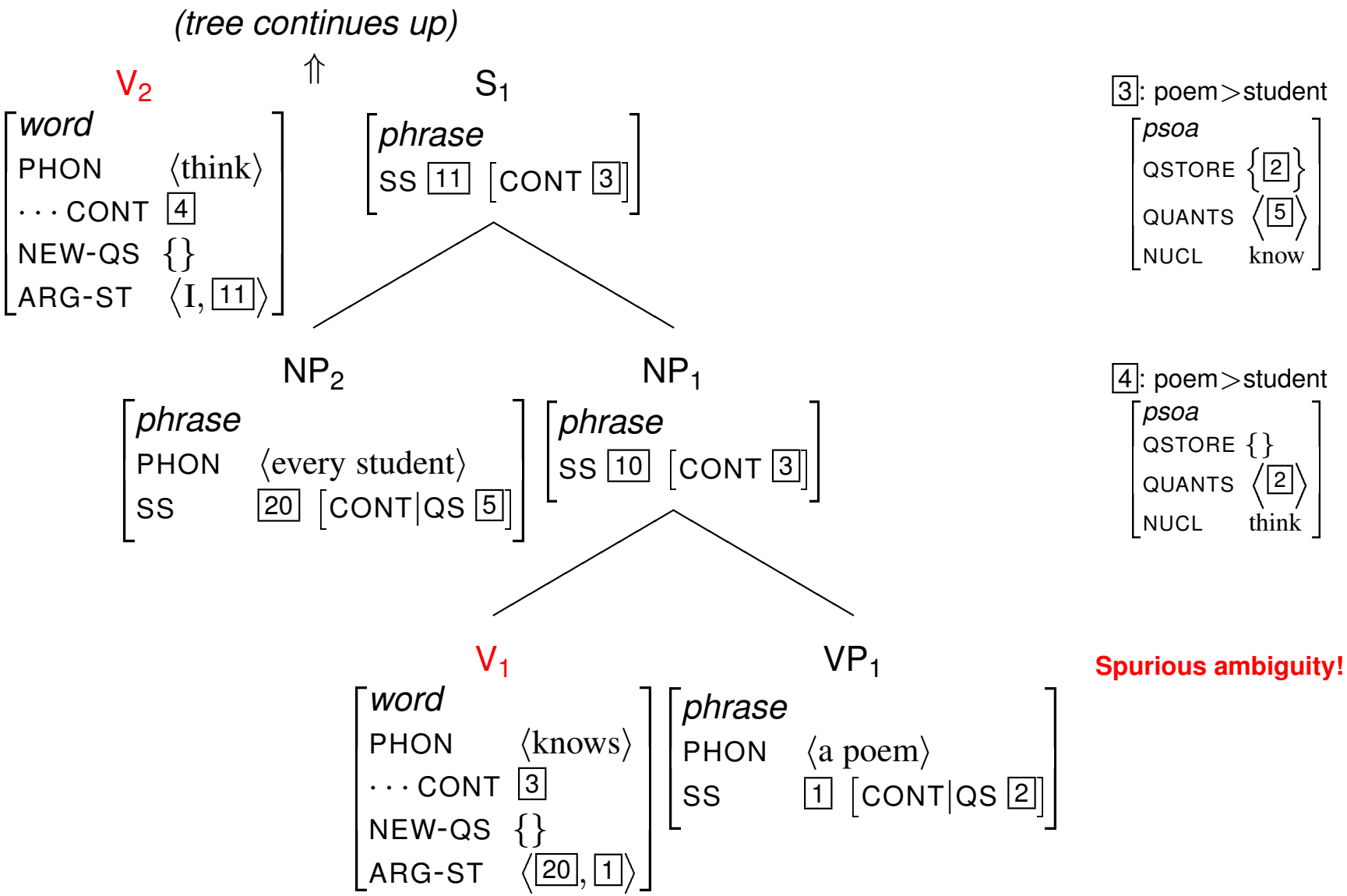
3: student>poem

psoa
QSTORE {}
QUANTS ⟨5, 2⟩
NUCL know

3: poem>student

psoa
QSTORE {}
QUANTS ⟨2, 5⟩
NUCL know

"I think every student knows a poem." ☹



Spurious ambiguities

"I think every student knows a poem."

- One quantifier passed up
  - a poem retrieved at **think** =
    a poem retrieved before every student at **knows**
  - every student retrieved at **think** =
    every student retrieved before a poem at **knows**
- Both quantifiers passed up
  - a poem retrieved before every student **think** =
    a poem retrieved before every student at **knows**
  - every student retrieved before a poem at **think** =
    every student retrieved before a poem at **knows**

Semantics Principle (paraphrased)

In a headed phrase...

- RETRIEVED = subset list of union of daughters' QSTOREs, and QSTORE is relative complement of that set
- If semantic head's CONTENT is *psoa* then...
  - NUCLEUS is identical to NUCLEUS of semantic head
  - QUANTS is QUANTS of semantic head + RETRIEVED

  else...
  - RETRIEVED = $\langle\rangle$
  - CONTENT is token-identical to CONTENT of semantic head

Problem: No more RETRIEVED!

Semantics Principle, redux

Mother:

$$\left[\text{SS|LOC|CONT}\left[\begin{array}{ll}\textit{psoa} & \\ \text{QUANTS} & \boxed{1} \\ \text{QSTORE} & \boxed{2} \\ \text{NUCLEUS} & \boxed{3}\end{array}\right]\right]$$

Daughter:

$$\left[\text{SS|LOC|CONT}\left[\begin{array}{ll}\textit{psoa} & \\ \text{QUANTS} & \boxed{1} \\ \text{QSTORE} & \boxed{2} \\ \text{NUCLEUS} & \boxed{3}\end{array}\right]\right]$$

- Forget the complicated one and go back to Chapter 1:

  For a headed phrase, the CONTENT value is token-identical to that of the semantic head. (Przepiórkowski 1997)

Summary

- Lexical retrieval fixes (some) spurious ambiguity problems
- Traceless extraction and wh- retrieval accounted for
- Simpler: Fewer constraints, all semantics in CONTENT

- What's left?
  - Further constraints on retrieval to fix remaining spurious ambiguity problems
  - Does reliance on older definition of Semantics Principle cause problems?

Questions?

References


Carl Pollard and Ivan A. Sag.
Head-Driven Phrase Structure Grammar.
University of Chicago Press and CSLI Publications, Chicago, Illinois, 1994.


Carl Pollard and Eun Jung Yoo.
A unified theory of scope for quantifiers and wh-phrases.
J. Linguistics, 34:415–445, 1998.


Adam Przepiórkowski.
Quantifiers, adjuncts as complements and scope ambiguities.
Unpublished manuscript, December 1997.


Adam Przepiórkowski.
'A Unified Theory of Scope' revisited: Quantifier retrieval without spurious ambiguities.
In Gosse Bouma, Geert-Jan Kruijff, and Richard Oehrle, editors, *Proceedings of FHCG'98*, 1998.
To appear.


Frank Richter.
A Web-based Course in Grammar Formalisms and Parsing.
http://milca.sfs.uni-tuebingen.de/A4/Course/PDF/gramandpars.pdf, 2005.
Electronic textbook.


David Spollen.
An HPSG analysis of French clitic pronouns.
B.A. Thesis, Trinity College, Dublin, 2004.