LSA.343
Precision Grammar Implementation for Linguistic Hypothesis Testing

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Constraint-Based Lexicalism (1 of 2)

Lexical Functional Grammar (Bresnan, 1979)

- Grammatical functions as first-place concepts: functional structure;
- non-transformational: enriched lexicon plus productive lexical rules;
- projection set-up: c- and f-structure jointly determine grammaticality.

Generalized Phrase Structure Grammar (Gazdar, 1981)

- WYSIWIG: no ‘deep’ structure and transformations; surface-driven;
- computationally restrictive: context-free formalism (with meta-rules);
- rich use of features and feature co-occurrence principles: unification.
Constraint-Based Lexicalism (2 of 2)


- Immediate successor to GPSG (Natural Language Project at HPL);
- headedness: importance of (lexical) head in most constructions;
- rich, hierarchically-organized lexicon (as typed feature structures);
- small inventory of schematic phrase structure rules for combination;
- *sign*-based approach: tight integration of syntax and semantics.
Interaction of Lexicon and Phrase Structure Schemata

\[
\begin{align*}
\text{phrase} & \quad \text{phrase} & \quad \text{phrase} \\
\text{HEAD} & \quad 1 & \quad \text{SPR} & \quad \langle \rangle & \quad \text{COMPS} & \quad 3 \\
\text{PHON} & \quad \langle Kim \rangle & \quad \text{HEAD} & \quad \text{noun} & \quad \text{AGR} & \quad 3sg \\
\text{PHON} & \quad \langle sleeps \rangle & \quad \text{HEAD} & \quad \text{verb} & \quad \text{AGR} & \quad 1 3sg \\
\text{HEA3} & \quad \langle \rangle & \quad \text{SPR} & \quad \langle \rangle & \quad \text{COMPS} & \quad \langle \rangle \quad \text{COMPS} & \quad 3 \\
\end{align*}
\]

Precision Grammar Implementation (4)
Modification: Dimensions of variation

- Determine what can modify what
  - PPs modify either nominal phrases or verbal phrases
  - Adjectives modify nominal phrases
  - Adverbs modify verbal phrases
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  - PPs follow head
  - Adjectives precede head (simple ones, anyway)
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- Distinguish modifier PPs from complement PPs

*The dog barked* **near the cat**

*Kim gave the cat to Sandy***
What modifies what, and who decides?

• Decide whether head or modifier does selection
  
  If head selects,
  
  then must allow for multiple modifier types, and determine order of each – redundancy for e.g. PPs
  
  If modifier selects,
  
  then can use abstract pos type *modifiable* as supertype of *verb* and *noun*
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- Decide whether head is *SPR*-saturated
  - Do PPs attach to S and NP, or to VP and N-bar?
    (and similarly for adjectives and adverbs)
Candidate grammar: VP/N-bar attachment

Positive

- Correct grammaticality results

  *The cat chased that fierce dog.*
  *The cat chased fierce that dog.*
Candidate grammar: VP/N-bar attachment

Positive

- Correct grammaticality results
  
  *The cat chased that fierce dog.*

Negative

- Spurious ambiguity
  
  *The fierce dog near the cat barked.*

[ [ fierce dog ] [ near the cat ] ]
[ fierce [ dog [ near the cat ] ] ]
Spurious ambiguity

- Consider restricting pre-head modifiers to modify only word, not phrase
  Undergenerates: the fierce fierce dog
- Consider attachment of post-head modifiers to NP/S, not Nbar/VP
NP/S attachment for (post-head) modifiers

Positive

- Still correct grammaticality for these data sets
- No spurious ambiguity
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Potential Negatives
- Asymmetry for adverb attachment
  - *The dogs left quickly.* (attaches to S)
  - *The dogs quickly left.* (attaches to VP)
- Asymmetry for adjectival modifiers (eventually)
  - *The dogs angry at the cats bark.* (attaches to NP)
  - *The angry dogs bark.* (attaches to N)
- Difficult semantics: scope of negation
  - *No dogs near the cat bark.*
Other alternatives, using VP/N-bar attachment

- Add boolean feature --PM (‘Post-Modified’)
  1. Modifier-head-rule says head-dtr must be [---PM --], but mother is unmarked (enabling *fierce* *fierce* dog)
  2. Head-modifier-rule says mother is [---PM +]
     so a post-modified phrase cannot be head-dtr in modifier-head rule
  3. Other rules preserve the --PM feature from head-dtr to mother

- Use additional types to distinguish “nuclear” vs. “extended” phrases
  Leads to additional complexity in the phrase type hierarchy
Order of modifier and head

- Have two modifier rules (unavoidable)
  \[
  \text{phrase} \rightarrow \text{head modifier} \\
  \text{phrase} \rightarrow \text{modifier head}
  \]

- Constrain HEAD value for each modifier daughter
  Requires additional abstract pos types: \textit{premodifier, postmodifier}
  Requires multiple inheritance for the type \textit{adv}
Prepositional phrases: Modifiers or complements?

Modifiers

- Iteration within a phrase
  
  *The dog barked near the cat on Monday near the office.*

- Transparent semantics
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Complements

- Obligatory co-occurrence
  
  *The dog gave the cat.*

- Idiosyncratic selection of preposition
  
  *The dog gave the cat at that aardvark.*

- Opaque (unpredictable) semantics
  
  *The dog belongs to the boy.*