Background to Head-driven Phrase Structure Grammar

Steve Harlow

sjh1@york.ac.uk

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Outline

1. Background
2. Basics of the formalism
3. Basic structures for English: words and phrases, complements, subjects, nouns and NPs, specifiers, prepositions
4. Verbs and auxiliaries
5. Clauses
6. Lexicon
7. Semantics
8. Lexical relations (passives)
9. Binding theory
10. Control and raising
11. Wh-movement
Introduction

1 A (very) brief history of post-war linguistics

1957 In *Syntactic Structures*, Chomsky argued that Context-free Phrase Structure Grammars are unable to capture linguistically significant generalisations about the syntactic properties of natural languages. He argued that this could only be achieved by supplementing CFPSGs with more powerful rule systems that map syntactic structures onto other syntactic structures – transformations.
Late 1960’s The Linguistic Wars break out, between Chomsky and Generative Semanticists (George Lakoff, Jim McCawley), who argue that Deep Structure is an unnecessary level of structure and that more abstract initial representations are required (e.g. representing kill as cause become not alive).

Early 1970’s Stanley Peters and Robert Ritchie demonstrate that the Aspects model of transformational grammar has the weak generative capacity of an unrestricted rewriting system (Turing Machine) i.e. the Standard Theory was so unconstrained that it made no claim at all about human languages other than that they could be characterised by some set of rules.

Subsequently Chomsky develops more constrained versions of transformational grammar. (Government-binding theory, Principles and parameters, Minimalism.)
2 Alternatives to transformations

What better way to constrain the power of transformations than to remove them entirely?

2.1 1980’s Non-transformational Frameworks

1. Lexical Functional Grammar (Joan Bresnan, Ronald Kaplan)
2. Categorial Grammar (Richard Montague, Barbara Partee, Emmon Bach)
3. Generalised Phrase Structure Grammar (Gerald Gazdar, Ivan Sag)
2.2 Further reading

3 HPSG – a quick overview

3.1 Indebted to (mainly non-derivational) approaches

- Categorial grammar
- Generalised Phrase Structure Grammar (GPSC)
- Arc Pair Grammar
- Lexical Functional Grammar (LFG)
- Situation Semantics
- computer science
Similarities with the Chomsky tradition

- Same goal – to characterise human linguistic competence
- Same empirical base – acceptability judgments of native speakers
- Grammaticality is determined by the interaction of highly articulated lexical entries and general principles of universal grammar
- Binding theory (but non-configurational)
- Multiple ‘levels’ of representation (but very different in kind)
3.2 Differences from the Chomsky tradition

- Non-primacy of syntax
- ‘Bottom up’ methodology - employs ‘fragment methodology’ of writing detailed explicit account of sub-parts of languages
- Inventory of levels is different
- No transformations – no movement (‘structure sharing’ instead)
- Mathematically rigorous
- Non-derivational – employs parallel representations mutually constrained by the grammar
- Fractal
- Local constraints only
More specifically

- No government
- No c-command
- No empty categories
- No traces (probably)
- No functional projections
- No distinction between internal and external arguments
- No Extended Projection Principle
- No NP-movement
- No Wh-movement
- No head movement
3.3 Brief history of HPSG

HPSG I


HPSG II


Textbook

Sag, Ivan A., Thomas Wasow, and Emily M. Bender (2003))


Formal foundations


Bibliography

The HPSG on-line bibliography:

http://hpsg.fu-berlin.de/HPSG-Bib/
Computational implementations

The LinGO English Resource Grammar (ERG):

http://www.delph-in.net/erg/

The Attribute Logic Engine (ALE):

http://www.cs.toronto.edu/~gpenn/ale.html
Sign-based Construction Grammar


### 4 Formal status of the theory

<table>
<thead>
<tr>
<th></th>
<th>formal language of descriptions</th>
<th>model</th>
<th>world of objects</th>
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<tbody>
<tr>
<td>Semantics</td>
<td>predicate calculus</td>
<td>sets of entities</td>
<td>the world</td>
</tr>
<tr>
<td>HPSG</td>
<td>linguistic descriptions</td>
<td>sorted feature structures</td>
<td>linguistic objects</td>
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4.1 Linguistic descriptions

These are usually given in the form of attribute value matrices (AVMs). E.g:

\[
\begin{array}{c|cccc}
\text{synsem} & \text{LEX} & + & \text{head} & \text{noun} \\
\text{HEAD} & \text{CAT} & \text{agr} & \text{NUMBER} & \text{plural} \\
 & \text{AGR} & \text{PERSON} & \text{third} \\
\end{array}
\]

Representing a third person plural noun, such as cats or they. Descriptions are usually partial.
4.2 Sorted feature structures

These are set-theoretic constructs taking the form of ordered triples of

- sort,
- attribute and
- value.

(In fact, they are functions from sort, attribute pairs to values.)
They are commonly represented by directed graphs:
Description of the English transitive verb *likes*

<table>
<thead>
<tr>
<th>word</th>
<th>( \langle \text{likes} \rangle )</th>
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<tbody>
<tr>
<td>PHON</td>
<td>synsem</td>
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<td>SYNSEM</td>
<td>LOC</td>
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Description of the English verb phrase *likes cheese*

```
hd-comp-ph
PHON 1 ⊕ 2
SYNSEM | LOC | CAT
       [ HEAD 3
       SUBJ 4
       COMPS ⟨ ⟩ ]

word
PHON 1 ⟨likes⟩
synsem

HD-DTR
DTRS
SYNSEM
LOC
CAT

phrase
PHON 2 ⟨cheese⟩
SYNSEM 6

non-hd-dtrs

LOCAL

CAT

cat
HEAD 3 verb
LEX +
SUBJ 4 ⟨NP⟩
COMPS 5 ⟨6 NP⟩
ARG-STR 4 ⊕ 5
```
A grammar is defined by a *signature*: a sortal hierarchy plus a set of constraints.

A linguistic structure is well-formed if it simultaneously satisfies all the constraints imposed by the grammar.