HPSG as a linguistic theory

- a member of the family of linguistic frameworks that are called *generative grammars* → a grammar which is formalized to a high degree and thus makes exact predictions about the objects (sentences) that are considered to belong to a language.
- HPSG does not have phrase structure rules or transformations.
- Instead, it is *declarative, non-derivational, and constraint-based*.
- Sets of constraints which hold simultaneously determine the collections of admissible linguistic structures without defining an order of the derivation or generation of signs.

The Beginnings

Is there such a thing as one single coherent HPSG framework that was created sometime in the early days of HPSG, remained unchanged, and is employed by all linguists working in HPSG?

- Two different HPSG formalisms have been informally presented by Carl Pollard and Ivan Sag:
  - the other one in their second book of 1994, Head-Driven Phrase Structure Grammar (Pollard & Sag 1994)
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HPSG began in the mid 1980s inspired by several other frameworks:

- Government and Binding Theory (Chomsky 1981)
- ideas of the combinatorial system of HPSG from Categorial Grammar
- combination of feature structure and phrase structure from Lexical Functional Grammar (LFG) (Bresnan 1982)
- and Generalized Phrase Structure Grammar (GPSG) (Gazdar et al. 1985)
HPSG 87 - HPSG 94

HPSG 87

- is a typical instance of a *unification-based* grammar formalism.
- Underlying intuition is that linguist specify pieces of partial information about a language in their grammars.
- All pieces of partial information about a language are then combined by operations such as *unification* to obtain all available information about that language.

HPSG 94

- can be called an object-based grammar formalism
- or a *constraint-based* grammar formalism.
- It envisions an architecture in which linguists use a logical language on order to specify language as a collection of total objects.

HPSG grammars from a formal perspective

An **HPSG grammar** formally consists of

I. the **signature** as declaration of the domain, and
II. the **theory** constraining the domain.

The signature of an HPSG grammar

- defines the ontology (‘declaration of what exists’):
  - which kind of objects are distinguished, and
  - which properties of which objects are modeled.
- consists of
  - the **type hierarchy** (or sort hierarchy) and
  - the **appropriateness conditions**, defining which type has which appropriate attributes (or features) with which appropriate values.
**Models of linguistic objects**

What do the mathematical structures used as model for HPSG theories look like?

- The objects are modelled by typed feature structures, which can be notated as directed graphs.
- Since these models represent objects in the world (and not knowledge about objects in the world) they are total with respect to the ontology declared in the signature. Formally speaking, the feature structures are:
  - **totally well-typed**: Every type has every one of the attributes and their values which are appropriate for it.
  - **sort-resolved**: Every type is maximally specific.

Note that type and sort are often used synonymously, as well as attribute and feature.

**Descriptions (cont.)**

Complex descriptions are obtained through conjunction (\(\land\)), disjunction (\(\lor\)) and negation (\(\neg\)). In the AVM notation, conjunction is implicit.
A linguistic object is admissible with respect to a theory iff it satisfies each of the descriptions in the theory and so does each of its substructures.

**The theory of an HPSG grammar**

A theory is a set of description language statements, often referred to as the constraints.

- The theory singles out a subset of the objects declared in the signature, namely those which are grammatical.
- A linguistic object is admissible with respect to a theory iff it satisfies each of the descriptions in the theory and so does each of its substructures.

**Connection between Theory, Model and Empirical Domain**

- **linguistic objects**
  - Modelling
  - Predicts
  - Set of descriptions constraints
  - Formal theory

- **model**
  - Feature structures
  - Specify
  - Are licensed

- **phenomena**
  - Modelling
Motivating subcat

(1) a. I laugh.  
    b. I saw him.  
    c. I give her the book.  
    d. I said that she left.

Cannot always be derived from semantics:

(2) a. Paul ate a steak.  
    b. Paul ate.

(3) a. Paul devoured a steak.  
    b. * Paul devoured

Properties of particular categories

Motivating VFORM

(4) a. Peter will win the race.  
    b. * Peter will won the race.  
    c. * Peter will to win the race.

(5) a. Peter has won the race.  
    b. * Peter has win the race.  
    c. Peter has to win the race.  

(6) a. Peter seems to win the race.  
    b. * Peter seems win the race.  
    c. * Peter seems won the race.
Motivating CASE

(7) a. He left. (nom)
b. * Him left.

(8) a. She sees him. (acc)
b. * She sees he.

Semantic representations

Indices

Auxiliary data structures

Alternative names for the attributes FIRST (FT) and REST (RT) of non-empty-list are HEAD (HD) and TAIL (TL).
Abbreviations for describing lists

- empty-list is abbreviated as e-list, <>
- non-empty-list is abbreviated as ne-list
- \[\text{FIRST } 1 | \text{REST } 2\] is abbreviated as \(\{1, 2\}\)
- \(\ldots [\ldots 1]\) is abbreviated as \(\ldots 1\)
- \[\text{FIRST } 1 | \text{FIRST } 2 | \text{REST } 3\] is abbreviated as \(\{1, 2, 3\}\)

The Lexicon

The basic lexicon is defined by the Word Principle as part of the theory. It is an implicational statement defining which of the ontologically possible words are grammatical:

\[
\text{word} \rightarrow \text{lexical-entry}_1 \lor \text{lexical-entry}_2 \lor \ldots
\]

with each of the lexical entries being descriptions, such as e.g.:

```
word
PHON <laughs>
SYNSEM|LOC
  CAT HEAD verb
  SUBCAT (NP[nom] 3rd,sing)
  CONTENT laugh'

PHON <drinks>
SYNSEM|LOC
  CAT HEAD verb
  SUBCAT (NP[nom] 3rd,sing), NP[acc]
  CONTENT DRINKER 1
```

Abbreviations for common AVMs

Pollard and Sag (1994) make use of the following abbreviations for describing synsem objects:

<table>
<thead>
<tr>
<th>Abbrev.</th>
<th>abbreviated AVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP</td>
<td>[\text{LOCAL}\</td>
</tr>
<tr>
<td>synsem</td>
<td>[\text{LOCAL}\</td>
</tr>
<tr>
<td>S</td>
<td>[\text{LOCAL}\</td>
</tr>
<tr>
<td>VP</td>
<td>[\text{LOCAL}\</td>
</tr>
</tbody>
</table>

An example lexicon

```
word \rightarrow<drinks>

S/L
   HEAD verb
   VFORM fin
   SUBCAT (NP[nom] 3rd,sing), NP[acc]
   CONTENT DRINKER 1

\|

word \rightarrow<drinks>

S/L
   HEAD verb
   VFORM fin
   SUBCAT (NP[nom] plur), NP[acc]
   CONTENT DRINKER 1
```
Introduction to HPSG

Historical Overview

The HPSG architecture

Signature

Linguistic Objects

Descriptions

Theory

An ontology of linguistic objects

Motivating some of the signature items

The lesson

References


