

Background to Head-driven Phrase Structure Grammar

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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.

1965 In *Aspects of the Theory of Syntax*, Chomsky develops the ‘Standard Theory’ of transformational grammar (with the ‘Deep Structure’/‘Surface Structure’ distinction).

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. Categorical Grammar (Richard Montague, Barbara Partee, Emmon Bach)
3. Generalised Phrase Structure Grammar (Gerald Gazdar, Ivan Sag)
4. Head-driven Phrase Structure Grammar (Ivan Sag, Carl Pollard).

2.2 Further reading

Newmeyer, F. (1986) *Linguistic Theory in America (2nd edition)*.
Academic Press.

3 HPSG – a quick overview

3.1 Indebted to (mainly non-derivational) approaches

- Categorical grammar
- Generalised Phrase Structure Grammar (GPSG)
- 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

Pollard, Carl and Ivan Sag (1987) *Information-based Syntax and Semantics, Volume 1: Fundamentals*. Stanford University, CSLI Publications.

HPSG II

Pollard, Carl and Ivan Sag (1994) *Head-Driven Phrase Structure Grammar*. Chicago, University of Chicago Press, Chapters 1 - 8.

HPSG III

Pollard, Carl and Ivan Sag (1994) *Head-Driven Phrase Structure Grammar*. Chicago, University of Chicago Press, Chapter 9.

Sag, Ivan (1997) English Relative Clause Constructions. *Journal of Linguistics*, 33.2, 431-484.

Jonathan Ginzburg and Ivan A. Sag (2000) *Interrogative Investigations: The form, meaning and use of English interrogative constructions*. Stanford: CSLI Publications.

Bouma, Gosse, Rob Malouf, and Ivan Sag (2001) Satisfying Constraints on Extraction and Adjunction. *Natural Language and Linguistic Theory*, 19.1, 1-65.

Copestake, Ann Dan Flickinger, Carl J. Pollard and Ivan A. Sag (2005) Minimal Recursion Semantics: an Introduction. *Research on Language and Computation*, 3.4, 281-332.

Textbook

Sag, Ivan A., Thomas Wasow, and Emily M. Bender (2003))
Syntactic Theory: A Formal Introduction. Stanford: CSLI
Publications. second edition.

Formal foundations

Richter, Frank (2000)) *A Mathematical Formalism for Linguistic
Theories with an Application in Head-driven Phrase Structure
Grammar*. Tbingen: Universität Tübingen dissertation.

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

Ivan A. Sag (1997) English Relative Clause Constructions. *Journal of Linguistics*, 33.2, 431-484.

Ivan A. Sag (2007) Sign-Based Construction Grammar: An informal synopsis. *Research on Language and Computation*, 1-65,

<http://lingo.stanford.edu/sag/papers/theo-syno.pdf>.

4 Formal status of the theory

	formal language of descriptions	model	world of objects
Semantics	predicate calculus	sets of entities	the world
HPSG	linguistic descriptions	sorted feature structures	linguistic objects

4.1 Linguistic descriptions

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

$$\left[\begin{array}{l} \textit{synsem} \\ \text{LEX} \quad + \\ \\ \text{HEAD} \quad \left[\begin{array}{l} \textit{head} \\ \text{CAT} \quad \textit{noun} \\ \text{AGR} \quad \left[\begin{array}{l} \textit{agr} \\ \text{NUMBER} \quad \textit{plural} \\ \text{PERSON} \quad \textit{third} \end{array} \right] \end{array} \right] \end{array} \right]$$

Representing a *third person plural noun*, such as *cats* or *they*.
Descriptions are usually *partial*.

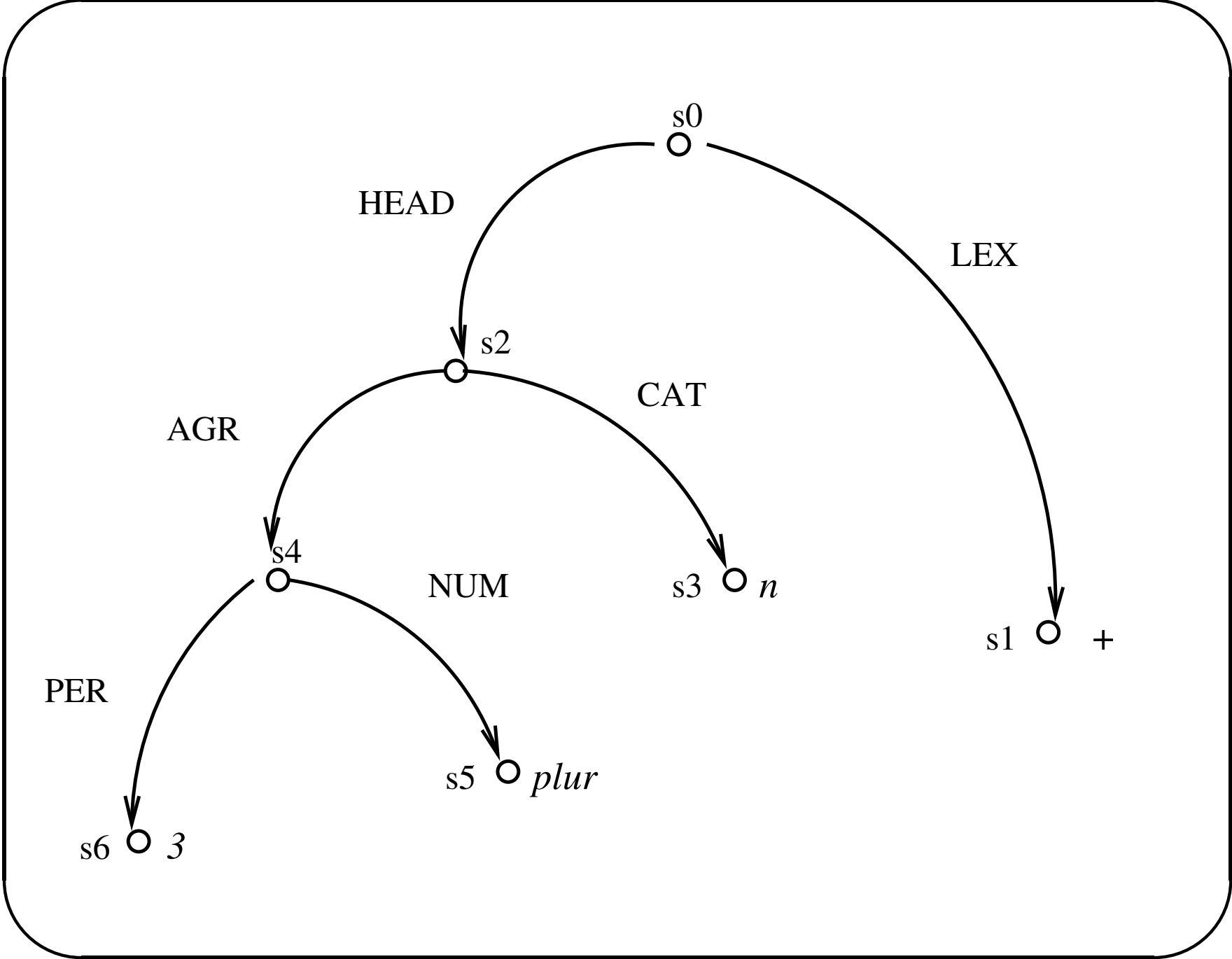
4.2 Sorted feature structures

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

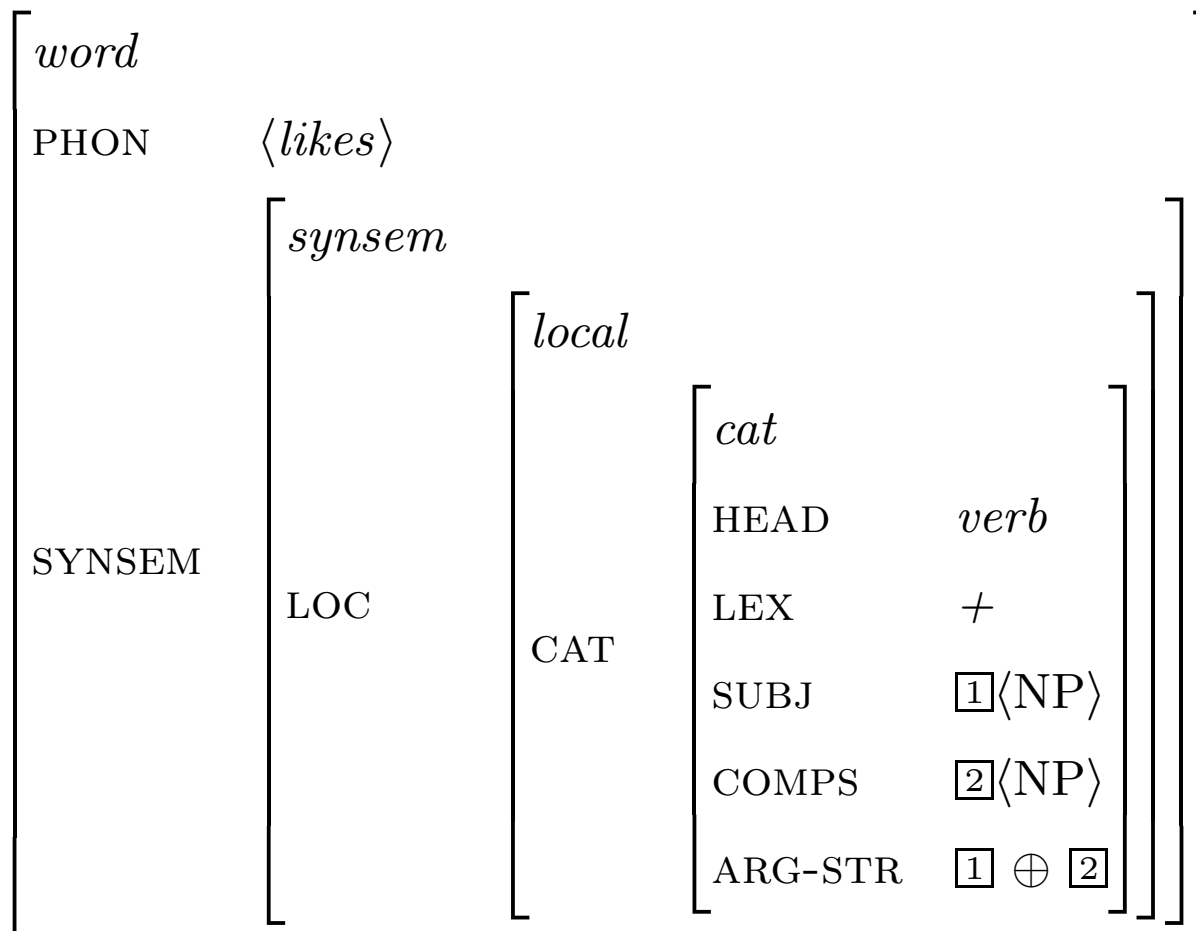
- sort,
- attribute and
- value.

(In fact, they are functions from sort, attribute pairs to values.)

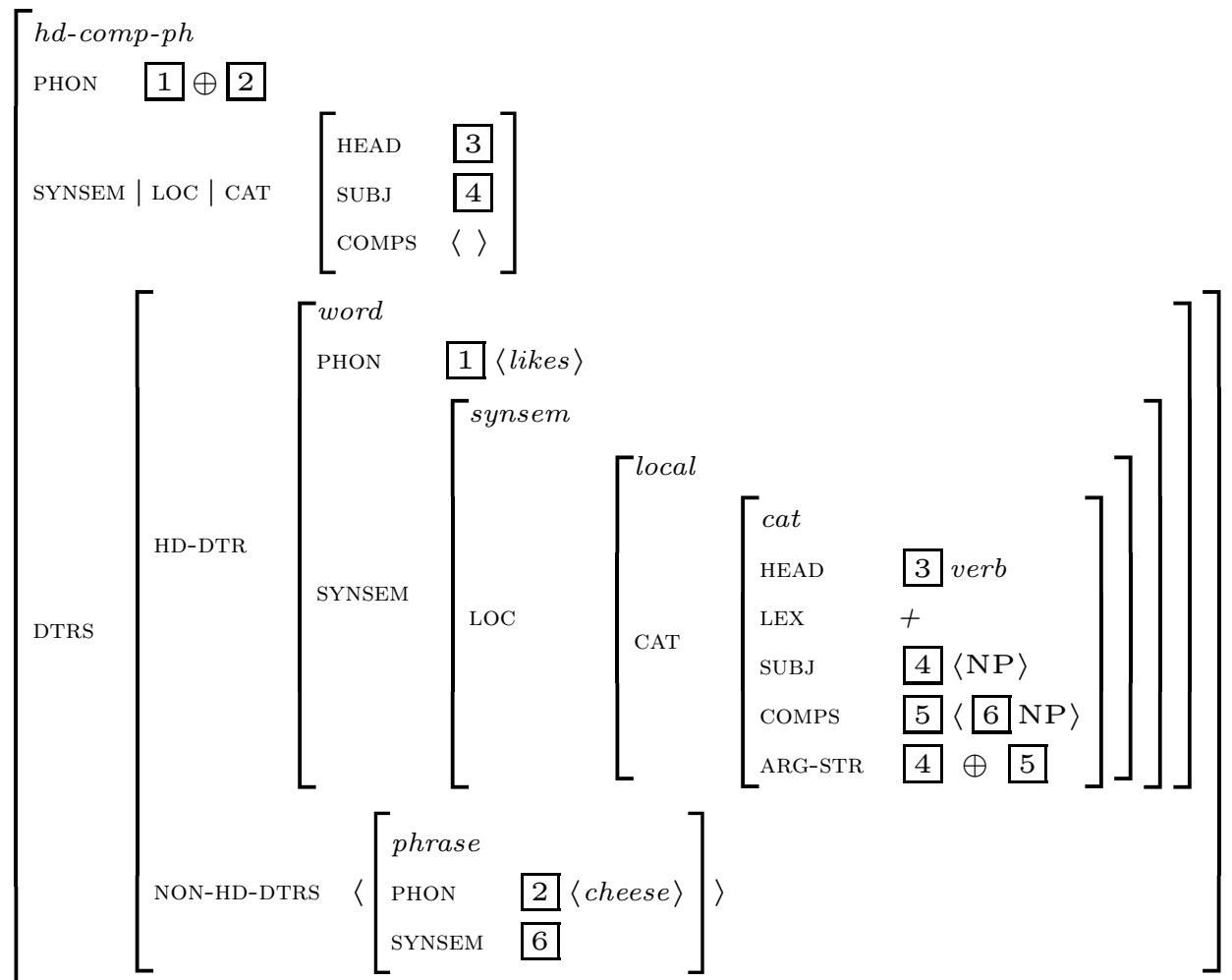
They are commonly represented by directed graphs:



Description of the English transitive verb *likes*



Description of the English verb phrase *likes cheese*



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