Chapter 1

Formal Foundations

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This chapter provides a condensed introduction to a formalism for Pollard & Sag (1994) and explains its fundamental concepts. It pays special attention to the model-theoretic meaning of HPSG grammars. In addition it establishes links to other, related formalisms, such as feature logics of partial information and the most relevant implementation platforms and their use of a very similar terminology.

Outline

The two HPSG books by Pollard and Sag (Pollard & Sag 1987; 1994) do not define grammar formalisms. Instead they refer to various inspirations in the logics of typed (sorted) feature structures, informally characterize the intended formalisms, and explain them as they are used in grammars of English. Pollard & Sag (1994) further clarifies their intentions in an appendix which lists most (but not all) of the components of their grammar of English explicitly.

This handbook article focuses on presenting a canonical formalism of the final version of HPSG in Pollard & Sag (1994), but it points out some of the differences to its 1987 precursor, since the older terminology is also still present in current HPSG papers and may sometimes be confusing to an audience unaware of the different usages of the a terminology that means different things in different formalisms.

1. Signatures and descriptions:
   The first section introduces the basic syntactic components of a grammar, explains sort hierarchies, assumptions about attributes and attribute inheritance, and relations such as `append`, `member` , `shuffle` or `union`. The

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definitions of the syntax of descriptions follow King (1999) with the relational extensions by Richter (2004), as it is much more compact than an AVM syntax, but the relationship between the two notations is clarified informally. HPSG grammars are defined as pairs of signatures and sets of descriptions. These descriptions are the principles of the grammar, including an appropriate characterization of all lexical items.

2. Meaning of signatures, descriptions, and sets of descriptions:
The next section sketches the interpretation of sorts as sets of objects, the meaning of attributes as partial functions from objects to objects, and the denotation of of simple and complex descriptions as sets of objects with attribute-defined substructures that are consistent with the path equations, sort assignments and relational restrictions that make up a description. A first approximation to the meaning of a grammar follows from this as an interpretation of a signature whose objects are all simultaneously consistent with all descriptions in the grammar, i.e., with the grammar principles.

3. Meaning of grammars:
This section explains why models of grammars are insufficient as a satisfactory notion of the meaning of a grammar: Models in the sense of the previous section can be of arbitrary size, and any well-formed utterance of a language consistent with the predictions of a grammar may be in it or not. Adequate models must contain all predictions of a grammar to be useful for the linguist. Informal characterizations of these special, intended models in Pollard & Sag (1994) and the subsequent technical elaborations by King (1999), Pollard (1999) and Richter (2007) reveal a range of available alternatives, and they exhibit substantially different views on what an adequate treatment of the meaning of a grammar should provide. One of the important insights of this section is the observation that none of the worked-out explanations of the meaning of HPSG grammars employs feature structures anymore.

4. Influential alternatives to a formalism of Pollard & Sag (1994):
This section very briefly sketches the terminology and structure of Pollard & Sag (1987), which is a framework that relies on partial feature structures in a Heyting algebra with unification as central basic operation. We highlight differences in the meaning of central HPSG expressions compared to later incarnations of HPSG, in particular with respect to the terms feature structure, type, and unification. The section will also provide references

to the terminology in grammar implementation. Space permitting, some topics of special interest could be picked up such as treatments of lexical rules, the role of defaults, and partiality of structures.

References

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