

Local Semantics in Head-Driven Phrase Structure Grammar

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1 Introduction

Semantic research is generally divided into *lexical semantics* (LS) and *compositional semantics* (CS). LS concentrates on the relation between a semantic functor and its arguments, be it in terms of *semantic selectional restrictions* or in terms of *linking*, i.e., in terms of the relation between syntactic complements and semantic argument slots. CS is concerned with the way the semantic contributions of constituents in a sentence are combined to arrive at the interpretation of the sentence. Here, the scope of quantifiers and other operators is the central notion. This division of labor in semantics has its parallel in syntax, as evidenced by the A- vs. A-bar syntax of Government and Binding Theory for example. In the case of syntax, the modularization and the interaction of the two “kinds” of syntax is relatively well studied. At the semantic side, however, the relation between the two kinds of semantics has hardly been addressed.

In this paper we will contribute to the study of the LS-CS interface by concentrating on one empirical phenomenon, namely selection, and by making a concrete proposal for a particular linguistic theory, *Head-Driven Phrase Structure Grammar* (HPSG, Pollard and Sag (1994)). HPSG is a rigidly formalized linguistic framework (Richter, 2000), and for both, LS and CS there are a number of substantial proposals to build on.

2 Selection and Semantics in HPSG

In a monostratal sign-based theory such as HPSG, all linguistically relevant properties of a sign are simultaneously present. Technically, a sign is a *feature structure* (FS) and all information is encoded as FSs that are contained within this large FS, connected by functions which are called *features* or *attributes*. Thus, a sign FS has an attribute PHON whose value is a FS that encodes the phonology. An other attribute SYNSEM contains the syntactic category and the semantic information. In the case of a syntactically complex sign, a DAUGHTERS value is a FS which represents the constituent structure. This monostratal representation still allows for a high degree of modularity. Thus, in Pollard and Sag (1994) (PS94), only FSs that represent synsem information are allowed as values of the selectional attributes. Consequently, a syntactic head cannot select for the phonological or the structural properties of its complements. As mentioned above, however, the syntactic category is part of a synsem FS. Therefore, categorial selection is possible.

In PS94 the semantic structure of a sign is a single FS which occurs inside the synsem information. By this, PS94 expresses the insight that semantic information is relevant for the expression of the selectional properties of a word. It should be noted, however, that this semantic FS contains the entire semantic representation, i.e., no distinction between parts that are relevant for LS and those important for CS has been made.

3 Data

We will review basic data on selection to substantiate the point that those parts that are important for CS such as quantifiers and other operators and their mutual scope relation are not relevant for at least the following phenomena: linking and semantic selectional restrictions.

Linking: Within HPSG, the most influential theory of linking is that of Koenig and Davis (2001). There, the linking properties of a verb depend on the particular semantic constant contributed by the verb and on the verb’s syntactic selectional properties. The linking properties are however independent of the presence of scope-bearing elements in the sentence or of their relative scopes:

- (1) a. Chris read *Syntactic Structures*.
- b. Every student read most books on syntax.

Semantic selectional restrictions: A typical example of a semantic selectional restriction can be seen in the case of the German verb *pflücken*. It means *pick*, but is restricted to flowers or fruits. This accounts for the oddness of (2b) in German (indicated by “??”), whereas the English translation is impeccable.

- (2) a. Chris pflückte ein Gänseblümchen. ‘Chris picked a daisy’
- b. ?? Chris pflückte ein Buch. ‘Chris picked a book.’

Ever since Chomsky (1965), the status of semantic selectional restrictions have been a matter of debate, i.e., whether they are semantic or pragmatic in nature. Within HPSG no explicit position has been taken so far. Even Androutsopoulos and Dale (2000), the only HPSG paper exclusively devoted to selectional restrictions, eventually

proposes two solutions: one which makes these restrictions part of the semantic structure, and one which ascribes them to pragmatics.

In contrast to the violation of categorial selectional restrictions, the violation of semantic selectional restrictions does not lead to ungrammaticality. Instead, a sentence like (2b) can be uttered unproblematically in a phantasy-world context, in which books would be assumed to grow on trees for example. Also the presence of certain semantic operators such as negation and modals renders the violation of semantic selectional restrictions grammatical:

- (3) a. ?? Tom ate a keyboard.
b. Tom cannot eat a keyboard. (Androutsopoulos and Dale, 2000)

It should be noted, however, that the reconciliation effect of semantic operators is independent of the particular idiosyncratic semantic restrictions. Therefore, for our purposes it suffices to observe that even if semantic selectional restrictions are part of the semantic representation, they need not refer to any semantic operators.

4 Analysis

As reviewed in Section 2, the architecture of linguistic signs proposed in PS94 does not discriminate between those part of the semantics of a linguistic sign that are relevant for local semantic phenomena such as those discussed in Section 3 and those parts that are important of CS phenomena such as operator scope. This would allow us in principle to write a lexical entry for a verb that selects for a universally quantified subject. However, as argued above, such a selectional restriction does not occur and should be excluded within an adequately constrained theory of selection.

Recently, techniques of semantic underspecification have been introduced to HPSG (Egg, 1998; Egg and Erk, 2002; Copestake et al., 2000; Richter and Sailer, 2003). While the major motivation for these systems stems from scope ambiguities, they provide a basis for introducing the desired distinction. In the referred systems, the logical form of a sign is no longer given as a single FS. Instead, it is a list of FSs, each of which expresses a small piece of the overall logical form. A general constraint, then, enforces that the overall logical form integrate those pieces. Scope ambiguity is expressed as re-ordering possibilities of such pieces of logical form. What is important for the present discussion is the following: one of the pieces of logical form can be considered the basic lexical semantic contribution of the sign.

We propose to divide the semantic contribution of a sign into two major parts: First, a CONTENT value which is part of the synsem FS and, thus, available for selection. Second, we add an attribute LF to the attributes defined on signs. The value of this attribute will be subject to the principles of compositional semantics. The CONTENT value on the other hand contains the basic lexical semantic contribution of a sign and is, thus, free of scopal effects. Instead, it will interact with the lexical semantic constraints.

In the talk, we will present a concrete realization of this proposal within the semantic system of *Lexical Resource Semantics* (Richter and Sailer, 2003).

5 Conclusion

In this paper, we addressed the traditional distinction between lexical and compositional semantics. We argued that the kind of information needed for the respective semantics is different. Finally, we showed that recent techniques of compositional semantics allow for a modular treatment of these two aspects of semantics and, consequently, enable us to express a more adequate theory of selection.

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