Systemic Functional Grammar in Natural Language Generation: Linguistic Description and Computational Representation

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Teich's book will be of interest to three groups of readers. First, specialists in Systemic Functional Grammar (SFG) will find a detailed description of the use of SFG theory for a specific application, a discussion of some fundamental problems in the theory that are revealed by the application, and proposals for a modification of SFG theory to handle these problems. Second, those working in natural language generation (NLG) will find a detailed discussion of why SFG is effective for NLG, an interesting comparison of the SFG-based Penman system with three other generation systems, and a description of a fully implemented SFG-based surface realization system for German.

The third group is less likely to read the book, but I recommend it to specialists in Head-driven Phrase Structure Grammar (HPSG). After identifying some fundamental problems in SFG theory, the author explains that these problems have been fully solved in HPSG. However, rather than abandoning SFG and adopting HPSG, the author prefers to try to integrate the HPSG-style solutions into the existing SFG theory. This conviction that the wider SFG framework has major advantages, so significant that they outweigh the identified problems, should be respected as deeply challenging for HPSG theory.

The basic approach to NLG, using SFG and the Penman system, has already been described in an earlier book (Matthiessen and Bateman 1991) from the same series, with examples from English and Japanese. Teich's distinctive contributions are the development of a large SFG-based grammar for German using the KOMET-Penman system, and a detailed analysis of the problems encountered due to the absence of any notion of head-daughter dependency within SFG theory. Comparing SFG and HPSG, Teich proposes a modification of SFG theory to allow the inclusion of dependency relations.

Chapter 1, "Introduction", presents the motivation for the book. The terminology used within SFG theory sometimes appears to be unnecessarily daunting. For example, we learn on p. 3 that the background is "linguistic theory as metasemiosis."

Chapter 2, "Theory and linguistic representation: Systemic functional linguistics," is intended as a short introduction to SFG theory. This is very well written for SFG specialists, but it covers an enormous amount of ground at great speed (even summarizing the theoretical differences between Hudson, Huddleston, Henrici, Halliday, Fawcett, and Berry) and is unsuitable as a first introduction to SFG. Instead, I recommend Berry (1975 and 1977). Although this old textbook was never intended to be used for any computational implementation, it gives a very clear account of how SFG actually works, and is especially good on realization rules.

Chapter 3, "Computational application: Grammar models in natural language generation," presents an interesting comparison of four different approaches to the use of grammars in surface generation: SFG in Penman, Meaning-Text Theory in GOSSIP, Functional Unification Grammar in COMET, and Tree Adjoining Grammar in Mumble-86 and SPOKESMAN.

As Teich points out, the key issue for SFG-based generators is when to choose which features from the system network. These decisions are taken in Penman by **choosers**, but the description of choosers (pp. 63–65) is obscure. In the example given (Figure 3.7), the PROCESS-TYPE chooser starts with an unexplained choice of static/nonstatic. This turns out to be irrelevant for verbal and mental processes, while it is the *only* distinction between relational and material processes. Why not call it material/nonmaterial? A more interesting issue here concerning the "generation gap" is the relationship between the Penman Upper Model ontology and these distinctions required by the grammar.

Chapter 4, "Description: A systemic functional grammar of German for natural language generation," gives a detailed description of the SFG-based grammar of German developed in KOMET. Although the details are mainly of interest for those working on German, this work has a wider significance as Teich accumulates evidence of the need for a head-dependency mechanism in SFG. The problems include government and case assignment in the clause, and lexical gender agreement in the noun group, which are highlighted in German but can be largely functionally motivated in English.

Chapter 5, "Computational representation: A proposal for dependency in systemic functional grammar," is, despite its title, mainly a discussion of noncomputational issues in grammatical theory. Teich describes the strengths of HPSG in handling head-dependency relations, and proposes a mechanism to support dependency in SFG. However, this proposal has important computational implications, as it includes reimplementing SFG in terms of typed feature structures, the formal basis underlying HPSG. Several computational systems for typed feature structures are listed, but the valuable work of Erbach (1994) (based on earlier work by Mellish) on multidimensional inheritance and typed feature structures for both SFG and HPSG is not mentioned.

Chapter 6, "Summary and conclusions," very briefly compares the strengths and weaknesses of SFG and HPSG, which are viewed as complementary. The discussion is theoretical and does not cover practical contributions such as the eclectic combination of ideas from SFG and HPSG in the SURGE generator (Elhadad and Robin 1996).

The book will be valuable to SFG specialists, and will also be of interest to others working in NLG, as it presents significant contributions in both fields. The suggested wider potential for synergy between SFG and HPSG remains to be explored.

References

Berry, Margaret. 1975 and 1977. *Introduction to Systemic Linguistics: 1 Structures and Systems* (1975), *2 Levels and Links* (1977). Batsford, London.

Elhadad, Michael and Jacques Robin. 1996. An overview of SURGE: A reusable comprehensive syntactic realization component. In *INLG'96 Demonstrations and Posters*, pages 1–4. Eighth International Natural Language Generation Workshop, Sussex, UK.

Erbach, Gregor. 1994. Multi-dimensional inheritance. In H. Trost, editor, *Proceedings of KONVENS '94*, pages 102–111, Vienna. Springer.

Matthiessen, Christian and John Bateman. 1991. *Text Generation and Systemic-Functional Linguistics: Experiences from English and Japanese*. Pinter, London.

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