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Luc Steels (Ed.)

Computational Issues in Fluid Construction Grammar

A New Formalism for the Representation of Lexicons and Grammars

Springer

Volume Editor

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Preface

Fluid construction grammar (FCG) is a new formalism for the representation of lexicons and grammars. It is fully operational and has been used in a wide range of case studies for different languages, both for studying specific grammatical phenomena and design patterns [2] and for investigating language learning and language evolution [3]. It is available for download at http://www.fcg-net.org/. FCG builds further on decades of research in formal and computational linguistics but applies these insights toward capturing the core ideas of a constructional approach to language [1]. This means that lexico-grammar takes the form of bi-directional associations between a semantic pole and a syntactic pole that capture, respectively, aspects of the meaning and the form of an utterance. In the case of FCG, these associations can be used unchanged either for parsing or for production.

This book is not a tutorial nor an introductory text on FCG. The reader is referred to [2] as well as the FCG website for such materials. Instead, it focuses on the many complex computational issues that arise when writing challenging real-world grammars. The book emphasizes depth of analysis rather than broad scope. It starts with Part I, Basics, which contains two papers. The first paper "Design Methods for Fluid Construction Grammar" by Luc Steels introduces some design methods that are currently used to write FCG grammars, emphasizing the use of templates that are computational abstractions over the intricate details that are needed to get operational reversible constructions. The second paper "Tools for Grammar Engineering" by Martin Loetzsch focuses on how grammar writers interface with the FCG system. This happens either through a Web-based graphical interface where both constructions and transient structures become active objects that can be inspected or through a text-based editor.

Part II, Implementation, discusses some of the aspects of the current implementation. The first contribution by Remi van Trijp entitled "A Reflective Architecture for Robust Language Processing and Learning" explores how the same representations and procedures for routine language processing can be reused for meta-level processing in order to handle problems or novelty in linguistic interactions, such as unknown words, ungrammatical utterances, or incomplete fragments. The second contribution by Kevin Stadler "Chunking Constructions" considers the problem of how a chain of constructions can be chunked together and stored as such in memory in order to avoid search and speed-up processing.

Part III, Case Studies, looks at a range of linguistic phenomena and shows each time how they can be handled in fluid construction grammar. Each contribution focuses on a particular human natural language which is representative for the phenomenon being studied. "Expressing Grammatical Meaning with Morphology: A Case Study for Russian Aspect" by Kateryna Gerasymova focuses on the complete system of expression of aspect in Russian. The contribution "Handling Scope

in Fluid Construction Grammar: A Case Study for Spanish Modals" by Katrien Beuls studies various typical challenges for grammars, such as syncretism (one form has multiple functions), scoping, sequencing of constructions, and handling of discourse context using Spanish modals as case study. Polish is the target language for a contribution by Sebastian Hoefer entitled "Complex Declension Systems and Morphology in Fluid Construction Grammar: A Case Study of Polish." Polish is notorious for a complex system of nominal declensions and this contribution shows that the design pattern of feature matrices can be extended to deal with them. The final case study entitled "Field Topology and Information Structure: A Case Study for German Constituent Order" by Vanessa Micelli studies a design pattern based on field topology. She shows how this pattern can be implemented in FCG and used to handle constituent ordering in the German main clause.

Part IV, Formal Analysis, looks at the formal foundations of FCG. The first paper by Joachim De Beule entitled "A Formal Deconstruction of Fluid Construction Grammar" defines the basic notions of FCG in a formal way. A companion paper by Josefina Sierra Santibáñez, "A Logic Programming Approach to Parsing and Production in Fluid Construction Grammar," compared FCG matching and merging with the standard unification operators of first order logic, which opens the door to using techniques from logic computation such as satisfiability problem solving to build alternative implementations.

The final part of this book, Part V Comparisons, takes a broader view and compares or seeks other implementations of construction grammar. The first paper by Nancy Chang, Joachim De Beule and Vanessa Micelli, entitled "Computational Construction Grammar: Comparing ECG and FCG," compares fluid construction grammar with another attempt at formalizing and operationalizing construction grammar, namely embodied construction grammar. The second paper, "Fluid Construction Grammar and Feature Constraint Logics," by Liviu Ciortuz and Vlad Saveluc tries to bridge the gap between FCG and mainstream unification grammars using feature constraint logics. Finally, the third paper, "Fluid Construction Grammar in the Brain," by Chrisantha Fernando describes the first efforts to find a neural implementation of FCG.

The papers in this volume attest to the rich research that is building up around fluid construction grammar, both from the viewpoint of linguistic case studies and from the viewpoint of language processing. It shows that deep language processing with precision grammars remains as challenging as ever and that many discoveries are still waiting to be made. This volume is just a stepping stone and much more work needs to be done.

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References

1. Goldberg, A.E.: Constructions: A New Theoretical Approach to Language. Trends in Cognitive Science 7(5), 219–224 (May 2003)
2. Steels, L. (ed.): Design Patterns in Fluid Construction Grammar. John Benjamins, Pub., Amsterdam (2011)
3. Steels, L. (ed.): Experiments in Cultural Language Evolution. John Benjamins, Pub., Amsterdam (2012)

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