

# Categorial Grammar: Logical Syntax, Semantics, and Processing

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The title of this book, *Categorial Grammar: Logical Syntax, Semantics, and Processing*, indicates that this will be a book about categorial grammar. In the preface, however, several strains of categorial grammar are discussed, including combinatory categorial grammar (Steedman 2000), pregroup grammar (Lambek 1999), and abstract categorial grammar (de Groote 2001), and it is clarified that the book investigates only the tradition of type-logical grammar, or rather, those grammars based on Lambek categorial grammar (Lambek 1958). That being said, this book contains a good introduction to type-logical grammar and its first part would make a good textbook in an advanced course on the theory of type-logical grammar. In particular, exercises are sprinkled throughout the book that will be illuminating to the uninitiated reader.

The book is neatly divided into three parts that are likely to be of varying levels of interest depending on the specific audience. Part I, titled “Lambek Categorial Grammar,” gives a concise introduction to a number of aspects of Lambek categorial grammar, which is suitable for an audience interested in the basic intuitions and mechanics of that grammar. Part II, titled “Logical Categorial Grammar,” introduces a number of extensions of Lambek’s grammar, each of which are motivated by linguistic considerations. This part is likely to be of relevance to linguists who are interested in the descriptive capabilities of type-logical grammar, but little attention is paid to computational aspects in this part. Part III is a collection of remaining topics that are loosely connected by their attention to processing. This part is directed towards those interested in psycho-linguistics and its connections to type-logical grammars.

Section 1 of Part I introduces the origin of type-logical grammar, which is found in the grammar of Ajdukiewicz (1935) and connected to Montague’s semantics (Montague and Thomason 1974). Section 2 introduces the syntax of Lambek categorial grammar, including the introduction of both a proof theory and a model theory. This section then discusses the cut elimination proof for the Lambek calculus, the logical system behind Lambek categorial grammar. Section 3 introduces the semantics for Lambek categorial grammar, including a discussion of the Curry–Howard isomorphism and its relevance to Lambek categorial grammar. Both Sections 2 and 3 include example sentences from English and analyses for those sentences that give the reader an insight into how type-logical grammar is applied to linguistic data. Section 4, titled “Processing,” introduces proof nets for Lambek categorial grammar as a more natural representation of type-logical syntax and semantics. Human performance on garden-path sentences is used to motivate the use of both proof nets, in particular, and type-logical grammar, more generally.

Part II begins with an identification of some linguistic shortcomings of Lambek's original grammar and introduces a number of extensions. In contrast to the broad introduction to Lambek categorial grammar given in Part I, Part II delves into more advanced material that is less well established. Section 5 introduces bracket operators for Lambek categorial grammar, motivated by examples of medial and parasitic extraction from English. This section, like the others in Part II, is short and has room only for the definitions and some linguistic examples. Section 6 introduces discontinuity operators, motivated by English examples of discontinuous idioms, quantification, VP ellipsis, medial extraction, and pied-piping, among other constructions. Section 7 introduces additive operators to Lambek categorial grammar to handle lexical ambiguity of prepositions more elegantly. Finally, section 8 gives a very brief introduction to modal Lambek categorial grammar and its application to English modals.

Part III, titled "Further Processing Issues," is much more loosely connected than the two preceding sections. Section 9 introduces the results of Caplan and Hildebrandt (1988) on the ability of aphasic speakers of English to understand certain sentences. The complexity of these sentences based on their analyses within Lambek categorial grammar is then analyzed and found to correspond to the experimental results. The primary purpose of this section appears to be a motivation for type-logical grammar from a psycho-linguistic standpoint. Section 10 introduces methods for pre-evaluating the syntax of a sentence using only the lexicon. Section 11 discusses a chart parsing algorithm based on the proof nets of section 4. This section lacks any analysis of running time, however, which is relevant due to the NP-completeness results for Lambek categorial grammar (Pentus 2006). Section 12 partially addresses these concerns through some philosophical arguments and offers some directions for future research.

The primary weakness of this book is that it remains quite firmly theoretical despite the fact that categorial grammar, in general, does not. Throughout the book, type-logical grammar is motivated via English examples and those English examples are not English utterances drawn from books or newspapers but rather carefully constructed examples such as those commonly found in mainstream linguistics research. As a result, the arguments made often have little relevance to mainstream computational linguistics. Furthermore, the relationship between type-logical grammar and more practically oriented categorial grammars such as combinatory categorial grammar (Steedman 2000) is completely overlooked. The end result is that much of the content of this book, especially Parts II and III, will remain inaccessible to a large portion of computational linguists.

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