

Combinators and Categorical Grammar

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Abstract From Ajdukiewicz onwards categorial grammar has failed to characterize adequately the twin roles of variable-binding operators and the variables they bind. Categorical grammars are, however, adequate for languages using combinators and dispensing with bound variables, but the combinators used hitherto have been insufficiently flexible to eliminate bound variables from languages which allow both higher-order quantification and multi-place functors, such as those of Leśniewski. This paper introduces seven multigrade combinators and shows how they can be used to eliminate bound variables from Leśniewskian languages, yielding logical languages as powerful as these but in perfect harmony with Ajdukiewicz's type of grammar. An alternative to multigrade combinators will also be considered and the significance of the result for the understanding of languages with more flexible category assignments is studied.

1 Introduction: Categorical grammar and bound variables The history of categorial grammar is usually said to have started with the 1935 paper by Ajdukiewicz [1] on syntactic connection. The practices Ajdukiewicz attempts to codify in the paper were applied explicitly by Leśniewski, although the basic principles of categorial grammar had already been enunciated without being applied by Husserl and had been applied without being enunciated by Frege. Ajdukiewicz's achievement consisted principally in the introduction of a notation for syntactic categories and an algorithm for testing the syntactic connection of strings of expressions. Since Ajdukiewicz's inception of categorial grammars they have been considerably refined in numerous ways, in particular in the direction of making them more adequate for natural languages (cf. [2] and the literature cited therein). Ajdukiewicz's account is, however, unsatisfactory in one crucial respect, which shows up in the treatment not of natural languages but of the languages of mathematics and logic which employ bound variables and operators binding

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