CATEGORIAL GRAMMAR

Categorial grammars are based on Husserl's idea of a logical grammar and of its formal constituents, the meaning categories (Fourth Logical Investigation). Husserl's analysis of incomplete meanings suggests the notion of a functorial category, therefore connecting to the definition given by Frege of unsaturated expressions. The category of a functor may be identified by the categories of its argument(s) and the category of the function value, as expressed by the algebraic notation, first introduced by Ajdukiewicz (1935).

Relevant subjects
Lesniewski's theory of semantic categories; Ajdukiewicz's syntactic connexion and exponent derivation as a procedure for sentence recognition; categorial grammar as a particular kind of phrase structure grammar; Bar-Hillel's bidirectional categorial grammars (1964); mechanical determination of syntactic structure; phrase structure grammars as devices for the generation of the set of grammatical sentences (well-formed strings) of a language vs. categorial grammars as devices for sentence recognition; categorial grammars within the Chomsky hierarchy.

SYNTACTIC CALCULUS

In Lambek (1958) a categorial grammar of a language may be viewed as consisting of the syntactic calculus freely generated from a finite set (s, n,...) of basic types together with a dictionary which assigns to each word of the language a finite set of types composed from the basic types and 1 by the three binary operations: product (.), left implication (\), right implication (/). The Syntactic Calculus is a deductive system L defining the set of types of a language and recognizing the set of its sentences.

Relevant subjects
Rules of functional application, composition, type raising, division; decision problem for the Syntactic Calculus; Heyting's intuitionistic propositional calculus without the structural rules of weakening, contraction, and exchange; Gentzen's decision procedure for the intuitionistic propositional calculus (1934); associative vs. non-associative systems; generative capacity (Pentus, Buszkowski, Kanazawa, Kandulski).

SYNTACTIC CALCULUS AND TYPE LOGICAL GRAMMARS

Inference rules and theorems of the Syntactic Calculus given by Prawitz-style natural deduction trees, where elimination rules of the two implications correspond to modus ponens, and introduction rules to hypothetical reasoning (Morrill 1994).

Relevant subjects
Grammar as deduction, linguistic composition and unbounded dependencies, English relative clauses; typing unbounded dependencies, extraction and disharmonic composition, coordination and islands constraints. Grammatical reasoning and the logic of residuation (Morrill, Carpenter, Moortgat).
LAMBEK CALCULUS AND NON-COMMUTATIVE LINEAR LOGIC

Lambek's Syntactic Calculus corresponds to the multiplicative and exponential free fragment of intuitionistic non-commutative linear logic. In fact the basic connectives of the Syntactic Calculus, the tensor product \( \otimes \), the left division \( \backslash \) and the right division \( / \), respectively correspond to the multiplicative conjunction and the two implications of Non-commutative Intuitionistic Linear Logic (NILL). This calculus is the result of the exclusion of the three structural rule of weakening, contraction and exchange.

Relevant subjects:
Classical non-commutative linear logic: sequent calculus and rules, theorems of the one-side sequent calculus, De Morgan laws and negation laws. Logical types and proof nets. Classical bilinear logic and Grishin rules (Girard, Yetter, Abrusci, Retoré, Lambek)

THE CALCULUS OF PREGROUPE

A pregroup \( \{G . 1 l r ->\} \) is a partially ordered monoid in which each element has a left adjoint and a right adjoint, where the dot \( . \) (usually omitted) stands for multiplication with unit 1, and the arrow denotes the partial order (Lambek 1999, ff.). In linguistic applications the symbol 1 stands for the empty string of types and multiplication is interpreted as concatenation. A Pregroup is freely generated by a partially ordered set of basic types; from basic types, simple types are formed by taking single or repeated adjoints; compound types, or types, are strings of simple types. To each word in the dictionary of the language is assigned one (or more) types. The only computations required are contractions and expansions. Developing a pregroup grammar for a language, such as Italian, consists in two main steps: (i) assign one or more (basic or compound) types to each word in the dictionary; (ii) check the grammaticality and sentencehood of a string of words by a calculation on the corresponding types, where the only rules involved are contractions, ordering postulates and appropriate conditions introduced in the lexicon, called metarules. Computations as mental representation and parsing (Miller).

Relevant subjects:
Unbounded dependencies in English and German, quantifiers and scope, clitics pronouns and inflection in Romance languages, linguistic composition in Latin, Arabic, Turkish, Japanese. A logically based linguistic typology.

BIBLIOGRAPHY


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