Preprint No. 29

Classification: S 1.3

TOWARDS A COMPUTATIONAL FORMALIZATION OF NATURAL LANGUAGE SEMANTICS

- R. M. Schwarcz -

INTERNATIONAL CONFERENCE

ON

COMPUTATIONAL LINGUISTICS

⇓

COLING

1969

KVAL
Forskningsgruppen
för
KVANTITATIV
LINGVISTIK

RESEARCH GROUP FOR QUANTITATIVE LINGUISTICS

Address: Fack Stockholm 40, SWEDEN

TOWARDS A COMPUTATIONAL FORMALIZATION OF NATURAL LANGUAGE SEMANTICS[1]

by Robert M. Schwarcz

System Development Corporation
Santa Monica, California, U.S.A.

[1]The work reported herein was supported by contract F33615-68-C-1473, Computer Aided Instruction Using Natural Language, for the training Research Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base, Ohio.

ABSTRACT

The formalization of natural language semantics is a problem central to a number of major academic and practical concerns. A semantic theory requires a formalized representation of messages, arrangements of morphological units, and the processes of encoding and decoding that relate them. Formal logic has provided a paradigm for semantics based on the notions of model, extension, and intension; with certain changes and additions, this paradigm indicates what is needed for a theory of natural language semantics. Possible computational avenues of approach to developing a semantic theory include machine translation, data management and information retrieval, language and picture processing, psychological modeling, natural-language CAI, and natural-language programming. Several linguists have developed semantic descriptions based on transformational grammar; the earliest of these regarded semantic interpretation as being derived from syntactic deep structure, while the more recent have regarded deep structure itself as being semantically meaningful. Computational approaches to date have treated semantics as a problem of translating natural language into predicate-calculus formulas, relational structures, or statements in a formal procedural language; the most significant of these approaches are those of Thompson, Simmons et al, Woods, and Kellogg. Considered individually, none of these approaches have produced adequate semantic theories for natural language, but all contribute something towards the formulation of an adequate approach.

An approach based on an operational theory of meaning is proposed as one that could lead to an adequate semantic theory. The approach is formulated in terms of a nondeterministic programming system which operates by goal-directed heuristic search and evaluation. Models are formulated in terms of hierarchical situation structures and operations on them, messages are programs in the system, and decoding and encoding are nondeterministic procedures programmed in the system. Possible implications of the approach for philosophy, linguistics, psychology, and computational applications are discussed.