

Dialogue project

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cognitive processes used by human beings in order to summarize texts. We intend to build a system which models the process of subjective understanding of episodes (based on interestingness and a personal view of the world) on the basis of MSRL. The representation of texts in MSRL are interpreted in order to get summaries and to answer 'how' and 'why' questions. The main goal of this research is to develop a theory of text understanding including both skimming and very deep understanding.

This research shall be done until 31st of October 1983 and is supported by the BMFT (Federal Government of Research and Technology) under grant PT135.01

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DIALOGUE PROJECT

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Linguistic, logical, and cognitive aspects of man-computer dialogues in natural language form the subject of an interdisciplinary research project at the Institute for Perception Research (IPO), a joint institute of Philips' Research labs and the Eindhoven University of Technology. At present the project group consists of Harry Bunt, Frank Leopold, Herman Muller, Floris van Nes, and Gemme thoe Schwartzenberg.

Since 1978 information dialogues between two people or between a computer and a human operator have been studied both experimentally (see Van Katwijk et al., 1979) and theoretically. A theory of information dialogues is emerging now, which is to serve as the basis for a rule-based dialogue system, capable of participating in information dialogues in a flexible way. A preliminary account of parts of the theory can be found in Bunt & Van Katwijk (1980, 1981). In this theory, an information dialogue is viewed as a sequence of communicative acts of a restricted type, called "dialogue acts." A dialogue act is defined by four components: 1. the speaker; 2. the addressee; 3. the communicative function; and 4. the ("propositional") content. Speaker and addressee are modeled as dynamic systems of propositions in an epistemic logical language, designed for this purpose (Bunt, forthcoming). The model of a dialogue participant describes the goals he wishes to attain, his beliefs concerning the discourse world, and his beliefs concerning the goals and beliefs of the other participant. Various levels of beliefs about beliefs are taken into consideration, as well as different strengths of beliefs. Dialogue acts are viewed as operations that modify the addressee's state (goals and beliefs), the communicative function of a dialogue act being defined as the function that specifies how the addressee's new state depends on the previous state and the content of the act. The dialogue system now being developed consists of 4 main components: a syntactic-semantic interpretation component, a pragmatic analysis component, an evaluation component, and a dialogue act generation component. Each of these components consists of several modules.

The interpretation component performs syntactic and semantic analysis of Dutch sentences, plus some preliminary pragmatic analysis. The syntactic-semantic analysis is modeled after the method of two-level model theoretic semantics (Bunt, 1981). This

method is based on ideas of Montague Grammar and on work on syntactic and semantic analysis by Harry Bunt, Jan Landsbergen, Remko Scha and others in the context of the PHLIQA1 project (see SIGART Newsletter, special issue on NL systems 1977, and Bronnenberg et al. 1980). The pragmatic analysis in this component consists of identifying the syntactic clues that provide information about the communicative function of the dialogue act that is expressed.

The pragmatic analysis component determines the communicative function of an incoming dialogue act on the basis of (1) the syntactic clues that were found; (2) the current model of the speaker. This determination depends crucially on the assumption that speakers in an information dialogue observe the felicity conditions obtaining for the dialogue acts they perform. Using a hierarchy of communicative functions, this module assigns to a dialogue act, of which the function has been partially determined on syntactic grounds, the most specific function for which there is no conflict with its felicity conditions given the current speaker model.

This component also contains a module for assigning 'indirect' interpretations to dialogue acts, i.e., for treating them as indirect speech acts. This module is always activated when no direct interpretation makes sense, given the current speaker model. It may also be activated in order to assign a second interpretation to a dialogue act. The evaluation component updates the system's current model of the speaker, given the communicative function and semantic content determined by earlier components. This may lead to changes in the model of the discourse world; such changes are indirect effects of dialogue acts, always mediated by changes in the speaker model.

The generation component produces dialogue acts which are subsequently expressed in natural language. (For the latter process, only ad hoc procedures have been considered so far.) Given the system's current goals and what is known about the partner's goals, a dialogue act is considered that would have the effect of achieving one of these goals. If all felicity conditions of the act are satisfied, this act is the one chosen; if a condition is not satisfied it is promoted to be a new subgoal, and so on.

It may be noted that the felicity conditions tied to the various types of dialogue acts play a role in 3 places in the system: (1) In the pragmatic analysis component, satisfaction of felicity conditions determines the assignment of communicative functions. (2) In the evaluation component, the modification of the speaker model consists essentially of adding the information that the relevant felicity conditions are satisfied. (Note that felicity conditions are always properties of the speaker's state.) (3) In the generation component, satisfaction or failure of felicity conditions directs, given a set of goals, the determination of an appropriate continuation of the dialogue.

Of the four components outlined above, a first version of the interpretation component is currently being implemented in PASCAL on a VAX11/780 computer; the other components are still in the design phase.

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KNOWLEDGE REPRESENTATION AND NATURAL LANGUAGE UNDERSTANDING

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ASSUMPTIONS

It is not necessary and it is even not advisable to translate the sentences into an internal representation [6]. It is preferable to keep them as they are, and to interpret them at variable depth. This concept consists of 3 aspects [4]: progressive description, multiplicity of inference strategies, and evaluation on demand of partial results.

EXPERIMENT

Here we are concerned with answering any question on a narrow semantic field. We supply the system with 70 sentences from a general encyclopedia, *le Quid*, concerning the development of young children. The answers are the result of elementary inferences which are described by conditional production rules [5].

Systems of a similar nature have already been set up (e.g., [9], [7]), but they use rigorous reasonings on groups of data, which are easily expressed (moon rock, or american warships are easily described by a small number of parameters). Our experiment tests methods of approximative reasoning on a group of non-formalized texts, which are small but significant.

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SURVEY OF NATURAL LANGUAGE PROCESSING

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The project is an attempt to develop a general linguistic frame-work for writing processing grammars for English (both for parsing and for generating). the techniques used are drawn from both linguistics and AI, but the motivation is largely that of theoretical linguistics - describing how sentence-understanding (and production) works, with the most general, adequate rules possible. The project is a continuation of a line of research which the investigator began some years ago.

This project has just begun (November 1981), and so far a version of Marcus' PIDGIN parser-writing language has been implemented, as a basis for constructing experimental grammars.

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