

INTRODUCTION TO THE DISCUSSION SECTION

As soon as the aim of natural language systems extends beyond the mere processing of isolated sentences or interaction with the user through isolated question-answer pairs, it becomes necessary for the system to maintain some sort of record of both the user's and the system's previous dialog contributions. In its simplest form, such a record would contain the objects being mentioned, and the recency of them being mentioned (the notion of "object" is used here in a broad sense, also denoting actions, events, states, etc.). Such a record may be exploited, for example, in resolving or generating anaphora, which in general may only refer to those objects that have been mentioned recently. Also the choice between definite and indefinite articles depends, among other factors, upon whether or not the objects being referred to have already been introduced in the previous dialog.

A slightly improved dialog record would not only contain the objects that have been mentioned, but also the (conceptual representation of) the dialog contributions themselves. This can be exploited, for example, in the analysis of argumentative structures in discourse, that is, for determining why one argument supports some other argument. More advanced forms would include representations of the current and previous dialog focuses, themes, dialog substructures, and dialog rules employed by the system, etc. The notion of "discourse model" has recently found wide acceptance for referring to this representation of the structure of a discourse.

However, when the user mentions an object in a dialog contribution, the system can assume that the user *knows* (or *believes* in the existence of) the mentioned object or the properties being attributed to it. These assumptions about the user must be taken into account in generating cooperative dialog contributions and certainly form part of the user model. For instance, from the UNIX commands the user mentions, the help system of Chin (1988) can draw assumptions about his/her level of expertise. Or, when the user asks, "Who is the present king of France?", a cooperative system might check the correctness of the user's belief that can be inferred from his/her question. Conversely, when the system mentions some fact, it can also assume that, from now on, the user knows this fact and regard it as being common knowledge, for instance within explanations.

Thus there seems to be some relationship between user models and discourse models, at least in view of the fact that entries that should be part of the discourse model might also possibly be contained in the user model in a similar form. At the user modeling meeting in Maria Laach, a talk by Ethel Schuster about this relationship provoked a lengthy discussion. Opinions that were propounded included that the discourse model and the user model are separate, but related to each other; that the discourse model is part of the user model; that the user model is part of the discourse model; that user model and discourse model are two sides of the same coin; and also that a discussion on the relationship doesn't make any sense since, as soon as the two concepts have been precisely defined, the problem will disappear.

It was agreed, however, that the discussion should be continued in written form in order to better pinpoint what issues are controversial and which ones are undisputed with respect to the question at hand. The discussion at the Maria Laach workshop was recorded on tape, so that transcripts could be prepared and distributed among the participants. Also, the first draft of each written contribution was circulated, so as to give the discussants the chance to respond to the rebuttals of their colleagues. Moreover, in order to filter out weaker contributions, all papers were subjected to an internal rating by all participants and reviewed by the editorial board of *Computational Linguistics*.

In order to increase the coherency of the discussion and to avoid redundant terminological definitions, two papers were chosen to form a common point of reference, namely Schuster's contribution and the paper by Grosz and Sidner (1986). The authors were told to assume that readers are familiar with these two works and to refer to them whenever possible in order to avoid redundancy. The papers should not serve as a target of repeated critique (as, for example, in the *BBS* journal), but form a common basis for the discussion.

Moreover, contributors were asked to define, as precisely as possible, in what sense they used the terms *user model* and *discourse model*. Most discussants regard the user model as containing "the system's beliefs about its users" (Schuster). Kobsa and Wahlster require that, in addition, "the user model be separable *by the system* from the rest of the system's knowledge" (Kobsa). And Cohen claims that "the user model must

Copyright 1988 by the Association for Computational Linguistics. Permission to copy without fee all or part of this material is granted provided that the copies are not made for direct commercial advantage and the *CL* reference and this copyright notice are included on the first page. To copy otherwise, or to republish, requires a fee and/or specific permission.

0362-613X/88/0100●●\$03.00

concentrate on information which is dynamic, has some potential for change”.

As far as the notion of discourse model is concerned, most discussants probably agree with Cohen's analysis that it includes “everything that should be derived from an analysis of discourse, to present a representation for the structure of the discourse, useful in subsequently responding”. And, following Grosz and Sidner (1986)—who, however, never used the term discourse model but only *discourse structure*—most contributors basically agree in that a discourse model consists of a linguistic structure (“the structure of the actual sequences of utterances in the discourse” (Grosz and Sidner 1986, p. 176), an intentional structure (the relationship between discourse segment purposes), and an attentional structure (“abstraction of the focus of attention of the discourse participants”, p. 177). Kobsa and Morik, in addition, discern a dialog memory which they regard as part of (Kobsa) or identical with (Morik) the attentional structure. Cohen slightly reinterprets the term *intentional structure*.

Two authors hold divergent opinions with respect to discourse models: Schuster defines them only as “containing representations of entities” mentioned in the ongoing discourse, “along with their properties and relations they participate in”. This view is countered by several discussants as being too narrow. Sparck Jones's concept of discourse model is somewhat broader than that of the other authors: She distinguishes between the system's world model, its user model, its system model (embodying, for example, its plans), and the system's text model (containing linguistically characterized text-based entities). The discourse model then, as defined by Sparck Jones, would relate these four different models.

The question as to the relationship between user models and discourse models has been answered by most authors in a set-theoretical sense with respect to whether or not contents are shared. That is, discussants investigated whether “the UM contains items that are missing from the DM; the DM contains items that are missing from the UM; and [whether] the two share some items” (Chin). Three different opinions were raised with respect to this kind of relationship: that the discourse model is part of the user model (Schuster); that the discourse model intersects the user model (Chin, Morik; Kobsa: that it intersects, but is nearly included); and that both models are separate, but still related to each other (Cohen, Wahlster). A number of arguments, counter-arguments, and illustrative examples are proposed by the discussants to support their standpoints.

However, Kobsa, Morik, and Wahlster claim that the relationship between user models and discourse models cannot solely be regarded from the point of view of the “contents being shared”. Kobsa argues that “extensionally overlapping notions may still prove useful if their intension highlights different aspects of a system”. He is skeptical, however, as to whether useful differen-

tial criteria can be found for separating user models from discourse models.

The aim of the preceding paragraphs was to outline basic common and divergent opinions, and thereby to provide a road map through the discussion. However, readers should bear in mind that it is somewhat problematic to summarize a discussion if one also participated in it oneself. The summary might easily turn into yet another position statement. Thus the preceding analysis should be regarded with caution.

The discussion will start with a summary of Schuster's position as presented at the user modeling meeting in Maria Laach. Then the other contributions follow in alphabetical order. In all papers, references to other position statements will be made by citing the name of the author only.

Finally, some information about the contributors:

David N. Chin is assistant professor of information and computer sciences at the University of Hawaii at Manoa. He conducted his Ph.D. studies at the University of California at Berkeley, where he worked on treating UC—the UNIX Consultant—as an intelligent agent that has its own goals, plans, and model of the user.

Robin Cohen completed her Ph.D. at the University of Toronto and has been assistant professor of computer science at the University of Waterloo since 1984. Her primary research interests are the development of pragmatic models for the analysis of discourse, and the application of these models to the design of user-specific interfaces to expert systems.

Alfred Kobsa is a project coordinator of the XTRA project in the German Special Collaborative Research Programme on Artificial Intelligence and Knowledge-Based Systems at the University of Saarbrücken, W. Germany. He is concerned with knowledge representation aspects and the development of a user model for the XTRA natural-language access system to expert systems. In his previous Ph.D. work at the University of Vienna, Austria, he developed the VIE-DPM user modeling system for the VIE-LANG natural language system.

Katharina Morik is internal project leader of the KIT-Lerner project at the Technical University of Berlin, working in the fields of knowledge acquisition and machine learning. She completed her Ph.D. thesis on belief systems and natural language understanding at the University of Hamburg in 1981. From 1982 to 1984, she worked on the *Hamburg Application Oriented Natural Language System* (HAM-ANS) with special emphasis being placed on user modeling and dialog strategy.

Ethel Schuster is a graduate student in the Department of Computer and Information Science at the University of Pennsylvania. For her dissertation, she is currently working on problems of reference to events and actions. She received her M.S.E. in computer and information science from the University of Pennsylvania.

nia in 1984 and her B.A. in computer science from Brandeis University in 1979. Her main research interest is in artificial intelligence, focusing on computational linguistics, natural language processing, user modeling, and tutoring systems. She has also done research work in code-switching and second language acquisition.

Karen Sparck Jones is a senior research associate and GEC Research Fellow at the University of Cambridge Computer Laboratory. She has worked on language and information processing problems since the late nineteen fifties, concentrating in recent years on inquiry interfaces and hence on the meaning representations and entity models these require.

Wolfgang Wahlster is professor of artificial intelli-

gence and database systems at the University of Saarbrücken, W. Germany. Besides user modeling, his interests include multimodal input into AI systems, natural language access systems, natural language generation, and explanation components for expert systems.

REFERENCES

- Chin, D.N. 1988 KNOME: Modeling What the User Knows in UC. In: Kobsa A. and Wahlster W., (eds.), *User Models in Dialog Systems*. Springer-Verlag, Berlin—New York.
- Grosz, B. and C. Sidner 1986 Attention, Intentions, and the Structure of Discourse. In *Computational Linguistics* 12;175–204.