Episodic Models in Discourse Processing

Teun A. van DIN

INTRODUCTION

In this chapter it is shown that models play an important role in both oral and written discourse processing. Although the term *model* has several other meanings, it will here exclusively be used to denote a specific kind of knowledge structure in memory. [1] In particular, the notion of model is intended here to account for the role of personal knowledge people have about real or imagined situations in the process of discourse production and understanding. In order to distinguish this notion from other uses of the term *model,* we speak of ***situational models.*** Such situational models are assumed to be representations of personal experiences and therefore are part of ***episodic memory.***

store particular information about each event or action—including verbal acts such as discourses—they have processed in short term memory. Since situational models are assumed to reside in episodic memory we also sometimes call them ***episodic models.***

Expressions in natural language in general, and discourse in particular, may be used to refer to, or denote, something "in the world" or in some sociocultural context. Discourse is about objects or people, about their properties and relations, about events or actions, or about complex episodes of these, that is, about some fragment of the world which we call a ***situation.*** A model, then, is the cognitive counterpart of such a situation: it is what people "have in mind" when they observe, participate in, or hear or read about such a situation. Thus, a model incorpo-

rates the personal knowledge people have about such a situation, and this knowledge has been accumulated during previous experiences with such a situation. Each new piece of information about that situation may be used to extend and update the model we have in episodic memory. For instance, I thus have a model of "shopping on Saturday," including the locations, shops, shopowners, my actions of buying, and the things I buy. And similarly, I have a personal model of "going to work," including going to a particular university building, information about the form and layout of the building, people with whom I work, and the kinds of things I do. Such information in memory is necessary to plan my actions, to execute these actions in a specific order, and to understand what others are doing in such situations. In this chapter, however, we show that such models of situations are also crucial in the understanding of discourse, because understanding (or producing) a discourse not only involves grasping the meaning of a discourse, but also understanding what it is about. From the shopping and going-to-work examples mentioned above, we *see* that models may be formed and transformed (updated or changed) about repeated personal actions or events, but of course we may also have a model of one unique situation, such as "the car accident I had last year in France." Also, models may typically involve highly personal knowledge about situations, but part of this information may also be shared by others or even by a whole sociocultural group, as is the case for important political or historical events. In other words, the episodic knowledge we have about situations may be more or less unique or general, and more or less personal or social. One of the tasks of this chapter is to indicate the specific role of models in discourse processing with respect to other (more general and social) knowledge of the world.

The analysis of this kind of cognitive models takes place against the background of a more embracing theory of discourse processing, as it has in part been elaborated together with Walter Kintsch (van Dijk & Kintsch, 1983). I briefly summarize some of the major points of that theory, so that the specific role of models can be explained in relation to this previous work.

There is growing interest in linguistics, philosophy, logic, cognitive psychology, and artificial intelligence in the role of models in language and discourse understanding. Although all this work cannot be reviewed here in detail, a next section offers a brief perspective on this other work and at the same time indicates our specific position among these various model theories.

The central aim of this chapter, however, is to provide some systematic hypotheses about the functions and the structures of situational models in discourse processing. Several researchers have recognized the

important role of models, but we hardly know what such models look like. Neither do we know in detail how models are formed, transformed, and actually used in processing discourse.

If people forro models of situations in which they participate or read about, it seems plausible that they also build a model of the communicative situation they participate in when producing or understanding a discourse (or when engaging in a conversation). Clearly such models are of particular interest for us, and we therefore also briefly pay attention to this special role of context models.

Finally, situation models should not remain theoretical components in a discourse-processing theory, but also should describe and explain empirical phenomena related to speaking, writing, listening, or reading. However, we can here mention only little experimental evidence, or make suggestions for relevant experiments, that exhibit the structures and functions of models.

We assume that situation models are equally necessary in spoken and in written discourse. Only the strategies for their actual use may be somewhat different in these two modes of communication. Yet, since context models are about the communicative situation, the differences between written and spoken discourse processing need to be represented in such context models.

Many of the situations modeled in episodic memory are social situations. This means that we might be able to apply and extend some of the insights from neighboring disciplines such as social psychology and microsociology into the structures of social situations. And conversely, our cognitive approach to discourse understanding may at the same time establish an important link with the relevant issues related to interaction and communication in these other disciplines by devising a theory of episodic models that incorporate such social information. Indeed, we have taken models to be some kind of knowledge structure, but it goes without saying that we not only have knowledge, in the narrow sense, about situations, but also personal beliefs, opinions, attitudes, and emotions. However, here we can only briefly draw some conclusions from this assumption, so that our cognitive theory of discourse should be supplied with an important social dimension in further work about cognitive models.

The discussion in this chapter is rather informal, although systematic. This means that we cannot go into many technical details of logical or cognitive model theories. Also, space limitations prevent us from specifying all aspects of the role of models in discourse processing, so that we can address only the major issues involved. Finally, cognitive model theory is a very recent development, so that many of our assumptions should be seen as, maybe very plausible, working hypotheses. Future

theoretical work and experimental research will need to specify the functions and roles of models in discourse processing. We do not repeat these final words about the limitations of this chapter in each section where such caution would be mandatory.

BACKGROUNDS: A STRATEGIC THEORY OF DISCOURSE PROCESSING

Situational models play a role in a more complex theory of discourse and discourse processing, of which some central notions are briefly mentioned in this section.

This more general theory of discourse processing should first be understood against the background of a general movement in several disciplines, since the early 1970s, toward an account of more natural language data, such as speech acts, language use in the social context, and actual texts or conversations (for a survey of these developments see van Dijk, 1985; for introduction, see Coulthard, 1977; de Beaugrande & Dressler, 1981). Within linguistics, this recognition of the importance of discourse phenomena has led to the development of so-called text grammars (van Dijk, 1972, 1977), in which notions such as local and global coherence were spelled out, among other semantic relationships among sentences in a discourse. Thus, global coherence of a discourse was formulated in terms of macrostructures that represent the overall gist or the topics of a discourse (van Dijk, 1980a).

However, an adequate account of the semantics, and hence of the interpretation, of discourse, in which notions such as coherence or macrostructure are an integral part, cannot be given without a cognitive dimension. Parallel to work in psychology and artificial intelligence about the cognitive processing of discourse, a theory was developed by Kintsch and myself about the comprehension of discourse (van Dijk & Kintsch, 1978, 1983; Kintsch & van Dijk, 1975, 1978). The major features of this theory can be summarized as follows:

1. Discourse understanding primarily involves the construction, by the language user, of a semantic representation of the input discourse in the form of a *textbase,* consisting of a locally and globally coherent sequence of propositions.

2. This process of constructive interpretation takes place in short term memory, but due to the capacity limits of short term memory this process must take place cyclically: input clauses are interpreted as propositions, propositions are coherently linked together and then gradually

stored in episodic memory, after which new clauses can be interpreted, and so on.

3. The processes of local and global interpretation also need various kinds of presupposed knowledge, e.g., as organized in frames or scripts (Schank & Abelson, 1977) within the memory of language users.

4. The various processes involved in understanding are supervised by a ***control system,*** in which, for each point of the interpretation process, the relevant topics (macropropositions), the actual goals of the reader/listener, and information from now-operating knowledge scripts are represented.

5. Finally, in van Dijk and Kintsch (1983), we have stressed and demonstrated in much theoretical and experimental detail that the processes of comprehension have a strategic nature (rather than a structural, rule-governed nature): understanding is gradual, on-line, often makes use of incomplete information, requires data from several discourse levels and from the communicative context, and is controlled by individually variable goals and beliefs. Such a strategic theory is intended to be more flexible and should be a better approximation of what language users really do when understanding (or producing) a discourse.

We see that one result of understanding a text is a representation of the meaning of the text in (episodic) memory, in the form of a textbase. However, this is not enough. In van Dijk and Kintsch (1983), it was also shown that discourse understanding requires the kind of situational models we have mentioned in our introduction. Thus, besides a textbase we also need a particular knowledge structure, in the form of a situation model in episodic memory. The textbase in that case would represent the actual meaning of a text, and the model would represent the situation the text is about (referring to, or denoting). We enumerated many arguments to explain why a model needs to be postulated in addition to a textbase. In accordance with other work on models that we mention below, for instance, such models would allow us to account for many referential aspects of discourse, such as coreference (and pronoun understanding), and local coherence between propositions. In this way we were able to build into the cognitive theory earlier ideas from logical and linguistic approaches to the semantics of discourse (van Dijk, 1973, 1977), using notions such as reference, interpretation relative to "possible worlds" and (logical) discourse models. Yet, although we mentioned several crucial uses for cognitive situational models, we did not specify the strategic processes of model formation, transformation, and use, nor did we have an idea about the possible structures of such models. It is the task of this chapter to fill these gaps.

MODELS IN FORMAL SEMANTICS

The theory of models in cognitive psychology owes part of its inspiration to logic and linguistics, in particular to formal semantics. Also in formal semantics, models are constructions used to formulate interpretation rules for expressions in some formal or natural language. In that respect, formal models can be seen as abstract reconstructions of the world to which expressions may refer. Expressions, such as sentences, are interpreted relative to such a formal model. Besides an interpretation function, a model consists of a model structure, featuring, for instance, a set of individuals (objects, persons, etc.). A predicate such as *is sick* can then be interpreted as a subset of these individuals, viz., as the set of sick people. With this elementary picture of the world, formal semantics can specify truth conditions for sentences. In philosophy and logic, such truth conditions have often been identified with the meaning of sentences. Since the mid 1970s it has been shown, however, that in order to interpret many other aspects of natural language sentences, such as modalities, tenses, adjectives, deictic expressions (such as *I, you,* or *here),* or natural connectives, model structures should be much more complex. Thus, we may need a set of "possible worlds" (among which our own, historical world is a special member), times or locations, and contextual features such as speakers and their information sets (Hughes & Cresswell, 1968; Keenan, 1975; Guenthner & Schmidt, 1979).

For our discussion it is more relevant to point to an important limitation of this kind of formal semantics and its models: it only is designed to interpret isolated sentences, not discourse. In recent years, however, there has been a development toward the formulation of discourse models (Stenning, 1978; Nash-Webber, 1978, 1981; Kamp, 1981), after earlier work in linguistics about the formal semantics of discourse (van Dijk, 1973, 1977; Petófi & Rieser, 1974), and after earlier suggestions by Karttunen (1975), introducing a notion such as "discourse referent." A discourse model should account for the fact that we do not just have a set of (unspecified) individuals, but a set of specifically described objects and persons, gradually introduced by the expressions of the text. Different expressions, thus, may refer to the same individual discourse referent, but we may find changes of time or location. Also, different speakers may be involved, as is the case in conversation. In other words, the interpretation rules and the necessary models become much more complex. They should, as it were, account for the dynamic nature of the gradually developing description of events and episodes. A model, thus, should permanently be updated, as should cognitive models.

It should be stressed, though, that formal models are merely highly abstract and reduced reconstructions of events and episodes, and we show below what else is needed in cognitive models in memory.

MODUS IN PSYCHOLOGY AND ARTIFICIAL INTELLIGENCE

Also in cognitive psychology and artificial intelligence, there has been increasing interest in the notion of episodic model. Thus, also inspired by ideas from logical semantics, and in order to account for specific problems of inference and the interpretation of pronouns, Johnson-Laird and collaborators have discussed the role of mental models (Johnson-Laird, 1983; Johnson-Laird & Garnham, 1980; Garnham, Oakhill, & Johnson-Laird, 1982; Garnham, 1981). That models play an essential role in the planning of our future actions, and that they allow us to use our past knowledge in such actions, has already been stressed earlier in psychology (e.g., by Craik, 1943; also quoted in Johnson-Laird, 1980). In this latter paper, Johnson-Laird argues at length that the meaning of sentences in natural language cannot simply be reduced to propositional representations, but that models are necessary:

> Mental models and propositional representations can be distinguished on a number of criteria. They differ preeminently in their functions: a propositional representation is a description. A description is true or false, ultimately with respect to the world. But human beings do *not* apprehend the world directly; they possess only internal representations of it. Hence a propositional representation is true or false with respect to a mental model of the world. In principie, this functional difference between models and propositions could be the only distinction between them: there need be nothing to distinguish them in form or content. . . . A model *represents* a state of affairs and accordingly its structure is not arbitrary like that of a propositional representation, but plays a direct representational or analogical role. Its structure mirrors the relevant aspects of the corresponding state of affairs in the world. (p. 98)

The last sentence in this quotation seems to suggest that there are differences, at least in form (propositions have arbitrary structure, and models may be analogical representations and be partly imagelike), and we may assume that there are also differences in content. Thus, the proposition "Last Saturday I went shopping" is conceptually much more simple than the complex personal knowledge structure, that is, the model, I have about such a situation. One of the uses Johnson-Laird (1980) sees for mental models is to explain specific inferences that may be drawn (or not) from sentences featuring spatial tercos such as *to the right of.* One of his examples is that, if we say of people around a round table that if B is sitting to the right of A, and C to the right of B, the

transitive nature of a predicate "to the right of" breaks down: the last person in the series would sit on the left of A, and not on the right. A mental model, which would capture an analogical (spatial) representation of reality, would faithfully show why the inference in this case does not hold. Indeed, as Johnson-Laird (1980, p. 104) also states, a model is not only based on information from the propositional representation, but also incorporates general knowledge and other relevant representations. In an experiment it was shown also that a (new) model was built up more easily if propositions describing dimensions of a spatial layout of objects are presented in a certain continuous order (Ehrlich, Mani, & Johnson-Laird, 1979). It was also assumed that models are easier to recall, whereas propositional recall would also display memory for verbatim structure.

Johnson-Laird (1983) elaborates these various ideas in more detail within a more embracing theory of meaning and interpretation in formal psychology. Although his notion of a mental model is close to our situational model concept, his illustrations are mainly within the framework of formal grammars of (isolated) sentences. One major reason for introducing the notion of models that both approaches share, however, is the importance of dealing with (co)reference in psychology. Whereas Johnson-Laird is more interested in inferences and reasoning, I here use the notion of situational model rather for the interpretation of discourse. Also, we pay more attention to the structures of models in terms of cognitive representations of situations, borrowing suggestions from other domains, such as social psychology and sociology. Finally, I hope to show in more detail the cognitive processes, such as interpretation strategies, involved in the use of models, and to make a distinction between ad hoc or particular models and more general models in episodic memory—which form the experiential basis for frames, scripts, or similar more abstract knowledge representations in semantic memory. Important, however, both for mental models and for situational models, is that they are distinguished from semantic representations of sentences or discourse.

Garnham (1981) seems to take one step further and assumes that these mental models are the representation of a text. The text meaning, its semantic representation, is only needed to form the model, and will after that no longer be necessary. As was shown also in van Dijk and Kintsch (1983), I assume that the propositional textbase, representing the meaning of a discourse, is not only used to construct (or to retrieve) an episodic situational model, but must be represented independently: we simply do have memory, at least for certain texts and contexts, for the specific different meanings of a text even if they are about the same

situation. The ordering of the propositions in a story may be different, and yet describe the same situation. Such different meaning structures may have different pragmatic implications and be required in different social contexts of communication. This does not mean that because people also construct a model and use this for further inferences, they will not often confuse different descriptions for the same individual (Garnham, 1981, p. 561). Similarly, Garnham was able to show that for certain prepositions, as in the sentences *The hostess bought a mink coat from the furrier* or in *The hostess bought a mink coat in the furrier's,* people will tend to confuse the originally used prepositions in recognition tests and similarity ratings. This is the case if the respective sentences describe more or less the same situation, that is, if a model is used to retrieve the original information.

Foss (1982) uses the term ***discourse model*** to explain that for certain high-level propositions in such a knowledge structure, the priming effect of concepts remains constant during a stretch of the text, instead of rapidly decaying, as was assumed in earlier work on semantic priming. Foss argues that language users construct and update a semantic model "in which reside entities representing elements and relations in the world of a speaker" (p. 594). However, it is not quite clear here, as in similar work about the role of models in discourse understanding, what the precise difference is between a semantic representation and a model of a text. One could in this case easily explain the results of the experiments in terms of semantic macrostructures (topics) of a text. These also stay active during the understanding of the relevant fragment of a text (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; van Dijk, 1980a).

Finally, Fletcher (1983) presents some experimental evidence for a tripartite distinction in memory for discourse among the surface structure, the semantic (propositional) representation, and the situation model. Thus, distractor items are easier to reject if they are at variance with the model than those items that only differ from textbase propositions.

From this brief view of some relevant work, we may conclude that there is some convergence about the general hypothesis that in addition to a semantic representation of a discourse we also need a situation model in memory, and that such a model plays an important role in such tasks as making inferences, drawing pictures, recall, and recognition. Obviously, much more experimental evidence needs to be accumulated. Also the precise structures and functions, and the differences with textbases, should be spelled out in more detail. One line of future experimental work could investigate when and how information from situa-

tion models, that cannot directly come from or be inferred from the original propositional representation of a text, is used in later tasks. Systematic recall and recognition errors or confusions for textual information may be expected as soon as subjects use situation models as dominant retrieval bases (see below). These expectations are in accordance with earlier work such as the experimenta by Bransford and his associates (see, e.g., Bransford & Franks, 1972).

In artificial intelligence, it has aboye all been the work of Roger Schank about scripts and the process of reminding that bears resemblance to our notion of a situation model (Schank, 1982). In the earlier work, scripts, taken as more general knowledge-representation formats (Schank & Abelson, 1977), were considered to be organized clusters of information about stereotypical events, such as eating in a restaurant, going to a party, or taking a bus ride. This kind of general information, which is largely socially shared, would be part of semantic long term memory. Yet, Schank (1982) later stresses that the knowledge we use for various tasks is primarily episodic: a script should rather be seen as the knowledge we have represented about some particular personal experience, as in the previously mentioned example of "my car accident last year in France." Only fragments of such scripts would have a more general nature; these are called Memory Organization Packages (MOPS). Thus, each train ride, which as a whole is unique, will contain some stereotypical episodes, such as buying tickets, getting into the train, and searching for a seat, and may therefore be represented as MOPS.

Schank's (personal) scripts and our situational models have been developed independently and from rather different perspectives. Yet, as episodic representations of personal episodes, they are very similar, especially in their relation to more general knowledge structures. The approach of my work with Kintsch, however, is formulated rather in terms of cognitive interpretation strategies (for discourse), and with the aim of providing an explicit cognitive semantics for coreference, coherence, and similar phenomena. We distinguish between particular models and generalized models, and further assume that models are built and searched for according to standard categorical structures, viz., a model schema. Finally, we would reserve a much more modest role for processes of reminding within the general framework of model retrieval strategies. As is shown in more detail below, models in our case are retrieved by conceptual structures in, e.g., the semantic representation of discourse, for instance macropropositions (themes), after having been inserted into the overall, monitoring control system. Future work will have to show whether and how various notions such as mental models, personal scripts, and situational models can be integrated into one theo-

retical framework for the representation of episodic knowledge and beliefs and for use in processes of understanding, representation, retrieval, updating and the processes relating episodic (personal) memory and semantic (social) memory.

MODEL STRUCTURES IN MEMORY

Before we are able to specify the functions of models in the processing of discourse, we should specify what such models look like. Suggestions for these internal structures of situational models in memory may be drawn from various sources in philosophy, psychology, linguistics, and the social sciences. Although in each case many technical and methodological problems are involved, we focus only on the major conclusions.

Situational Models versus Real SItuatIons

If situational models in memory can be taken as cognitive reconstructions of the kind of world fragments we have called situations, the structure of such real situations may have some analogies with models. It is however an old insight in ontology and epistemology that the structure of "what there is" is closely related to "what we (can) know" about reality. Indeed, as Johnson-Laird (1983) points out: we only grasp reality via our models (see also Lippmann, 1922). This means that our intuitive, commonsense notions and categories used to interpret reality are in fact notions and categories that make up our models of reality. Thus, we usually distinguish between different, discrete entities, such as different objects or persons, and do not see reality as one continuous mass. Similarly, we distinguish different natural categories of such entities, such as tables, chairs, women, or theories. Also, individuals of some category may be seen as having certain properties or as being parts in some relation. And finally, individuals being assigned such properties or relations make up processes, events, or actions, that is, "facts" of some real or imagined situation. These various types of things also appear in the logical models encountered aboye. Yet there are also differences between real situations and their cognitive counterparts. For instance:

1. Since we cannot and need not know all facts of the world, cognitive models are typically fragmentary and incomplete.
2. Models may represent real situations at different levels of generality. Thus, we may globally represent in a model the complex action "John made a trip to Portugal," whereas in reality this action consists of

a highly complex and continuous sequence of events, actions, objects, and people, of which only a small subset appear in the model.

3. The concepts in a model are not arbitrary but reflect socially relevant interpretations of situations. For instance, the transmission of an object from one person to another in some social situation may be seen as "giving a present."

4. Apart from the social constraints on conceptualizations of situations, cognitive models are of course personal or subjective: the same situation may be interpreted in different ways, from different perspectives, and with individually different goals in mind, by different people.

These and other specific features of cognitive models have been formulated, sometimes in different terms, in several approaches in the social sciences, and we should take them into account in our theory of model structures in memory. And conversely, our cognitive model theory is intended as a systematic explanation of the well-known features of "understanding the world" mentioned aboye.

Language and Discourse

In our discussion about formal semantics we have seen that language use and discourse are also related to the world. Thus, we may describe situations in discourse and its sentences. Language users in that case express their interpretation of the world, their models, and we may assume that this expression is not arbitrary. Indeed, various functional grammars (Dik, 1978; Givón, 1979) stress that, for instance, syntactic structure is functionally related to underlying semantic representations (and to communicative acts). These are taken to consist of a predicate (often expressed by a verb phrase) and a number of arguments with different roles, such as agent, patient, instrument, or goal. Apparently, such functional categories show how we analyze the structure of action, for instance. In other words, syntactic and semantic categories tell us something about the makeup of our models of reality.

Similarly, discourse structures tell us something about our understanding of episodes, i.e., sequences of events or actions, as is the case for the respective sentences in a story. Oyeran macrostructures (topics), and their expression in, for instance, titles, show how we are able to represent higher-level, more abstract, structures of situations. These stories may feature conventional categories, such as a setting and a complication, that show how we can organize episodes in different categories. The same holds for the sentential and textual differentiation

between foreground and background, or the special categories for time, place, or circumstances (van Dijk, 1977, 1980a). In other words, syntactic and semantic structures of sentences and discourses are not arbitrary; they reflect basic categories and structures of our cognitive models of reality.

Social Cognition and the definition of Situation

In social psychology and microsociology there has long been interest in the objective and subjective features of situations and their role in the understanding of interaction (for detailed reviews see Forgas, 1979; Argyle *et al.,* 1981). In order to be able to participate in social situations, social members need models of such situations. These represent what traditionally has been called the "definition of the situation" (Thomas, 1928). Such models are accumulations of previous, biographically determined experiences of (similar) situations (Schutz, 1970).

Forgas (1979) in his review shows that most work on situations deals with holistic properties of situations, such as variations along dimensions such as pleasant vs. unpleasant, relaxed vs. formal, involved vs. uninvolved. How people are able to make such overall evaluations is not spelled out. He also shows that despite the many different taxonomies of situations, there are only a limited number (some 30) of basic everyday social situations.

Argyle *et al.* (1981) conclude from much theoretical work that social situations and their component interactions are analyzable into categories such as (1) persons and their properties, (2) social structures, such as status and role, (3) elements of interaction, such as friendliness, (4) relevant objects of attention, such as drinks or food at a party, (5) the environmental setting, such as boundaries, props, or spaces, and (6) rules and conventions that specify what actions may or must be performed in such situations. These elements systematically determine how people act and understand each other's actions.

This renewed research about the structures and the interpretation of (social) situations also has common historical sources with work on cognitive models. Thus, Lippmann (1922) in his book on public opinion not only provided important new ideas about the nature of social stereotypes (a notion introduced by him), or about the properties of news, but based his theoretical analysis of public opinion on a notion "pictures in our heads" that is similar to the notion of a situational model:

> For the real environment is altogether too big, too complex, and too fleeting for direct acquaintance. We are not equipped to deal with so much subtlety, so much variety, so many permutations and combinations. And although we have to act in that

environment, we have to reconstruct it on a simpler *model* [italics added] before we can manage with it. To traverse the world, men must have maps of the world. . . . The analyst . . . must begin, then, by recognizing the triangular relationship between the scene of action, the human picture of that scene, and the human response to that picture working itself out upon the scene of action. (pp. 16-17)

The very fact that men theorize at all is proof that their pseudo-environments, their interior representations of the world, are a determining element in thought, feeling and action. For if the connection between reality and human response were direct and immediate, rather than indirect and inferred, indecision and failure would be unknown. (p. 27)

These statements of a journalist of more than 60 years ago are still very pertinent today, and would not be out of place in a contemporary study of cognitive social psychology (except for the reference to "men" who traverse the world and theorize . . .). We also find early suggestions for the application of cognitive model theory in the study of social stereotypes and group representations to which we briefly turn at the end of this chapter.

Situation Schemata

Our final step in this section is to bring together the various suggestions discussed into a first sketch for a theoretical framework. The basic idea we propose is that people make use of so-called situation schemata to build situation models. That is, people make models all the time, and this process is not arbitrary, nor very much context dependent. Rather they use more-or-less stable categories for the kinds of things that should make up a situation model. This also means that people use effective strategies to build models (van Dijk Kintsch, 1983), which implies that they analyze different situations in much the same way. Only the contents differ to make different models: the schematic skeleton of each situation is more or less invariant (although for some situations not all categories are always relevant). In Figure 5.1 we have made an attempt to put together the various situational categories we have met aboye. The terminal nodes of the schema are filled by sets of propositions, which again may be summarized by macropropositions. [3] This kind of schema is similar in several respects to schemata we find elsewhere in the literature (P. Brown & Fraser, 1979), especially in work about story structures, in which narrative structures are often identified with the structure of real world episodes (van Dijk, 1980b). Also, the schema is rather close to the functional structures underlying the semantic representations of sentences (Dik, 1978; Givón, 1979). Yet the difference with an actual representation of a particular discourse (the textbase) is that the model schema may take much information in its
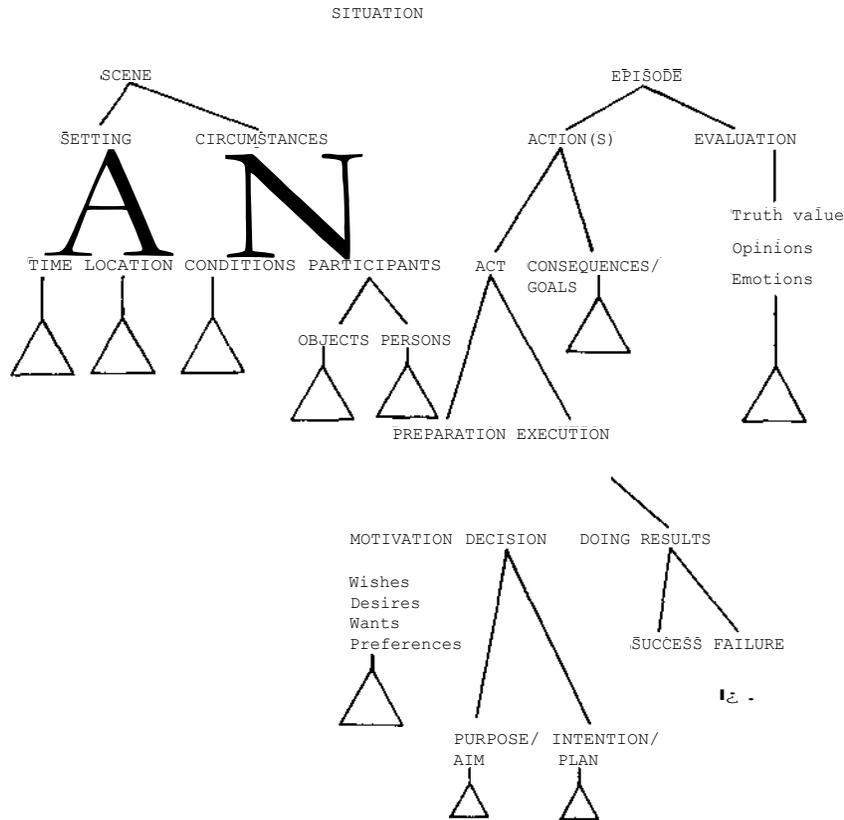
SITUATION

FIGURE 5.1. The schematic structure of a situational (action) model.

terminal categories that is not and need not be expressed in sentences or discourse, e.g., because it is presupposed general knowledge or personal episodic memories that are not relevant in a particular discourse. These differences between textbases and models are considered below.

Another feature of a situation schema is that for various of its component categories, such as (human) participants or action, people also have general knowledge schemata: they have intuitive theories of persons and of actions and, if relevant, these may become part of the model schema.

For reasons of simplicity we have assumed that the terminal nodes of model schemata are filled by propositional (macro-) structures. We have assumed earlier, however, that models need not only be propositional, but may also feature analogical information, such as the structural lay-

out of locations, the spatial relations between objects, and configural properties of objects and persons (see Johnson-Laird, 1983, for a discussion). The schema merely shows that, whatever the kind of information about situations involved, people make systematic distinctions between, e.g., settings, circumstances, participants and their actions, or the various properties of these components. Finally, the schema allows us to assign overall properties to a situation, both at higher (macro-)levels, and lower (micro-)levels. A birthday party, as a whole, may be boring, and so may individual people at the party. In other words, beliefs and opinions of people can also be part of their modeling of situations. In the description of a situation, such beliefs and opinions might only appear indirectly, viz., in the form of specific stylistic choices of words, which would usually not be represented as special propositions in the textbase. Rather, the choice of, for instance, *hooligans* instead of *demonstrators* in a news story (see, e. g., Halloran *et al.,* 1970), would express an evaluative proposition that is part of the model the journalist has of the demonstration (see also van Dijk, 1987b,c).

Finally, we should of course allow for the possibility that models are complex, i.e., consist of other models. That is, within the overall situation of a birthday party, we may have the more specific "situation" of a fight or a tire, requiring its own time and circumstances, and its own subset of participants and events. Typically, the embedding situation may in that case function as some sort of background, e.g., in a circumstance category, for the foregrounded situation. More in general, we may assume that models are not just isolated knowledge structures in episodic memory, but are systematically linked along one or more categories or dimensions, such as "the time I visited California last year," or situations in which "Harry was a participant." Such links enable the combination or even fusion of particular models, but also the process of reminding as described by Schank (1982).

THE FUNCTIONS OF MOdUS IN diSCOURSE COMPREHENSION

We started this chapter by assuming that models play an important role in discourse processing. More specifically, it was suggested that situational models provide the episodic knowledge base for the understanding of discourse. They are what a discourse is about. We have also seen that, when hearing or reading a discourse, people do not only construct its meaning in the form of a textbase, but at the same time they build or retrieve from memory a model which represents what they

imagine of the situation the discourse is about. Although this assumption may seem plausible for several reasons, we still do not know exactly how this use of models takes place. In this section I try to specify some of these functions of situation models. Although models play a role in all kinds of information processing, such as in perception and action, I limit the discussion to discourse processing.

The Episodic Nature of Models

It has been assumed that situation models are part of episodic memory. This means, first of all, that they represent the personal experiences of people. Yet this criterion is still rather vague. Strictly speaking, we would in that case have models only of situations in which we have participated ourselves, at least as observers. We think that this condition is too strict, however, and we assume that we also may construct (and retrieve) models on the basis of indirect information, e.g., from stories or other discourses. If John tells us about a fight during a birthday party, we try to model that fight and that party much in the same way as if we had been there ourselves. This is possible because we have partial information about specific particulars from John's story, but we also have general frame or script knowledge about fights and parties, as well as our own previous experiences of parties, that is, personal party or even fight-at-party models. These various information sources allow us to make at least part of the model of the situation John is telling about. Obviously, if we had been at the party ourselves, our model would have been more complete. The same takes place, we assume, when people read or hear the news. Models that have been constructed about the same situation, such as the civil war in El Salvador or the Israeli invasion of Lebanon, on the basis of previous news items about these topics (and information from war scripts), are updated with new information (van Dijk, 1987b,c). The specific episodic nature of these models in this case resides in the fact that we will also represent when and where and by whom we were told about the new events (Tulving, 1983).

Particular and General Models

Situations are, by definition, unique. They embody events or actions that are defined by particular time and place parameters and a unique series of events or actions and their participants. This would also imply that our models of such situations would be unique. Again, we find this condition too strict. Of course, we do have unique models of unique experiences (or situations read about), and we are sometimes even able

to retrieve such particular models from memory, for instance if they are about highly interesting or prominent situations in our lives, or if they are linked with deep emotions. In that case, new situations may indeed remind us of these specific occurrences.

However, such a theory of episodic models would not explain what seems to go on when we understand a discourse. Especially, we would like to make explicit what goes on in the process of updating our personal knowledge. We therefore make a distinction between particular and generalized models. A particular model is, indeed, the unique representation of a unique situation we are involved in or read or hear about. This unique model is constructed out of the following kinds of information: (1) fragments of general models we already have, (2) information from the present discourse/observations, (3) instantiated fragments of general semantic knowledge. In other words, each particular model is an ad hoc construction, a composition of other forms of knowledge. After discourse understanding, that particular model is seldom of any use anymore, however, and we assume that the new elements in this particular model are used to update the more general models we have. The information about a particular fight at a particular party may be used to update our personal knowledge about fights and parties. Only on some later occasions do we need the particular model, for instance when we want to tell a story about it. For most everyday situations, however, this uniqueness is not required. The respective situations of our everyday working, shopping, household, or seeing-friends activities hardly need be kept retrievable as particular instances. Rather, we combine information from the particular models into more general (but still personal!) models of such situations. In such cases, the general model is defined in terms of the same location, maybe same time periods, same participants, and same types of action or events. We abstract from irrelevant details of the circumstances or the actions. It should be stressed that such generalized models do not contain the same kind of general, stereotypical, knowledge as is usually represented in frames or scripts. This information is socially shared and is not about particular locations or participants, but only about general cultural properties of social situations, such as having drinks or giving presents at a birthday party. Such social scripts may provide part of the structure of general models, but only by substituting general terms by particular terms. In fact, our personal models may be rather different from the social scripts.

We make an even stronger assumption: general script information is only used through its instantiation in a general or particular model if people understand a situation or a discourse about it. If I model a birthday party I went to, I model the fact that I gave a present and that I had

drinks or had a conversation with John. Formally speaking, then, scripts would at most define possible models. A script would define, socially speaking, what kinds of models we could call birthday parties. Our accumulated experiences of birthday parties, that is, our general model of such parties, may embody recurrent personal facts that are not at all present in the social script. If we use our personal models for the formation of social scripts, viz., in processes of social learning, then we will in general abstract from such specific personal experiences. We normalize our experiences by comparing them to those of others, e.g., when we understand and store their stories and their models of similar situations. Many episodic (general) models do not even have a corresponding script.

The fact that we may have personal models of unique events of course does not preclude the existence of socially shared knowledge about such events, especially when they have been communicated by the media. Many people have a personal model about the assassination of President Kennedy, often paired with specific contextual information (about when and where they heard that news; see R. Brown & Kulik, 1977), but personal models of unique events may be shared and thereby become social knowledge. In other words, not all social knowledge is frame- or scriptlike, as is the case for recurrent, stereotypical episodes in some culture. Interesting for our discussion is that this shared social knowledge about public events may be presupposed in discourse.

The Strategic Use of Models

Like all knowledge, models are used strategically during discourse processing (van Dijk & Kintsch, 1983). The strategies for the use of models are geared toward an effective use of relevant personal knowledge. For instance, in order to understand a story about a birthday party, we probably need not retrieve all we know about such parties, either socially or personally. Maybe only fragments of our models are necessary, depending on goals, text, and context. And we assumed aboye that in order to construct a particular model for the situation we are confronted with, it may be necessary to combine these various fragments into a new, ad hoc model. Let us try to specify these assumptions more systematically by enumerating the strategic moves people may go through when using models:

1. *Communicative context.* First, people participate in and understand the communicative context in which the discourse they read or hear should be interpreted, and therefore retrieve particular or general

models of similar previous contexts, e.g., a job interview or a lecture (see below). At this point it is relevant that communicative context models may as such be used to retrieve relevant situation models the discourse in such context may be about. For instance, a job interview model may be used to retrieve models of previous job interview experiences; reading the newspaper activates sociopolitical and public event models.

2. Goals and interests. More specifically, not only the type of communicative event but also our actual goals and interests may as such—that is without having yet read or heard the discourse—be used to activate or retrieve particular situation models. I may read the newspaper with the intention of getting new information about the latest developments in Central America, and such a specific goal may already have triggered my personal Central America models.

3. Titles, announcements, and initial thematic sentences. Expressions of fragments of the macrostructures (topics) of a discourse, e.g., in the title or the initial thematic sentences, are not only used to strategically set up the probable macrostructure of the text, but also to activate the relevant knowledge about the specific events. Thus, if a newspaper headline says *NEW FIGHTING IN LEBANON* we not only get a summary of new events, but also a powerful retrieval cue for our previous models about fighting in Lebanon.

4. Sentences. Understanding the respective sentences of a discourse takes place by the strategic construction of propositional schemata. These will be coherently linked, on line, with previous propositions, e.g., on the basis of conditional relations between facts or the identity of arguments. If no situational model fragment has been activated and retrieved by the context, our goals, or previous (macro-)information, the initial propositions of a text may do so. If the initial propositions provide new information, an appropriate model may be searched for and the new information be added to it. Coherence between the sentences, then, requires a match with local information in the model: if a conditional link is possible, we construct a conditional link between facts denoted. The same holds for the referential identity of discourse partidpants: does the current description fit the same person in the model we are now talking or reading about? Time, location, and circumstance categories in sentences and propositions will then monitor the possible continuity or changes in the respective episodes of the model.

5. Monitoring. The complex process of local and global understanding, the activation and retrieval of models and scripts or other knowledge, and the permanent match between text and communicative context needs to be monitored, viz., by a control system. This control system is fed with the macroinformation about the communicative con-

text, such as sort of communicative situation, genre of discourse, properties of the participants, as well as with the current goals or interests of the language user, and finally the current macroproposition for a fragment of the discourse. We assume that this control system keeps track of the general scripts that are now needed for processing in short term memory, as well as the current personal models needed or activated. It is this control system which is also responsible for the strategic combination of several situational models: it uses local information from short term memory or the textbase in episodic memory, and matches this with the overall context and goal information, as well as with general scripts, and then makes an effective hypothesis about the kinds of model fragments that should be searched for, activated, and how they should be combined.

6. Updating. Strategic model use does not imply that we need to activate all our personal knowledge about some situation, nor even that relevant information be activated all at once. Rather, the on-line nature of understanding would suggest that a particular model is built gradually, both from new information and from old models. This also allows that new information be added to the particular model at the precise points where this is relevant, and not in an arbitrary manner. Only in some cases may it be necessary to completely transform a previous model in such an updating process, e.g., when we see that we previously had completely misunderstood similar situations.

7. Evaluation. The interpretation of discourse seems to have two major components, viz., the construction of a coherent textbase and the construction of a particular model by transformations such as recombination of old model fragments and processes of updating. Yet, more is at stake. We may also want to evaluate both the incoming information and the possible or actual model transformations that this information would involve. For instance, we would want to know whether information is true or false. False propositions are of course represented in the textbase because they are part of what is said and what was meant, but they need not be taken up in the particular model if the information is inconsistent with information in the models we already have. We see that for the important decision regarding the truth or plausibility of sentences and discourses, we must have a cognitive theory involving episodic models.

Similarly, discourse is not merely evaluated for its truth value, but also for its relations with personal norms and values, that is, with respect to current opinions of the language user. Again, not only the discourse or the textbase may thus be evaluated (as good, bad, interesting, stupid, etc.), but also the facts it denotes. At several points in a particular model, then, the reader/hearer will assign personal values to

participants, events, or acts. This is another reason why models are both essentially episodic and personal. In later stages we often do not remember details of a situation, but only our positive or negative evaluation of the situation or episode (Forgas, 1979). Bower (1980) has shown that associated moods alone may be sufficient to serve as retrieval cues in the selection of experiences that have been recorded in the same mood.

CONTEXT MODELS

It may be trivial to repeat that discourses are not produced or read or heard in a vacuum. They are an integral part of a communicative situation. We therefore assume that language users also make a model of the particular situation of which they are by definition a participant. Whereas situation models may be called semantic, such so-called context models are pragmatic and social. They are necessary, as we have seen aboye, in order to establish a coherent textbase, to define the discourse genre, to represent the goals or interests of the speech participants, and to keep track of established or locally negotiated social properties of the participants, such as status and roles. These conditions are necessary also to assign a pragmatic interpretation to the discourse, that is, to define what speech act is being performed: is this a threat, an assertion or a request? (van Dijk, 1981).

Context models are by definition particular: they are models of this specific communicative situation. Yet, on some occasions we may derive more general models from them, for instance models about important or difficult talks we had, or a model of when we heard or read an important discourse, such as a job interview, a lecture, or a news item on TV.

Since a specific discourse is part of a communicative context, we must assume that a representation of a text is part of a context model. Indeed, we sometimes may remember what was said (that is, part of the textbase) as well as how, when, and by whom it was said (Keenan, MacWhinney, & Mayhew, 1977). Discourse is an integral part of the context. It is not only about things, and therefore not only situational models are necessary to understand it. Discourses are themselves social actions that may be remembered in their own right. Such discourses may cause important changes in social relations and establish changes in social situations. A court trial, for instance, largely consists of situated discourses such as accusations (indictments), pleas, testimonies, interrogations, and judgments, which together may have important social implications. Hence it is often important that people construct context models of these communicative situations that have crucial conse-

quences for their lives. We may even remember only a context model of a talk we had with somebody and not at a remember what we talked about (the situational model).

It is ultimately the context model that provides the typical episodic nature for a discourse and a particular situation model: it specifies when, where, and how we heard about some situation. Although we have made theoretical distinctions between a textbase and general or particular models in episodic memory, and between personal and social models, it should be realized that together with the context model here discussed our memory system is an integrated structure of these "sorts" of information. We have already seen that the representation of the discourse itself (textbase and surface structure) is part of the context model, and this context model is systematically related to the particular situational model now being constructed. In Figure 5.2 we show how these various memory models are related.

The context model also allows us to theorize about the differences between oral and written discourse (Rubin, 1980). Generally speaking, we assumed that models of the situation are formed and needed for the understanding of oral and written texts. Yet, the difference in communication mode may sometimes be relevant, and therefore needs to be represented in the context model. On some occasions we may still remember whether we have read or heard some information, or who said or wrote it. Also, in written discourse we may find various signals for the formation of textbases, macrostructures, and models that we do not have, as such, in oral discourse, such as typographical organization, headlines, types of printing. We have seen that in such cases the formation of macrostructures may be facilitated, as well as the retrieval of situation models.

Major differences between oral and written communication, however, should be sought in the strategic processes of production and understanding (Hildyard & Olson, 1982). Contrary to listening, reading allows personal speed in decoding, understanding, and the integration of knowledge. This means that people can reserve more time for the retrieval of personal models, or can activate more information from such models. The effects of this process may be conflicting though: it may lead to better understanding due to more extensive and more relevant model use, but uncontrolled activation of personal memories may also be confused with actual discourse and the now-relevant situation model information. On the other hand, the rich information from oral discourse (intonation, gestures, paraverbal acts) leads to a possibly more-differentiated context model, and hence to better recall of the communicative situation itself.
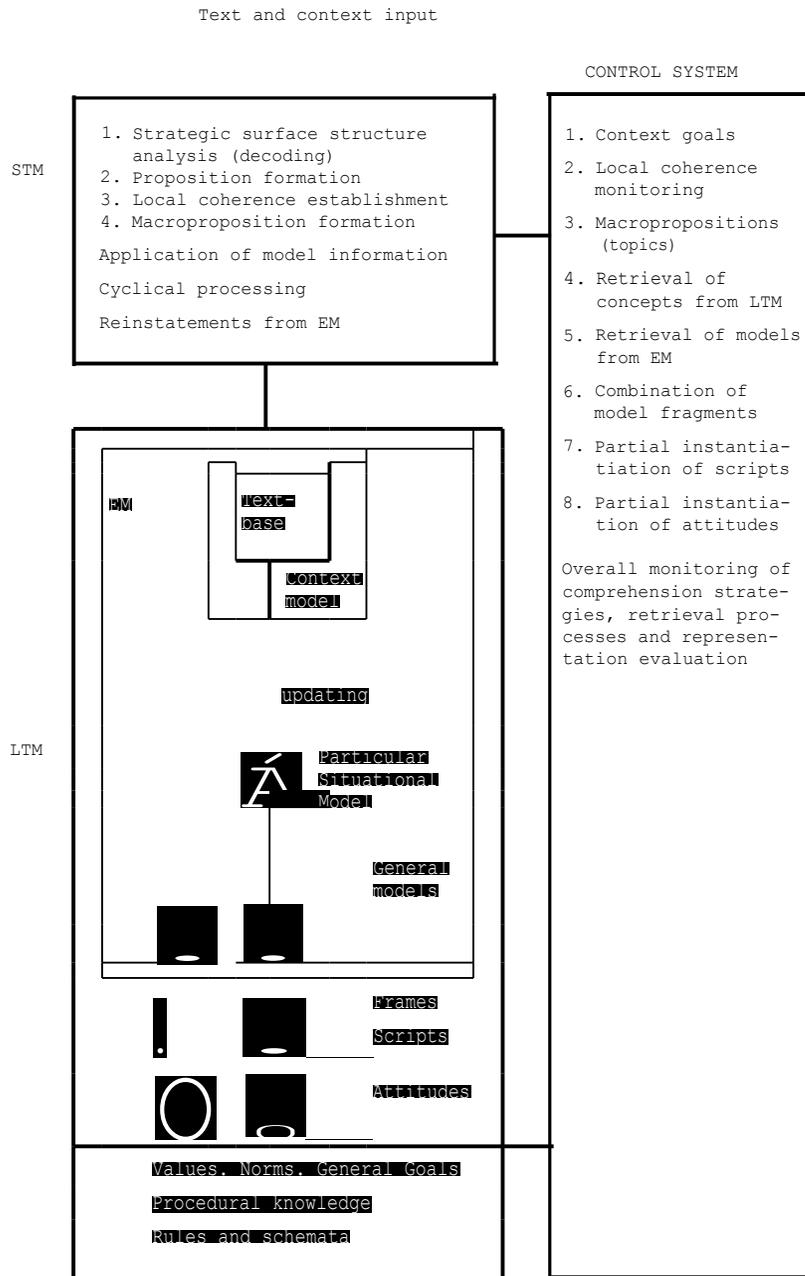
Text and context input

CONTROL SYSTEM

STM

```
1. Strategic surface structure
   analysis (decoding)
2. Proposition formation
3. Local coherence establishment
4. Macroproposition formation

Application of model information

Cyclical processing

Reinstatements from EM
```

```
1. Context goals

2. Local coherence
   monitoring

3. Macropropositions
   (topics)

4. Retrieval of
   concepts from LTM

5. Retrieval of models
   from EM

6. Combination of
   model fragments

7. Partial instantia-
   tiation of scripts

8. Partial instantia-
   tion of attitudes

Overall monitoring of
comprehension strate-
gies, retrieval pro-
cesses and represen-
tation evaluation
```

LTM

EM

Text-base

Context model

updating

Á   Particular Situational Model

General models

Frames

Scripts

Attitudes

Values. Norms. General Goals

Procedural knowledge

Rules and schemata

FIGURE 5.2. A schematic representation of the role of models in discourse comprehension.

AN EXAMPLE: A NEWS ITEM AND ITS
ASSOCIATED MODELS

Although a full analysis of the relevant model knowledge required for the understanding of a simple text would probably cover most of the space of this chapter, we can only give some fragments of such an analysis. In Figure 5.3 we have copied and analyzed the beginning of a news item translated from a Dutch newspaper *(NRC-Handelsblad,* July 12, 1983). In the left column we find (in natural English, not formal notation) the information expressed by the text or part of the communicative context, and in the right column the assumed models that are activated, used, and updated during the reading process. Since there is no standard way of representing the many processes involved, our notation of the models, their contents, the retrieval steps, the updating, and the establishment of links within and across models, is ad hoc.

First we see that the context provides and activates some information about the kind of communication (newspaper), the kind of newspaper, and the consequences for the background ideology (conservative) that may be implicit in the news item. This may imply that only negative information will be given of leftist guerrilla movements.

The headline of the text and its underlying semantic representation provide the concepts that may be used to activate the major models of this text, viz., PERU and (ARMED) ATTACK. The particular model in that case is a combination of information from these two models together with information from the text: an attack has taken place in Peru. The models embody both general information about Peru and about armed attacks, as well as possible personal information, such as having friends in Peru for example. The information in Model A.c and d derives from recent news items in the press about guerrilla activities in Peru. This information may even trigger recent particular text and context models and hence a particular model about these guerrilla activities. The conventional categories of the ATTACK model, such as participants, goal, action, are partly filled in (updated) from the information in the textbase. That arms are used in the attack is part of our general model (and scripts) of attacks, but also presupposed by the new information in the titie *(one killed).* The knowledge we have about Peru makes it plausible that it is a political action. The next sentences gradually fill in further information about these models: precise location (Lima, HQ of PAP), number of attackers, sort and number of victims, and arms used. Much information, however, may be used or inferred that is not expressed in the text, e.g., that Lima is the capital of Peru, that the attackers are opposed to the ruling PA party, and maybe even the evaluative opinion

```
                 Text ONE KILLED IN PERU IN ATTACK AT PARTY BUREAU

              During an attack by five armed men on the headquarters of the ruling
              Popular Action Party in Lima a woman was killed and thirty people were
              wounded. The police assumes that the attackers are members of the
              Maoist inspired guerrilla movement Sendero Luminoso.
              About seven o'clock yesterday evening local time ,the five men started
              to shoot with submachine guns and to throw bombs from cars at the buil-
              ding of Popular Action, where a meeting of the women's section had just
              begun.
              Javier Alva Orlandini, secretary-general of the party, called the attack
              "the most barbarían" in the three years since the guerrilla-movement Sen-
              dero Luminoso started its activities.
              Just before the attack other bombs had exploded at fifteen other places
              in the capital. There were no casulaties there. (AP, AFP).
```

CONTEXT INFORMATION	MODEL INFORMATION

CONTEXT INFORMATION

1. Newspaper
2. Inside page, small article
3. International news

TEXTBASE FRAGMENTS

4. Title

    One killed in Peru
    in attack at party bureau

MODEL INFORMATION

1. MODEL: (DUTCH) NEWSPAPER
       a. conservative
2. Relatively unimportant international event
      a. serial and political events

N.B. Information acquired from the textbase is in italics, also when already known.
Relevant discourse/model referents are numbered (pl, p2,...) for co-reference.

3. MODEL A: PERU
      a. Country. LOCATION EVENTS   e. I have friends (k,m) in Peru.
      b. Northwest of South America
      c. Actual political troubles (from 1 and 2a)   (MODELS k and m)
      d. Guerrilla activities

4. MODEL B: ARMED ATTACK (news event, violent events in third world, from la).

      a. Participants: attackers(p1), attacked (p2)(victims: one killed (p3)).
      b. Goal: party bureau (buildingXp4)
      c. Action: attack
      d. Instruments: arms
      e. Reasons: political (from B.b. and A.c.)

5. Five armed men attacked the HQ of the ruling Popular Action Party in Lima.	5. MODEL B.a. Armed <u>men</u> (p1), five (p1)
	        B.b. Party bureau = 12(p4)
	                Modifier: Popular <u>Action Party</u> (P5)
	                        Modifier: PAP <u>part of</u> government
	6. MODEL A: Lima: capital
	
	           MODEL B: Location: Lima
	
	7. MODEL B.e.I.Attackers opposed to ruling party (from B.b.)
	              2.Attackers members of guerrilla? (from B.e. and A.c-d.)

6. One woman was killed and thirty people were wounded.	8. MODEL B: Consequences: woman(p3), <u>thirty of</u> p2 <u>wounded.</u> B.e. Evaluative Modifier: Attackers are mean (kill women).

7. The police assumes that The attackers are members of the Maoist inspired guerrilla movement Sendero Luminoso.	9. MODEL 8: Reaction: <u>Police</u> action, declaration.
	
	10. Model B.a.: (7.2. Confirmed?) and A.d.: Guerrilla: <u>Sendero Luminoso:</u> MODEL C.
	
	    MODEL C. <u>SENDERO LUMINOSO</u>
	
	                <u>a.</u> <u>Guerrilla movement</u> in Peru. e. Recent article in newspaper
	                <u>b.</u> <u>Maoist</u> ideology (orthodox) f. Spanish: Shining Path.
	                c. Have support from poor farmers g. Are mean? (From B.e.)
	                d. Headed by ex-university professor h. MODEL: NEWSPAPER information

8. About seven o'clock yesterday evening local time, the five men started to shoot with submachine guns and to throw bombs from cars at the building of Popular Action, where a meeting of the women's section had just begun.	11. MODEL B: Time: <u>About seven o'clock, yesterday, local time</u> (time in Peru)
	              B.o.: <u>started to shoot with submachine</u> guns(p1)
	                    <u>throw bombs</u> (p1)
	            8: Origin: <u>from cars.</u> (NB: repeated info in text about Target not here.Cf.4).
	
	12. MODEL B: Circumstances: <u>meeting of women's section of P5 had just begun</u>.
	                          (women in the building: women(p3))
	                    (MODEL A.e.: MODELS k and m: Friends hurt?
	                                Friends member of SLT(MODEL C))

FIGURE 5.3. Sample analysis of a text, its textbase, and its situational model.

that those who attack defenseless women are bad people. Previous information in the press may have set up a next model, viz., about the guerrilla movement SENDERO LUMINOSO, which may trigger information not in the text, such as their (earlier) support from farmers. This lack of information in the text may tie in with the model we have about the particular newspaper (for details about news understanding see van Dijk & Kintsch, 1983).

Not represented here is of course the possible imagery we have about the situation: how does the action take place exactly? Did the men shoot from the cars, and how can they throw bombs from a (moving?) car? The same may be asked about the picture we have about a (party) building, in a town, etc. [4]

Most important, though, is that this example shows how fragments of models are retrieved by text cues, used, and updated.

EMPIRICAL EVIDENCE

If the notion of a situational model has any empirical relevance, we should at least try to experimentally test some of its more specific implications. Some experimental work is reviewed aboye, and of course there is much previous experimental work that could be reinterpreted in light of a model theory. Space limitations, however, do not allow a detailed examination of these experimental results in this chapter. We, therefore, only make some brief suggestions and formulate some tentative predictions.

1. A first general expectation is of course that if language users do not have a model of a situation, or have only a very fragmentary one, understanding of a discourse is generally impaired. This may imply slower reading times, less recall, more errors in recall or recognition, and other consequences of a lesser degree of understanding. Thus, stories about highly unusual experiences may be more difficult because we do not have a ready-made model or cannot construct a particular model as easily. This is typically the case for stories about events and actions in other cultures (Kintsch & Greene, 1979).

2. We may expect that certain properties of discourse facilitate or impair the construction of a particular model. This is typically the case for abstract texts, in which imagery of concrete persons, objects, events, or actions does not play a role (Paivio, 1971).

3. Discourse that provides a description of a situation may follow the canonical structure of a model and in that case it may be easier to con-

struct the model than when we have a transformed description of the situation (Mandler, 1978; Ehrlich *et al.,* 1979; Levelt, 1982; Jarvella & Klein, 1982).

4. If indeed a discourse is structurally rather different from the canonical structure of a model, it may make understanding more difficult but at the same time it may be easier to recognize the passages that do not have the canonical ordering. The same would hold for specific stylistic choices and rhetorical operations.

5. If particular models are assembled from fragments of other models, one should expect that if more models need to be retrieved and combined, it will take more time to understand a discourse. Also, recall may be less than with the description of one-model situations.

6. Especially after longer delays, people will increasingly tend to confuse specific textual information with model information. This effect will be enhanced as soon as they have read several texts about the same situation, as is the case for news in the paper (see also Bower, Black, & Turner, 1979).

7. If models play a role in the process of updating, we may expect that texts with much new information are more difficult to read, understand, or recall than those with much old model information, because in that case more constructive work must be done.

8. Models provide the background knowledge for the understanding of discourse. Hence, if models are more complete, a text may be more implicit and be relatively less coherent: we will find enhanced use of presuppositions and less explicit connectives or linking propositions.

9. If particular models have only an ad hoc function in the updating of more general models, it will be more difficult to retrieve these particular models than the (updated) general models.

10. We have assumed that general (social) scripts are used in discourse comprehension only through their instantiations in episodic models. This might mean that instantiated script fragments are better recalled than noninstantiated ones. However, we should also take into account the possibility that general, stereotypical knowledge is easier to retrieve than episodic models. We here need further exploratory evidence.

11. Models are formed not only on the basis of textual information, but also on the basis of the interpretation of real scenes and pictures. A series of experiments is necessary to explore the possible confusion of model information derived from text and information derived from other modes of comprehension (Schallert, 1980). It should also be experimentally possible to separate understanding and recall of textual information from model information.

Although we here have formulated some rather general predictions about the role of models, it will in general not be easy to precisely separate textbase information from information in particular models, general models, or scripts. [5]

Of course, empirical evidence for the cognitive reality of situation models need not come only from controlled experiments in the laboratory. On the contrary, data about the contents and the personal strategies of episodic models may be drawn from more natural expressions of such models, e.g., in self-reports, stories, or interviews. Access, assessment, and manipulation of the personal experiences that form our personal models indeed would be difficult to obtain in experimental conditions. There is much work on different methods, and these will precisely yield evidence about the contents, the structures, and the uses of personal models (Linton, 1975; Neisser, 1982; Whitten & Mauriello Leonard, 1981).

Finally, we should at least mention one interesting application of cognitive model theory. In our work in a project about ethnic prejudice in conversations about ethnic minorities in the Netherlands, it appeared that different kinds of prejudice and at the same time different strategies of expressing these (or not) in discourse closely correspond to the theoretical distinctions made between different kinds of models in this chapter (van Dijk, 1984, 1987a): Prejudices based on personal experiences, i.e., derived from models of the situation in some neighborhood, are different from the kinds of prejudices people derive from more general, social stereotype schemata about ethnic groups. However, personal prejudices are quickly extended from particular models to general models, or may be used as "evidence" of negative social attitudes.

Work on social cognition (see, e.g., Forgas, 1981) and its application in social stereotype research (Hamilton, 1981), also has given increasing attention to the important role of social representations of situations, persons, and groups. Notions such as schemata and scripts have been borrowed from psychology and artificial intelligence in order to model the structures and uses of stereotypical beliefs about minority groups. Our work suggests that, in addition to much more explicit representation formats and precise strategies of social information processing, situational models are also important to account for the formation and uses of ethnic beliefs and attitudes. Without the notion of a model, it is not clear how prejudiced people actually interpret interethnic situations and how they act in such situations. The lack of concrete personal experiences, such as encounters with minority group members, will urge people to "imagine" such experiences by constructing models "by default,"

i.e., by instantiating preestablished ethnic attitude schemata from semantic (social, shared) memory. Conversely, a single particular model of such an encounter may strategically be used to form general models and abstract attitude schemata about minority groups (for detail see van Dijk, 1987a).

We have given this example of work in progress not only because it shows the relevance of the notion of episodic model in other domains of psychology and sociology, or to account for a number of specific properties of prejudiced discourse, but also to stress the need for interdisciplinary integration in the further development of such a notion and to point to the possibility of making cognitive theories really useful in the analysis of pressing social problems.

CONCLUSIONS

We have shown that a cognitive theory of discourse processing needs a model theory. Modeis are cognitive representations in episodic memory of the situations discourses are about. They embody accumulated experiences of previous occasions with the same or similar things, persons, or events. We need them as an interpretation basis for discourse. Only with respect to such models can we evaluate discourse with respect to truth values, establish referential identity, and decide about the local and global coherence of discourse.

We have assumed that situational models are built up around a model schema, consisting of a limited number of categories people use to interpret situations. These schemata are then filled with concrete information we obtain about such a situation in different observational or communicative contexts. Discourse is usually processed in order to update existing models or to build new ones. Since discourses may be about different kinds of experiences at the same time, we often need to construct a new, particular, model from fragments of existing models. In this way, each particular model is constructed by (1) information from the discourse, (2) fragments of old models, and (3) instantiations from general knowledge (scripts).

Finally, it was shown that discourse understanding also requires the formation of particular context models, of which the actual discourse is an integrated part. Such context models not only provide the necessary social dimension for the text, but also serve as the proper episodic and communicative dimension of the situation models conveyed by discourse processing.

ACKNOWLEDGMENTS

NOTES

' One confusion that should be avoided is that with the notion of model that roughly is equivalent to theory. In this chapter, a cognitive model is not a model (theory) of cognition, but a knowledge representation in memory.

² Especially in this section we cannot possibly do justice to the many suggestions about the sociocognitive aspects of situations and episodes that have been elaborated in decades of research. For details see Forgas (1979) and Argyle, Furnham, and Graham (1981). A useful reader with many papers from several disciplines about the notion of (social) situation is Furnham and Argyle (1981).

³ These macropropositions are necessary in order to hierarchically organize the sometimes vast amounts of knowledge that may be accumulated during many previous experiences (including discourse) about the various categories of the schema, e.g., details about persons, objects, or actions we are confronted with regularly.

⁴ Other newspaper accounts in the Dutch press, as well as the item in *The Guardian* of July 13, 1983, provide different details of the same event, and hence express and induce different models (which we may call **model variaras** or **alternative models)** of the situation. Thus, *The Guardian* mentions that the attackers were led by a woman, that three people were killed, and that the attackers actually left their cars and entered the party building. Despite the exactness of the numbers in news stories (rhetorically used to signify credibility), the different agencies and papers seem to convey different models.

This is rather a practical problem for controlled experimentation. This chapter however has shown that there are systematic differences in content, functions, and uses for these various knowledge/belief structures in memory, even if they are multiply interconnected. Since episodic memory not only stores episodes, and semantic long-term memory is not only semantic (and also features episode schemata), we suggest that it might make more sense to speak of **personal** and **social** memory, respectively.

APPENDiX

Rebels Blast Lima HQ*

LIMA: More than 15,000 police yesterday hunted for leftwing guerrillas who made a bloody bomb and submachinegun attack on the headquarters of the ruling Popular Action Party in what President Fernando Belaunde Terry said amounted to an act of war. Three people were killed and 32 wounded.

"Yes, gentlemen, war is what Peru is fighting," President Belaunde said in an

emotional appearance at the headquarters after Monday night's attack. The party HQ is only 200 yards from the Civil Guard headquarters.

The country, he said, was passing through a grave hour—a reflection of growing government concern over escalating guerrilla actions and rebel ability to strike during a 60-day national emergency declared to fight terrorism.

The Civil Guard said the hunt for guerrilla suspects in and around the Peruvian capital had resulted in several arrests.

The guerrilla strike was the first made directly on people since the Maoist movement called Shining Path started fighting the government three years ago. The rebels also set off a dozen bombs elsewhere in Lima, causing brief power cuts.

Witnesses said that four or five guerrillas led by a woman burst into the unguarded two-storey building firing sub-machineguns and throwing at least four dynamite bombs. The guerrillas sped away in a waiting car.

The executive committee of Mr. Belaunde's party demanded the restoration of the death penalty.

President Belaunde abolished the death penalty except for wartime treason when he took office in 1980 after his election ended 12 years of military rule.—AP/Reuter.

The Guardian, Wednesday, July 13, 1983.

Dode in Peru bij aanslag op partijbureau *

LIMA, 12 juli—Bij een aanval van vijf gewapende mannen op het hoofdkwartier van de regerende Volksactie-partij in Lima is een vrouw gedood en dertig mensen gewond. De politie vermoedt dat de daders van de aanslag lid zijn van de maoistisch geinspireerde guerrillabeweging Sendero Luminoso.

Omstreeks zeven uur gisteravond plaatselijke tijd begonnen de vijf mannen vanuit auto's met mitrailleurs te schieten en gooiden zij bommen naar het gebouw van Volksactie, waar juist een vergadering van de vrouwenafdeling was begonnen.

Javier Alva Orlandini, de secretaris-generaal van de partij, noemde de aanval "de meest barbaarse" in de drie jaar dat de guerrillabeweging Sendero Luminoso actief is.

Vlak voor de aanval waren op vijftien andere plaatsen in de Peruaanse hoofdstad bommen ontploft. Hierbij vielen geen slachtoffers. (AP, AFP)

NRC-Handelsblad, Tuesday, July 12, 1983.

REFERENCES

Argyle, M., Furnham, A., & Graham, J. A. (1981). *Social situations.* London: Cambridge University Press.

Beaugrande, R. de, & Dressler, W. U. (1981). *Introduction to text linguistics.* London: Longman.

Bower, G. H. (1980). Mood and memory. *American Psychologist,* 36, 129-148.

Bower, G. H., Black, J. B., & Turner, T. J. (1979). Scripts in memory for text. *Cognitive Psychology, 11,* 177-220.

Bransford, J. D., & Franks, J. J. (1972). The abstraction of linguistic ideas. *Cognitive Psychology, 2,* 331-350.

Brown, P., & Fraser, C. (1979). Speech as a marker of situation. In K. R. Scherer & H. Giles (Eds.), *Social markers in speech.* London: Cambridge University Press.

Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition,* 5, 73-99.

Coulthard, M. (1977). *Introduction to discourse analysis.* London: Longman.

Craik, K. (1943). *The nature of explanation.* Cambridge: Cambridge University Press.

Dik, S. (1978). *Functional grammar.* Amsterdam: North-Holland.

Ehrlich, K., Mani, K., & Johnson-Laird, P. N. (1979). *Mental models of spatial relations.* University of Sussex: Laboratory of Experimental Psychology.

Fletcher, C. R. (1983). *Surface forms, textbases and situational models. Recognition memory for three* types *of textual information.* University of Colorado, Boulder: Department of Psychology.

Forgas, J. P. (1979). *Social episodes.* New York: Academic Press.

Forgas, J. P. (Ed.). (1981). *Social cognition.* New York: Academic Press.

Foss, D. J. (1982). A discourse on semantic priming. *Cognitive Psychology,* 14, 590-607.

Furnham, A., & Argyle, M. (Eds.). (1981). *The psychology of social situations.* London: Pergamon.

Garnham, A. (1981). Mental models as representations of text. *Memory & Cognition,* 9, 560-565.

Garnham, A., Oakhill, J., & Johnson-Laird, P. N. (1982). Referential continuity and the coherence of discourse. *Cognition, 11,* 29-46.

Givón, T. (1979). *On understanding grammar.* New York: Academic Press.

Guenthner, F., & Schmidt, S. J. (Eds.). (1979). *Formal semantics and pragmatics for natural languages.* Dordrecht, The Netherlands: Reidel.

Halloran, J. D., Elliott, P., & Murdock, G. (1970). *Demonstrations and communication.* Harmondsworth, England: Penguin Books.

Hamilton, D. (Ed.). (1981). *Cognitive processes in stereotyping and intergroup behavior.* Hillsdale, NJ: Erlsbaum.

Hildyard, H., & Olson, D. R. (1982). On the comprehension and memory of oral vs. written discourse. In D. Tannen (Ed.), *Spoken and written language.* Norwood, NJ: Ablex.

Hughes, G. E., & Cresswell, M. J. (1968). *An introduction to modal logic.* London: Methuen.

Jarvella, R. J., & Klein, W. (Eds.). (1982). *Speech, place and action.* Chichester, England: Wiley.

Johnson-Laird, P. N. (1980). Mental models in cognitive science. *Cognitive Science,* 4, 72-115.

Johnson-Laird, P. N. (1983). *Mental models.* London: Cambridge University Press.

Johnson-Laird, P. N., & Garnham, A. (1980). Descriptions and discourse models. *Linguistics and Philosophy, 3,* 371-393.

Kamp, H. (1981). A theory of truth and semantic representation. In J. A. G. Groenendijk, T. Janssen, & M. Stokhof (Eds.), *Formal methods in the study of language.* Amsterdam: Mathematical Centre Tracts.

Karttunen, L. (1975). Discourse referents. In J. D. McCawley (Ed.), *Syntax and semantics* (Vol. *7).* New York: Academic Press.

Keenan, E. L. (Ed.). (1975). *Formal semantics of natural language.* Cambridge: Cambridge University Press.

Keenan, J. M., MacWhinney, B., & Mayhew, D. (1977). Pragmatics in memory: A study of natural conversation. *Journal of Verbal Learning and Verbal Behavior,* 16, 549-560.

Kintsch, W., & Greene, E. (1978). The role of culture-specific schemata in the comprehension and recall of stories. *Discourse Processes,* 1, 1-13.

Kintsch, W., & van Dijk, T. A. (1975). Comment on se rappelle et on resume des histoires. *Langages, 40,* 98-116.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review,* 85, 363-394.

Levelt, W. J. M. (1982). Linearization in describing spatial networks. In S. Peters & E. Saarinen (Eds.), *Processes, beliefs and questions.* Dordrecht, Netherlands: Reidel.

Linton, M. (1975). Memory for real-world events. In D. A. Norman & D. E. Rumelhart (Eds.), *Explorations in cognition.* San Francisco: Freeman.

Lippmann, W. (1922). *Public opinion.* New York: Harcourt.

Mandler, J. (1978). A code in the node: The use of a story schema in retrieval. *Discourse Processes,* 1, 14-35.

Nash-Webber, B. L. (1978). *A formal approach to discourse anaphora* (Tech. Rep.). Cambridge, MA: Bolt, Beranek & Newman.

Nash-Webber, B. L. (1981). Discourse model synthesis: Preliminaries to reference. In A. K. Joshi, B. L. Webber, & I. A. Sag (Eds.), *Elements of discourse understanding.* London: Cambridge University Press.

Neisser, U. (Ed.). (1982). *Memory observed: Remembering in natural contexts.* San Francisco: Freeman.

Paivio, A. (1971). *Imagery and verbal processes.* New York: Holt.

Petófi, J. S., & Rieser, H. (1974). *Probleme der modelltheoretischen Interpretation von Texten.* Hamburg: Buske.

Rubin, A. (1980). A theoretical taxonomy of the differences between oral and written language. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension.* Hillsdale, NJ: Erlbaum.

Schallert, D. L. (1980). The role of illustrations in reading comprehension. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *theoretical issues in reading comprehension.* Hillsdale, NJ: Erlbaum.

Schank, R. C. (1982). *Dynamic memory.* London: Cambridge University Press.

Schank, R. C., & Abelson, R. P. (1977). *Scripts, plans, goals and understanding. Hillsdale,* NJ: Erlbaum.

Schutz, A. (1970). On phenomenology and social relations. In H. R. Wagner (Ed.), *Alfred Schutz on phenomenology and social relations.* Chicago: University of Chicago Press.

Stenning, K. (1978). Anaphora as an approach to pragmatics. In M. Halle *et al.* (Eds.), *Linguistic theory and linguistic reality.* Cambridge, MA: MIT Press.

Thomas, W. I. (1928). Situational analysis. The behavior pattem and the situation. In M. Janovits (Ed.), W. *1. Thomas on social organization and social personality.* Chicago: University of Chicago Press.

Tulving, E. (1983). *Elements of episodic memory.* London: Oxford University Press.

van Dijk, T. A. (1972). *Some aspects of text grammars.* The Hague: Mouton.

van Dijk, T. A. (1973). Text grammar and text logic. In J. S. Petófi & H. Rieser (Eds.), *Studies in text grammar.* Dordrecht, Netherlands: Reidel.

van Dijk, T. A. (1977). *Text and context.* London: Longman.

van Dijk, T. A. (1980a). *Macrostructures.* Hillsdale, NJ: Erlbaum.

van Dijk, T. A. (Ed.). (1980b). *Story comprehension.* [Special issue]. *Poetics, 8, (1M).*

van Dijk, T. A. (1981). *Studies in the pragmatics of discourse.* Berlin: Mouton.

van Dijk, T. A. (1983). Cognitive and conversational strategies in the expression of ethnic prejudice. *Text, 3,* 375-404.

van Dijk, T. A. (1984). *Prejudice in discourse.* Amsterdam: Benjamins.

van Dijk, T. A. (Ed.). (1985). *Handbook of discourse analysis.* (4 vols.). London: Academic Press.

van Dijk, T. A. (1987a). *Communicating racism: Ethnic prejudice in thought and taik.* Newbury Park, CA: Sage.

van Dijk, T. A. (1987b). *News as discourse.* Hillsdale, NJ: Erlbaum.

van Dijk, T. A. (1987c). *News analysis.* Hillsdale, NJ: Erlbaum.

van Dijk, T. A., & Kintsch, W. (1978). Cognitive psychology and discourse. Recalling and summarizing stories. In W. U. Dressler (Ed.), *Current trends in text linguistics.* Berlin: de Gruyter.

van Dijk, T. A., & Kintsch, W. (1983). *Strategies of discourse comprehension.* New York: Academic Press.

Whitten, W. B., & Mauriello Leonard, J. (1981). Directed search through autobiographical memory. *Memory & Cognition,* 9, 566-579.